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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/159,841	03/13/2012	8135420	2101-3515	3203

35884 7590 02/22/2012

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 689 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Young Dae Lee, Gyeonggi-do, KOREA, REPUBLIC OF;
Sung Duck Chun, Gyeonggi-do, KOREA, REPUBLIC OF;
Myung Cheul Jung, Seoul, KOREA, REPUBLIC OF;
Sung Jun Park, Gyeonggi-do, KOREA, REPUBLIC OF;

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	Bost, Dwayne D.
Attorney Docket Number	2101-3515

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	7426175		2008-09-16	Zhuang, et al.	

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
Change(s) applied to document, /L.S./ 10/29/2011	1	20030156624		2003-08-21	~~Null~~ Koslar	
	2	20020160744		2002-10-31	Choi, et al.	
	3	20020009129		2002-01-24	Choi, et al.	

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FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /U.C./

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

38884 7590 12/29/2011

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
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Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/139,841	10/22/2008	Young Dae Lee	2101-3515	3203

TITLE OF INVENTION: METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1740	$300	$0	$2040	03/29/2012

EXAMINER	ART UNIT	CLASS-SUBCLASS
CHO, UN C	2617	455-458000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address Form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 LEE, HONG, DEGERMAN, KANG & WAIMEY
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: LG ELECTRONICS INC.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): SEOUL, REPUBLIC OF KOREA

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☑ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

☑ Issue Fee

☑ Publication Fee (No small entity discount permitted)

☐ Advance Order - # of Copies:

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

☐ A check is enclosed.

☑ Payment by credit card. Form PTO-2038 is attached.

☑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 50-2290 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature /David G. Majdali/ Date February 1, 2012

Typed or printed name David G. Majdali, Esq. Registration No. 53,257

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Electronic Patent Application Fee Transmittal

Application Number:	12159841
Filing Date:	22-Oct-2008
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Filer:	David Gerard Majdali/Anna Tounian
Attorney Docket Number:	2101-3515

Filed as Large Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl issue fee	1501	1	1740	1740
Publ. Fee- early, voluntary, or normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**2040**

Electronic Acknowledgement Receipt

EFS ID:	11979767
Application Number:	12159841
International Application Number:	
Confirmation Number:	3203
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Customer Number:	35884
Filer:	David Gerard Majdali/Anna Tounian
Filer Authorized By:	David Gerard Majdali
Attorney Docket Number:	2101-3515
Receipt Date:	01-FEB-2012
Filing Date:	22-OCT-2008
Time Stamp:	20:18:55
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$2040
RAM confirmation Number	7701
Deposit Account	502290
Authorized User	MAJDALI,DAVID G.
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	2101-3515-Transmittal-IssueFee.pdf	71375 76aaeb3a5b90879ec9ce2a1830ff01f8e0abe666	no	1
Warnings:					
Information:					
2	Issue Fee Payment (PTO-85B)	2101-3515-IssueFeeForm.pdf	344485 3e067e9267f0890d11891c1a0134d983073d5711	no	1
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	32143 b90ef4080413ab5a39c9a04792204eda73accd1d	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	448003		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Customer No. 035884 **Docket No. 2101-3515**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Young Dae LEE, et al.			
Serial No:	12/159,841	Art Unit:	2617
Filed:	October 22, 2008	Examiner:	CHO, Un C.
For:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM	Conf. No.:	3203

TRANSMITTAL OF ISSUE FEE

Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the Notice of Allowance dated December 29, 2011, enclosed are the following:

☒ Form Part B - Issue Fee Transmittal.

☒ Inventor(s) or Assignee(s) is entitled to **LARGE** entity.

☒ The Commissioner is hereby authorized to charge the Issue Fee in the amount of $2,040 to the credit card and any deficiency in payment or credit any overpayment to **Deposit Account No. 502290.**

Respectfully submitted,

Lee, Hong, Degerman, Kang & Waimey

Date: February 1, 2012

By: /David G. Majdali/
David G. Majdali
Registration No. 53,257
Attorney for Applicant(s)

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/159,841	10/22/2008	Young Dae Lee	2101-3515	3203

35884 7590 01/25/2012

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

EXAMINER	
CHO, UN C	

ART UNIT	PAPER NUMBER
2617	

NOTIFICATION DATE	DELIVERY MODE
01/25/2012	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

uspto@lhlaw.com
ip.lhlaw@gmail.com
ip.lhlaw@live.com

Response to Rule 312 Communication	Application No.	Applicant(s)
	12/159,841	LEE ET AL.
	Examiner	Art Unit
	UN C. CHO	2617

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address –

1. ☒ The amendment filed on *17 January 2012* under 37 CFR 1.312 has been considered, and has been:

   a) ☒ entered.

   b) ☐ entered as directed to matters of form not affecting the scope of the invention.

   c) ☐ disapproved because the amendment was filed after the payment of the issue fee.
   Any amendment filed after the date the issue fee is paid must be accompanied by a petition under 37 CFR 1.313(c)(1) and the required fee to withdraw the application from issue.

   d) ☐ disapproved. See explanation below.

   e) ☐ entered in part. See explanation below.

/UN C. CHO/
Primary Examiner, Art Unit 2617

Customer No. 035884 Docket No. 2101-3515

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Young Dae LEE, et al.		Art Unit:	2617
Serial No:	12/159,841	Examiner:	CHO, Un C.
Filed:	October 22, 2008	Conf. No.:	3203
For:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM		

AMENDMENT AFTER NOTICE OF ALLOWANCE (NOA) PURSUANT TO 37 CFR 1.312

OK TO ENTER: /U.C./

Mail Stop Issue Fee
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the Notice of Allowance dated December 29, 2011, for which the Issue Fee is due March 29, 2012, this paper is submitted prior to payment of the Issue Fee. Applicant respectfully requests that the Examiner amend the above-identified application as follows prior to issuance:

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/159,841	10/22/2008	Young Dae Lee	2101-3515	3203

35884 7590 01/19/2012

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

EXAMINER	
CHO, UN C	

ART UNIT	PAPER NUMBER
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NOTIFICATION DATE	DELIVERY MODE
01/19/2012	ELECTRONIC

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APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
12/159,841	22 October, 2008	LEE ET AL.	2101-3515

		EXAMINER	
LEE, HONG, DEGERMAN, KANG & WAIMEY 660 S. FIGUEROA STREET Suite 2300 LOS ANGELES, CA 90017		UN C. CHO	
		ART UNIT	PAPER
		2617	01142012

DATE MAILED:

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Commissioner for Patents

The IDS filed on 1/12/2012 has been placed in record and considered by the examiner.

/UN C. CHO/
Primary Examiner, Art Unit 2617

PTO-90C (Rev.04-03)

PTO/SB/08a (01-10)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young-Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	548916	TW		2003-08-21	ERICSSON TELEFON AB LM		☐
	2	I253824	TW		2006-04-21	NOKIA CORP		☐

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young-Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	3rd Generation Partnership Project (3GPP), "Technical Specification Group Radio Access Network; Introduction of the Multimedia Broadcast Multicast Service (MBMS) in the Radio Access Network (RAN); Stage 2 (Release 6)," 3GPP TS 25.346 V6.7.0, December 2005.	☐

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EXAMINER SIGNATURE

Examiner Signature	/Un Cho/	Date Considered	01/14/2012

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/159,841	10/22/2008	Young Dae Lee	2101-3515	3203

35884 7590 01/18/2012

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EXAMINER	
CHO, UN C	

ART UNIT	PAPER NUMBER
2617	

NOTIFICATION DATE	DELIVERY MODE
01/18/2012	ELECTRONIC

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APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
12/159,841	22 October, 2008	LEE ET AL.	2101-3515

		EXAMINER	
LEE, HONG, DEGERMAN, KANG & WAIMEY 660 S. FIGUEROA STREET Suite 2300 LOS ANGELES, CA 90017		UN C. CHO	
		ART UNIT	PAPER
		2617	01122012

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Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner for Patents

The IDS filed on 1/10/2012 has been placed in record and considered by the examiner.

/UN C. CHO/
Primary Examiner, Art Unit 2617

PTO-90C (Rev.04-03)

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Application Number	12159841
Filing Date	2008-10-22
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Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20040248600		2004-12-09	Kim	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	12159841
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	First Named Inventor	Young-Dae Lee
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	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

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EXAMINER SIGNATURE

Examiner Signature	/Un Cho/	Date Considered	01/12/2012

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /U.C./

Customer No. 035884 Docket No. 2101-3515

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Young Dae LEE, et al.		
Serial No:	12/159,841	Art Unit:	2617
Filed:	October 22, 2008	Examiner:	CHO, Un C.
For:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM	Conf. No.:	3203

AMENDMENT AFTER NOTICE OF ALLOWANCE (NOA) PURSUANT TO 37 CFR 1.312

Mail Stop Issue Fee
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the Notice of Allowance dated December 29, 2011, for which the Issue Fee is due March 29, 2012, this paper is submitted prior to payment of the Issue Fee. Applicant respectfully requests that the Examiner amend the above-identified application as follows prior to issuance:

IN THE SPECIFICATION:

Please insert the following paragraph and heading on page 1 of the specification, which is after the title of the invention and before Technical Field, as follows:

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is the National Stage filing under 35 U.S.C. 371 of International Application No. PCT/KR2007/000078, filed on January 5, 2007, which claims the benefit of earlier filing date and right of priority to Korean Application No. 10-2007-0000936, filed on January 4, 2007, and also claims the benefit of U.S. Provisional Application Serial Nos. 60/797,402, filed on May 2, 2006, 60/784,680, filed on March 21, 2006, 60/783,250, filed on March 16, 2006, and 60/757,063, filed on January 5, 2006.

REMARKS

Claims 1-11 and 13-15 are all the claims in the application, which have been allowed. Applicant respectfully submits that the amendments to the specification are intended to correct formal matters and do not change the scope of the claims.

The specification has been amended to include a *Cross-Reference to Related Applications* section. No new matter has been added to the specification. In view of the allowance of claims 1-11 and 13-15, which have not been amended with this paper, it is respectfully submitted that claims 1-11 and 13-15 are still in condition for allowance. The Examiner is requested to issue a Response to Rule 312 Communication (PTO-271) as soon as possible.

If for any reason the Examiner finds the proposed amendments not in condition for entry or if further changes are deemed necessary, the Examiner is requested to call the undersigned attorney at the Los Angeles, California, telephone number (213) 623-2221.

Respectfully Submitted,
LEE, HONG, DEGERMAN, KANG & WAIMEY

Date: January 17, 2012

By: /David G. Majdali/
David G. Majdali
Registration No. 53,257
Attorney for Applicant(s)

Customer No. 035884

Electronic Acknowledgement Receipt

EFS ID:	11857376
Application Number:	12159841
International Application Number:	
Confirmation Number:	3203
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Customer Number:	35884
Filer:	David Gerard Majdali/Anna Tounian
Filer Authorized By:	David Gerard Majdali
Attorney Docket Number:	2101-3515
Receipt Date:	17-JAN-2012
Filing Date:	22-OCT-2008
Time Stamp:	21:28:09
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	2101-3515-AppDataSheet.pdf	1089632 3dc7561f9569707654b4d113cdbdf52370c937bc	no	5

Warnings:	
Information:	

2		2101-3515-312Amendment.pdf	95074 70ce4995a3e2ef78e8d9f4d970109bb272fd8ff3	yes	3

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Amendment after Notice of Allowance (Rule 312)	1	1
Specification	2	2
Applicant Arguments/Remarks Made in an Amendment	3	3

Warnings:	
Information:	
Total Files Size (in bytes):	1184706

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/14 (11-08)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	2101-3515
	Application Number	
Title of Invention	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Applicant Information:

Applicant 1 Remove

Applicant Authority ◉ Inventor ○ Legal Representative under 35 U.S.C. 117 ○ Party of Interest under 35 U.S.C. 118

Prefix	Given Name	Middle Name	Family Name	Suffix
	Young Dae		LEE	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Hanam-si, Gyeonggi-do	Country Of Residence[i]	KR
Citizenship under 37 CFR 1.41(b)[i]	KR		

Mailing Address of Applicant:

Address 1	419-1501 Sinan Apt., Changu-dong		
Address 2			
City	Hanam-si, Gyeonggi-do	State/Province	
Postal Code	465-711	Country[i]	KR

Applicant 2 Remove

Applicant Authority ◉ Inventor ○ Legal Representative under 35 U.S.C. 117 ○ Party of Interest under 35 U.S.C. 118

Prefix	Given Name	Middle Name	Family Name	Suffix
	Sung Duck		CHUN	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Anyang-si, Gyeonggi-do	Country Of Residence[i]	KR
Citizenship under 37 CFR 1.41(b)[i]	KR		

Mailing Address of Applicant:

Address 1	601-1007 Saetbyeol Hanyang Apt.		
Address 2	Daran-dong, Dongan-gu		
City	Anyang-si, Gyeonggi-do	State/Province	
Postal Code	431-773	Country[i]	KR

Applicant 3 Remove

Applicant Authority ◉ Inventor ○ Legal Representative under 35 U.S.C. 117 ○ Party of Interest under 35 U.S.C. 118

Prefix	Given Name	Middle Name	Family Name	Suffix
	Myung Cheul		JUNG	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Seoul	Country Of Residence[i]	KR

PTO/SB/14 (11-08)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	2101-3515
	Application Number	
Title of Invention	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM	

Citizenship under 37 CFR 1.41(b) i	KR			
Mailing Address of Applicant:				
Address 1	2/2, 358-36 Sangdo 2-dong, Dongjak-gu			
Address 2				
City	Seoul	**State/Province**		
Postal Code	156-832	**Country**i	KR	

Applicant 4 Remove

Applicant Authority (•) Inventor ( ) Legal Representative under 35 U.S.C. 117 ( ) Party of Interest under 35 U.S.C. 118

Prefix	Given Name	Middle Name	Family Name	Suffix
	Sung Jun		PARK	

Residence Information (Select One) ( ) US Residency (•) Non US Residency ( ) Active US Military Service

City	Gunpo-si, Gyeonggi-do	**Country Of Residence**i	KR
Citizenship under 37 CFR 1.41(b) i	KR		
Mailing Address of Applicant:			
Address 1	1323-401 Gaenari Apt., Sanbon 2-dong		
Address 2			
City	Gunpo-si, Gyeonggi-do	**State/Province**	
Postal Code	435-768	**Country**i	KR

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	35884		
Email Address	patent@lhlaw.com	Add Email	Remove Email

Application Information:

Title of the Invention	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM		
Attorney Docket Number	2101-3515	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		**Sub Class (if any)**	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	8	**Suggested Figure for Publication (if any)**	

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	2101-3515
	Application Number	
Title of Invention	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM	

Publication Information:

☐	Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐	**Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S. C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Enter either Customer Number or complete the Representative Name section below. If both sections are completed the Customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	035884		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	a 371 of international	PCT/KR2007/000078	2007-01-05
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
PCT/KR2007/000078	non provisional of	60797402	2006-05-02
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
PCT/KR2007/000078	non provisional of	60784680	2006-03-21
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
PCT/KR2007/000078	non provisional of	60783250	2006-03-16
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
PCT/KR2007/000078	non provisional of	60757063	2006-01-05
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button.			Add

PTO/SB/14 (11-08)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	2101-3515
	Application Number	
Title of Invention	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM	

Foreign Priority Information:

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

Remove

Application Number	Country [i]	Parent Filing Date (YYYY-MM-DD)	Priority Claimed
10-2007-0000936	KR	2007-01-04	(•) Yes ( ) No

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. Add

Assignee Information:

Providing this information in the application data sheet does not substitute for compliance with any requirement of part 3 of Title 37 of the CFR to have an assignment recorded in the Office.

Remove

Assignee 1

If the Assignee is an Organization check here. [X]

Organization Name	LG ELECTRONICS INC.		
Mailing Address Information:			
Address 1	20 Yeouido-dong, Yeongdeungpo-gu		
Address 2			
City	Seoul	**State/Province**	
Country [i]	KR	Postal Code	150-721
Phone Number		Fax Number	
Email Address			

Additional Assignee Data may be generated within this form by selecting the **Add** button. Add

Signature:

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the form of the signature.

Signature	/David G. Majdali/			Date (YYYY-MM-DD)	2012-01-17
First Name	David G.	Last Name	Majdali	Registration Number	53257

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young-Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] ¡	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	548916	TW		2003-08-21	ERICSSON TELEFON AB LM		☐
	2	I253824	TW		2006-04-21	NOKIA CORP		☐

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young-Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	3rd Generation Partnership Project (3GPP), "Technical Specification Group Radio Access Network; Introduction of the Multimedia Broadcast Multicast Service (MBMS) in the Radio Access Network (RAN); Stage 2 (Release 6)," 3GPP TS 25.346 V6.7.0, December 2005.	☐

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young-Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/David Majdali/	Date (YYYY-MM-DD)	2012-01-12
Name/Print	David Majdali	Registration Number	53,257

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Espacenet Bibliographic data: TW548916 (B) — 2003-08-21

IP address allocation for mobile terminals

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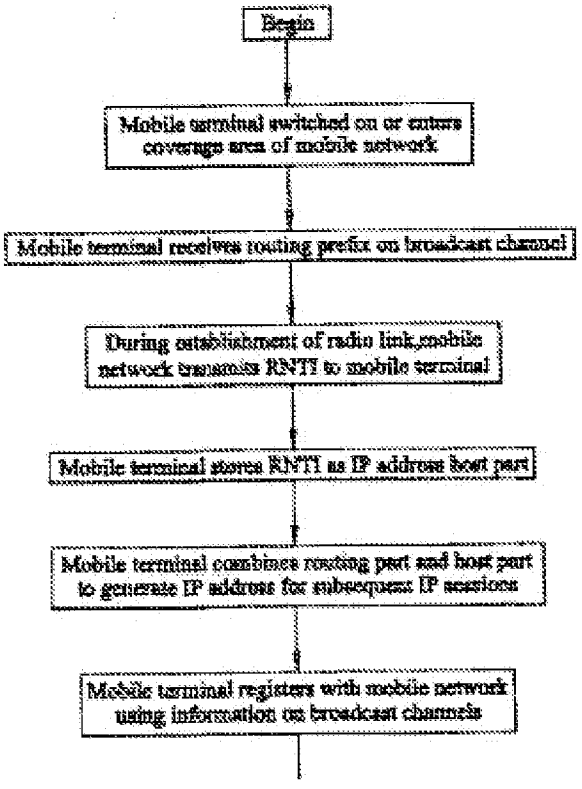
Applicant(s):	ERICSSON TELEFON AB L M [SE] +
Classification:	**- international:** ***H04L12/28; H04L12/56; H04L29/06; H04L29/12; H04W8/26; H04W8/08; H04W80/04; H04W92/02;*** (IPC1-7): H04L12/00; H04Q7/00
	- European: H04L29/12A3A; H04L29/12A3H; H04L29/12A3I; H04L29/12A9A; H04Q7/22S3P; H04W8/26
Application number:	TW20000103485 20000229
Priority number(s):	GB19990007335 19990331
Also published as:	GB2348569 (A) GB2348569 (B) ZA200106935 (A) US6771635 (B1) JP2002541734 (A) more

Abstract of TW548916 (B)

A method of allocating an Internet Protocol (IP) address to a mobile wireless terminal 7 within a mobile telecommunications 1 network. During the establishment of the radio link between the terminal 7 and the network 1, a negotiation is conducted to provide the mobile terminal 7 with a host part for an IP address, where the host part is unique within the radio network 1. In the case of a UMTS network, the host part is the RNTI.



Last updated: 5.12.2011 Worldwide Database 5.7.31; 92p

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[11]公告編號：548916
[44]中華民國　92年 (2003)　08月21日
發明　　全 3 頁

[51] Int.Cl [07]：　H04L12/00
H04Q7/00

[54]名　稱：行動終端之網際網路協定位址配置

[21]申請案號：　089103485　　[22]申請日期：中華民國　89年 (2000)　02月29日

[72]發 明 人：
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1

[57]申請專利範圍：

1.一種配置一IP位址給位於一行動電信網路內部之一行動無線終端之方法，該方法包含進行行動終端與網路間的協商而決定該IP位址的主機部分，該主機部分為關聯標準化空氣介面協定層之一而配置給該行動終端之一識別碼，其中該主機部分是行動終端使用，以產生一IP位址用於隨後的IP階段作業。

2.如申請專利範圍第1項之方法，其中主機部分係由無線網路所提議。

3.如申請專利範圍第1項之方法，其中行動網路為UMTS網路，以及無線網路暫時識別(RNTI)作為主機部分。

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4.如申請專利範圍第1項之方法，其中主機部分係由行動終端提議。

5.如申請專利範圍第1項之方法，其中該協商係於無線鏈接建立期間介於行動終端與行動網路間進行。

6.如申請專利範圍第1項之方法，其中行動網路包含一無線網路部分，以及配置一主機部分給行動終端係由該無線網路控制。

7.如申請專利範圍第6項之方法，其中配置一主機部分給行動終端係由該行動網路的無線網路控制器(RNC)控制。

8.一種配置一IP位址給位於一行動電信網路內部之一行動無線終端之裝

置，該裝置包含分布於行動無線終端與行動電信網路間之裝置，用以於建立一無線鏈接期間進行終端與網路間的協商，俾決定一IP位址的主機部分；該主機部分為關聯標準化空氣介面協定層之一而配置給該行動終端之一識別碼，而且該行動終端進一步包含產生裝置，用以產生一IP位址結合該主機部分用於隨後的IP階段作業。

9.一種網際網路致能的行動無線終端，該行動終端係配置成進行與一行動電信網路的協商而決定一IP位址的主機部分；該主機部分為關聯標準化空氣介面協定層之一而配置給該行動終端之一識別碼，而且該行動終端進一步配置成產生一IP位址，結合該主機部分用於隨後的IP階段作業。

10.一種提供一IP位址給位於一行動電信網路內部之一行動無線終端之方法，其中該IP位址包含一路由部分和一主機部分，該方法包含利用一由行動網路傳輸給行動終端的參數作為該主機部分。

11.如申請專利範圍第10項之方法，其中參數為一無線網路暫時識別(RNTI)。

圖式簡單說明：

圖1示意舉例說明一行動電信系統；

圖2舉例說明根據IPv6之IP位址結構；以及

圖3為流程圖舉例說明一種於圖2系統中配置IP位址的主機部分之方法。

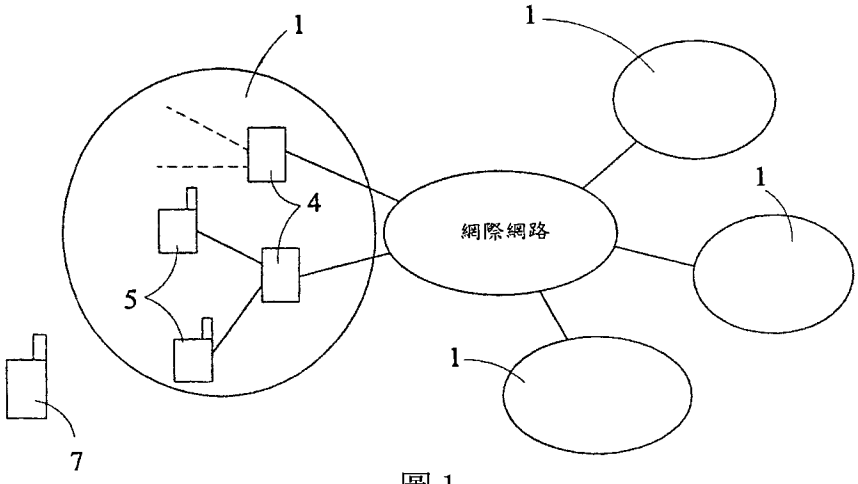

圖1

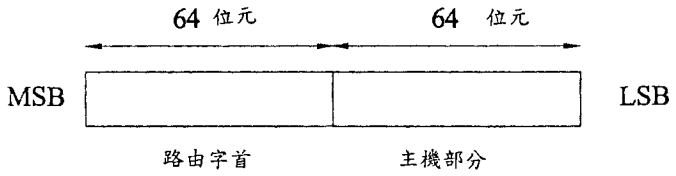
64 位元
64 位元
MSB
LSB
路由字首
主機部分

圖 2

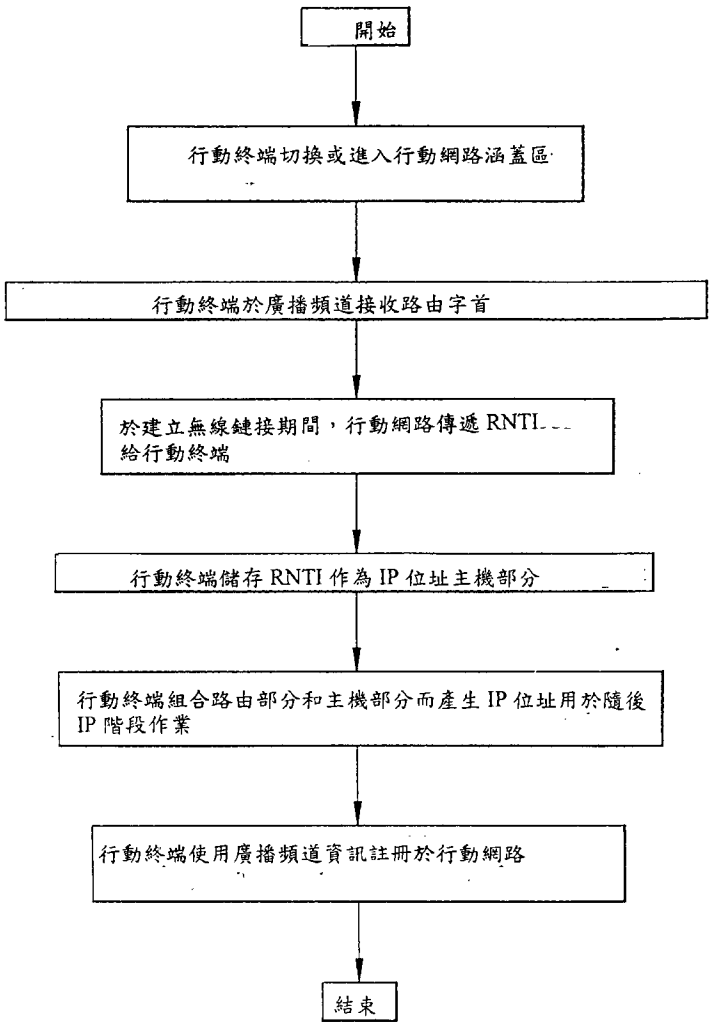
開始
行動終端切換或進入行動網路涵蓋區
行動終端於廣播頻道接收路由字首
於建立無線鏈接期間，行動網路傳遞 RNTI 給行動終端
行動終端儲存 RNTI 作為 IP 位址主機部分
行動終端組合路由部分和主機部分而產生 IP 位址用於隨後 IP 階段作業
行動終端使用廣播頻道資訊註冊於行動網路
結束

圖 3

Bibliographic data: TWI253824 (B) — 2006-04-21

System, method and computer program product for downloading pushed content

Inventor(s):	SALO JUHA H [FI]; AALTONEN JANNE LA [FI]; CUGI GUIDO [IT] ±
Applicant(s):	NOKIA CORP [FI] ±
Classification:	- **international:** ***G06F21/00; H04L29/02; H04L29/06;*** (IPC1-7): H04L29/02 - **European:** G06F21/00N7D; H04L29/06S12A; H04L29/06S8C
Application number:	TW20040131607 20041019
Priority number (s):	US20030689396 20031020
Also published as:	WO2005039146 (A2) WO2005039146 (A3) US2005083929 (A1) US7721104 (B2) KR20060092264 (A) more

Abstract of TWI253824 (B)

A system is provided for downloading pushed content includes a terminal capable of receiving service loading content that identifies download content and has a digital signature. The terminal is capable of authenticating the service loading content based upon the digital signature, and if the service loading content is authenticated, pulling the download content to the terminal. In this regard, the terminal is capable of authenticating the service loading content, and pulling the download content, in response to receiving the service loading content and independent of interaction from a user of the terminal. The terminal can also be capable of determining if an interruption occurs in receiving the download content such that the terminal receives less than the entire download content. And if an interruption occurs, the terminal can be capable of recovering the download content such that the terminal receives the plurality of data packets.

（此處由本局於收文時黏貼條碼）

發明專利說明書

（本說明書格式、順序及粗體字，請勿任意更動，※記號部分請勿填寫）

※ 申請案號：93131609

※ 申請日期：93.10.19　　※IPC 分類：H04L 9/32

一、發明名稱：（中文/英文）

下載推送內容所用之系統、方法及電腦程式產品

SYSTEM, METHOD AND COMPUTER PROGRAM PRODUCT FOR DOWNLOADING PUSHED CONTENT

二、申請人：（共 1 人）

姓名或名稱：（中文/英文）

諾基亞股份有限公司

NOKIA CORPORATION

代表人：（中文/英文）福克約翰遜（Folke Johansson）

住居所或營業所地址：（中文/英文）

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Keilalahdentie 4, FIN-02150 Espoo, Finland

國　籍：（中文/英文）芬蘭/FI

三、發明人：（共 3 人）

姓　名：（中文/英文）

1.裘華薩羅/SALO, JUHA H.

2.詹尼阿頓寧/AALTONEN, JANNE LA

3.凱羅丘吉/CUGI, GUIDO

國　籍：（中文/英文）

1~2 芬蘭/FI　3 義大利/IT

四、聲明事項：

☐ 主張專利法第二十二條第二項☐第一款或☐第二款規定之事實，其事實發生日期為：　年　月　日。

☑ 申請前已向下列國家（地區）申請專利：

【格式請依：受理國家（地區）、申請日、申請案號　順序註記】

☑ 有主張專利法第二十七條第一項國際優先權：

美國　2003/10/20　10/689,396

☐ 無主張專利法第二十七條第一項國際優先權：

☐ 主張專利法第二十九條第一項國內優先權：

【格式請依：申請日、申請案號　順序註記】

☐ 主張專利法第三十條生物材料：

☐ 須寄存生物材料者：

國內生物材料　【格式請依：寄存機構、日期、號碼　順序註記】

國外生物材料　【格式請依：寄存國家、機構、日期、號碼　順序註記】

☐ 不須寄存生物材料者：

所屬技術領域中具有通常知識者易於獲得時，不須寄存。

九、發明說明：

【發明所屬之技術領域】

本發明係概括的涉及一種下載內容所用之系統及方法，更明確地說，係涉及一種根據記號下載內容所用之系統、方法及電腦程式產品。

【先前技術】

現代通訊產生了有線及無線網路之迅速擴張。因應消費者之要求，電腦網路、電視網路以及電話技術正經驗到前所未有之技術性發展。無線及行動網路技術針對消費者之要求已提供更具彈性及即時傳輸資訊之機器。

為使用戶容易及方便傳輸資訊，網路技術不斷在進步。由於地方性、區域性以及全球性網路，之迅速擴大帶給社會龐大量之資訊。這些網路技術擴展至包括無線及行動電話之技術領域。經由這些網路可將資訊下載至桌上系統、無線系統、行動系統等。舉例而言，現在能經由網際網路將所要之資訊下載至例如行動電話機、個人數位輔助機(PDAs)及膝上型電腦等。能使無線裝置傳送及接收網際網路內容之一項技術為無線應用協定(WAP)，此技術係使網際網路及其它網路整合於無線網路平台。一般而言，WAP 係一套說明網際網路及無線服務規範之特性及功能的協定(protocols)。它是獨立於無線網路規定，是一種開放規範(open standard)。WAP 跨接有線網際網路範疇與無線領域之間之空隙，使無線裝置用戶能享用連結兩個平台之網際網路之好處。

第二代無線服務(通訊技術)，通稱為 2G 無線服務，係基於電路轉接技術之一項目前的無線服務。因此 2G 系統，例如行動式通訊(GSM)及個人通訊服務(PCS)用之全球通訊系統，係使用數位無線電技術改進第一 代行動式通訊技術之品質及增大其服務之範圍。第三代無線服務（通訊技術）通稱為 3G 無線服務，係一套數位技術，它是終端機及網路之間使用基於新的封包式傳輸法改進傳輸能力、速度及效率之技術。3G 裝置及網路之用戶可以存（檔）取例如所要視訊(video-on- demand)、視訊會談、快速網頁存取及檔案傳送等多媒體通訊服務。現有及將來之服務會或將會繼續是由網路業者經由網路提供予行動式裝置（手機）用戶。

現有之傳輸資訊之一項特別的服務特徵係一種“推送(push)”特徵（亦稱為“通告”或“警告”特徵）。在一個典型的用戶伺服器模式中，用戶向伺服器發出服務或資訊之要求，隨後由伺服器傳送資訊回應用戶。這個工作一般稱為取出(pull)技術，用戶可從伺服器取得資訊。例如，在用戶端裝置登錄(entry)一致性資源定址器(URL)，即傳送至伺服器取出關連之資料乃為一種取出動作(pull transaction)。

與此對比，“推送(push)”技術通常是指不必先前用戶動作將資訊傳送至一或多個裝置之手段。因此，在伺服器傳送其資訊之前並無來自用戶之明確的要求，也因此推送技術必須是含有伺服器引發的動作

(transactions)。推送技術可與各種協定及通訊技術相連使用。例如，有些代表性推送技術包括短訊息服務(SMS)、無線應用協定(WAP)推送、多媒體訊息傳送服務(MMS)及對話起動協定(SIP)等。

根據 WAP 推送架構，例如其內容之遞送（傳輸）係由推送起動器（伺服器）觸發，然後由該起動器送出一推送訊息(push message)至用戶端，通知用戶有一訊息進來。隨後用戶根據該推送訊息中之參數，開始作下載處理而從該推送啟動器(push initiator)下載內容。更明確地說，用戶具推送啟動器之間之下載通信(download session)開始後，能將一個服務指示傳遞給用戶，於是該服務指示內容便可提供予該用戶之使用者（例如“有進來的廣告你想接收嗎？”）隨後使用者可根據該服務指示作接收或拒絕服務之決定。若該服務被接收，該內容便可從推送啟動器下載至客戶端。有關此種 WAP 推送架構的詳細可參閱如"Wireless Application Protocol Forum, WAP Push Architecture Overview WAP-250-PushArchOverview-20010703-a；這些文獻之內容併入本說明書中作為參考。

雖然傳統之推送技術足以推送內容至用戶端，但此技術仍有若干缺失。為此如 WAP 推送架構所提供之傳統推送架構，需要有用戶端（或用戶端之使用者）交談機制(interaction)以實行從推送啟動器將內容下載至用戶端（即終端使用者在內容傳送前必須接收所推送之內

容)。對多種不同服務及內容，最好是在下載時不要求終端使用者(end-user)明確地接收內容下將內容推送至用戶端。

解決要求終端使用者接收推送的內容之缺點的一個方法有 WAP 界定的服務載入技術，此技術可在無終端使用者干擾下，被用戶端用以下載內容。於是，推送啟動器推送服務載入內容(service loading content)至用戶端，而用戶端接收該服務載入內容時即能自動的從起端伺服器下載（即“取出 pull”）該服務載入內容所標記之內容。有關此 WAP 服務載入架構的詳細可參閱 "Wireless Application Protocol Forum, Service Loading, WAP-168-Service Load-20010731-a"，其內容併入本說明書中供作參考。

雖然服務載入技術解決了要求終端使用者通信接收內容之缺點，但此技術仍有缺點。關於此點，用戶/非用戶推送型服務（例如電子郵件）易被濫用(spamming) 。如所用知，所謂濫用通常指接收非法的服務，例如大量的電子郵件。為此，亟需開發一種減小接收非法服務或內容且又在無終端使用者介入之下推送內容至用戶端之系統及方法。

如所周知，時下的多種通過大氣(air)下載內容之技術至少某些程度期望其內容能於一個傳輸或一個下載對話(down load session)被下載。舉例而言，時下之根據 Over the Air (OTA)協定之下載內容用開放型移動連盟

(OMA)技術至少某些程度期望內容能於一個下載對話中被下載。但若是用戶端下載大量之內容時，通常需很多時間，如此在下載時用戶端將有遭遇某些型式之錯誤或傳輸中斷之可能性。例如，終端使用者能打斷下載內容之傳輸，若該終端使用者想利用該用戶端作諸如接收內容以外之其他目的使用時。再者，例如用戶端之錯誤（例如電池失電、失靈及破裂等）或網路失效（例如非涵蓋地區之場合）等意外事發生時均會打斷下載內容之傳輸。

通常，當內容在單一下載通信中被下載，而假如在下載程序中發生錯誤或傳輸中斷時，用戶端必須再開始下載以完全的下載內容。例如，用戶端通過汎用封包無線電服務(GPRS)下載一具有320百萬字元大小之內容而遭遇到錯誤或其他阻擾而中斷時，使用端通常必須再開始下載而接收內容，即便其在錯誤或中斷前已下載了大部分之內容。目前已開發有例如檔案傳輸協定(FTP)技術等數種技術用以再取得因遭遇到錯誤或中斷之下載通信(download session)。但這些技術僅能再取得那些遭遇到網路連結錯誤（例如數據機失靈）之下載對話而無法取得因停機(halted)或其他原因而中斷之下載通信。為此，亟需開發一種不但無終端使用者干擾及減小接收非法服務或內容且又能額外或依希望取得因用戶端之錯誤或網路失效而中斷之下載對話而將內容推送至用戶端之系統及方法。此系統及方法最好又能夠提供快速的認證(authentication)希望接收內容之使用者及確認使用者有

權接收該內容或服務。此外，該系統最好能使使用者方便的接收已付費的內容，以免為該內容之下載通信遭遇到錯誤而付還該已付的費用。

【發明內容】

鑑於上述之背景，本發明提供一種推送內容的下載的改良系統，方法以及電腦程式產品。依本發明能夠將內容推送至終端機，無終端使用者干擾且又可減少終端機接收非法內容，同時又能認證推送啟動(push initiator)、起端伺服器(origin server)及例如依標識或認證技術從起端伺服器推送至終端機之內容，且更能在內容被推送至終端機之前，即依服務下載技術從起端伺服器推送至終端機之前認證推送者、起端伺服器及/或內容。藉由服務下載技術推送內容至終端機時，可在無終終端使用者干擾下將內容推送至終端機。又，藉由要求終端機認證推送者、起端伺服器及/或內容，本發明可減少終端機接收非法（即無授權的）內容的可能性。

除了能在無使用者干擾下將內容推送至終端機並減少接收非法內容之可能性外，本發明之系統、方法及電腦程式產品能恢復曾遭遇到終端機錯誤及網路錯誤之下載通信。於是，接收到之下載內容部分可連同下載描述符(descriptor)、資訊封包或其他標示下載內容及下載內容狀態一起儲存於一非揮發性記憶體(non-volatile cache)中。因此，內容之下載中斷時，下載描述符及/或資料封包便可用以決定內容之殘留部分，使該殘留內容得以下

載而完成內容之下載。

本發明之第 1 目的為提供一種下載推送內容用系統。此系統含有一個能接收服務載入內容(service loading content)之終端機，上述服務載入內容標示有下載內容且具有數位簽章(digital signature)。該終端機能根據該數位簽章認證服務下載內容，服務下載內容之認證完了後即可將下載內容取出至終端機。例如，終端機可用公鍵(public key)檢驗數位簽章從而認證服務載入內容。於是，該系統亦可包含一推送啟動器(push initiator)用以與該公鍵連用之私鍵(private key)數位式的簽署該服務載入內容，然後將該載入內容傳送至終端機。然而不管終端機怎麼認證服務載入內容，該終端 機可回應服務載入內容之接收及不受終端機之使用者的干擾認證該服務載入內容而取下下載內容。

除該下載內容之外，服務載入內容可識別與下載內容連用之起端伺服器。為此，本發明之系統亦可包含識別起端伺服器。在此場合，終端機可在服務載入內容經認證後藉發出下載內容之要求至起端伺服器而取出該下載內容，然後回應該要求從起端伺服器接收該下載內容。更具體地說，終端機能接收下載描述符，然後再接收下載內容。同樣地，下載內容可含多數之資料封包，在此場合，終端機可決定在接收多數之資料封包時是否發生中斷以致終端機接收較該多數資料封包為少之下載內容。又假設在接收多數之資料封包時發生中斷，該終

端機能恢復下載內容，使終端機在無需再傳送中斷前已成功的傳送之資料封包下，接收到多數之資料封包。該終端機更能決定至少一個殘留之資料封包在終端機接收以達成多數下載內容之資料封包之完全接收。然後終端機指示起端伺服器傳送該至少一個殘留之資料封包，隨後接收該至少一個殘留之資料封包，於是終端機接收該多數之資料封包。

當下載內容含有多數之資料封包時，經濟機能接收該多數之資料封包及接收有關一或多個資料封包之一或多個組群之一或多個資訊封包(information packet)。在此場合，終端機能監視接收到之資料封包而根據至少一個資訊封包決定在接收該多數之資料封包時是否發生中斷以致終端機收到較該多數資料封包為少之下載內容。又假設在接收多數之資料封包時發生中斷，該終端機能恢復下載內容，使終端機無需再傳送中斷前已成功的傳送之資料封包下，接收到多數之資料封包。

本發明之另一目的為提供一種下載推送內容用之方法及電腦程式產品。因此本發明涉及下載推送內容用之改良系統、方法及電腦程式產品。與先前技術之推送內容至終端機之技術對比，本發明可在無終端使用者干擾下推送內容至終端機，並且可減少終端機接收例如濫發內容等非法內容之可能性。再者，與先前之下載推送內容的技術相較，本發明能夠恢復曾遭受到終端機錯誤或網路錯誤之下載通信。因此本發明之終端機、系統及方

法可解決先前技術所識別之各種問題並提供額外之利點。

【實施方式】

茲佐以附圖將本發明之較佳實施例詳細說明於下。由於本發明可以許多不同形式實施，因此本發明之範圍不應侷限於所舉之實施例。在圖中所示之同一符號代表同一元件或構件。

現說明第 1 圖，此圖所示者為本發明提供之終端機及系統之一型式。本發明之系統、終端機以及方法基本上係關連移動通訊的應用加以說明，但應知其可同樣適用於其他各種應用途徑，包括移動式通訊工業以及移動式通訊工業以外之例如有線及/或無線網路（例如網際網路等）等之應用途徑。

如圖所示，終端機 10 可包含傳送信號及從基地台(BS)14 接收信號所用之天線 12。基地台 14 為蜂巢式網路的一部分，它包括操作網路所用之元件，如行動交換中心(MSC)16。熟悉此項技術者所知，蜂巢式網路亦稱為基地台/MSC/工作介面功能(BMI)。操作時，該 MSC 能因應終端機之發出及接收呼叫(call)而傳送呼叫及訊息。當終端機在作呼叫處理時該 MSC 亦提供傳輸幹線，而該 MSC 能連接至伺服器之閘道(GTW)一如無線應用協定閘道(WAPGTW)。此無線應用閘道含有一或多個閘道，例如推送代理閘道 18 及方法代理閘道 20。

MSC16 可接通資料網路，例如區域網路(LAN)、都

會區網路(MAN)及/或廣域網路(WAN)。又，MSC 能經由 WAPGTW（例如經由推送代理 GTW18 及/或方法代理 GTW20 等）直接及/或間接的接連至資料網路。一個代表性實例為 MSC 連接於 WANGTW，而 GTW 連接於網際網路 22 等廣域網路(WAN)。再者，如處理元件（如個人電腦、伺服器電腦等）等裝置可經由網際網路連接至終端機 10。例如將於下面說明，處理元件可包含與推送啟始器 24 連用之一或多個處理元件，以及與一或多個起端伺服器 26 連用之一或多個處理元件，一如第 1 圖所示。

除 MSC16 之外，基地台(BS)14 可連接於信號處理 GPRS（通用封包無線電服務）支援節點(SG SN)28。如所周知，SGSN 能與 MSC16 同樣作為封包轉換服務用。此 SGSN 與 MSC 同樣可連接於例如網際網路 22 等資料網路。SGSN 可直接連接於資料網路，但更代表性之實施態樣是連接於例如 GPRS 核網路 33 等封包轉換型核網路。此封包轉換型核網路乃再連接於例如 GTW GPRS 支援節點(GGSN)30 等另一個 GTW，而 GGSN 則連接於網際網路。除此 GGSN 之外，封包轉換型核網路亦可連接於 WAN GTW(例如推送代理/ GTM 18 及/或方法代理/ GTW 20)。

藉連接 SGSN 28 於 GPRS 核網路 33 及 GGSN 30，起端伺服器 26 等裝置可經由網際網路 22、SGSN 及 GGSN 連接於終端機 10。如此，起端伺服器等裝置便能通 過 SGSN、GPRS 及 GGSN 而與終端機連通。舉例而

言，起端伺服器可依多媒體播放多廣播服務(MBMS)提供內容予終端機。有關 MBMS 之詳細可參閱第三代夥伴計劃(3GPP)技術規格 3GPP TS 22.146，標題為"Multimedia Broadcast Multicast Service (MBMS)。

除連接於 BS 14 外，終端機 10 可無線的連接於一或多個無線接取點(APs)30。此無線接取點 30 可包含依無線頻率(RF)、藍芽(BT)、紅外線(IrDA)等技術或包括 WLAN 技術等各種無線網路技術之一種連通之存取點(access points)。上述 APs 30 亦可連接於網際網路 22。與 MSC 16 同樣，APs 可直接連接於網際網路。但較可取之一實施態樣是經由 WAN GTW，包括推送代理/GTW 及方法代理/GTW，間接的連接於網際網路。由下述可知，藉直接或間接的連接終端機 10 及推送啟動器 24、起端伺服器 26 以及其他裝置之一或多個於網際網路時，終端機便能與推送引發器，起端伺服器等互相連通以進行終端機之各種功能，例如從推送啟動器，起端伺服器等傳送資料、內容等及/或接收內容、資料等。

進而言之，終端機 10 可視需要將其經由例如地面數位視頻廣播（例如 DVB-T、DVB-H、ISDB-T、ATSC 等）網路等數位廣播網路連接於數位廣播機 34。由往後之說明將可知，將終端機直接或間接的連接於數位廣播機，該終端機即能從數位廣播機接收到電視、無線電及/或資料頻道之一或多數內容。為此該數位廣播機可含有或連接至例如 DVB-T TX 等一發報（射）機(TX, transmitter)

36。同樣的，該終端機可含有例如 DVB-T 接收機（未圖示）等接收機。該終端機能從多數之不同實體(entities)以一或多數不同方法接收內容。以一實施言之，例如該終端機可含一種能依 DVB（如 DVB-T，DVB-H 等）技術或蜂巢式（如 1G，2G，2.5G，3G 等）通訊技術發送及/或接收資料之一終端機 10'。在此種實施態樣中，該終端機 10'可含一從 TX 接收內容之一天線 12A，及發出信號及從 BA 14 接收信號之另一天線 12B。有關此種終端機之詳細可參關美國專利申請第 09/894,532，發明名稱"Receiver"，2001 年 6 月 29 日申請，其內容併入本說明書中供作參考。

另外，通過 TX 36 將終端機 10 直接連於數位廣播機 34，該終端即可連接於數位廣播接收終端機 38，而此終端機復可直接及/或經由 TX 連接於數位廣播機 34。在此場合，該數位廣播接收終端機 38 可以機上盒(set top box)型式含有 DVB-T 接收機等一種 DVB-T 接收機。終端機可例如經由個人區網路(personal area network)局部的連接於數位廣播接收終端機。但較佳之實施態樣為將終端機經由網際網路 22 間接的連接於數位廣播接收終端機。

根據數種如 DVB-T 等數位廣播技術，網際網路資料傳播(IPPC)能用以提供聲頻、視頻及/或其他內容予終端機 10。如此，數位廣播機 34 可利用數位廣播技術將網際網路資料(IP)提供給終端機。如熟習此項技術的人所

知，DVB-T 等數位廣播技術基本上是蜂巢型態，具有與不同細胞(cells)之各個細胞關連之傳輸站(transmission site)。例如 DVB-T 利用 MPEG-2 傳送流，如此 IP 資料即可封裝於傳送自數位廣播機或更具體而言，TX 36，之 DVB 傳輸信號中。於是可將含有 IP 資料封(datagram)之資料流從數個來源(sources)供給並且可藉 IP 封裝機（未圖示）封裝。然後從該 IP 封裝機將封裝的 IP 資料流供給至資料廣播（如 DVB-T）網路中。

繼之，將該封裝的 IP 資料流傳送至一或多個傳輸站，而在該站形造資料廣播網路之細胞(cells)。例如，封裝的IP資料流可被傳輸到MPEG-2傳送流中之一或多個傳輸站，然後通過大氣直接傳輸至終端機，或備有一或多個終端機之接收站。由下說明可知，該 MPEG-2 傳送流，從在 IP 封裝機產生及直至在終端機或接收站接收，係為均一方向性的。於是，含有資料之 IP 封包可被嵌入（包裝）於多協定封裝(MPE)區塊而傳輸於傳送流封包中。

除IP封包外，MPE區塊亦可包含正向錯誤校正(FEC)資訊及時間截分資訊。藉包含此種時間截分資訊等資訊，資料即可用接收器（如終端器 10）間歇（不連續）的傳輸，於是在無資料傳輸至接收器時將其切斷即可節省電池的電力。易言之，利用時間截分技術替代連續數位廣播（如 DVB-T）傳輸之現行的預設方法(current default method)，則能使用分時多工型配置技術（參照如

DVB-H 標準）。運用此方法則能迅速提供服務，使接收器不接收資料時即時停擺而在需要時再起動接收資料封包。

現說明第 2 圖。所示為一種能當作終端機 10、推送代理/GTW 18、方法代理/GTW 20、推送啟動器 24 及/或起端伺服器 26 運作之實體(entity)的方塊圖。雖然圖中以各別實體顯示，但在有些實施例中，一或多個實體可支援一或多個的終端機、推送代理/GTW、方法代理/GTW，推送啟動器及/或起端伺服器邏輯的分離但一起配設於一或多個實體中者。舉例而言，單一之實體可支援邏輯的分離但配設一起之推送代理/GTW 與方法代理/GTW。同樣地，例如單一的實體可支援邏輯的分離但配設一起的推送啟動器與起端伺服器。

如圖所示，能充當終端機 10、推送代理/GTW 18、方法代理/GTW 20、推送啟動器 24 及/或起端伺服器 26 運作之實體通常含有一連接於記憶體 42 及介面 44 之處理機 40。上述記憶體 42 可含揮發性記憶體及/或非揮發性記憶體且通常含軟體應用程式、指令程式或類似程式使處理機得以執行與本發明實施例之實體的操作相連之步驟。例如，作為終端機之場合，該記憶體可包含：依超文件傳送協定(HTTP)之傳統通訊用網頁瀏覽器等用戶或主機應用程式(user or host applications)、檔案傳送（如 FTP）應用程式、遠端應用程式(telnet application)、同層間存取應用程式等。該記憶體亦可包含如下將予

說明之幫助內容完全下載至終端機之軟體下載代理程式(download agent)。此外，如下說明，該記憶體亦可含有非揮發性快取記憶體42A用以儲存不完整之下載內容及用以儲存完整之下載內容之非揮發性記憶體42B。

現說明第3圖，其中所示為可依本發明之實施例作為終端機10運作之移動台之功能性圖式。應知，上述及將說明之行動台僅例舉可從本發明獲得利益之一種終端機，因此不應以其限制本發明之範圍。在上面已說明終端機之數種實施態樣，但本發明亦可應用於例如手提型數位助理機(PDAs)、呼叫器、膝上型電腦及其他型之聲音及文件通訊裝置。

行動台含有發送器44、接收器46及傳送信號給及從該發送器及接收器接收信號所用之控制器48。這些信號含有根據細胞系統之介面標準之信號處理資訊以及用戶語音及/或用戶產生之資料。於是，行動台可用一或多個的空氣介面標準、通訊協定、調變型及存取型運作。更具體的說，行動台可依第1代(1G)、第2代(2G)、第2.5代(2.5G)及/或第3代(3G)通訊協定等運作。例如，行動台能依2G無線通訊協定IS-136(TDMA)、GSM及IS-195(CDMA)運作。行動台亦能依各種數位廣播技術，例如DVB技術（如DVB-T，ETSI標準EN 300744）等一種或多種運作。另外，行動台亦可依例如MBMS技術（如3GPP TS22.146）等各種廣播及/或群播技術運作。進而言之，行動台可依ISDB-T（日本地面整體服務數位

廣播）、DAB（數位聲頻廣播）、ATSC（先進電視系統委員會）技術等運作。有些窄頻 AMPS（即 NAMPS）及 TACS，利用本發明之教導，在移動終端機可獲得利益，雙頻及高頻電話機（如數位/類比或 TDMA/CDMA/類比電話機）亦然。

如所周知，控制器 48 含有執行行動台之聲頻及邏輯功能所需之電路。例如，控制器可含有數位信號處理器、微處理器、各種類比-數位轉換器、各種數位-類比轉換器及其他支援電路。行動台之控制及信號處理功能依該等裝置之各個能力配置於該等裝置之間。因此控制器具備有於調變及傳輸前迴旋的編碼及交插訊息及資料之功能。控制器另能含有內部聲音編碼器(VC)47A，且又可含內部資料調變解調器(DM)48B。此外控制器可含有操作一或多個軟體應用程式（此可儲存於記憶體中）之功能。

行動台亦含有包含傳統之耳機或揚聲器 50、電鈴 52、麥克風 54、顯示器 56 及用戶輸入介面之用戶介面，而這些元 件均連接於控制器 48。用戶介面允許行動台接收資料，而係由例如小鍵盤 58、觸動顯示器（未圖示）或其他裝置等一種或多種所構成。一種實施例包含小鍵盤，此小鍵盤備有供行動台操作所用之傳統數字鍵(0~9)及相關之鍵(#，※)及其他功能鍵。

行動台依各種有線及/或無線技術亦可含與一種或數種電子裝置（例如另一終端機、起端伺服器 26、AP

32、數位廣播接收終端機 38、數位廣播機 34）區域通訊所用之一種或多種裝置。舉例而言，行動台可含高頻(RF)收發機 60 及/或紅外線(IR)收發機 62，使行動台依高頻及/或紅外線技術實行區域通訊。又，行動台亦含藍芽(BT)收發機 64 使行動台依藍芽傳輸技術實行區域通訊。雖然無示於圖中，行動台更能視需要傳輸及/或接收來自各種依有線及/或無線網路技術，包括 LAN 及/或 WLAN 技術配設之電子裝置之資料。為此，如第 1 圖所示之終端機 10'，行動台可含一額外之天線或類似元件傳輸及/或接收來自電子裝置（如數位廣播機）之資料。

行動台可進一步含有如用戶識別模(SIM)66 及可移用戶識別模(R-UIM)等記憶體，用以儲存有關行動用戶之資訊。除 SIM 之外，行動台亦可含有其他記憶體，即含有揮發性記憶體，如含有資料臨時儲存用快取區(cache area)之揮發性隨機存取記憶體(RAM)。行動台亦可含有其他非揮發性記憶體 70，此記憶體可為固設者及/或可移出者。非揮發性記憶體可含 EEPROM，瞬間記憶體及硬碟等。此等記憶體可儲存多種資訊及資料，供行動台實行行動台之功能。例如，記憶體可含：依超文件傳送協定(HTTP)之傳統通訊用網頁瀏覽器等用戶或主機應用程式、檔案傳輸（如 FTP）應用程式、遠端應用程式及同層間存取應用程式等。該記憶體亦可含如下將予說明之幫助內容完全下載至終端機之軟體下載代理程式。另外，非揮發性記憶體可含一緩衝區（未圖示）供

儲存不完整之下載內容，亦可含一供儲存例如完整下載內容等其他內容之儲存部。

依本發明之實施態樣，系統可依一或多種推送技術運作，如在上面先前技術部分所述，由 WAP 推送架構提供之傳統推送技術需要用戶（或用戶之使用者）之介入實行從推送啟動器下載內容至用戶之動作（即在內容傳送前終端使用者需先接收推送內容)。由於傳統之服務載入技術能在終端使用者無介入下推送內容，故在用戶/非用戶推送型服務（如電子郵件等）上易發生濫發(spamming)情形。對此，本發明在終端使用者無介入下可將內容推送至終端機 10，同時又能減少終端機接收非法之內容之可能性。在此所謂之“內容”是指可被推送至或提供給終端機或被終端機接受之各種不同內容及內容等之一或多個。

更具體的說，本發明之終端機 10 可根據記號認證技術監別一或多個推送引發器 24、起端伺服器 26 及從起端伺服器推送至終端機之內容。最好該終端機能例如依服務下載技術從起端伺服器將內容推送至終端機之前認證推送啟動器、起端伺服器及/或內容。然後，若終端機認證到推送啟動器、起端伺服器及/或內容時，終端機即接收該推送內容，反之終端機即拒收該推送內容。要求終端機作上述之認證且終端機有認證到推送引發器、起端伺服器及/或內容而將內容依服務載入技術推送至終端機，該終端機即能在無終端使用者介入下接收該推

送內容且又能減少終端機接收不法(即非授權的)內容。

現參照第 4 圖，所示為依本發明實施例實行推送內容至終端機 10 下載之方法所用之系統之各元件的控制流程圖。圖示方法係認證推送啟動器 24，但本發明可同樣認證提供資料予終端機之起端伺服器 26 及/或所提供之內容。該方法另包含根據信號(token-based)認證技 術監別推送啟動器。該方法亦可依各種公用或私用鍵技術認證推送啟動器、起端伺服器及/或所提供內容。

如第 4 圖所示，推送內容至終端機 10 下載之方法包含傳送特約請求(subscription request)至推送啟動器 24 而接收一認證票或書證，或稱為公鑰(public key)之終端機。上述特約請求可含任何數之各種適合請求該公鑰之資訊。上述特約請求例如含終端機希望認證推送啟動器使得終端機接收到源自推送啟動器之推送內容之一指示。除上述之指示外，該特約請求能監別一或多個之起端伺服器 26 及/或終端機希望在接收到推送內容前進一步認證之內容。

接收到該特約要求時，推送啟動器 24 即回應而將一公鑰傳送至終端機 10，使該公鑰與該特約要求相結合。然後終端機乃例如在記憶體 42 中儲存該公鑰及該特約要求（例如於終端機授權一個以上之推送啟動器之瞬間）。上述公鑰除與特約要求組合（在推送啟動器及/或終端機）外亦具有一連合（連用）之私鑰。為此，該推送啟動器以隱私但可供終端機使用公鑰（非秘密鑰）之

方式保持該私鑰。如下所述，推送啟動器能使用私鑰數位的簽署傳輸給終端機之資料。終端機乃根據該數位簽章及公鑰認證該資料係源(來)自被授權之推送啟動器。

在推送啟動器 24 傳輸公鑰給終端機 10 後之任何時點，該推送啟動器可依例如 WAP 服務載入架構等一種服務載入架構與終端機連絡以開始將內容發送至終端機。為此，該推送啟動器能依推送存取協定(PAP)將服務載入內容傳送至推送代理/GTW 18，並指示該推送代理/GTW 將該服務載入內容傳輸至終端機 10。但，在推送啟動器傳送服務載入內容至推送代理/GTW 前，該推送啟動器乃例如依習知之任一種技術用私鑰數位的簽章服務載入內容。除了數位簽章外，該服務內容通常含有待終端機接收之內容之一均勻資源識別符(URI)。

由下述可知，在諸多情況，該推送啟動器 24，或另一裝置及伺服器等能控制該推送啟動器之裝置可保持一限制的表列(listing)，包括一或多個之被授權起端伺服器 26 及/或被授權內容，及/或一或多個之被封鎖的起端伺服器及/或被封鎖的內容。在此場合，在推送啟動器將服務載入內容傳送至推送代理/GTW 18 前，及在推送啟動器數位的簽章服務載入內容前，上述之限制的表列可藉推送啟動器或其他裝置、伺服器等核對以保持該限制的表列確保該起端伺服器及/或內容係被授權，及/或該起端伺服器及/或內容是無封鎖。藉核對該限制的表列，該推送啟動器能將服務載入內容傳送至終端機，假如該服

務載入內容，更具體的說，經服務載入內容驗證該起端伺服器及內容與該限制的表列相符時。

在推送啟動器傳送數位的簽署之服務載入內容後，終端機 10 會於接收到該內容時，在無使用者干擾下取出經由 URI 識別之內容。但，在取出內容前，該終端機會再在無使用者干擾下使用服務載入內容驗證該數位簽章而自動的認證服務載入內容。為此，該終端機能使用由推送引發器傳送至終端機之公鑰驗證該數位簽章。藉驗證該數位簽章，終端機即能證明發生於被授權之推送引發器 24 之服務載入內容及能證明服務載入內容確認在一被授權之起端伺服器 26 之被授權內容(authorized content)，假如其在特約要求中有指定。

若是終端機因例如無法驗證具有服務載入內容之數位簽章等而無法確認服務載入內容之場合，該終端機 10 能以各種方式回應。例如，終端機停止與推送代理/ GTW 18 連絡。另外，終端機能通知推送啟動器 24、推送代理/GTW 及/或終端機之使用者有關終端機無法驗證接收到之服務載入內容之事，此種失誤可能歸因於終端機之濫用。

若是終端機藉驗證明具有服務載入內容之數位簽章而成功的證明該服務載入內容，則該終端機能將標示於服務載入內容之內容取出或下載。為此，終端機能根據無線電對話協定(WSP)與方法代理/GTW 20 連絡。更具體的說，終端機能指示方法代理/GTW 要求來自起端伺

服器 26 之 URI 驗證內容或控制存取該驗證內容。上述方法代理/GTW 能根據超文件傳送協定(HTTP)等與起端伺服器連絡以要求該驗證內容。當起端伺服器接到該要求時，即回應而將該認證內容依無線標示語言(WTL)傳送至方法代理/GTW，然後由其將該驗證內容傳送至終端機。

一如於先前技術項中所述，若終端機 10 例如從起端伺服器，通過方法代理/GTW 20 下載大量的內容，需相當多時間，因而終端機在下載處理時有增高遭遇某種錯誤或傳送中斷之可能性。以往，當內容於單一下載通信期間下載時，若在下載程序發生錯誤或傳送中斷時，必須重覆下載程序以完全下載內容。然則，本發明不但可在無終端使用者干擾下推送內容至用戶端且可減少接收不法服務或內容之可能性，甚且能恢復遭受到終端機錯誤及網路錯誤之下載通信。

如上述，本發明之系統可利用方法代理/GTW 20 恢復起端伺服器 26 與終端機 10 間之下載通信。但應知，該系統亦可恢復終端機與伺服器等能與終端機連絡之任何裝置間之下載通信。舉例而言，該系統可恢復終端機與起端伺服器、下載伺服器及數位廣播機 34（參照第 1 圖）間之下載通信。又，應知，若是下載內容含有點對點、單播、多播及廣播內容之任何一者或多者時，該系統能恢復終端機與任何其他裝置間之下載通信。

現說明第 5 圖，此圖表示本發明可取實施例之一之

從起端伺服器 26 下載內容之終端機 10 的操作方塊圖。如圖所示，該終端機如習知之網路瀏覽器(web browser)等能操作應用程式 72，依 HTTP 等接收內容 74。該終端機亦能操作下載代理者(download agent)76 將內容傳送至應用程式 72。為此，該下載代理 76 需能存取內容儲存體 76（如第 3 圖之非揮發性記憶體 42B）及不完整下載內容儲存體 80（如第 3 圖之非揮發性快取記憶體 42A），而此不完整下載內容記憶體之可取實施例為非揮發性記憶體。

如下進一步說明，依本發明之一實施例，係使用改良型開放移動連盟(OMA)通過空氣傳輸(OTA)下載對話來恢復下載(download recovery)。有關 OMA OTA 架構之詳細可參照 Open Mobile Alliance, "Generic Content Download Over the Air", OMA-Download-OTA- vl. 0-20030221-c，此篇論文之內容併入本文中供作參考。

現說明第 6 圖之控制流程圖。本發明之一實施例之下載恢復方法係含有如通過方法代理/GTW 20 等存取（近接）起端伺服器 26 之終端機 10，從該起端伺服器下載內容 74。若希望下載，於終端機近接起端伺服器時，依各種方式認證該終端機至起端伺服器。同時，於終端機近接起端伺服器時，該終端機能使用應用程式 72 存取與伺服器相關連或由伺服器控制之內容而下載內容及鑑別待下載之內容。

為從起端伺服器 26 下載內容 74，應用程式 72 能發

出內容之要求至下載代理者 76，例如發出獲取內容(GetContent)之訊息至下載代理者。然後再由下載代理者將該內容之要求（例如 GetContent 訊息）傳送至起端伺服器。起端伺服器接收到內容要求時能將下載描述符 82 傳送至終端機 10。下載代理者能接收下載描述符，然後將該下載描述符儲存於不完整下載記憶體 80 中。上述下載描述符 82 能含各種方便終端機下載的要求內容之資訊，但在一實施例中該下載描述符含有例如所要求內容之大小及可獲取內容之位置的均一資源描述符(URI)等屬性(attributes)。另外亦可含有關下載要求內容之最佳時間，地點以及方法等資訊。

下載代理者 76 於接到下載描述符 82 後指示起端伺服器 26 取出該要求內容 74，例如將“獲得媒體物件(GetMediaObject)”之指示傳送至下載內容描述符 82 中規定之 URI。從下載代理者接到指示時，起端伺服器即將該要求內容傳送至終端機 10，具體而言，傳送至下載代理者。此時內容以數個內容資料封包 74_1，74_2...74_n 從起端伺服器傳送至下載代理。而下載代理接到各分封時將其分別儲存於不完整記憶體 80 中。如下所述，起端伺服器可橫過單向或雙向網路傳送內容至下載代理者（終端機）。該起端伺服器亦能依上面配合第 4 圖所述之方法與終端機要求，接收或使用公鑰無關係的傳送內容。

在封包之一或多個組群或區塊 84 間進行下載對話時，如第 7 圖所示，可將資訊封包加到封包流中。此時，

下載代理 76 能接收資訊封包而將其分別儲存於例如不完整下載儲存體 80 以便恢復下載。每一資訊封包通常包含有關下載代理在接收繼後的資料封包前被期待接收之封包區塊中之封包數等資訊或有關一或多個循環多餘密碼(cyclic redundancy code, CRC'S)之順序等其他資訊。又，各個資訊封包亦可包含有關下載代理在前資料封包之後應接收之封包區塊中之封包數等資料或有關封包之其他資訊。除了有關在資訊封包之前或後之封包區塊中之封包數之資訊外，每一資料封包可在資訊封包之前或後包含描述該封包之特殊資訊（例如封包排序 CRC'S）以及識別終端機 10、資訊封包、要求內容及/或下載通信之一或多個識別符。

根據使用者資料封協定(UDP)，封包可以與起端伺服器 26 傳送封包不同之排序送達至下載代理者 76。但，通常根據 UDP 等協定之封包係不含有關封包排序或包含要求內容之資料封包總數等資訊。因此，除了在資訊封包之前或後之封包區塊中之封包數 外，每一資訊封包可含有一識別符，用以配合內容的其他資料封包鑑別相關資料封包的佈局。另外每一資料封包可含一表格，用以在各該資料封包之前或後之獨特的識別封包區塊及封包的正確排序。每一封包由個別的資訊封包標記。舉例而言，每一資料封包能含有一包含封包排序(CRC'S)或在個別資料封包前或後之獨特的描述封包區塊之封包資料欄位(data field)之一表格。藉直接或間接的識別資

料封包之排序，下載代理者即能依起端伺服器傳送封包之相同順序將封包排序。

由下面說明可知，封包區塊之每一個可包含相同數之封包，或每一封包區塊之封包數可依不同區塊而改變。由下面說明亦可知，在封包區塊含有相同數之封包之場合，在下載對話開始時資料封包可以，但不需被只傳送一次。此外，雖然起端伺服器 26 能含資料封包區塊間之資料封包，但若是該資訊為包含在資料封包中之資訊，則可加入該資料封包之一或多個之中。進而言之，一如上述，下載代理者 76 能接收並儲存（記憶）每一資料封包以便恢復下載。然而，該下載代理者並不需要將接收到之全部資料封包保持於記憶體中。亦即說，下載代理者能形成為僅將最後接收到之資料封包之一或多個加以記憶儲存。

繼之在下載通信期間，下載代理者 76 能用資料封包監視該接收到之資料封包。具體而言，下載代理者能監視該接收之資料封包確是該接收到之封包及要求內容之封包區塊或部分之數及正確性。於是，接收到之封包及要求內容之封包區塊或部分之數能在下載通信期間之任何一時點與要求內容之封包的識別數作比較。接收到之封包及要求內容之封包區塊或部分的正確性可用例如各個封包之循環多餘密碼(CRC)資料等任何方式確認，同樣的，CRC 或其他任何正確性特性均可含於每一個被傳輸之封包及要求內容之封包區塊或部分中。

假如或當下載通信遭遇阻斷時，下載代理者 76 可藉確認接收到之封包的數及正確性來識別。此種在下載通信期間遭遇阻斷係可依各種方式識別。例如，假如接收到之封包要求內容之封包區塊或部分之總數（此數通常可藉下載識別符 73 及/或一或多個資料封包識別）與下載通信結束（終止）時之總數不相等時，下載通信被視為受阻斷（中斷）。同樣，假如錯誤的接收到之封包數超過下載通信結束時之封包設定數時，下載通訊被視為受阻斷。此封包設定數可依下載通信結束時之下載內容的形式（絕對數或相對）決定。此外，若是終端機 10 之使用者（用戶）結束下載通信，或終端機（例如因電力發生故障等）終斷下載通信時，下載通信亦被視為阻斷。

假設例如在傳送第 3 封包期間等下載要求內容 74 期間發生阻斷，則在阻斷後終端機 10，更明確地說下載代理者 76，能用起端伺服器 26 重建通信，且若希望可實行認知。因此，阻斷信號被傳送至起端伺服器 26。假如阻斷係原因於電力故障或其他終端機無法用起端伺服器重建通信等事故時，則有能恢復下載通信之例如一或數種資訊封包及/或下載描述符 82 等資料留在不完整下載記憶體 80 中供隨後當終端機能重建通信及終端機之使用者希望恢復下載時重建通信。

下載阻斷後，例如因起端伺服器重建通信後，下載代理者能從不完整下載記憶體 80 取得下載描述符 82 及一或多個資訊封包。從儲存於該不完整下載記憶體 80

中之該下載描述符 82 及完整封包之表(list)可確定待下載以滿足所要內容之下載之封包。為此，應用程式（軟體）72 可要求儲存於不完整下載記憶體 80 中之完整封包之表，例如傳送一“取得受阻斷 GetInterrpted DLO”訊息至下載代理者。下載代理者從應用程式 72 接到該要求後，即將該完整封包之表傳送至該應用程式 72。

待確定下載之完成情形（程度）後，下載代理者 76 乃被指示恢復受阻斷之封包及待傳送至終端機 10 完成內容下載之殘留封包(remaining packet)。為此，該應用程式 72 可發出例如恢復下載之訊息等指令給下載代理者，令其恢復受阻斷之封包及下載殘留之封包。隨後，該下載代理者 76 可發出例如恢復下載之訊息等指令給起端伺服器 26。為此，該指令可明示一指定書下載通信期之通信識別符，指定有要求內容之物件識別符，及/或指定受阻斷封包之指定符。又，該指令亦可包括識別終端機之識別符，及/或描述阻斷原因之描述符。

從終端機 10，更明確的說，下載代理者 76 接到指令後，起端伺服器 26 即可把受阻斷的封包以及要求內容 74 之殘留封包傳送至下載代理者。接到該封包後，一如前述，該下載代理者可將該封包儲存於不完整下載記憶體 80 中。然後，於該下載代理者接到所要求內容之全部封包時，該下載代理者能，但不必一定將下載已成功的完畢之訊息傳送至起端伺服器。該下載代理者亦 能將要求內容從不完整下載代理者傳送至內容儲存 78，並將

內容已成功的下載之訊息告知應用程式 72。隨後該應用程式若需要，能用該內容將內容已下載之訊息告知終端機之使用者。

本發明特徵之一為，本發明系統之全部或部分，例如終端機 10，推送啟動器 24，及/或起端伺服器 26，通常係藉由電腦程式產品（例如下載代理者 76）操作。操作本發明方法所用之電腦程式產品含有例如排揮發性記憶媒體等電腦可讀記憶體，及配設於電腦可讀記憶體內之一系列電腦指令等電腦可讀碼。

第 4 及 6 圖所示為本發明方法、系統及程式產品之控制流程圖。該流程圖中之每一控制步驟（示於方塊內）及方塊間之結合可根據電腦程式的指示實行。此電腦程式指令可載入電腦或其他可程式化裝置而產生一機器，使在電腦或其他可程式化裝置上執行之指令建構一執行該控制流程圖之各步驟指定之作用（功能）。這些電腦程式指令亦可儲存於能指導電腦或其他可程式化裝置依指定方式操作之電腦可讀記憶體中，藉此儲存之指令產生含有能依流程圖指定之步驟執行控制之指令裝置(instruction means)。電腦程式指令亦可載入電腦或其他可程式化裝置，使一系列操作步驟得在電腦或其他可程式化裝置中執行而產生一電腦執行程序，使在電腦或其他可程式化裝置執行之指令提供執行該流程圖所定各步驟所定的功能之步驟。

因此，控制流程圖之各步驟支援執行特定功能之手

段（裝置）之組合，執行特定功能之步驟之組合及執行特定功能之程式指令裝置。又，應知控制流程圖之各個步驟及其組合可藉專用硬體電腦系統執行該特定之功能或步驟，或專用硬體及電腦指令之組合完成。

精於此項技術之人可根據上述之說明及附圖對於本發明之實施態樣作多種修飾及變更。但本發明不侷限於所舉之實施例，其修飾及變更亦應涵蓋於本發明之範圍內。另外，本文中所用技術名詞為一般性及描述性之名詞，不以限制為目的。

【圖式簡單說明】

第 1 圖為本發明一實施例之無線通訊系統之示意方塊圖；包含細胞網路及資料網路，其中終端機經由無線 RF 連線雙向聯結於資料網路。

第 2 圖表示依本發明實施例可當作終端機、推送代理/GTW、方法代理/GTW，推送啟動器及/或起端伺服器操作之實體之示意方塊圖。

第 3 圖表示依本發明實施例可當作終端機操作之行動台之示意方塊圖。

第 4 圖表示依本發明實施例根據推送內容之下載方法操作之系統元件之控制流程圖。

第 5 圖表示從起端伺服器下載內容之終端機功能方塊圖。

第 6 圖表示依本發明實施例根據恢復受阻斷下載通信之方法操作之系統元件之控制流程圖。

第 7 圖表示下載內容分割成為一或多個資料封包之數個群或區塊並依本發明實施例在封包流中添加一或多個封包之圖。

【主要元件符號說明】

10	終端機	22	網際網路
24	推送啟動器	26	起端伺服器
30	GGSN 支援節點	36	發報機(TX)
38	數位廣播接收終端機	40	處理機
42	記憶體	42A	快取記憶體

42B	儲存體	44	發送器
46	接收器	48	控制器
50	擴音器	52	電鈴
54	麥克風·微音器	56	顯示器
58	鍵盤	60	高頻收發機
62	紅外線收發機	64	藍芽收發機
68	揮發性記憶體	70	非揮發性記憶體
72	應用程式（應用軟體）		
74	下載內容	76	下載代理者
78	內容儲存體	84	封包區塊

五、中文發明摘要：

提供含有能識別下載內容及具有數位簽章之服務載入內容之終端機之一種下載推送內容所用之系統。該終端機能根據該數位簽章認證該服務載入內容，若是該服務載入內容被認證，則將下載內容取出至終端機。為此，該終端機能認證該服務載入內容及回應接收服務載入內容及不受終端機使用者之干擾下取出該下載內容。

該終端機亦能決定在接收下載內容時是否發生阻斷以致該終端機接收到少於全體之下載內容。若是發生阻斷，該終端機能恢復下載內容使終端機接收該複數之資料封包。

六、英文發明摘要：

A system is provided for downloading pushed content includes a terminal capable of receiving service loading content that identifies download content and has a digital signature. The terminal is capable of authenticating the service loading content based upon the digital signature, and if the service loading content is authenticated, pulling the download content to the terminal. In this regard, the terminal is capable of authenticating the service loading content, and pulling the download content, in response to receiving the service loading content and independent of interaction from a user of the terminal. The terminal can also be capable of determining if an interruption occurs in receiving the download content such that the terminal receives less than the entire download content. And if an interruption occurs, the terminal can be capable of recovering the download content such that the terminal receives the plurality of data packets.

十、申請專利範圍：

1.一種下載推送內容所用之系統；包括：

含有能識別下載內容及具有數位簽章之服務載入內容之處理機的一終端機；其中該處理機能根據該數位簽章認證該服務載入內容，若是該服務載入內容被認證，則將該下載內容取出至終端機，及其中該處理機能認證該服務載入內容及回應接收服務載入內容及不受終端機使用者之干擾下取出該下載內容。

2.如申請專利範圍第 1 項之系統，其中該終端機之處理機係能用公鑰查驗該數位簽章，從而認證該服務載入內容。

3.如申請專利範圍第 2 項之系統，進一步包括：

能用一與該公鑰關連之私鑰數位的簽章該服務載入內容，隨後將該服務載入內容傳送至終端機所用之推送起動器(push initiator)。

4.如申請專利範圍第 1 項之系統，進一步包括：

與該下載內容關連之一起端伺服器，其中該服務載入內容識別與該下載內容關連之起端伺服器；

其中該終端機之處理機能於該服務載入內容被認證時，能將下載內容之要求傳送至起端伺服器，而該處理機能回應該要求接收來自起端伺服器之下載內容。

5.如申請專利範圍第 4 項之系統，其中該終端機之

處理機係能操作下載代理，而該下載代理能接收下載描述符，然後接收該下載內容。

6.如申請專利範圍第 5 項之系統，其中該下載內容包括複數之資料封包，而該下載代理者能決定是否在接收該複數之資料封包時發生阻斷致使下載代理者接收到少於複數之資料封包之下載內容，若是在接收資料封包時發生阻斷，即恢復下載內容，使下載代理者接收到該複數之資料封包。

7.如申請專利範圍第 6 項之系統，其中該下載代理者進一步能決定待由下載代理者接收之至少一個殘留之資料封包，俾完全的接收到該下載內容之複數資料封包，並且能指示該起端伺服器將該至少一個殘留之資料封包送出及接收該至少一個殘留之資料封包，使該下載代理者接收到複數之資料封包。

8.如申請專利範圍第 4 項之系統，其中該下載內容包含複數之資料封包，而該終端機之處理機能操作一能接收複數之資料封包及接收有關該資料封包之至少一個之至少一群之至少一個資訊封包之下載代理者。

9.如申請專利範圍第 8 項之系統；其中該下載代理者係能監測接收到之資料封包並根據至少一個資訊封包決定在接收複數之資料封包時是否發生阻斷以致該下載代理者接收到少於下載內容之該複數資料封包，若是在

接收該複數資料封包時發生阻斷，該下載代理者能恢復下載內容，使下載代理者接收該複數之資料封包。

10.一種下載推送內容至終端機之方法；該方法包括：

於終端機接收服務載入內容，其中該服務載入內容識別下載內容及具有數位簽章；

根據該數位簽章認證該服務載入內容；及

認證服務載入內容後，取出該下載內容至終端機，其中該終端機認證該服務載入內容，並回應接收服務載入內容及不受終端機之使用者之干擾下將該下載內容取出。

11.如申請專利範圍第 10 項之方法；其中該服務載入內容之認證包括用公鑰查驗該數位簽章。

12.如申請專利範圍第 11 項之方法；進一步包括：

利用與該公鑰連用之私鑰數位的簽章該服務載入內容；及

將該服務載入內容傳輸至終端機。

13.如申請專利範圍第 10 項之方法；其中該服務載入內容識別與該下載內容關連之起端伺服器；而該下載內容之取出包括：

於該服務載入內容被認證後，將要求下載內容之信號送至起端伺服器；及

回應該要求，在終端機接收來自起端伺服器之下載內容。

14.如申請專利範圍第 13 項之方法；其中下載內容之接收包括：接收下載描述符，然後接收下載內容。

15.如申請專利範圍第 14 項之方法；其中該下載內容含有複數之資料封包，而其中接收下載內容尚包括：

決定在接收複數之資料封包時，是否發生阻斷以致該終端機接收到少於下載內容之該複數資料封包；及

若是在接收該複數之資料包時發生阻斷，則恢復下載內容使該終端機接收該複數之資料封包。

16.如申請專利範圍第 15 項之方法；其中恢復下載內容包括：

決定待由該終端機接收之至少一個殘留之資料封包，俾完全的接收到下載內容之該複數之資料封包；

指示起端伺服器發出該至少一個殘留封包；及

接收該至少一個殘留封包，使終端機接收到該複數之資料封包。

17.如申請專利範圍第 13 項之方法；其中該下載內

容包含複數之資料封包，而接收下載內容係包括：接收複數之資料封包及接收有關該資料封包之至少一個之至少一群之至少一個資訊封包。

18.如申請專利範圍第 17 項之方法；其中接收複數之資料封包係包括：

監測接收到之資料封包並根據至少一個資訊封包決定在接收複數之資料封包時是否發生阻斷以致該終端機接收到少於下載內容之該複數資料封包；及

若是在接收該複數資料封包時發生阻斷，則恢復下載內容使終端機接收該複數之資料封包。

19.一種下載推送內容至終端機所用之電腦程式產品；該產品含有至少一個在其中儲存有電腦可讀程式碼之電腦可讀儲存媒體，該程式碼包括：

供終端機接收服務載入內容所用之第一可執行程式碼，而該服務載入內容識別下載內容並具有一數位簽章；

根據該數位簽章認證該服務載入內容所用之第二可執行程式碼；及

當該服務載入內容被認證時，取出該下載內容至終端機所用之第三可執行程式碼，其中該第二及第三可執行程式碼係回應接收服務載入內容及不受該終端機之使用者之干擾下，分別實行服務載入內容之認證及取出下載內容。

20.如申請專利範圍第 19 項之電腦程式產品；其中該第二可行程式碼係用公鑰確認該數位簽章，以認證服務載入內容。

21.如申請專利範圍第 20 項之電腦程式產品；進一步包含：

使用與該公鑰關連之私鑰數位的簽署該服務載入內容所用之第四可執行程式碼；及傳輸該服務載入內容至終端機所用之第五可執行程式碼。

22.如申請專利範圍第 19 項之電腦程式產品；其中該服務載入內容識別與該下載內容關連之一起端伺服器，而該第三可執行程式碼乃於該服務載入內容被認證時，將下載內容之要求傳送至該起端伺服器，然後應該要求而於該終端機接收來自該起端伺服器之下載內容。

23.如申請專利範圍第 22 項之電腦程式產品；其中該第三可執行程式碼係用以接收下載描述符。

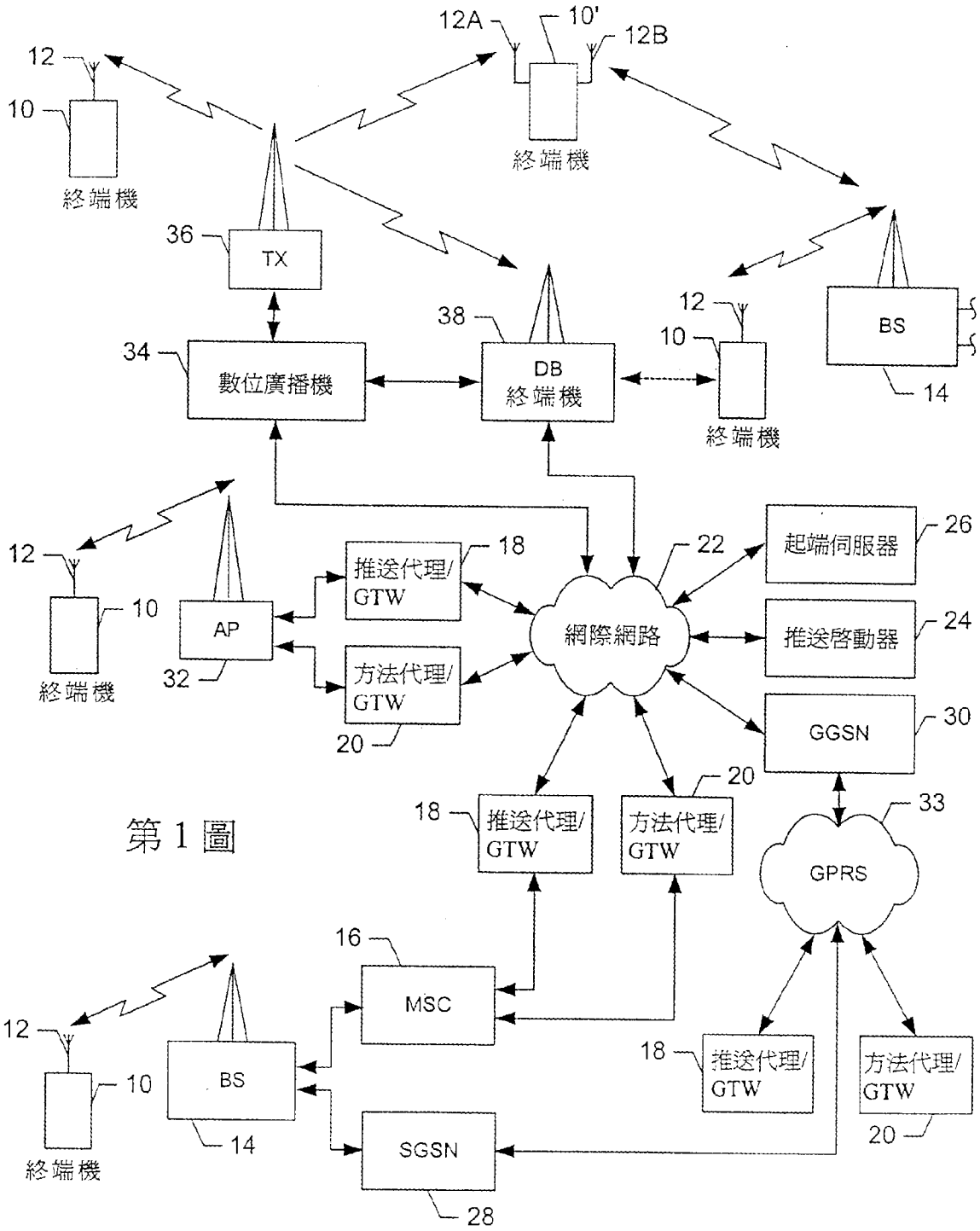
24.如申請專利範圍第 23 項之電腦程式產品；其中該下載內容含複數之資料封包，而該第三可執行程式碼更能用以決定在接收該複數之資料封包時是否發生阻斷以致該終端機接收到少於下載內容之該資料封包；及若

是在接收該複數之資料封包時發生阻斷，則恢復下載內容使該終端機接收該複數之資料封包。

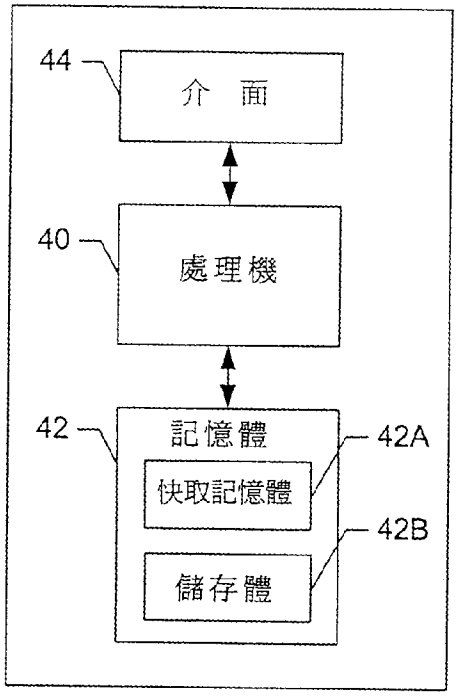
25.如申請專利範圍第 24 項之電腦程式產品；其中該第三可執行程式碼係用以藉由決定待由終端機接收之至少一個殘留之資料封包恢復下載內容以完成該下載內容之複數之資料封包之接收；指令該起端伺服器傳送該殘留資料封包之至少一個；及接收該殘留資料封包之至少一個，使該終端機接收該複數之資料封包。

26.如申請專利範圍第 22 項之電腦程式產品；其中該下載內容含有複數之資料封包，其中該第三可執行程式碼係用以接收該複數之資料封包及接收有關該資料封包之至少一個之至少一群之至少一個資訊封包。

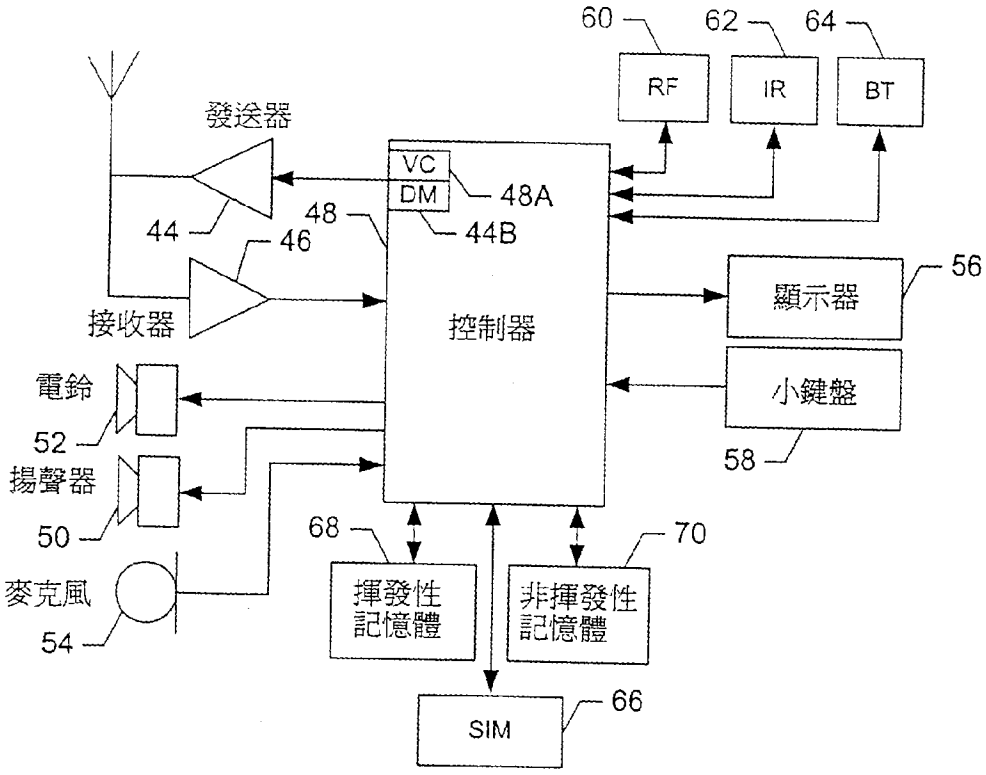
27.如申請專利範圍第 26 項之電腦程式產品；其中該第三可執行程式碼係更用以根據資訊封包之至少一個監別該接收到之資料封包決定在接收該複數之資料封時，是否發生阻斷以致該終端機接收到少於下載內容之該複數資料封包，及若是在接收該複數之資訊封包時發生阻斷，該第三可執行程式碼乃用以恢復下載內容使該終端機接收該複數之資料封包。


12
10
終端機
12A
10'
12B
終端機
36
TX
38
DB
終端機
12
10
終端機
BS
14
34
數位廣播機
12
10
終端機
32
AP
推送代理/
GTW
18
方法代理/
GTW
20
網際網路
22
起端伺服器
26
推送啓動器
24
GGSN
30
18
推送代理/
GTW
20
方法代理/
GTW
33
GPRS
16
MSC
12
10
終端機
BS
14
SGSN
28
18
推送代理/
GTW
方法代理/
GTW
20

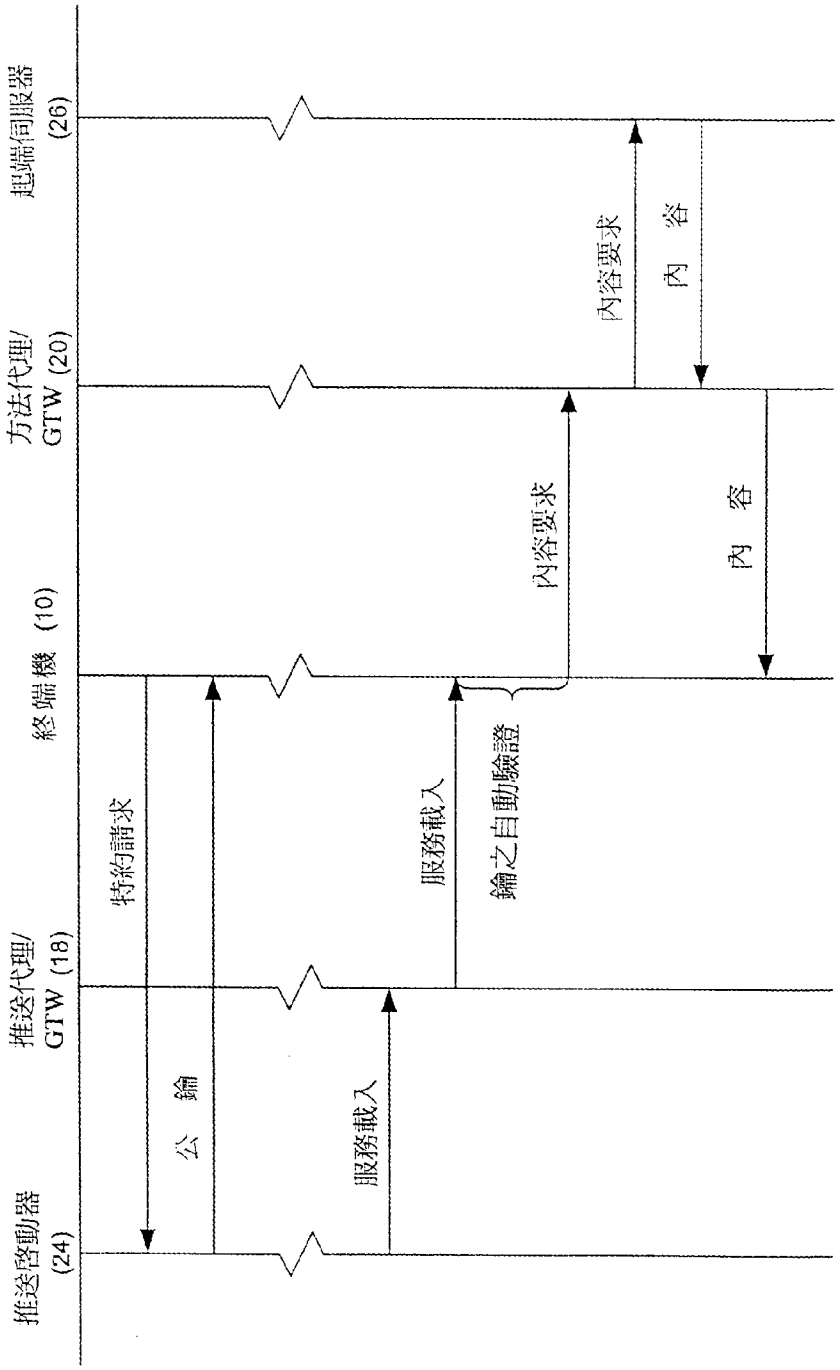
第 1 圖



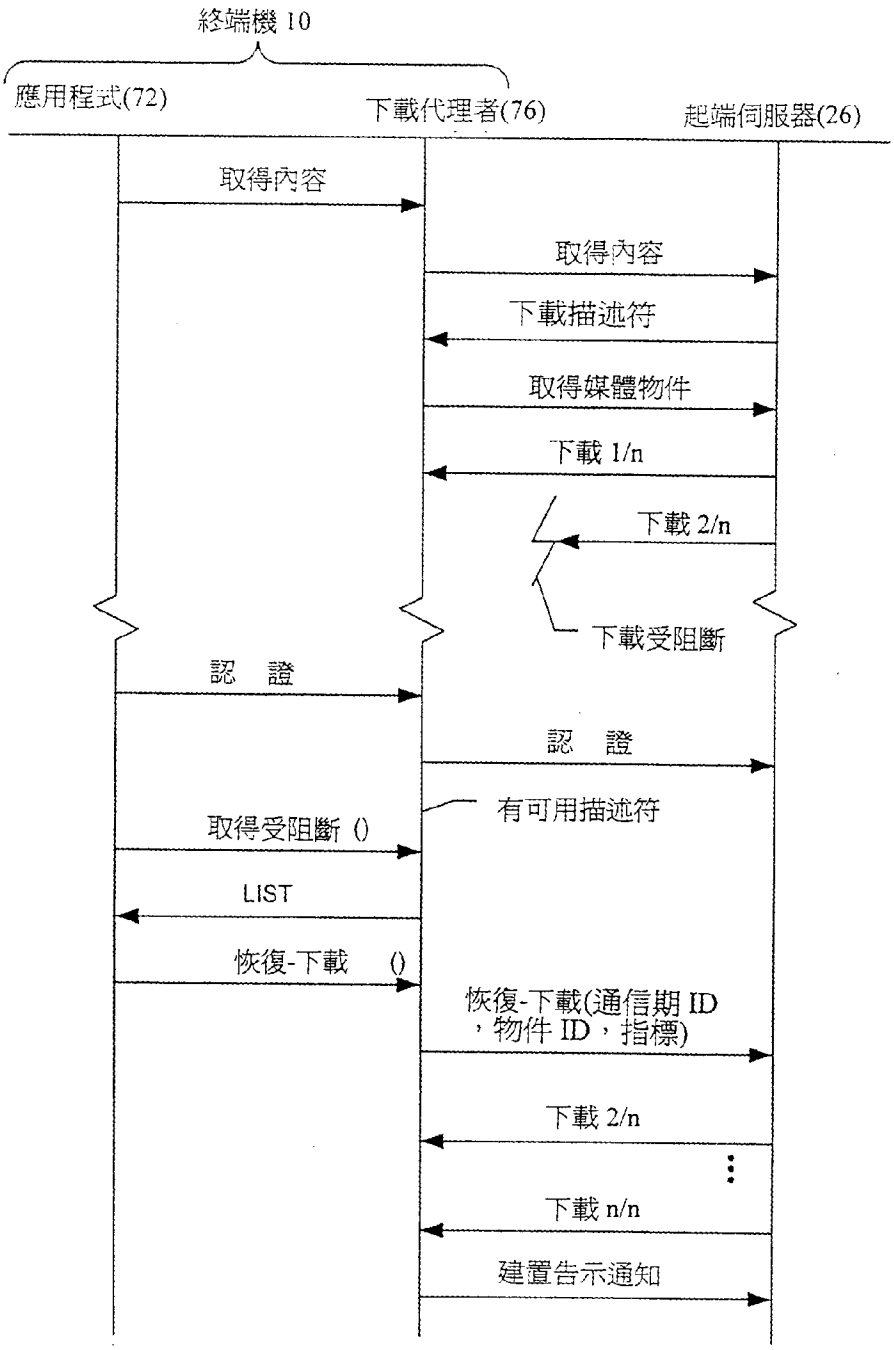
第 2 圖


60
62
64
RF
IR
BT
發送器
VC
DM
48A
48
44B
44
46
接收器
控制器
顯示器
56
電鈴
小鍵盤
52
揚聲器
58
50
68
70
麥克風
揮發性
記憶體
非揮發性
記憶體
54
SIM
66

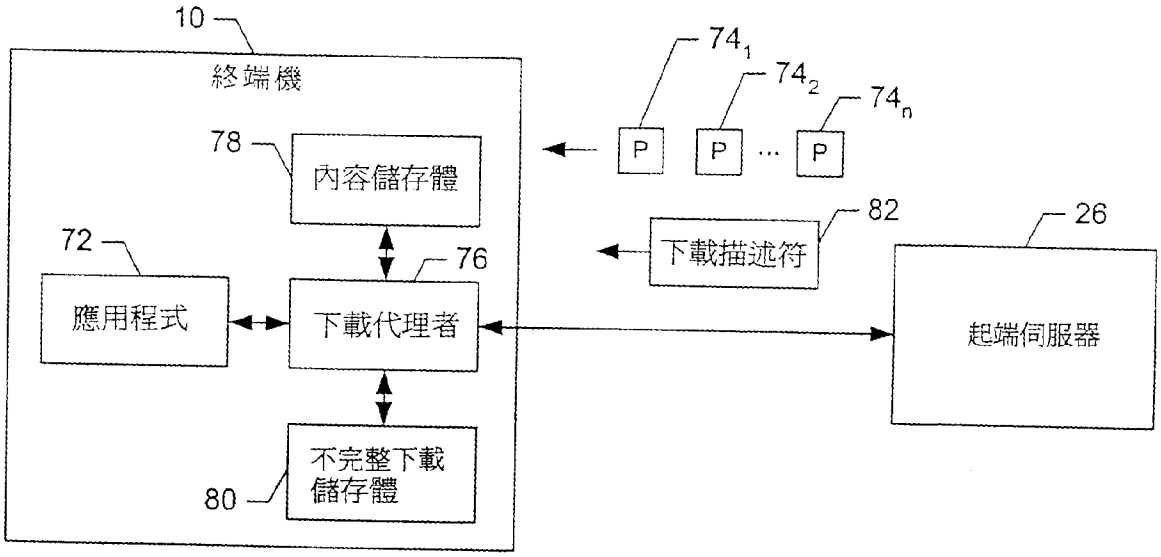
第 3 圖


推送啓動器 (24)
推送代理/ GTW (18)
終端機 (10)
方法代理/ GTW (20)
起端伺服器 (26)
特約請求
公 鑰
服務載入
服務載入
鑰之自動驗證
內容要求
內 容
內容要求
內 容

第 4 圖


終端機 10
應用程式(72)
下載代理者(76)
起端伺服器(26)
取得內容
取得內容
下載描述符
取得媒體物件
下載 1/n
下載 2/n
下載受阻斷
認　證
認　證
有可用描述符
取得受阻斷 ()
LIST
恢復-下載　()
恢復-下載(通信期 ID，物件 ID，指標)
下載 2/n
下載 n/n
建置告示通知

第 6 圖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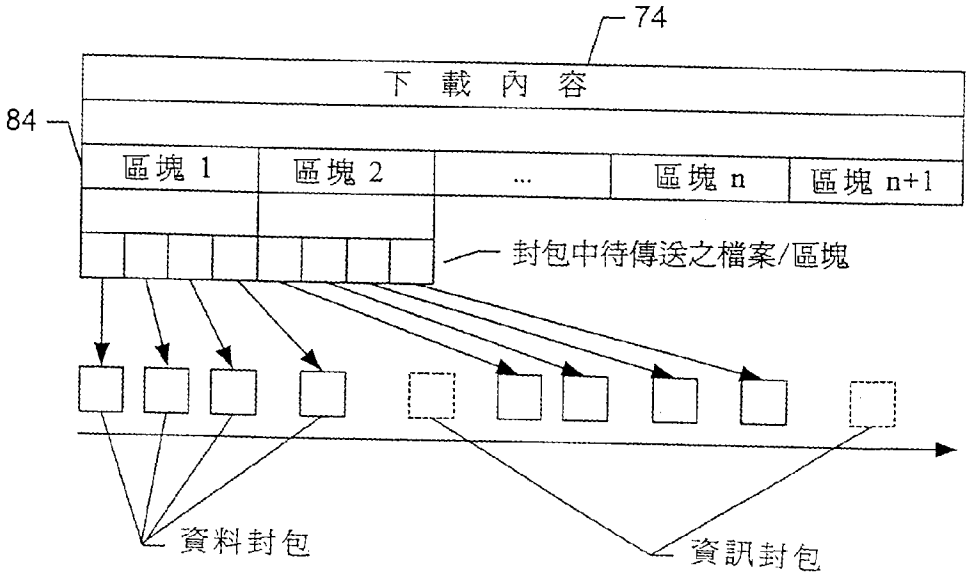
終端機
78
內容儲存體
72
應用程式
76
下載代理者
80
不完整下載
儲存體
74₁
74₂
74n
P
P
P
82
下載描述符
26
起端伺服器

第 5 圖


74
下 載 內 容
84
區塊 1
區塊 2
...
區塊 n
區塊 n+1
封包中待傳送之檔案/區塊
資料封包
資訊封包

第 7 圖

七、指定代表圖：

(一)本案指定代表圖為：第（ 1 ）圖。

(二)本代表圖之元件符號簡單說明:

10	終端機	12	天線
14	基地台	18	推送代理/GTW
20	方法代理/GTW	22	網際網路
24	推送啟動器	26	起端伺服器
30	GGSN 支援節點	32	無線接取點(AP)
34	數位廣播機	36	發報機(TX)
38	數位廣播接收終端機		

八、本案若有化學式時，請揭示最能顯示發明特徵的化學式：

Electronic Patent Application Fee Transmittal

Application Number:	12159841
Filing Date:	22-Oct-2008
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Filer:	David Gerard Majdali/Neeti Rajput
Attorney Docket Number:	2101-3515

Filed as Large Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt

EFS ID:	11827824
Application Number:	12159841
International Application Number:	
Confirmation Number:	3203
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Customer Number:	35884
Filer:	David Gerard Majdali/Neeti Rajput
Filer Authorized By:	David Gerard Majdali
Attorney Docket Number:	2101-3515
Receipt Date:	12-JAN-2012
Filing Date:	22-OCT-2008
Time Stamp:	22:01:13
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	7036
Deposit Account	502290
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	2101-3515_11112_IDSform.pdf	612421 42e68da85e72c29d41a40573758a22be3682e6c1	no	4
Warnings:					
Information:					
A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.					
2	Foreign Reference	TW548916.pdf	319635 d799f795abf6c1124c9cc1593186ea9bb52b3fbe	no	5
Warnings:					
Information:					
3	Foreign Reference	TWI253824.pdf	11089934 a7deba5d87955324e6cd1c9dab041fe3be4d9e03	no	50
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Information:					
4	Non Patent Literature	3GPP.pdf	805843 69ffd70667cca9e642c22a9a0158078c8758c52f	no	59
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Information:					
		Total Files Size (in bytes):	12858526		

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young-Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20040248600		2004-12-09	Kim	

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FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young-Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

	1		☐

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young-Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/David Majdali/	Date (YYYY-MM-DD)	2012-01-10
Name/Print	David Majdali	Registration Number	53,257

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	12159841
Filing Date:	22-Oct-2008
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Filer:	David Gerard Majdali/Neeti Rajput
Attorney Docket Number:	2101-3515

Filed as Large Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt

EFS ID:	11805948
Application Number:	12159841
International Application Number:	
Confirmation Number:	3203
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Customer Number:	35884
Filer:	David Gerard Majdali/Neeti Rajput
Filer Authorized By:	David Gerard Majdali
Attorney Docket Number:	2101-3515
Receipt Date:	10-JAN-2012
Filing Date:	22-OCT-2008
Time Stamp:	22:36:32
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	6947
Deposit Account	502290
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	2101-3515_10412_IDSform.pdf	612175 3c3e55dd9c226065708f446102857f46c19c4497	no	4
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30693 d60299870e000e8fa30299ea2fbc9d2faaedb695	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	642868		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/159,841	10/22/2008	Young Dae Lee	2101-3515	3203

35884 7590 01/04/2012

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

EXAMINER	
CHO, UN C	

ART UNIT	PAPER NUMBER
2617	

NOTIFICATION DATE	DELIVERY MODE
01/04/2012	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

uspto@lhlaw.com
ip.lhlaw@gmail.com
ip.lhlaw@live.com

UNITED STATES DEPARTMENT OF COMMERCE
U.S. Patent and Trademark Office
Address : COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450

APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
12/159,841	22 October, 2008	LEE ET AL.	2101-3515

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Suite 2300
LOS ANGELES, CA 90017

EXAMINER	
UN C. CHO	
ART UNIT	PAPER
2617	12292011

DATE MAILED:

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner for Patents

The IDS submitted on 12/27/2011 has been placed in record and considered by the examiner.

/UN C. CHO/
Primary Examiner, Art Unit 2617

PTO-90C (Rev.04-03)

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	Cho, Un C
Attorney Docket Number	2101-3515

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6791963		2004-09-14	Hwang, et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /U.C./

Receipt date: 12/27/2011	Application Number	12159841 12159841 - GAU: 2617
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	Cho, Un C
	Attorney Docket Number	2101-3515

	1		☐

If you wish to add additional non-patent literature document citation information please click the Add button **Add**

EXAMINER SIGNATURE

Examiner Signature	/Un Cho/	Date Considered	12/29/2011

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /U.C./

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

35884 7590 12/29/2011

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

EXAMINER
CHO, UN C

ART UNIT	PAPER NUMBER
2617	

DATE MAILED: 12/29/2011

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/159,841	10/22/2008	Young Dae Lee	2101-3515	3203

TITLE OF INVENTION: METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1740	$300	$0	$2040	03/29/2012

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

35884 7590 12/29/2011

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/159,841	10/22/2008	Young Dae Lee	2101-3515	3203

TITLE OF INVENTION: METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1740	$300	$0	$2040	03/29/2012

EXAMINER	ART UNIT	CLASS-SUBCLASS
CHO, UN C	2617	455-458000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:

❑ Issue Fee

❑ Publication Fee (No small entity discount permitted)

❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

❑ A check is enclosed.

❑ Payment by credit card. Form PTO-2038 is attached.

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

❑ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

❑ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

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United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/159,841	10/22/2008	Young Dae Lee	2101-3515	3203

35884 7590 12/29/2011

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

EXAMINER	
CHO, UN C	

ART UNIT	PAPER NUMBER
2617	

DATE MAILED: 12/29/2011

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 563 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 563 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No.	Applicant(s)	
	12/159,841	LEE ET AL.	
	Examiner	Art Unit	
	UN C. CHO	2617	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *12/12/2011*.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are *1-11 and 13-15*.

4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☒ All b) ☐ Some* c) ☐ None of the:
      1. ☒ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 12/12/2011
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

/UN C. CHO/
Primary Examiner, Art Unit 2617

Information Disclosure Statement

1. The information disclosure statement (IDS) submitted on 12/12/2011 has been placed in record and considered by the examiner.

Allowable Subject Matter

2. Claims 1 – 11 and 13 – 15 are allowed.

The following is an examiner's statement of reasons for allowance:

Applicant's claims are allowed for the reasons recited by applicant in the amendment filed on 8/24/2011.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to UN C. CHO whose telephone number is (571)272-7919. The examiner can normally be reached on 9:00AM - 6:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, George Eng can be reached on 571-272-7495. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/UN C. CHO/
Primary Examiner, Art Unit 2617

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /U.C./

Receipt date: 12/12/2011	Application Number	12159841	12159841 - GAU: 2617
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2008-10-22	
	First Named Inventor	Young Dae Lee	
	Art Unit	2617	
	Examiner Name	CHO, UN C	
	Attorney Docket Number	2101-3515	

	1	IPWireless, "Layer 2 functions for LTE," R2-052377, 3GPP TSG RAN WG2 #48bis, October 2005.	☐
	2	LG Electronics Inc., "MAC Architecture of LTE," R2-060105, 3GPP TSG-RAN WG2 #50, January 2006.	☐
	3	LG Electronics Inc., "HARQ and ARQ Operation," R2-060563, 3GPP TSG-RAN WG2 #51, February 2006.	☐
	4	LG Electronics Inc., "Discussion on RLC PDU Structure," R2-070721, 3GPP TSG-RAN WG2 #57, February 2007.	☐

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EXAMINER SIGNATURE

Examiner Signature	/Un Cho/	Date Considered	12/17/2011

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /U.C./

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
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L42	870296	L40 and L38	US-PGPUB; USPAT	OR	OFF	2011/12/19 04:21
L43	594457	L40 and L39	US-PGPUB; USPAT	OR	OFF	2011/12/19 04:21
L44	424	PICH same PCH	US-PGPUB; USPAT	OR	OFF	2011/12/19 04:21
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EAST Search History (Interference)

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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12159841	LEE, YOUNG DAE
	Examiner	Art Unit
	UN C CHO	2617

SEARCHED

Class	Subclass	Date	Examiner
455	458,447,450,515	7/18/2011	UC

SEARCH NOTES

Search Notes	Date	Examiner
East Search including keywords, class/subclass, inventor, assignee	7/18/2011	UC
Updated East Search including inventor, assignee, claim language	9/6/2011	UC
Updated East Search including inventor, assignee, claim language	12/19/2011	UC

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner
See Search Report		9/6/2011	UC
See Search Report		12/19/2011	UC

	/UN C CHO/ Primary Examiner.Art Unit 2617

Issue Classification

Application/Control No.	Applicant(s)/Patent Under Reexamination
12159841	LEE, YOUNG DAE
Examiner	**Art Unit**
UN C CHO	2617

ORIGINAL		INTERNATIONAL CLASSIFICATION									
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED				
455	458	H	0	4	W	68 / 00 (2009.01.01)	H	0	4	B	7 / 00 (2006.01.01)
CROSS REFERENCE(S)		H	0	4	W	72 / 00 (2009.01.01)					

CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
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☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☒ T.D. ☐ R.1.47

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(Assistant Examiner)	(Date)	Total Claims Allowed: 14	
/UN C CHO/ Primary Examiner.Art Unit 2617	12/19/2011	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	5

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12159841	LEE, YOUNG DAE
	Examiner	**Art Unit**
	UN C CHO	2617

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☒ T.D. ☐ R.1.47

CLAIM		DATE								
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PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	Cho, Un C
Attorney Docket Number	2101-3515

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6791963		2004-09-14	Hwang, et al.	

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	Cho, Un C
	Attorney Docket Number	2101-3515

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EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	Cho, Un C
	Attorney Docket Number	2101-3515

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/David G. Majdali/	Date (YYYY-MM-DD)	2011-12-27
Name/Print	David G. Majdali	Registration Number	53,257

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	11714617
Application Number:	12159841
International Application Number:	
Confirmation Number:	3203
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Customer Number:	35884
Filer:	David Gerard Majdali/Diana Kim
Filer Authorized By:	David Gerard Majdali
Attorney Docket Number:	2101-3515
Receipt Date:	27-DEC-2011
Filing Date:	22-OCT-2008
Time Stamp:	19:53:49
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	2101-3515_122611_IDSForm.pdf	612223 49e4b1372dfc5d87ba4e36ee5945d14753f67286	no	4

Warnings:	
Information:	

Total Files Size (in bytes):	612223

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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PTO/SB/08a (01-10)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

	1	IPWireless, "Layer 2 functions for LTE," R2-052377, 3GPP TSG RAN WG2 #48bis, October 2005.	☐
	2	LG Electronics Inc., "MAC Architecture of LTE," R2-060105, 3GPP TSG-RAN WG2 #50, January 2006.	☐
	3	LG Electronics Inc., "HARQ and ARQ Operation," R2-060563, 3GPP TSG-RAN WG2 #51, February 2006.	☐
	4	LG Electronics Inc., "Discussion on RLC PDU Structure," R2-070721, 3GPP TSG-RAN WG2 #57, February 2007.	☐

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EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/David Majdali/	Date (YYYY-MM-DD)	2011-12-12
Name/Print	David Majdali	Registration Number	53,257

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Doc code: RCEX
Doc description: Request for Continued Examination (RCE)

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REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	12/159,841	Filing Date	2008-10-22	Docket Number (if applicable)	2101-3515	Art Unit	2617
First Named Inventor	Young Dae Lee			Examiner Name	CHO, UN C		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ☐ Other _____

☒ Enclosed

- ☐ Amendment/Reply
- ☒ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____ (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

☒ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 502290

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

☐ Applicant Signature

PTO/SB/30EFS (07-09)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Signature of Registered U.S. Patent Practitioner			
Signature	/David Majdali/	Date (YYYY-MM-DD)	2011-12-12
Name	David Majdali	Registration Number	53257

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If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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Electronic Patent Application Fee Transmittal

Application Number:	12159841
Filing Date:	22-Oct-2008
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Filer:	David Gerard Majdali/Neeti Rajput
Attorney Docket Number:	2101-3515

Filed as Large Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Request for continued examination	1801	1	930	930
		Total in USD ($)		**930**

Electronic Acknowledgement Receipt

EFS ID:	11594123
Application Number:	12159841
International Application Number:	
Confirmation Number:	3203
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Customer Number:	35884
Filer:	David Gerard Majdali/Neeti Rajput
Filer Authorized By:	David Gerard Majdali
Attorney Docket Number:	2101-3515
Receipt Date:	12-DEC-2011
Filing Date:	22-OCT-2008
Time Stamp:	14:48:28
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$930
RAM confirmation Number	1206
Deposit Account	502290
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	2101-3515_120611_IDSform.pdf	612508 89d13b1b72964532dc835ca3bc70c97be649e88b	no	4
Warnings:					
Information:					
A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.					
2	Request for Continued Examination (RCE)	2101-3515_RCE.pdf	697892 1dd5e928967c3803860ea7f28ba3b10cf369502a	no	3
Warnings:					
Information:					
3	Non Patent Literature	R2-052377.pdf	73596 e36565d04752d51c22dd0cbfe8ade53d1efd8ad5	no	7
Warnings:					
Information:					
4	Non Patent Literature	R2-060105.pdf	88158 78b2c319c24fd2ee0bd4bfdf28bcb85dc0171466	no	4
Warnings:					
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5	Non Patent Literature	R2-060563.pdf	107792 181040d8ac0a90475f6b628b9fbc6256e33eadfd	no	4
Warnings:					
Information:					
6	Non Patent Literature	R2-070721.pdf	51413 c6f2f933dc7c7564152a7e66569e609649878bbb	no	3
Warnings:					
Information:					
7	Fee Worksheet (SB06)	fee-info.pdf	30646 0b324a403a012c606567fd5e72d50163c3c9890c	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1662005		

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/159,841	10/22/2008	Young Dae Lee	2101-3515	3203

35884 7590 12/09/2011

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

EXAMINER	
CHO, UN C	

ART UNIT	PAPER NUMBER
2617	

NOTIFICATION DATE	DELIVERY MODE
12/09/2011	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
12/159,841	22 October, 2008	LEE ET AL.	2101-3515

		EXAMINER	
LEE, HONG, DEGERMAN, KANG & WAIMEY 660 S. FIGUEROA STREET Suite 2300 LOS ANGELES, CA 90017		UN C. CHO	
		ART UNIT	PAPER
		2617	12052011

DATE MAILED:

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner for Patents

The IDSs filed on 12/1/2011 have been placed in record and considered by the examiner.

/UN C. CHO/
Primary Examiner, Art Unit 2617

PTO-90C (Rev.04-03)

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	Cho, Un C.
Attorney Docket Number	2101-3515

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20080069031		2008-03-20	Zhang, et al.	
	2	20050063336		2005-03-24	Kim, et al.	
	3	20020131375		2002-09-19	Vogel, et al.	
	4	20060002367		2006-01-05	Lee, et al.	

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Receipt date: 12/01/2011	Application Number	12159841	12159841 - GAU: 2617
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2008-10-22	
	First Named Inventor	Young Dae Lee	
	Art Unit	2617	
	Examiner Name	Cho, Un C.	
	Attorney Docket Number	2101-3515	

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Examiner Signature	/Un Cho/	Date Considered	12/05/2011

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	1692661	CN		2005-11-02	Matsushita Electric Ind Co., Ltd.		☐
	2	06-121001	JP		1994-04-28	Matsushita Electric Ind Co., Ltd.		☐

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Receipt date: 12/01/2011	Application Number	12159841 12159841 - GAU: 2617
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2008-10-22
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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1		☐

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Examiner Signature	/Un Cho/	Date Considered	12/05/2011

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PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20080069031		2008-03-20	Zhang, et al.	
	2	20050063336		2005-03-24	Kim, et al.	
	3	20020131375		2002-09-19	Vogel, et al.	
	4	20060002367		2006-01-05	Lee, et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] ¡	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]

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	First Named Inventor	Young Dae Lee
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	1							☐

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	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	Cho, Un C.
	Attorney Docket Number	2101-3515

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Harry S. Lee/	Date (YYYY-MM-DD)	2011-12-01
Name/Print	Harry S. Lee	Registration Number	56,814

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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

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Bibliographic data: CN 1692661 (A)

Method for cell modification in mobile communication system

Publication date:	2005-11-02
Inventor(s):	DRAGAN PETROVIC [JP]; EIKO SEIDEL [JP] +
Applicant(s):	MATSUSHITA ELECTRIC IND CO LTD [JP] +
Classification:	- **international:** ***H04L12/56; H04W28/26; H04W36/12; H04W28/10; H04W36/00; H04W72/04; H04W84/04;*** (IPC1-7): H04Q7/22 - **European:** H04Q7/38H8; H04W28/26; H04W36/12
Application number:	CN20038100545 20031222
Priority number (s):	EP20020028631 20021220
Also published as:	• EP 1432262 (A1) • AU 2003292739 (A1) • US 2005207374 (A1) • WO 2004057887 (A1)

Abstract not available for CN 1692661 (A)

Abstract of corresponding document: EP 1432262 (A1)

A cellular system is provided that comprises a mobile station, a first base station in a source cell, a first radio network controller for controlling the first base station, a second base station in a target cel, and a second radio network controller for controlling the second base station. The first radio network controller and/or the first base station comprise a flow control unit and a function for determining that a cell change is to be performed. The cell change is for transferring the radio link of the mobile station from the source cell to the target cell. The flow control unit is adapted to block capacity assignments for data transmissions from the first radio network controller to the first base station before a network connection to the target cell is established. The technique is particularly applicable to UMTS systems.

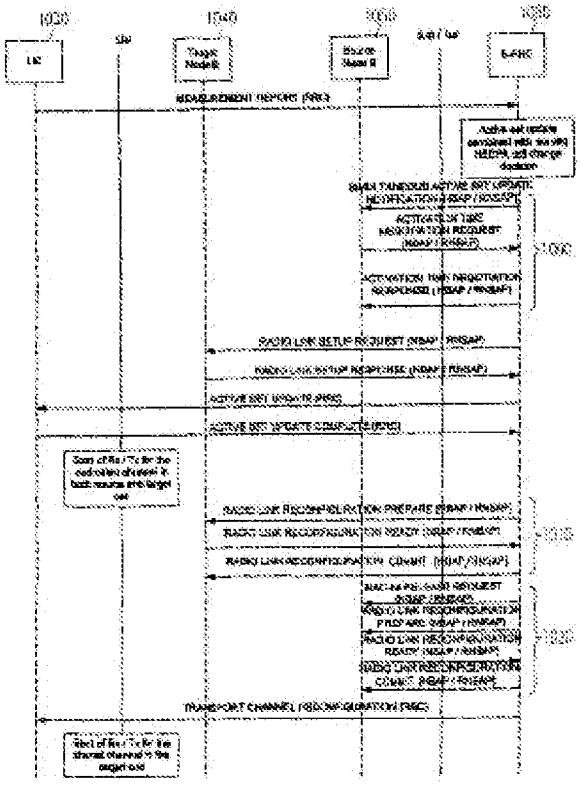

Fig.10

[19] 中华人民共和国国家知识产权局

[51] Int. Cl.[7]
H04Q 7/22

[12] 发明专利申请公开说明书

[21] 申请号 200380100545.X

[43] 公开日 2005 年 11 月 2 日

[11] 公开号 CN 1692661A

[22] 申请日 2003.12.22
[21] 申请号 200380100545.X
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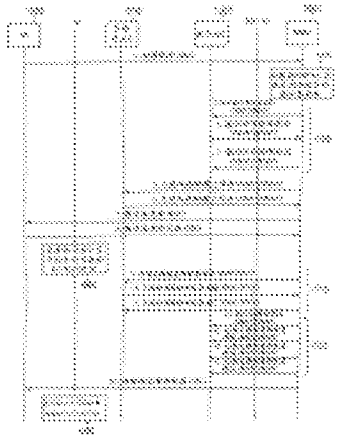
[87] 国际公布 WO2004/057887 日 2004.7.8
[85] 进入国家阶段日期 2004.12.20
[71] 申请人 松下电器产业株式会社
地址 日本大阪府
[72] 发明人 德雷甘·波得罗维克 艾科·塞德尔
[74] 专利代理机构 北京市柳沈律师事务所
代理人 邸万奎 黄小临

权利要求书 3 页 说明书 19 页 附图 11 页

[54] 发明名称 移动通信系统中的小区更改方法

[57] 摘要

S－RNC(1060)根据接收的测量报告消息而判断无线电链路添加以及与此结合的负责 HS－DSCH 小区更改的必要性，并决定开始激活集更新和小区更改处理(处理 1070)。此后，将指示已决定激活集更新的消息立即发到源基站(源节点 B)(1050)(信令 2)。源基站(1050)发送激活时间协商请求消息(信令 3)到 S－RNC(1060)。S－RNC(1060)发送激活时间协商响应消息(信令 4)到源基站(1050)。由此，源基站(1050)可以知道该激活时间，并停止对于向移动台(1030)的数据发送的容量分配，并通过相对于其它移动台增加优先权而发送缓冲器中的分组到移动台(1030)。



ISSN 1007-2747

1. 一种小区改变方法，用于在第一和第二基站受无线电网络控制站控制的蜂窝式系统中将移动台的无线电链路从第一基站控制的源小区改变到第二基站控制的目标小区，其中第一和第二基站和/或无线电网络控制站执行无线电资源管理和流控制，所述小区改变方法包括以下步骤：

确定将执行移动台的无线电链路的小区改变；和

在建立到目标小区的无线电链路之前，阻止对第一基站用于向移动台的数据发送的容量分配。

2. 根据权利要求1的小区改变方法，其中在无线电网络控制站执行流控制的蜂窝式系统中，该无线电网络控制站通过停止向第一基站发出容量请求消息，而阻止对第一基站的容量分配。

3. 根据权利要求1的小区改变方法，其中在第一基站执行无线电资源管理和流控制的蜂窝式系统中，通过第一基站响应于与该移动台相关的容量请求消息而停止向该无线电网络控制站发出容量许可消息，而阻止对第一基站的容量分配。

4. 根据权利要求1的小区改变方法，其中当阻止对第一基站的容量分配时，使得待初始发送/重发的移动台的数据的优先权高于调度中的其它移动台的优先权。

5. 根据权利要求1的小区改变方法，其中该资源管理处理还包括：

当该无线电网络控制站更新与该移动台相关的无线电链路的激活集的更新处理与移动台的无线电链路的小区改变处理同步时，与确定执行小区改变同时地确定执行更新处理的步骤；

将更新通知消息从第一无线电网络控制站发送到第一基站的步骤，该更新通知消息指示与更新处理同时地执行小区改变；和

将时间通知消息从第一无线电网络控制站发送到第一基站的步骤，该时间通知消息指示激活更新处理和小区改变的激活时间。

6. 根据权利要求5的小区改变方法，还包括以下步骤：在第一基站和无线电网络控制站中决定执行小区改变处理的定时，其中所述决定步骤包括：

在接收了用于协商不同激活时间的时间通知消息之后，从第一基站向无线电网络控制站发送消息的步骤；和

响应于所述消息从无线电网络控制站向第一基站发送消息的步骤。

7. 根据权利要求 1 的小区改变方法，其中该资源管理处理还包括：

当该无线电网络控制站和/或第一基站更新与该移动台相关的无线电链路的激活集的更新处理与移动台的无线电链路的小区改变处理不同步时，确定是否在该无线电网络控制基站执行更新处理的步骤；和

当确定将执行更新处理时，确定第一基站执行小区改变处理的步骤。

8. 根据权利要求 7 的小区改变方法，其中确定将执行小区改变处理的步骤包括以下步骤：在第一基站中监视共享信道的质量、关联专用物理信道中使用的发送功率或功率控制命令。

9. 根据权利要求 7 的小区改变方法，还包括在第一基站中决定执行小区改变处理的定时的步骤，其中所述决定步骤包括以下步骤：

在第一基站中确定激活小区改变的激活时间；和

从第一基站向第一无线电网络控制站发送指示该激活时间的时间通知消息。

10. 根据权利要求 7 的小区改变方法，还包括在第一无线电网络控制站和/或第一基站中决定执行小区改变过程的定时的步骤，其中所述决定步骤包括以下步骤：

在无线电网络控制站中确定激活该更新处理的激活时间；

从无线电网络控制站向第一基站发送指示该激活时间的时间通知消息；和

从第一基站向无线电网络控制站发送消息，并从无线电网络控制站向第一基站发送消息，用于协商不同的激活时间。

11. 根据权利要求 1 的小区改变方法，其中所述蜂窝式系统是 UMTS 系统，第一和第二基站以及无线电网络控制站包括在 UTRAN 中，而所述流控制处理是 HS-DSCH FP 的功能。

12. 根据权利要求 11 的小区改变方法，其中，当阻止对第一基站的容量分配时，第一基站使得待初始发送/重发的移动台的数据的优先权高于在 MAC-hs 子层中调度的其它移动台的数据的优先权。

13. 根据权利要求 11 或权利要求 12 的小区改变方法，其中，该无线电网络控制站和第一基站交换 NBAP/RNSAP 协议中的控制平面信令消息，以执行激活时间协商。

14. 一种蜂窝式系统，包括：

移动台；

源小区中的第一基站；

目标小区中的第二基站；

用于控制该第一和第二基站的无线电网络控制站；

其中该无线电网络控制站和/或第一基站包括用于确定将执行小区改变的流控制单元和无线电资源管理功能，所述小区改变用于从源小区向目标小区转移移动台的无线电链路，其中该流控制单元适配为在建立到目标小区的无线电链路之前，阻止对第一基站用于向移动台的数据发送的容量分配。

移动通信系统中的小区更改方法

技术领域

本发明涉及能应用于移动通信系统尤其是蜂窝式系统的无线电资源管理中的一种小区变换方法。

背景技术

一种用于通信系统中非实时服务的误差检测的通用技术是可与前向纠错(FEC)合并的自动重复请求(ARQ)方案。在 ARQ 中，如果通过循环冗余校验(CRC)在 PDU(协议数据单元)中检测到误差，则接收机请求发射机发出附加位。在移动通信中，在现有 ARQ 方案中，最经常地使用 SAW(停止并等待)方案和 SR(选择性重复)方案。SAW 是这样一种方案，其中发射机发出 PDU，并在确认某一时间周期内没有来自接收机的重复请求之后，发送下一 PDU。SR 方案是这样一种方案，其中为 PDU 分配序列号，并根据与从接收机返回的序列号对应的重复请求(ACK/NACK)的存在/不存在而仅对需要重发的 PDU 执行重发。

在发射机发送前，PDU 被编码。现在已研究一种通过合并使用编码和 ARQ 而实现更有效的误差控制的方案。它们被称作混合自动重复请求(HARQ)，并大致分为下面三种类型。(例如，S. Kallel, "Analysis of a type II hybrid ARQ scheme with code combining", IEEE Transactions on Communications, Vol. 38#8, August 1990, 和 S. Kallel et al., "Throughput performance of Memory ARQ schemes", IEEE Transactions on Vehicular Technology, vol. 48#3, May 1999.)

这些类型是:

类型 I: 错误的 PDU 被丢弃，并且该 PDU 的新拷贝被单独重发和解码。这没有合并该 PDU 的较早和稍后版本。

类型 II: 需要重发的错误 PDU 没有被丢弃，而与发射机提供的一些增加的冗余位合并，用于随后的解码。重发的 PDU 有时具有较高的编码率，并在接收机与存储的值合并。这意味着每次重发时仅添加少量冗余。

类型 III：除了每个重发的 PDU 是可自解码的之外，它与类型 II 相同。这暗示 PDU 无需与先前 PDU 合并就可解码。如果一些 PDU 严重受损使得几乎没有信息可重用时，这是非常有用的。

链路自适应的另一种技术是自适应调制和编码(AMC)。AMC 的描述可见 3GPP TSG RAN "Physical Layer Aspects of High Speed Downlink Packet Access" TR25.848V5.0.0 和 A. Ghosh et al., "Performance of Coded Higher Order Modulation and Hybrid ARQ for Next Generation Cellular CDMA Systems", Proceedings of VTC 2000。

AMC 的原理是在系统限制下，根据信道条件的变更而改变调制和编码格式。可例如基于来自接收机的反馈而估计信道条件。在具有 AMC 的系统中，处于有利位置的用户(移动台)，例如接近小区站点的用户一般分配有较高码率的较高阶调制(例如 R=3/4 Turbo 码的 64QAM)，而处于不利位置的用户，例如接近小区边界的用户一般分配有较低码率的较低阶调制(例如 R=1/2 Turbo 码的 QPSK)。在以下描述中，编码和调制的不同合并将称作调制编码方案(MCS)级别。这里，发送将分裂为多个发送时间间隔(TTI)，而每一 TTI 的 MCS 级别可改变。HSDPA(高速下行分组接入，称为段 0)的 TTI 间隔等于 2ms。实现 AMC 的主要好处在于：处于有利位置的用户可得到较高数据率，这反过来增加小区的平均吞吐量，并降低由于基于调制/编码方案的变更而不是发射功率的变更的链路自适应而引起的干扰变更。

分组的发送格式还具有另一可配置参数。通过增加一个 TTI 中的正交码的数量，也增加可发送的信息总量。在下文中，正交码的数量和 MCS 将称作发送格式资源合并(TFRC)。

分组调度是用于将发送机会和发送格式分派给允许进入共享信道的用户的一种资源管理算法。由此，例如通过将发送机会分派给处于有利信道条件下的用户，而在基于分组的移动无线电网络中与自适应调制和编码合并使用分组调度，以最大化吞吐量。

尽管以上对背景技术的描述主要集中在例如 HARQ 方案的重发协议、以及例如 AMC 和分组调度的链路自适应技术上，现在将参考图和附图而更详细地描述可能应用这些技术的公知领域。更具体地，现在将在 3GPP(第 3 代伙伴项目)中进行标准化的 HSDPA(高速下行分组接入)技术称为 UMTS(通用移动电信系统)的特征。

图 1 中示出了 UMTS 架构的概念图(见例如 H. Holma, et al., "WCDMA for UMTS", John Wiley, 2000)。该网络元件从功能上分组为核心网(CN)100、UMTS 地面无线电接入网(UTRAN)110、和移动台——用户设备(UE)120。UTRAN 110 负责处理所有与无线电相关的功能性，而 CN 100 负责将呼叫和数据连接路由发送到外部网络。如图中可见，开放(open)接口 Iu 和 Uu 限定这些网络元件的互连。应注意 UMTS 系统是模块化的，所以可能具有相同类型的几个网络元件。

图 2 更详细地图示了 UTRAN 的架构。多个无线电网络控制器(RNC)220 和 230 与 CN 100 相连。每一 RNC 220、230 控制一个或几个基站(节点 B) 240-270，而这些基站又与 UE 120 通信。控制几个基站 240-270 的 RNC 220、230 称为这些基站的控制无线电网络控制站(C-RNC)。由它们的 C-RNC 伴随的一组受控基站称为无线电网络子系统(RNS)200、210。

对于用户设备 120 和 UTRAN 110 之间的每一线路，一个 RNS 200、210 起到服务无线电网络控制系统(S-RNS)的作用。S-RNS 维持与核心网(CN)100 的 Iu 线路。当需要时，漂移(Drift)无线电网络控制系统(D-RNS)300 通过提供无线电资源而支持服务 RNS 310，如图 3 所示。将各 RNC 称作服务无线电网络控制站(S-RNC)310 和漂移无线电网络控制站(D-RNC)300。下面，为了简化起见，假设 C-RNC 和 D-RNC 相同，从而将仅使用缩写 S-RNC 或 RNC。

高速下行分组接入(HSDPA)是在 UMTS 版本 5 中标准化的技术，它将通过例如自适应调制和编码在 Uu 接口引入增强而在下行链路中提供更高数据率。HSDPA 依赖于 HARQ 类型 II/III，共享信道中激活的 UE 的快速选择、和根据随时间变化的信道条件的发送格式参数的自适应。

图 4 示出了 3GPP TSG RAN TR 25.308, "High Speed Downlink Packet Access (HSDPA): Overall Description Stage 2", V5.2.0 中描述的 HSDPA 的用户平面无线电接口协议架构。HARQ 协议和调度功能属于跨越基站——节点 B 240-270、和 UE 120 分布的 MAC-hs 子层。应注意也可在确认模式下 RLC 子层的级别上的 RNC 220、230 和 UE 120 之间建立基于 SR ARQ 协议的滑动窗口机制。从 RLC 子层提供的用于 CN 100 和 UE 120 之间的 P to P(点到点)连接的服务称为无线电接入载体(RAB，radio access bearer)。每一 RAB 随后映射到从 MAC 层提供的服务。该服务称为逻辑信道(LC)。

在图 4 的架构中，HS-DSCH FP(高速下行链路共享信道帧协议)负责节点

B 240-270 和 RNC 220、230 之间的流控制。它基于从 RNC 220、230 获得的请求，而确定可授予 RNC 220、230 的用于跨越传输网发送分组的容量(调节位置)。更具体地，由源于 S-RNC 310 的 HS-DSCH FP 的 CAPACITY REQUEST (容量请求)消息请求该容量。由从节点 B 240-270 发出的 CAPACITY GRANT (授予容量)消息授权允许在一定时间周期内发送一定量的数据。

通过在控制平面发信令(signaling)来配置协议的参数。通过用于在无线电网络(即 S-RNC 310 和 UE 120)之间发信令的无线电资源控制(RRC)协议、以及应用协议、Iub 接口上的节点 B 应用部分(NBAP)和 Iur 接口上的 RNSAP(无线电网络子系统应用部分)来管理该信令。

在更详细地讨论 UTRAN 内移动管理的方面之前，现在将根据 3GPP TR 21.905, "Vocabulary for 3GPP Specifications", V 5.1.0 给出一些定义。下面将解释有关移动管理的一些过程。

术语"无线电链路"是单个 UE 和单个 UTRAN 接入点之间的逻辑关联。其物理实现包括无线电载体发送。

"交接(handover)"定义为 MS(移动台)连接从一个无线电载体到另一个无线电载体的改变(硬交接)，其中发生连接的暂时中断；或将无线电载体包括/排除在 MS 连接中/外，使得 UE 一直与 UTRAN 连接(软交接)。软交接特别用于采用码分多址(CDMA)技术的网络中。由移动无线电网络中 S-RNC 控制交接执行。

"激活集(active set)"包括在 MS 和无线电网络之间的特定通信服务中同时包括的一组无线电链路。

"激活集更新过程"更改 UE 和 UTRAN 之间的通信的激活集。见例如 3GPP TSG RAN WG2, "Radio Resource management Strategies", V. 4. 0. 0。该过程包括三个功能：无线电链路添加、无线电链路去除、和合并的无线电链路添加和去除。将同时无线电链路的最大数目设置为 8。一旦各基站的导频信号强度相对于激活集内的最强基站的导频信号超过预定第一阈值，则将新无线电链路添加到该激活集中。另外，一旦各基站的导频信号强度相对于激活集内的最强成员低于预定第二阈值，则从该激活集中删除新无线电链路。一般将用于无线电链路添加的第一阈值选择为高于用于无线电链路删除的第二阈值。因此，添加和删除事件相对于导频信号强度形成滞后现象(hysteresis)。利用 RRC 信令将导频信号测量从 UE 报告给网络(S-RNC)。在发出测量结果

之前，通常进行一些滤波以使快速衰落达到平均。一般滤波持续时间为大约200ms(见例如 3GPP TSG RAN WG2, "Requirements for Support of Radio Resource Management (FDD)", V. 4. 0. 0)。并对交接延迟有贡献。基于测量结果，S-RNC 能决定开始执行激活集更新过程的一项功能。

应注意 HSDPA 架构可分为两个不同的方面：(1)重发协议的下行发送实体(entity)RLC 和 MAC-hs 分别位于 S-RNC 和节点 B 中；和(2)无线电资源管理算法，交接控制和分组调度基于从 UE 获得的测量，并分别位于 S-RNC 和节点 B 中。这些特征对 HSDPA 中的移动管理和上下文保持有一定暗示。

HS-PDSCH(高速物理下行链路共享信道)是与 HS-DSCH 关联的物理信道。用关联专用物理信道(A-DPCH)发送该 HS-PDSCH。作为专用信道，A-DPCH 受功率控制。将 HS-PDSCH 的帧(2ms 的 TTI)选择为与专用信道的帧(10ms)相比特别短，以允许快速调度和链路自适应。施加软交接将引起激活集内所有节点 B 的调度操作的负担。即使解决了该问题，仍然需要特别严格的定时，以提供对激活集的所有成员的调度决策。所以，HS-PDSCH 不支持软交接。同时，允许 A-DPCH 的软交接，这意味着可以从多于一个基站向合并获得的信号的 UE 进行发送。该与 HSDPA 无线电链路相关的交接过程称为"服务 HS-DSCH 小区改变"。

在服务 HS-DSCH 小区改变过程中，服务 HS-DSCH 链路的角色从一个无线电链路转移到另一个无线电链路(参考图 5)。该过程中涉及的两个小区标注为源 HS-DSCH 小区和目标 HS-DSCH 小区。该"网络控制的服务 HS-DSCH 小区改变"具有这样的特性，即网络对目标小区做出决定。在 UMTS 中，在 S-RNC 中执行该决定处理。该小区改变过程可由 UE 启动，从而称为"受 UE 控制的服务 HS-DSCH 改变过程"。分类小区改变过程的另一标准是关于服务 HS-DSCH 节点 B 的标准。

将控制用于特定 UE 的服务 HS-DSCH 小区的节点 B 定义为"服务 HS-DSCH 节点 B"。"节点 B 内服务 HS-DSCH 小区改变过程"是由同一节点 B 控制的源和目标 HS-DSCH 小区的小区改变过程。在"节点 B 间服务 HS-DSCH 小区改变过程"中，由不同节点 B 控制源和目标 HS-DSCH 小区。在图 5 中，与 UE 500 相关的服务 HS-DSCH 无线电链路(L1)从源 HS-DSCH 节点 B 510 控制的源 HS-DSCH 小区转移到目标 HS-DSCH 节点 B 520 控制的

目标 HS-DSCH 小区。顺便提及，源 HS-DSCH 节点 B 510 和目标 HS-DSCH 节点 B 520 都由 RNC 530 控制。

还应注意“同步服务小区改变过程”允许节点 B 和 UE 在交接完成后同时开始发送/接收信号。用由 S-RNC 中的 RRC 实体设置的激活定时器来维持 UE 和网络之间的同步。由于 Iub/Iur 接口上的未知延迟、处理和协议延迟，当确定激活定时器设置时采用合适的容限。该容限对交接延迟也有贡献。

应注意执行节点 B 间服务 HS-DSCH 小区改变过程也暗示执行“服务 HS-DSCH 节点 B 重定位过程”，并且这时出现 HARQ 上下文重定位的问题。

下面，将参考图 6 讨论在同步节点 B 间服务小区改变过程期间的信令的例子。应注意，在图 6 中，为了便于理解而为每个信令分配一个编号。(见 3GPP TSG RAN、TR 25.308 “High Speed Downlink Packet Access (HSDPA): Overall Description Stage 2”，和 3GPP TSG RAN、TR 25.877 “High Speed Downlink Packet Access: Iub/Iur Protocol Aspects”, V. 5. 1. 0)

在图 6 中，假设在 S-RNC 中同时进行对开始激活集更新和小区改变过程的决定。

首先，假设移动台(UE)600 经由 RRC 信令将 MEASUREMENT REPORT(测量报告)消息(信令 1)发送到 S-RNC 630。然后 S-RNC 630 基于接收的测量报告确定合并无线电链路添加和服务 HS-DSCH 小区改变的需要，并进行对开始激活集更新和小区改变过程的决定(处理 640)。

在第一步骤，S-RNC 630 通过经由 RNSAP/NBAP 协议发送 RADIO LINK SETUP REQUEST(无线电链路建立请求)消息(信令 2)而启动到目标基站(目标节点 B)610 的专用信道的新无线电链路的建立。目标节点 B 610 通过经由 RNSAP/NBAP 协议将 RADIO LINK SETUP RESPONSE(无线电链路建立响应)消息(信令 3)发送到 S-RNC 630，而确认无线电链路的建立。S-RNC 630 还经由 RRC 协议将 ACTIVE SET UPDATE(激活集更新)消息(信令 4)发送到 UE 600。该 ACTIVE SET UPDATE 消息包括用于在添加的无线电链路(而非 HS-PDSCH)中建立专用物理信道的必要信息。现在，该 UE 600 将添加新无线电链路，并经由 RRC 协议将 ACTIVE SET UPDATE COMPLETE(激活集更新完成)消息(信令 5)返回到 S-RNC 630。这完成了专用信道的新无线电链路的添加，并开始源和目标小区两者中的专用信道的发送和接收(处理 650)。

现在，S-RNC 630 将进行该过程的下一步骤，即服务 HS-DSCH 小区改

变。对于同步的服务 HS-DSCH 小区改变，源基站(源节点 B)620 和目标基站 610 都首先准备在激活时间执行交接和小区改变。

首先，S-RNC 630 经由 NBAP/RNSAP 协议与源节点 B 620 交换信令消息，包括 MAC-hs RELEASE REQUEST(MAC-hs 释放请求)(信令 6)、RADIO LINK RECONFIGURATION PREPARE(无线电链路重新配置准备)(信令 7)、RADIO LINK RECONFIRURATION READY(无线电链路重新配置就绪)(信令 8)、和 RADIO LINK RECONFIGURATION COMMIT(无线电链路重新配置提交)(信令 9)。应注意 RADIO LINK RECONFIGURATION COMMIT 消息包括源节点 B 620 的激活时间信息。随后也在 S-RNC 630 和目标节点 B 610 之间交换相同的消息集(信令 10-12)。期望供源节点 B 620 和目标节点 B 610 使用的信令的差别仅在于 S-RNC 630 通过 NBAP/RNSAP 协议的 MAC-hs RELEASE REQUEST 通知源节点 B 620 执行 MAC-hs 实体的复位。

最后，经由 RRC 信令从 S-RNC 630 向 UE 600 发出 PHYSICAL CHANNEL RECONFIGURATION(物理信道重新配置)消息(信令 13)。它包括激活时间信息和对 UE 600 的 MAC-hs 复位的请求。当建立通信时，UE 600 以 PHYSICAL CHANNEL RECONFIGURATION COMPLETE(物理信道重新配置完成)消息做出响应。这完成了共享信道的新无线电链路的添加，并开始目标小区中的共享信道的发送和接收(处理 660)。

然而，如下面更详细描述的一样，在传统节点 B 间服务小区改变过程期间，可出现几个问题。这些问题可归纳为与由于小区改变过程引起的分组丢失和延迟有关，并与由于决策延迟引起的频繁小区改变有关。

首先，讨论由于小区改变过程引起的分组丢失问题。如上所述，该服务 HS-DSCH 节点 B 重定位过程也涉及将 HARQ 上下文从源节点 B 转移到目标节点 B 的问题。不存在 UTRAN 内不同基站之间的直接物理接口，因此将不得不经由 RNC 执行该上下文转移。当不得不执行节点 B 重定位过程时，这将包括显著的转移延迟，并且这是当前方案受限于清洗(flush)UE 侧的重新排序缓冲器并将所有成功接收的分组转移到更高层的原因。而且，一旦执行了服务节点 B 改变，则不得不丢弃节点 B 中缓存的所有分组。

假设 S-RNC 与 D-RNC 相同，并且单向 Iub 延迟等于 50ms，则可如下表所示计算每个用户和特定服务的最差情况节点 B 缓冲器占用(将消耗的缓存区域)。该表格描绘了节点 B 最小缓冲器占用。根据 Iub 接口上采用的特定流

控制算法，节点B缓冲器占用可改变。

服务	1.2 Mbps	3.6 Mbps	10 Mbps
平均节点 B 缓冲器占用(字节)	7500	22500	62500

此外，该数据丢失也可导致额外的延迟。现在将更详细地讨论由于小区改变过程引起的延迟问题。

除了对所有过程特定的并可从如上所示测量和同步延迟产生的交接延迟之外，还存在由数据丢失引入的额外延迟。该延迟由于对丢失分组的补偿而发生。

对于需要数据发送的高可靠性的交互式服务，通常配置RLC子层以确认模式工作。由于RLC的实体位于RNC和UE内，所以RLC对于节点B间服务小区改变过程是透明的。由此，从节点B缓冲器丢失的分组和从UE重新排序缓冲器转发到更高层的分组的序列号中检测到的任何错过的分组不得不通过RLC重发来进行补偿。这将导致主要由于在传输网络的接口上重发这些分组引起的额外延迟。

该增加的延迟可触发用于端到端(终端间)发送的可靠传输协议(TCP)的寄生(spurious)超时，并且由于拥塞控制机制，它可减慢输入到UTRAN的分组的数据率。这在例如W. Stevens, "TCP/IP Illustrated", vol. 1, Addison Wesley, 1999中进行了描述。假设TCP段尺寸等于1500字节，则节点B缓冲器中丢失的数据量(见上表)在从5到41段的范围内。在执行小区改变过程之后，将很可能改善用户的信道条件。然而，由于调用的TCP拥塞控制，使得可用于调度的分组数目保持减少，并且不能有效利用无线电资源。

在具有以未确认模式配置的RLC协议的网络中，或具有仅在节点B和UE中的重发协议实体的概念网络中，甚至能发生更严重的问题。在这种情况下，从HARQ上下文中丢失的所有分组将不得不进行端到端重发，由此导致更高的延迟和无线电资源的无效利用。

上面已详细描述了由于小区改变过程引起的分组丢失和延迟问题。随着由于决策延迟引起的频繁小区改变，将出现其它问题。

如上所述，如果某一节点B的导频信号相对于当前激活集的最强导频信号超出某一阈值，则触发激活集更新过程的无线电链路添加功能。由此，在利用HSDPA无线电链路完成UE的专用信道的无线电链路添加之后，有可能

新成员小区可以将最佳无线电信道条件提供给该 UE。然而，与无线电链路添加同步的 HSDPA 服务向新成员小区的切换不必作为最佳决策。

传统架构存在两种可能的情况：要么，S-RNC 使得激活集更新过程的无线电链路添加功能和服务小区改变过程的触发决定同步(即，服务小区改变过程与激活集更新过程同步)。要么，在完成激活集更新过程的无线电链路添加功能之后，做出触发服务小区改变过程的决定(即，服务小区改变过程与激活集更新过程不同步)。

尤其当服务小区改变与激活集更新过程不同步时，可能出现问题。如果以显著延迟做出触发小区改变过程的决定，则到该过程结束时，信道条件可能转回。这将导致小区之间的连续乒乓行为，在此期间，不可能调度用户。由此，如果激活集更新和服务小区改变过程不同步，则尽可能快地触发该小区改变过程是有用的。

WO 01/35586 A1 公开了一种分组交换电信网络中的网络控制交接的方法和设备。基于参数将移动台接入共享信道的无线电资源需求存储到基站系统级别中。由此，可以发生受网络控制的交接，而无需将分组提供给基站系统的元件的控制。

WO 02/11397 A1 公开了一种在移动数据通信网络中的交接期间的报头压缩上下文控制方法。由发射机/接收机向报头控制器通知交接完成，以根据先前转移的上下文来恢复操作。

US 6414947 B1 公开了一种通信网络以及一种为其定位资源的方法。描述了软交接中的资源调度。

发明内容

给定现有技术中的上述问题，本发明的一个目的是提供能在从一个基站到另一个基站的服务小区改变过程期间，克服数据丢失和延迟的负面影响的一种小区改变方法和对应的蜂窝式系统。

如独立权利要求所要求保护的一样，通过本发明实现了这一目的。

在从属权利要求中定义了优选实施例。

附图合并到说明书中，并形成其一部分，用于解释本发明的原理。附图不解释为将本发明限制到如何进行和使用本发明的图示和描述的例子。如附图所示，通过下面对本发明更具体的描述，其它特征和优点将变得更清楚。

附图说明

图 1 图示了根据现有技术的高级 UMTS 架构;

图 2 图示了 UTRAN 的传统架构;

图 3 图示了漂移和服务无线电网络子系统;

图 4 图示了 HSDPA 的用户平面无线电接口架构;

图 5 图示了源和目标 HS-DSCH 小区之间的交接;

图 6 图示了节点 B 间服务 HS-DSCH 小区改变信令;

图 7 图示了可依照本发明的技术使用的 UE HSDPA 架构;

图 8 图示了可依照本发明的技术使用的节点 B HSDPA 架构;

图 9 图示了可依照本发明的技术使用的反馈测量发送定时;

图 10 图示了根据本发明一个实施例的进行激活时间协商的一个受 RNC 控制的节点 B 间服务小区改变过程;

图 11 图示了根据本发明一个实施例的进行激活时间协商的另一个受 RNC 控制的节点 B 间服务小区改变过程;

图 12 图示了根据本发明一个实施例的不进行激活时间协商的受节点 B 控制的节点 B 间服务小区改变过程; 和

图 13 图示了根据本发明一个实施例的进行激活时间协商的受节点 B 控制的节点 B 间服务小区改变过程。

具体实施方式

下面，将参考附图描述本发明的实施例。

在更详细讨论根据本发明的协议上下文保持之前，将首先参考图 7 到 9 来描述其中可使用本发明的 HSDPA 架构。

首先，参考图 7，解释 UE HSDPA 架构。应注意每一 HARQ 处理 700、705、710 被分配一定量的软缓存，用于合并来自未完成的重发的分组的比特。一旦成功接收了分组，就将该分组转发到重新排序缓冲器 720、730、740，从而向 RLC 子层提供顺序传递。根据该架构，可使该重新排序队列与特定优先权关联。

应注意可用软缓冲器尺寸可取决于 UE 无线电接入能力参数，例如在 3GPP TSG RAN, "Physical Layer Aspects of High Speed Downlink Packet

Access", TR25.848, V5.0.0 中描述的那些一样。某一 MCS 级的 UE 的处理时间以及最小 TTI 间间隔(两个连续调度时刻之间的最小时间)也可看作能力参数。它们由 RRC 协议从 UE 发信令到 RNC，并从 RNC 再发信令到节点 B。

接下来，参考图 8，解释节点 B HSDPA 架构。存在具有将从节点 B 发送到 UE 的数据分组的许多不同的数据流(逻辑信道)。分别定位于节点 B 和 UE 中的 HARQ 发送和接收实体的集合可称为 HARQ 处理。可预先定义每个 UE 的 HARQ 处理 800、810、820 的最大数目。这些数据流可具有不同 QoS(例如延迟和误差需求)，并可需要不同配置的 HARQ 实例。调度程序在将资源分派给不同 UE 时将考虑这些参数。调度功能 830 在一个时间发送间隔(TTI)中的当前 MCS 级中，控制共享信道(HS-DSCH: 高速下行共享信道)分派到不同用户或同一用户的多个数据流，并管理每个用户的现有 HARQ 实例。数据流或甚至数据流的特定分组可具有不同优先权。所以，数据分组可以在不同优先权队列 840、850、860、870 中排队。具有类似 QoS 需求的不同数据流也可多路复用到一起(例如数据流 #2 和 #3)。除了承载数据分组的高速下行共享信道之外，还存在映射到 HS-SCCH(高速共享控制信道)的控制数据。这可承载接收机正确接收、解调、合并和解码该分组所需要的例如 HARQ 处理 ID、调制方案、码分派、传输格式等的数据。

应注意可能有多个分组等待调度以初始发送到一些可用 HARQ 处理，还有多个分组有待重发。此外，HARQ 处理的状态取决于它们可适用于接受用于初始发送的分组还是它们仍然重发将合并到 UE 中的待决分组。在下面描述中，该信息将称作 "HARQ 上下文" 或 "UE 的 MAC-hs 协议上下文"。

具体说，该 HARQ 上下文可包括：等待初始发送的分组、等待重发的分组、和 HARQ 处理的状态。

涉及从 UE 获得的 A-DPCH 的功率控制命令可用作估计信道质量的索引。

估计信道质量的另一可能性在于借助于从上行信令获得的信道质量指示符(CQI)。

现在参考 HSDPA 上行信令，可借助于由 UE 发送的专用上行反馈信道来执行该信令。在该信道上发送的 CQI 包括 TFRC(传输格式资源合并)。与发信令通知信道状态相比，请求 TFRC 的主要好处在于：它能为特定信道状态下的一定传输格式而处理导致不同性能的不同 UE 实现。低 TFRC 值对应于差信道条件(较低电平调制、低码率)，而高 TFRC 值最大化好信道条件的吞吐量。

节点 B 并非必须遵循该 UE 请求。UE 可使用一定标准来确定在给定信道条件下能接收哪个发送格式。所有编码比特将映射到 HSDPA UL-DPCCH(上行专用物理控制信道)。在 UMTS FDD(频分复用)中，与 HS-DSCH 相关的上行信令可使用具有扩频因子 = 256 的 DPCCH-HS，其是与现有专用上行物理信道多路复用的代码。

信道质量指示符的发送周期和定时由 UTRAN 确定，并由控制平面发信令通知。测量反馈周期 k 具有可能值{1, 5, 10, 20, 40, 80}TTI。k 的值越大，在以降低下行链路的调度性能为代价的情况下的上行链路的信令开销越小。仍然不得不确定测量反馈偏移 *l* 的值集。图 9 给出了反馈测量发送定时的图示。

尽管至此已描述了可能执行本发明的环境，现在将更详细地讨论本发明的上下文保持技术。从以下描述可明白，将保持源节点 B 的部分 HARQ 上下文(即待初始发送的分组和待重发的分组)。实现这一点的步骤可为以下途径中的一个或多个：

(1) 节点 B 间服务小区改变识别 HS-DSCH FP 中的流控制

(2) 节点 B 间服务小区改变识别 MAC-hs 中的调度功能

(3) 附加控制平面发信令通知 NBAP/RNSAP 协议内的消息

从以下更详细的描述将明白，本发明可应用于同步和不同步的激活集更新以及服务小区改变过程。以下实施例将分组为同步的激活集更新和节点 B 间服务小区改变过程的类别，以及不同步的激活集更新和节点 B 间服务小区改变过程的类别。在同步过程的情况下，假设服务小区改变和激活集更新过程由 S-RNC 同时决定并在同一时刻(time instant)执行。该时刻标注为激活时间。换言之，该激活时间是激活激活集更新处理和交接的时间。

在同步过程的类别中，不改变激活时间的受 RNC 控制的服务小区改变可区别于改变激活时间的服务小区改变。类似地，不同步过程可划分为不改变激活时间和改变激活时间的受节点 B 控制的服务小区改变。

1. 同步激活集更新和节点 B 间服务小区改变过程

在不改变激活时间的受 RNC 控制的服务小区改变的情况下，可区分两种途径。在第一种途径中，在 RNC 中执行智能流控制，而在第二种途径中，在节点 B 中执行智能流控制和调度功能。应注意可合并这两种途径。

RNC 中的智能流控制意味着一旦已做出激活集更新和服务小区改变过程

的决定，则 RNC 应停止向源节点 B 发出 CAPACITY REQUEST 消息。

节点 B 中的智能流控制和调度功能可包含以下步骤。S-RNC 将该决定和激活时间通知节点 B。然后，(HS-DSH FP 中的)节点 B 流控制拒绝来自用户的所有 CAPACITY REQUESTS。此外，为了在激活时间前加速它们的传递，(MAC-hs 中的)节点 B 调度功能将比其它 UE 高的优先权给予来自用户的待初始发送/重发的分组。

如上所述，改变激活时间的受 RNC 控制的服务小区改变技术与不改变激活时间的受 RNC 控制的服务小区改变类似，而与其不同之处在于在由 S-RNC 通知初始值之后，节点 B 可提出新的激活时间值。S-RNC 可决定接受该值还是保持旧值。下面，将该过程称为激活时间协商过程。

然后可如下描述流控制和调度功能。首先，S-RNC 将该决定和激活时间通知节点 B。通过在节点 B 和 RNC 之间交换 NBAP/RNSAP ACTIVATION TIME NEGOTIATION REQUEST 和 REPONSE 消息而执行激活时间协商过程。此外，(HS-DSH FP 中的)节点 B 流控制拒绝来自用户的所有 CAPACITY REQUESTS。此外，为了在到达约定的激活时间前加速它们的传递，(MAC-hs 中的)节点 B 调度功能将比其它 UE 高的优先权给予来自用户的待初始发送/重发的分组。

现在将参考图 10 描述改变激活时间的受 RNC 控制的服务小区改变的信令例子。应注意，在图 10 中，为了便于理解，为每个信令分配了一个编号。

首先，假设移动台(UE)1030 经由 RRC 信令将 MEASUREMENT REPORT 消息(信令 1)发送到 S-RNC 1060，然后 S-RNC 1060 基于接收的测量报告而确定合并无线电链路添加和服务 HS-DSCH 小区改变的需求，并做出开始激活集更新和小区改变过程的决定(处理 1070)。

此后，S-RNC 1060 立即经由 RNSAP/NBAP 协议通知源基站(源节点 B)做出了激活集更新决定(信令 2)。源节点 B 1050 经由 RNSAP/NBAP 协议将 ACTIVATION TIME NEGOTIATION REQUEST(激活时间协商请求)消息(信令 3)发送到 S-RNC 1060。S-RNC 1060 经由 RNSAP/NBAP 协议将 ACTIVATION TIME NEGOTIATION RESPONSE(激活时间协商响应)消息(信令 4)发送到源节点 B 1050。通过以上信令 2-4 的处理 1000，因为在决定开始服务节点 B 小区改变过程之后立即向源节点 B 1050 通知激活时间，所以有可能停止源节点 B 中用于向 UE 1030 发送数据的容量分配，同时源节点 B 1050

有可能将缓存的分组发送到具有比其它 UE 更高优先权的 UE 1030。结果，与现有技术相比，有可能降低分组损失。

接下来，S-RNC 1060 通过经由 RNSAP/NBAP 协议发送 RADIO LINK SETUP REQUEST 消息(信令 5)，而启动到目标基站(目标节点 B)1040 的专用信道的新无线电链路的建立。目标节点 B 1040 通过经由 RNSAP/NBAP 协议发送 RADIO LINK SETUP RESPONSE 消息(信令 6)到 S-RNC 1060，而确认无线电链路的建立。S-RNC 1060 还经由 RRC 协议发送 ACTIVE SET UPDATE 消息(信令 7)到 UE 1030。该 ACTIVE SET UPDATE 消息包括用于在添加的无线电链路(而非 HS-PDSCH)中建立专用物理信道的必要信息。现在，UE 1030 将添加新无线电链路，并经由 RRC 协议将 ACTIVE SET UPDATE COMPLETE 消息(信令 8)返回到 S-RNC 1060。这完成了专用信道的新无线电链路的添加，并开始源和目标两小区中专用信道的发送和接收(处理 1080)。

现在，S-RNC 1060 将进行该过程的下一步骤，即服务 HS-DSCH 小区改变。对于同步的服务 HS-DSCH 小区改变，源基站 1050 和目标基站 1040 都首先准备在激活时间执行交接和小区改变。

首先，S-RNC 1060 经由 NBAP/RNSAP 协议与目标节点 B 1040 交换信令消息(处理 1010)，包括 RADIO LINK RECONFIGURATION PREPARE(信令 9)、RADIO LINK RECONFIRURATION READY(信令 10)、和 RADIO LINK RECONFIGURATION COMMIT(信令 11)。S-RNC 1060 经由 NBAP/RNSAP 协议和源节点 B 1050 交换信令消息(处理 1020)，包括 MAC-hs 释放请求(信令 12)、RADIO LINK RECONFIGURATION PREPARE(信令 13)、RADIO LINK RECONFIRURATION READY (信令 14)、和 RADIO LINK RECONFIGURATION COMMIT(信令 15)。结果，在通过处理 1010 向目标节点 B 通知激活时间之后，然后将发出 CMAC-HS-Release-REQ 原语(MAC-RRC 之间的与 HS-DSCH 相关的开放请求原语(primitive))1020。

最后，经由 RRC 信令从 S-RNC 1060 向 UE 1030 发出 PHYSICAL CHANNEL RECONFIGURATION 消息(信令 16)。它包括激活时间信息和对 UE 1030 的 MAC-hs 复位的请求。当建立通信时，UE 1030 以 PHYSICAL CHANNEL RECONFIGURATION COMPLETE 消息做出响应。这完成了共享信道的新无线电链路的添加，并开始目标小区中共享信道的发送和接收(处理 1090)。

2. 非同步的激活集更新和节点B间服务小区改变过程

在这种情况下，假设在更新激活集之后，节点B对服务小区改变过程做出决定。这一途径适用于激活集更新和服务小区改变过程不同步的情况。

用于测量的更高层信令需要大量时间，因为该信令需要一直到达S-RNC。所以，快速小区站点选择可以是基于物理层测量(CQI、A-DCH的功率控制命令、发送功率)由节点B启动的。这有助于降低小区改变过程决策延迟并避免乒乓效应。由于节点B对启动小区改变过程做出决定，所以它可调整调度算法，从而防止上下文丢失。下面可描述该过程。

首先，S-RNC通知源节点B将执行激活集更新过程。从那时开始，允许节点B启动服务小区改变过程，将新添加的节点B作为目标节点B。然后，节点B可例如通过监视CQI报告的时间平均值、A-DCH的功率控制命令、和/或发送功率，而监视信道质量和/或信道中使用的发送功率，直至其对小区改变过程为止做出决定。然后，(例如通过NBAP/RNSAP CELL CHANGE PROCEDURE NOTIFICATION(小区改变过程通知)消息)节点B通知S-RNC应当启动小区改变过程。(HS-DSH FP中的)节点B流控制功能停止接纳(admit)来自对特定用户的RNC的任何附加分组。此外，为了在激活时间前加速它们的传递，(MAC-hs中的)节点B调度功能将比其它UE高的优先权给予来自用户的待初始发送/重发的分组。

关于激活时间设置，已提到非同步过程可划分为不改变和改变激活时间的受节点B控制的服务小区改变。由此，在受节点B控制的服务小区改变方法中确定激活时间有两种可能性。

首先，该激活时间可由节点B设置，并在NBAP/RNSAP CELL CHANGE PROCEDURE NOTIFICATION消息中传达给S-RNC。在这种情况下，该方法称为不改变激活时间的受节点B控制的服务小区改变。

其次，激活时间可由S-RNC设置，并在CELL CHANGE PROCEDURE NOTIFICATION消息(NBAP/RNSAP ACTIVATION TIME NOTIFICATION(激活时间通知)消息)后传达给节点B。节点B可通过使用如上所述的相同消息集而启动和执行激活时间的协商过程。在这种情况下，该方法称为改变激活时间的受节点B控制的服务小区改变。

由此，已描述了可用于保持基站间交接的上下文的各种实施例。下表给出了简要概述。

	HS-DSCH FP 流控制	MAC-hs 调度	激活集更新和服务小区改变过程的关系	激活时间
不改变激活时间的受 RNC 控制的服务小区改变	在 RNC 或节点 B 或这两个网络元件中	如果流控制仅在 RNC 中，则不使用，反之则使用	同步的	由 RNC 确定
改变激活时间的受 RNC 控制的服务小区改变	是，在节点 B	是	同步的	由 RNC 初始设置并在 RNC 和源节点 B 之间协商
不改变激活时间的受节点 B 控制的服务小区改变	是，在节点 B	是	不同步的	由节点 B 确定
改变激活时间的受节点 B 控制的服务小区改变	是，在节点 B	是	不同步的	由 RNC 初始设置并在 RNC 和源节点 B 之间协商

现在参考图 11，将讨论改变激活时间的受 RNC 控制的服务小区改变的更详细的实施例。应注意在该图 11 中，为了便于理解，为每个信令分配了一个编号。

首先，S-RNC 1150 判定存在添加将变为新服务 HS-DSCH 小区的无线电链路的需求。作为第一步，S-RNC 1150 通过发送 RADIO LINK ADDITION REQUEST(无线电链路添加请求)消息(信令 1)到 D-RNC 1140 而请求 D-RNC 1140 建立没有 HS-DSCH 资源的新无线电链路。

然后，D-RNC 1140 为新无线电链路分派无线电资源，并通过发送包括 DCH 建立所需参数的 RADIO LINK SETUP REQUEST 消息(信令 2)而请求目标节点 B 1120 建立新无线电链路。

目标节点 B 1120 分派资源，并始新无线电链路上 DPCH 1140 的物理层接收，并响应 RADIO LINK SETUP RESPONSE 消息(信令 3)。

D-RNC 1140 通过发送 RADIO LINK ADDITION RESPONSE(无线电链路添加响应)消息(信令 4)而响应 S-RNC 1150。然后建立 DCH 传输载体。

然后，S-RNC 1150 准备 ACTIVE SET UPDATE 消息(信令 5)，并将其发送到移动台(UE)1110。该消息包括要添加的无线电链路的标识。

现在，UE 1110 将新无线电链路添加到其激活集，并将 ACTIVE SET UPDATE COMPLETE 消息(信令 6)返回到 S-RNC 1150。

信令 7 到 12 用于执行根据本实施例的激活时间协商处理 1100。S-RNC 1150 将 RNSAP SIMULTANEOUS ACTIVE SET UPDATE NOTIFICATION(同时激活集更新通知)消息发送到 D-RNC 1140，D-RNC 1140 通过将 NBAP SIMULTANEOUS ACTIVE SET UPDATE NOTIFICATION 消息发送到节点 B 1130 而做出反应(信令 7 和 8)。节点 B 1130 将 NBAP ACTIVATION TIME NEGOTIATION REQUEST(激活时间协商请求)(信令 9)发送到 D-RNC 1140，D-RNC 1140 通过将 RNSAP ACTIVATION TIME NEGOTIATION REQUEST 发送到 S-RNC 1150 而做出反应(信令 10)。响应于此，S-RNC 1150 将 RNSAP ACTIVATION TIME NEGOTIATION RESPONSE(激活时间协商响应)消息发送到 D-RNC 1140，D-RNC 1140 通过将 NBAP ACTIVATION TIME NEGOTIATION RESPONSE 消息发送到节点 B 1130 而做出反应(信令 11 和 12)。由此，图 11 的激活时间协商处理 1100 基本上对应于图 10 的处理 1000。

作为下一步骤，S-RNC 1150 准备发送到 D-RNC 1140 的 RADIO LINK RECONFIGURATION REQUEST(无线电链路重新配置请求)消息(信令 13)。该消息指示出目标 HS-DSCH 小区。

如果假设由不同节点 B 控制源和目标 HS-DSCH 小区，则 D-RNC 1140 利用 RADIO LINK RECONFIGURATION REQUEST 消息(信令 14)请求源 HS-DSCH 节点 B 1130 执行同步无线电链路重新配置，为源 HS-DSCH 无线电链路去除其 HS-DSCH 资源。然后，源节点 B 1130 将 RADIO LINK RECONFIGURATION READY(无线电链路重新配置就绪)消息(信令 15)返回到 D-RNC 1140。

D-RNC 1140 利用 RADIO LINK RECONFIGURATION REQUEST 消息(信令 16)请求目标 HS-DSCH 节点 B 1120 执行同步无线电链路重新配置，为目标 HS-DSCH 无线电链路添加 HS-DSCH 资源。该消息也包括在目标 HS-DSCH 小区中设置 HS-DSCH 资源的必要信息，包括 D-RNC 选择的

HS-DSCH UE 的标识号。源 HS-DSCH 节点 B 1130 返回 RADIO LINK RECONFIGURATION READY 消息(信令 17)。然后，D-RNC 1140 将 RADIO LINK RECONFIGURATION READY 消息(信令 18)返回到 S-RNC 1150。该消息包括目标 HS-DSCH 小区的扰码、和 HS-DSCH UE 的标识。

现在建立到目标 HS-DSCH 节点 B 1120 的 HS-DSCH 传输载体。S-RNC 1150 通过以 CFN 的形式将包括 S-RNC 选择激活时间的 RADIO LINK RECONFIGURATION COMMIT(无线电链路重新配置提交)消息(信令 19)发送到 D-RNC 1140 而继续。

D-RNC 将包括激活时间的 RADIO LINK RECONFIGURATION COMMIT 消息(信令 20)发送到源 HS-DSCH 节点 B 1130 和目标 HS-DSCH 节点 B 1120。在该指示的激活时间，源 HS-DSCH 节点 B 1130 停止而目标 HS-DSCH 节点 B 1120 开始在 HS-DSCH 上向 UE 1110 发送。

S-RNC 1150 也发送 PHYSICAL CHANNEL RECONFIGURATION(物理信道重新配置)消息(信令 21)到 UE 1110。该消息包括激活时间、MAC-hs 复位指示符、服务 HS-DSCH 无线电链路指示符、HS-SCCH 设置信息和 HS-DSCH UE 标识。

最后，在该指示的激活时间，UE 1110 复位 MAC-hs，停止在源 HS-DSCH 小区接收 HS-DSCH，并在目标 HS-DSCH 小区开始 HS-DSCH 接收。然后，UE 1110 将 PHYSICAL CHANNEL RECONFIGURATION COMPLETE(物理信道重新配置完成)消息(信令 22)返回到 S-RNC。释放到源 HS-DSCH 节点 B 1130 的 HS-DSCH 传输载体。

现在转到图 12，描绘不改变激活时间的受节点 B 控制的服务小区改变的实施例。大多数信令与以上参考图 11 描述的相同。附加地，提供了过程 1200。源节点 B 1230 将 NBAP CELL CHANGE PROCEDURE NOTIFICATION(小区改变过程通知)消息(信令 7)发送到 D-RNC 1240，其由此产生 RNSAP CELL CHANGE PROCEDURE NOTIFICATION 消息(信令 8)并将其发送到 S-RNC 1250。借助于这些消息，源节点 B 1230 可以控制服务小区改变，如上面更详细描述的一样。

图 13 描绘了改变激活时间的受节点 B 控制的服务小区改变的实施例。在该实施例中，信令 7 和 8 对应于图 12 的信令。除此之外，处理 1300 包括与激活时间相关信令 9 到 14。详细地，S-RNC 1350 发送 RNSAP ACTIVATION

TIME NOTIFICATION(激活时间通知)消息(信令 9)到 D-RNC 1340，并在 D-RNC 1340，对应的 NBAP 消息作为信令 10 而产生并发送到源节点 B 1330。下面的信令 11 到 14 对应于图 11 的信令 9 到 12，参见以上相应描述。

从前面的描述可明白，本发明涉及通信系统中的无线电资源管理，并特别适用于蜂窝式系统。当移动台(MS)改变其服务节点 B 时，可保持协议上下文(状态变量和缓存的分组)，以改善等待时间以及网络资源利用率。

本发明也涉及 ARQ II 类和 III 类方案，其中合并了所接收的发送(重发)。由此，因为可根据信道条件而适配冗余，所以可将各种实施例的技术考虑为链路自适应技术。应注意各种实施例还可考虑为改善的分组调度技术，其中可假设调度程序基于 TTI 而工作。

此外，已经很明显，本发明可具体应用到 HSDPA。尽管本实施例中的大多数是指 HSDPA，但是本发明不限于该系统。所以，数据发送不必依赖于特定无线电接入方案。本发明可应用到具有分布式架构的任何移动通信系统。

本说明书基于 2002 年 12 月 20 日提交的欧洲专利申请第 EP02028631.6 号，这里通过引用而明确合并其全体内容。

工业实用性

本发明可适宜地应用于移动通信系统，尤其是蜂窝式系统。

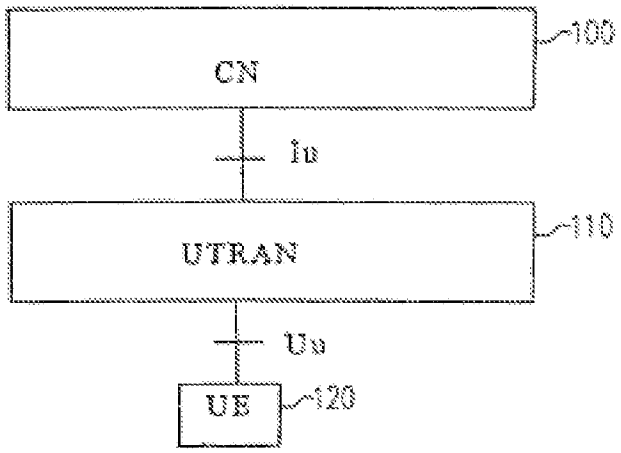


图 1 (现有技术)

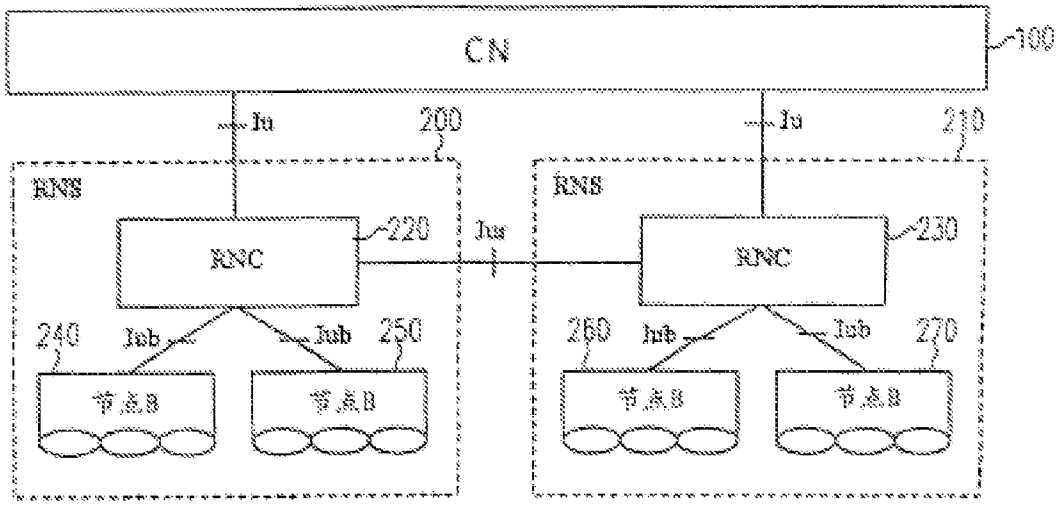


图 2 (现有技术)

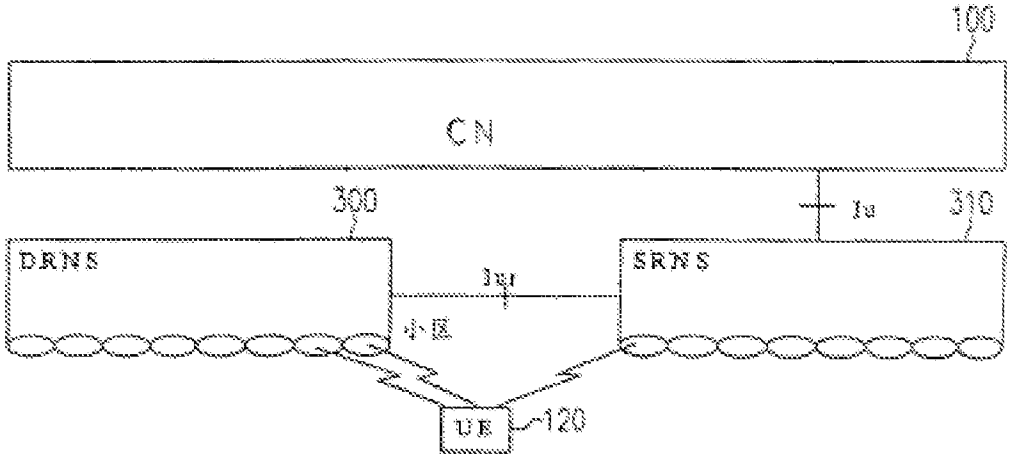


图 3 (现有技术)

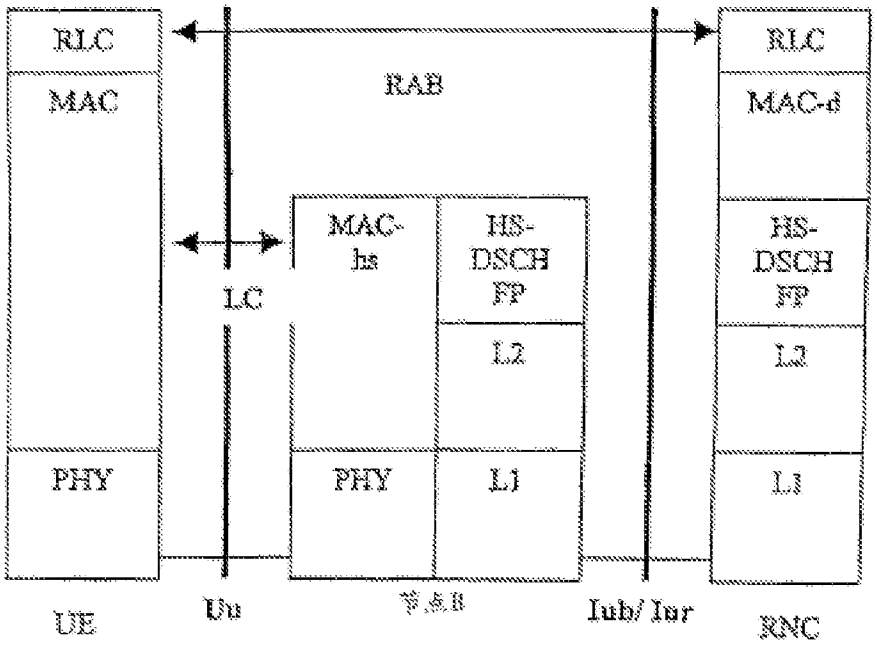


图 4 (现有技术)

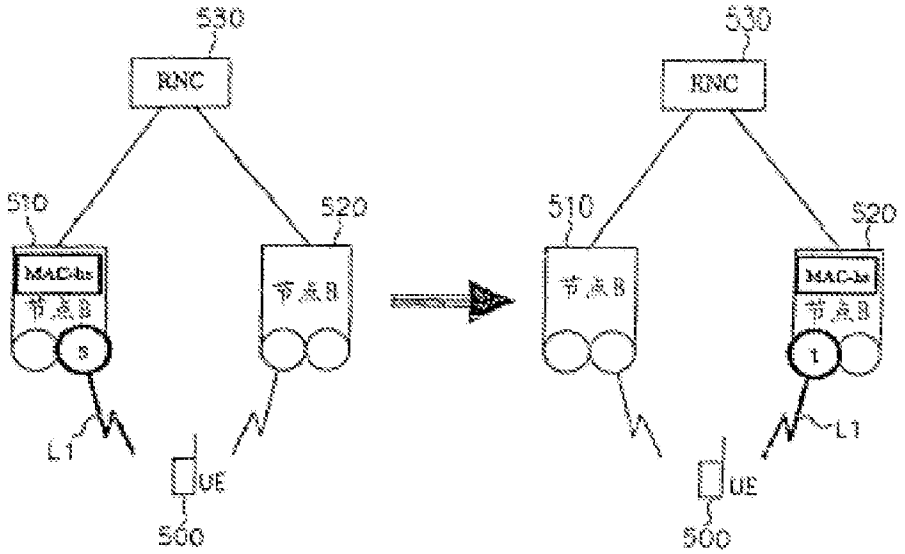

530
RNC
510
520
MAC-hs
节点B
节点B
L1
UE
500
530
RNC
510
520
节点B
MAC-hs
节点B
L1
UE
500

图 5 (现有技术)

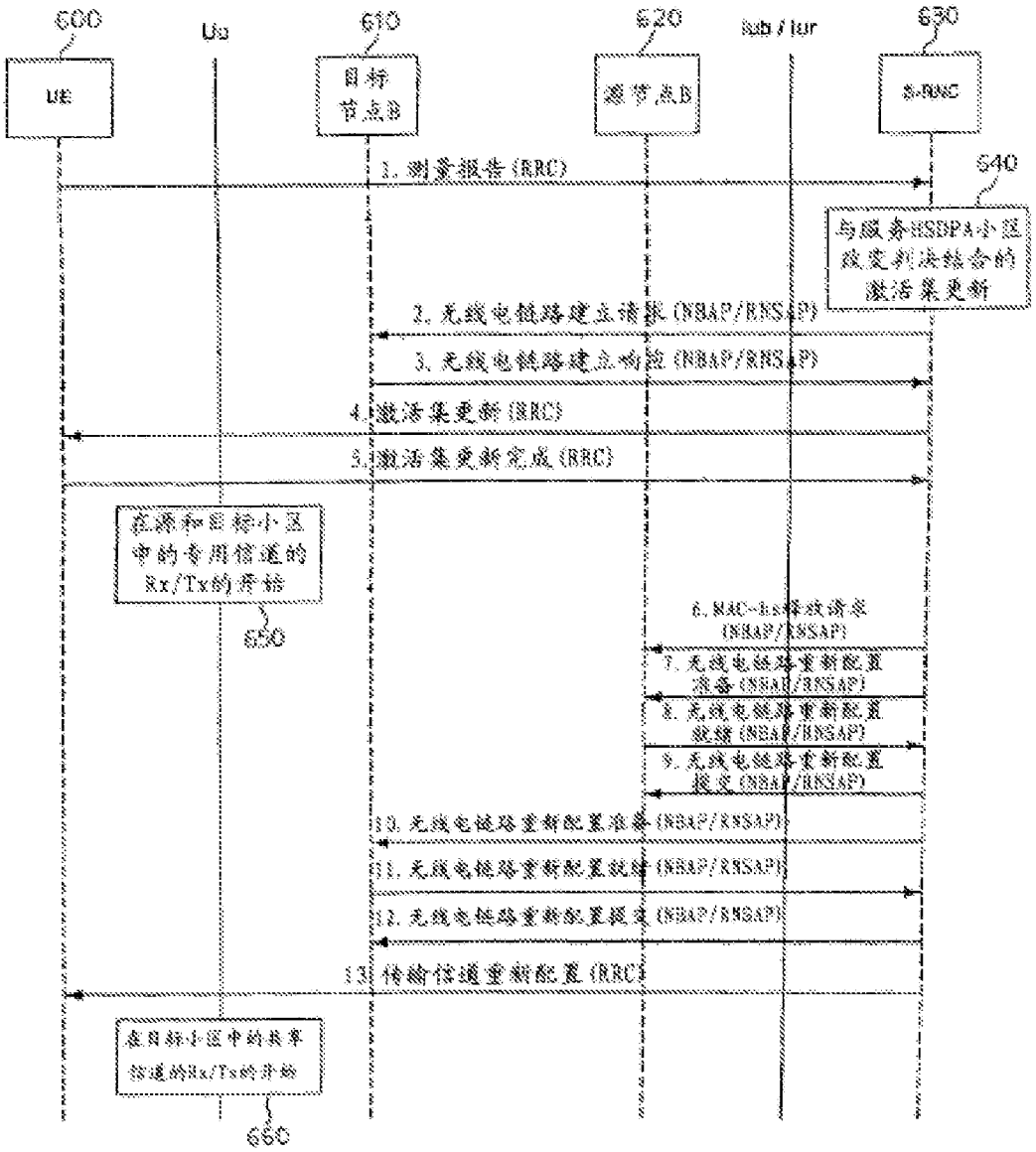

600
UE
Uu
610
目标
节点B
620
源节点B
Iub / Iur
630
S-RNC
640
与服务HSDPA小区
改变判决结合的
激活集更新
1. 测量报告 (RRC)
2. 无线电链路建立请求 (NBAP/RNSAP)
3. 无线电链路建立响应 (NBAP/RNSAP)
4. 激活集更新 (RRC)
5. 激活集更新完成 (RRC)
在源和目标小区
中的专用信道的
Rx/Tx的开始
650
6. RAC-L3释放请求
(RRAP/RNSAP)
7. 无线电链路重新配置
准备 (NBAP/RNSAP)
8. 无线电链路重新配置
就绪 (NBAP/RNSAP)
9. 无线电链路重新配置
提交 (NBAP/RNSAP)
10. 无线电链路重新配置准备 (NBAP/RNSAP)
11. 无线电链路重新配置就绪 (NBAP/RNSAP)
12. 无线电链路重新配置提交 (NBAP/RNSAP)
13. 传输信道重新配置 (RRC)
在目标小区中的共享
信道的Rx/Tx的开始
660

图 6 (现有技术)

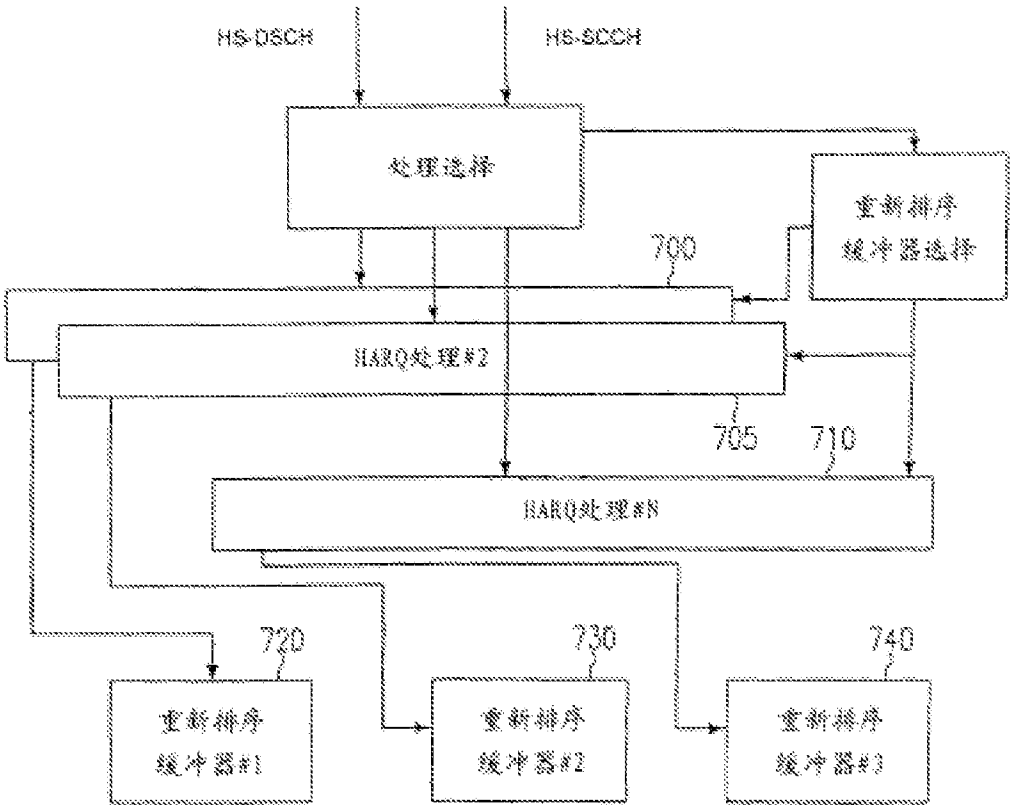

HS-DSCH
HS-SCCH
处理选择
重新排序
缓冲器选择
700
HARQ处理#2
705
710
HARQ处理#N
720
730
740
重新排序
缓冲器#1
重新排序
缓冲器#2
重新排序
缓冲器#3

图 7

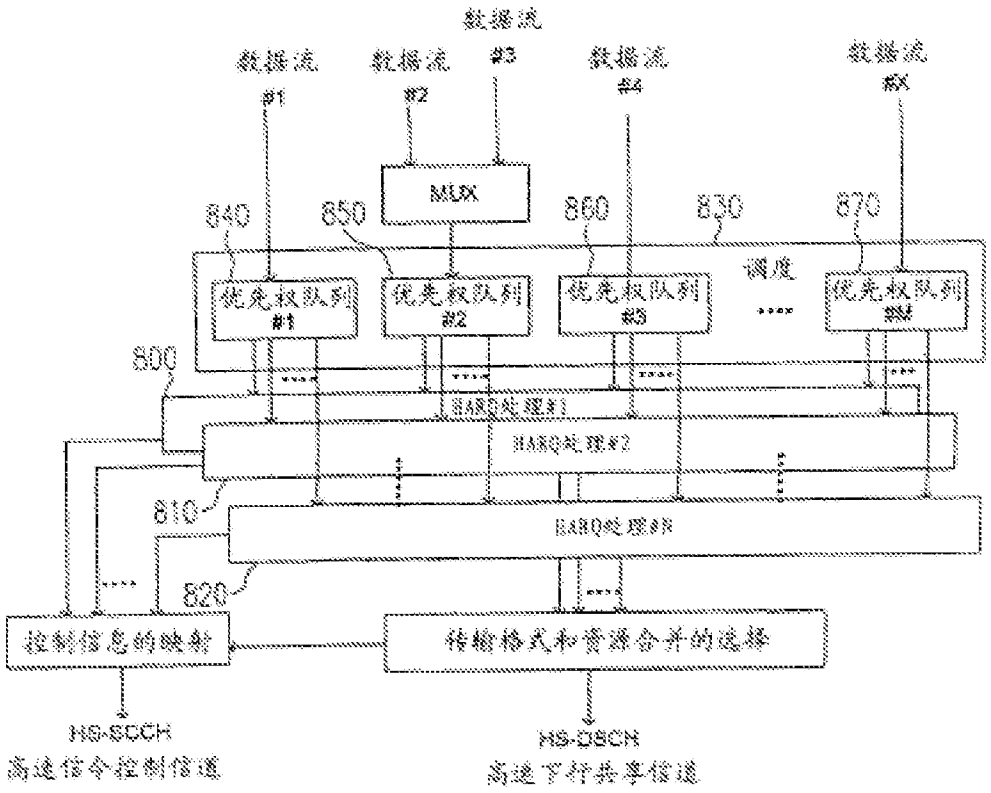

数据流
#1
数据流
#2
数据流
#3
数据流
#4
数据流
#X
MUX
840
850
860
830
870
调度
优先权队列
#1
优先权队列
#2
优先权队列
#3
优先权队列
#M
800
HARQ处理#1
HARQ处理#2
HARQ处理#8
810
820
控制信息的映射
传输格式和资源合并的选择
HS-SCCH
高速指令控制信道
HS-DSCH
高速下行共享信道

图 8

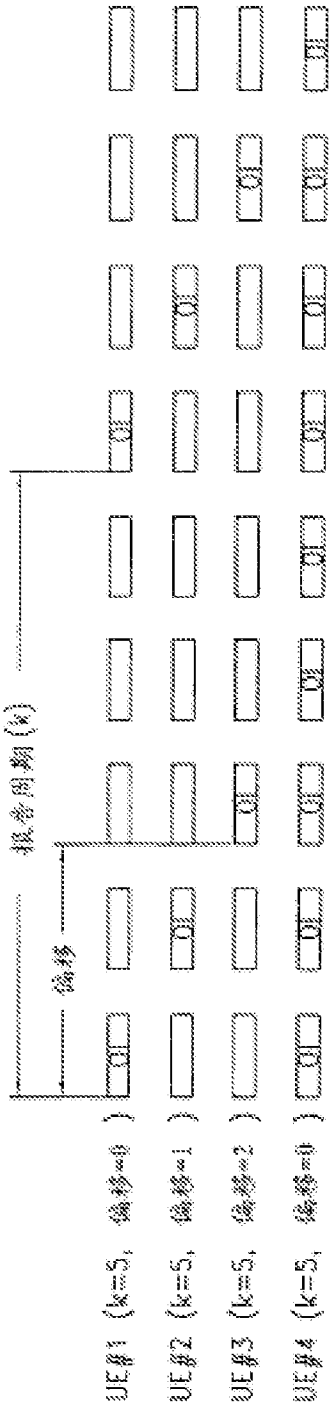


图 9

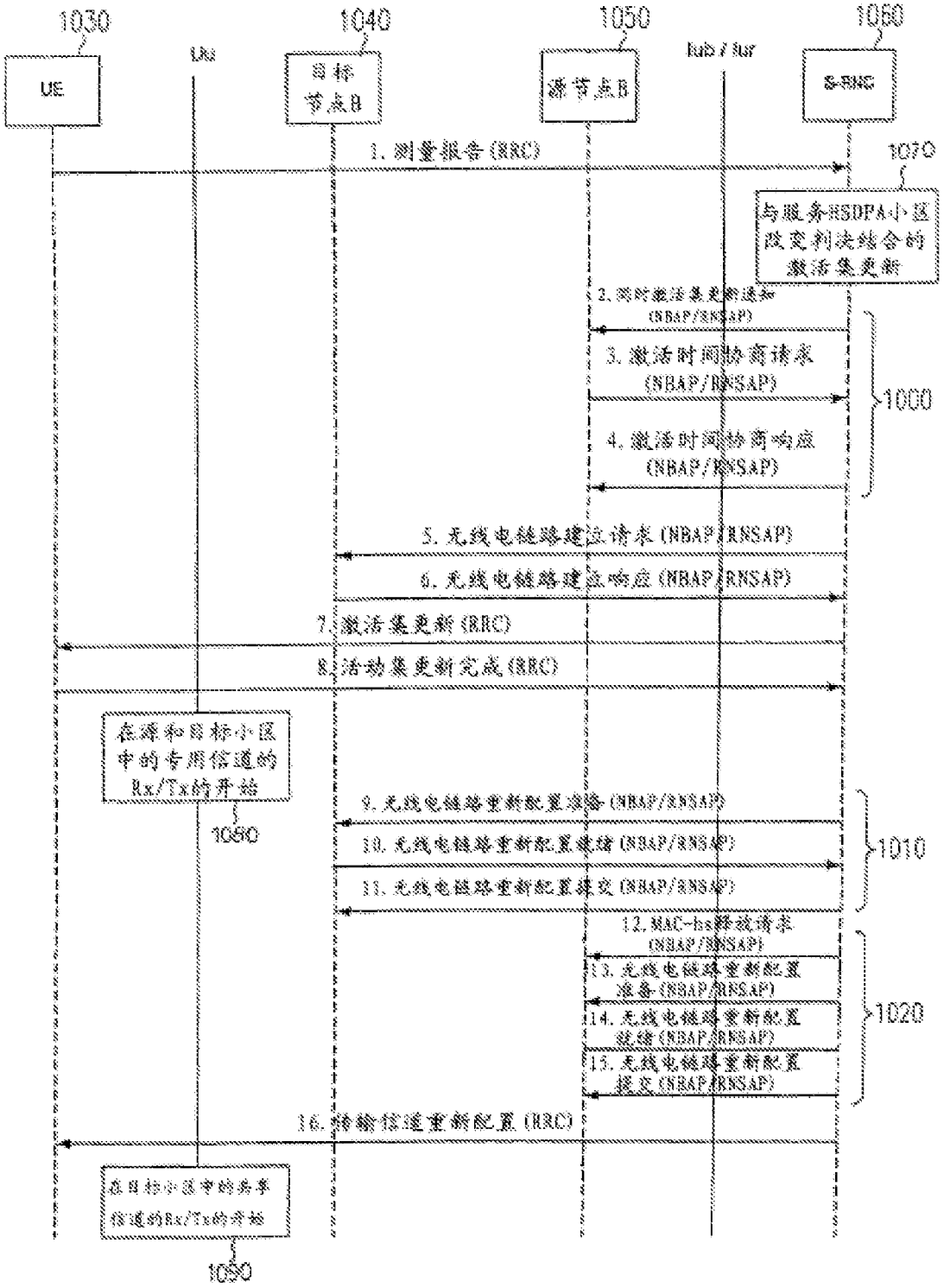

1030
UE
Uu
1040
目标节点B
1050
源节点B
Iub / Iur
1060
S-RNC
1. 测量报告 (RRC)
1070
与服务HSDPA小区改变判决结合的激活集更新
2. 同时激活集更新请求 (NBAP/RNSAP)
3. 激活时间协商请求 (NBAP/RNSAP)
4. 激活时间协商响应 (NBAP/RNSAP)
1000
5. 无线电链路建立请求 (NBAP/RNSAP)
6. 无线电链路建立响应 (NBAP/RNSAP)
7. 激活集更新 (RRC)
8. 活动集更新完成 (RRC)
在源和目标小区中的专用信道的Rx/Tx的开始
1080
9. 无线电链路重新配置准备 (NBAP/RNSAP)
10. 无线电链路重新配置就绪 (NBAP/RNSAP)
11. 无线电链路重新配置提交 (NBAP/RNSAP)
1010
12. MAC-hs释放请求 (NBAP/RNSAP)
13. 无线电链路重新配置准备 (NBAP/RNSAP)
14. 无线电链路重新配置就绪 (NBAP/RNSAP)
15. 无线电链路重新配置提交 (NBAP/RNSAP)
1020
16. 传输信道重新配置 (RRC)
在目标小区中的共享信道的Rx/Tx的开始
1090

图 10

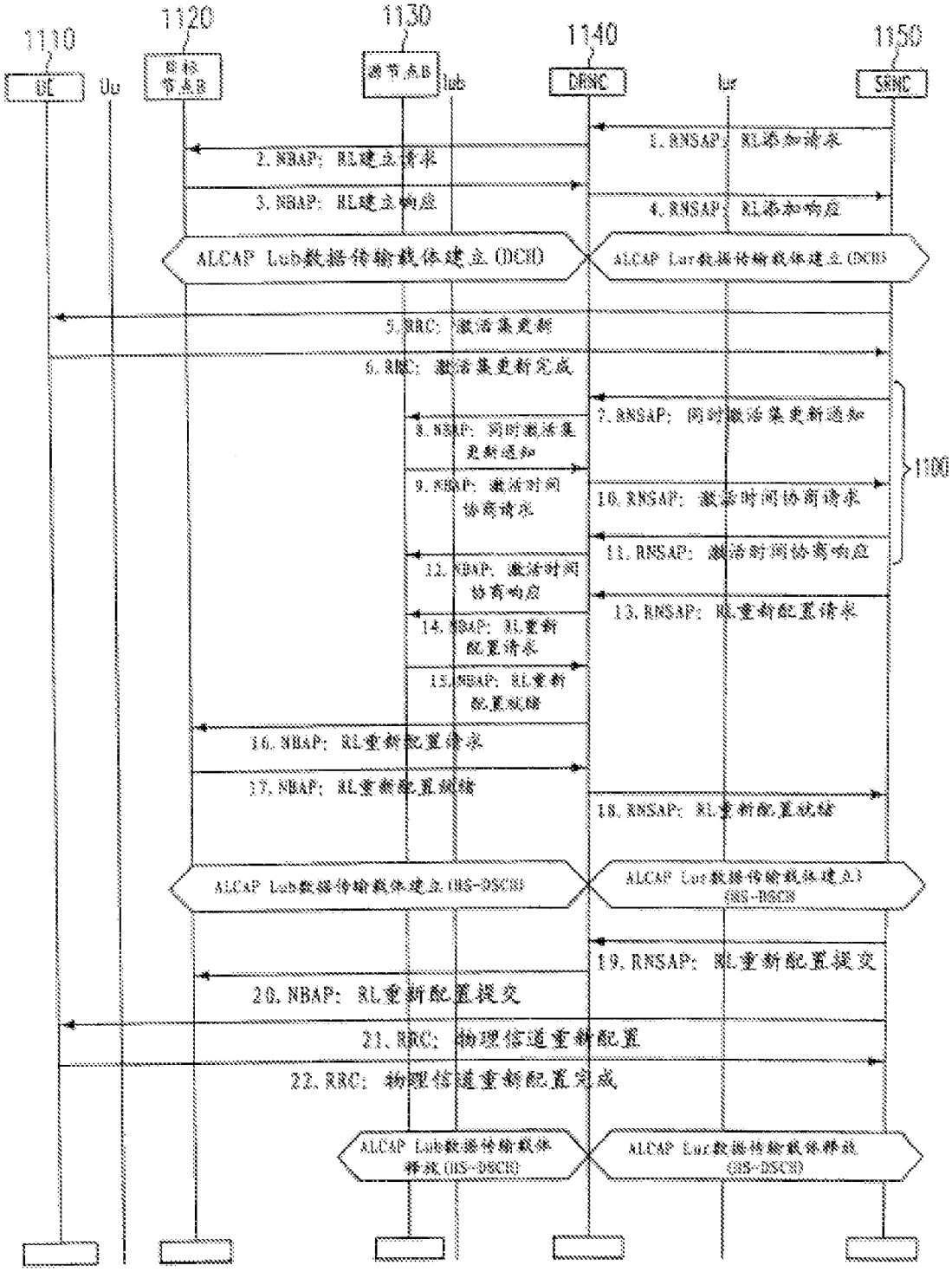

1110
UE
Uu
1120
基站
节点B
1130
漂移节点B
Iub
1140
DRNC
Iur
1150
SRNC
1. RNSAP：RL添加请求
2. NBAP：RL建立请求
3. NBAP：RL建立响应
4. RNSAP：RL添加响应
ALCAP Iub数据传输载体建立（DCH）
ALCAP Iur数据传输载体建立（DCH）
5. RRC：激活集更新
6. RRC：激活集更新完成
7. RNSAP：同时激活集更新通知
8. NBAP：同时激活集更新通知
9. NBAP：激活时间协商请求
10. RNSAP：激活时间协商请求
11. RNSAP：激活时间协商响应
12. NBAP：激活时间协商响应
13. RNSAP：RL重新配置请求
14. NBAP：RL重新配置请求
15. NBAP：RL重新配置就绪
16. NBAP：RL重新配置请求
17. NBAP：RL重新配置就绪
18. RNSAP：RL重新配置就绪
ALCAP Iub数据传输载体建立（HS-DSCH）
ALCAP Iur数据传输载体建立（HS-DSCH）
19. RNSAP：RL重新配置提交
20. NBAP：RL重新配置提交
21. RRC：物理信道重新配置
22. RRC：物理信道重新配置完成
ALCAP Iub数据传输载体释放（HS-DSCH）
ALCAP Iur数据传输载体释放（HS-DSCH）
11图

图 11

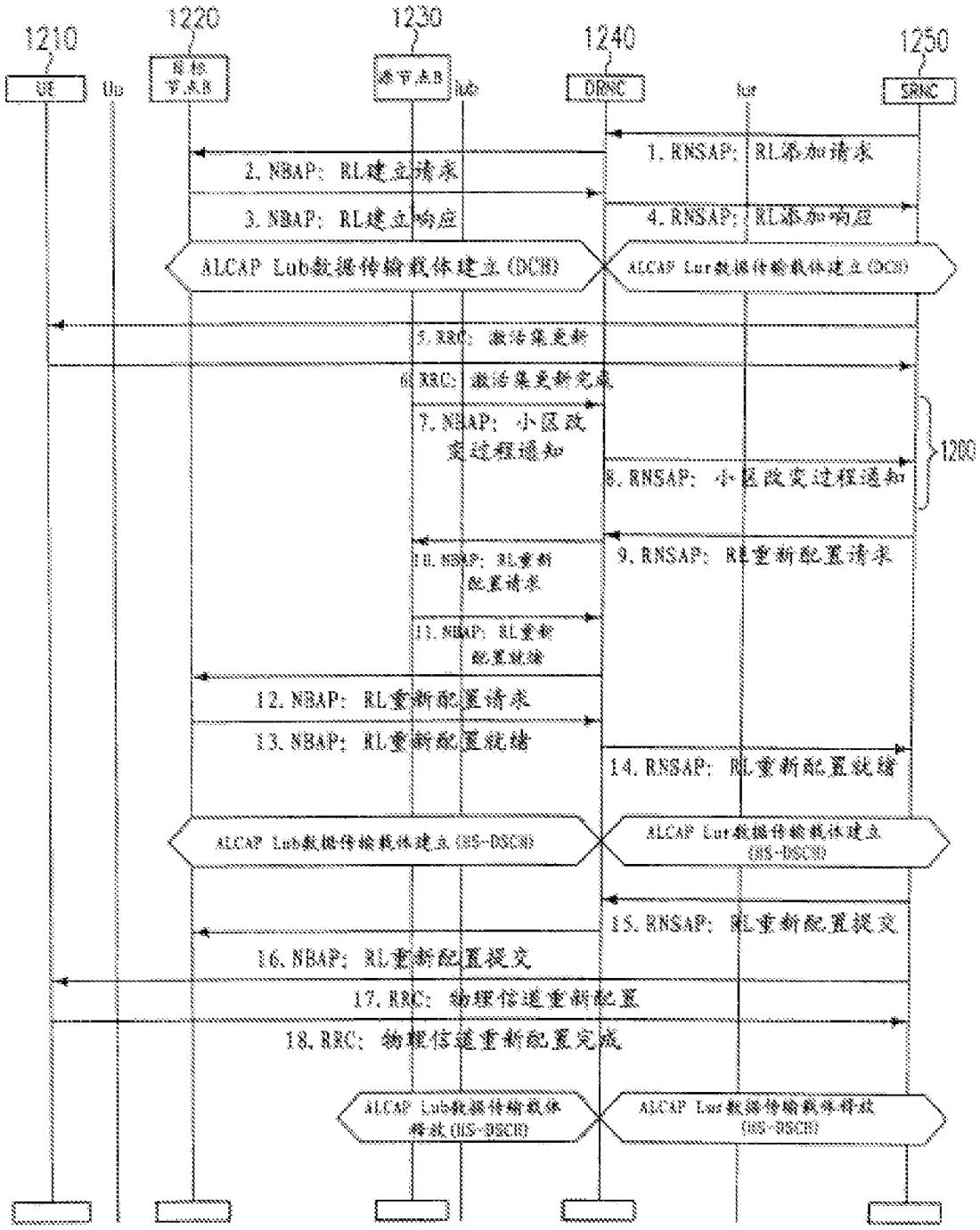
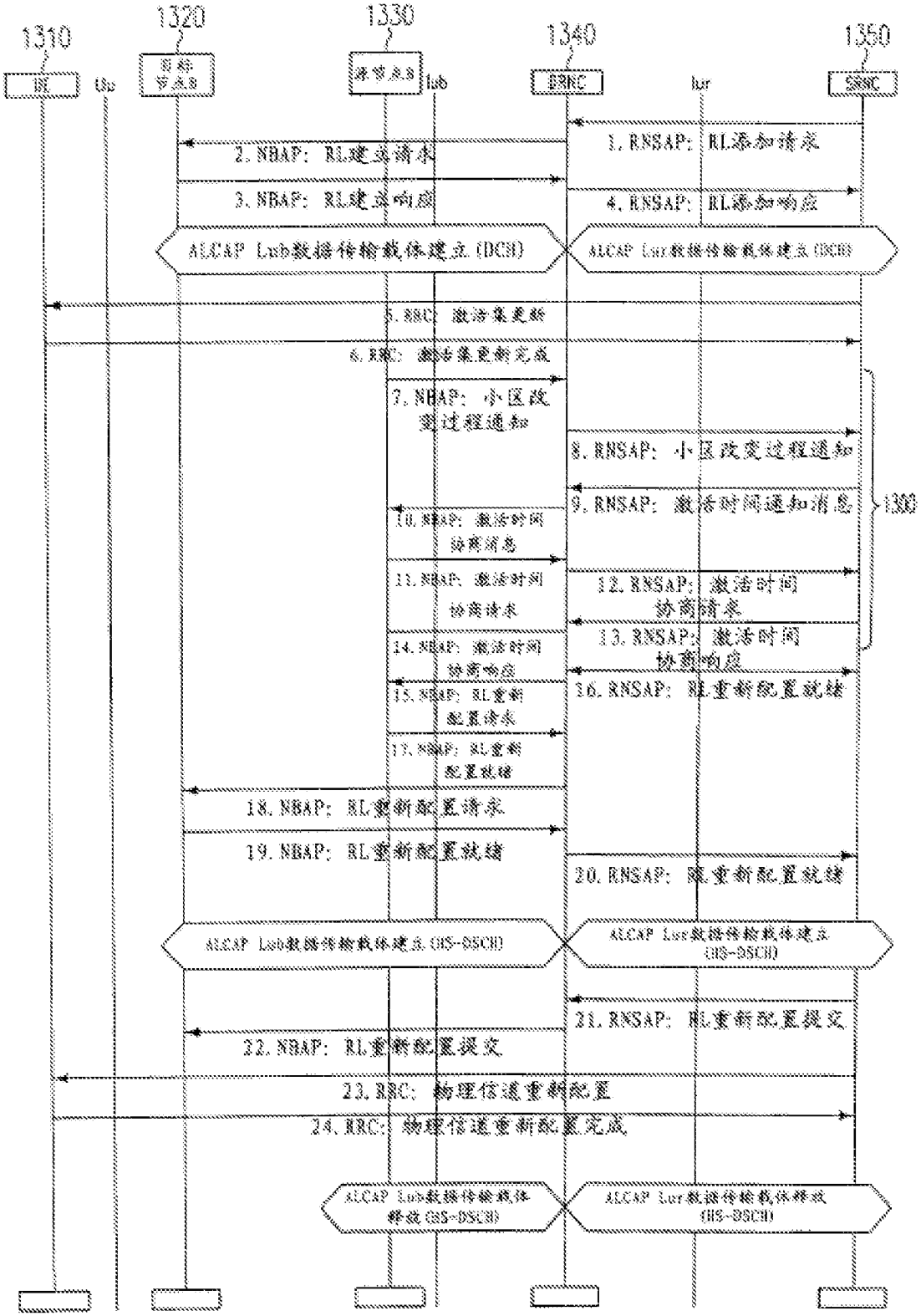

1210
1220
1230
1240
1250
UE
Uu
Iub
Iur
1. RNSAP: RL添加请求
2. NBAP: RL建立请求
3. NBAP: RL建立响应
4. RNSAP: RL添加响应
ALCAP Iub数据传输载体建立(DCH)
ALCAP Iur数据传输载体建立(DCH)
5. RRC: 激活集更新
6. RRC: 激活集更新完成
7. NBAP: 小区改变过程通知
8. RNSAP: 小区改变过程通知
1200
10. NBAP: RL重新配置请求
9. RNSAP: RL重新配置请求
11. NBAP: RL重新配置就绪
12. NBAP: RL重新配置请求
13. NBAP: RL重新配置就绪
14. RNSAP: RL重新配置就绪
ALCAP Iub数据传输载体建立(HS-DSCH)
ALCAP Iur数据传输载体建立(HS-DSCH)
15. RNSAP: RL重新配置提交
16. NBAP: RL重新配置提交
17. RRC: 物理信道重新配置
18. RRC: 物理信道重新配置完成
ALCAP Iub数据传输载体释放(HS-DSCH)
ALCAP Iur数据传输载体释放(HS-DSCH)

图 12


1310
1320
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UE
Uu
Iub
Iur
CRNC
SRNC
2. NBAP: RL建立请求
1. RNSAP: RL添加请求
3. NBAP: RL建立响应
4. RNSAP: RL添加响应
ALCAP Iub数据传输载体建立(DCH)
ALCAP Iur数据传输载体建立(DCH)
5. RRC: 激活集更新
6. RRC: 激活集更新完成
7. NBAP: 小区改变过程通知
8. RNSAP: 小区改变过程通知
9. RNSAP: 激活时间通知消息
10. NBAP: 激活时间协商消息
11. NBAP: 激活时间协商请求
12. RNSAP: 激活时间协商请求
13. RNSAP: 激活时间协商响应
14. NBAP: 激活时间协商响应
15. NBAP: RL重新配置请求
16. RNSAP: RL重新配置就绪
17. NBAP: RL重新配置就绪
18. NBAP: RL重新配置请求
19. NBAP: RL重新配置就绪
20. RNSAP: RL重新配置就绪
ALCAP Iub数据传输载体建立(HS-DSCH)
ALCAP Iur数据传输载体建立(HS-DSCH)
21. RNSAP: RL重新配置提交
22. NBAP: RL重新配置提交
23. RRC: 物理信道重新配置
24. RRC: 物理信道重新配置完成
ALCAP Iub数据传输载体释放(HS-DSCH)
ALCAP Iur数据传输载体释放(HS-DSCH)
1300

图 13

Abstract of Cited Reference 3

PATENT ABSTRACTS OF JAPAN

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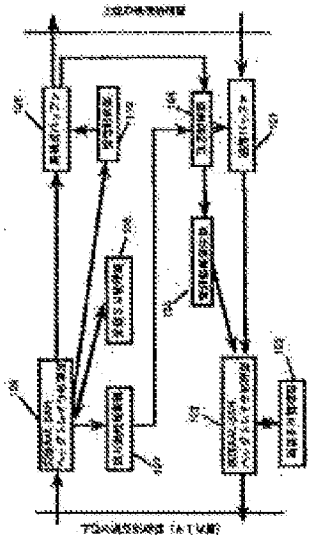
H04L 1/16
H04L 12/48

(21)Application number : 04-263915
(22)Date of filing : 01.10.1992

(71)Applicant : MATSUSHITA ELECTRIC IND CO LTD
(72)Inventor : KUBOTA KOJI

(54) RETRANSMISSION CONTROL SYSTEM FOR CELLULAR COMMUNICATION ERROR

(57)Abstract:
PURPOSE: To simplify procedures and to avoid retransmission of unnecessary cells with respect to retransmission control of AAL(ATM adaptation layer) in ATM(asynchronous transfer mode).
CONSTITUTION: If it is found that a cell cannot be normally received, a reception-side AAL header trailer processing part 106 transmits a management cell, which indicates the stop of transmission of following cells, to the transmission side and reports the occurrence of cell reception error to a higher-order communication processing layer. Meanwhile, the transmission-side AAL receives the request of the stop of cell transmission to stop the cell transmission and abandons user information in a transmission buffer 101. Thus, a network is efficiently used.



Cited Reference 3

(19)日本国特許庁（ＪＰ）　(12)**公開特許公報（Ａ）**　(11)特許出願公開番号

特開平6－121001

(43)公開日　平成６年(1994)４月28日

(51)Int.Cl.⁵	識別記号	庁内整理番号	Ｆ Ｉ	技術表示箇所
Ｈ０４Ｌ　29/08				
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12/48				
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		8732－5K	11/20　Ｚ	

審査請求　未請求　請求項の数３(全　９　頁)

(21)出願番号　特願平4－263915

(22)出願日　平成４年(1992)10月１日

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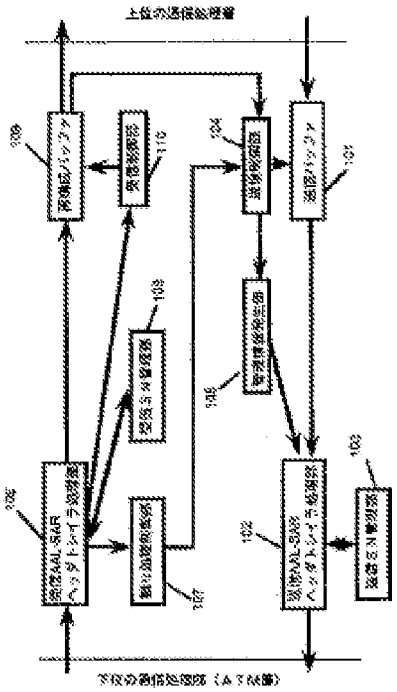
(74)代理人　弁理士　中島　司朗

(54)【発明の名称】　セル通信誤り時の再送制御方式

(57)【要約】
【目的】　ＡＴＭ（Asynchronous Transfer Mode：非同期転送モード）におけるＡＡＬ（ATM Adaptation Layer）の再送制御で、手順を簡素化し、また、不必要なセルの再送を避ける。
【構成】　受信側ＡＡＬヘッダトレイラ処理部１０６で、正常にセルの受信ができなかったのを発見したときに、送信側に対してそのセル以降のセル送信を中止する指示を持った管理用セルを送信すると共に、上位の通信処理層に対してセル受信エラーの発生を通知する。一方、前述のセル送信中止要求を受け取った送信側ＡＡＬでは、セルの送信を中止し、併せて送信バッファ１０１内のユーザ情報を廃棄する。
【効果】　ネットワークの使用が効率的になる。



1

【特許請求の範囲】

【請求項1】　上位の通信処理層から送られるユーザ情報をセルに分割し、該セルを下位の通信処理層が提供する機能を用いて通信の相手方に転送し、前記セル通信の受信方においては、下位の通信処理層から送られるセルを元のユーザ情報の形に再構成し、前記再構成されたユーザ情報を上位の通信処理層に引き渡すセル通信方式において、

送信側からのセル通信を正常に受信できなかった場合に、上位の通信処理層に受信の障害の発生を通知するステップと、

該ステップと同時に、前記セル送信側に対して前記正常に受信できず欠落したセル以降のセルの送信を中止するように指示を出すステップと、

セル送信側がセル通信の受信方から前記セルの送信中止の指示を受け取った場合には、セルの送信を中止するステップとを有することを特徴とするセル通信誤り時の再送制御方式。

【請求項2】　上位の通信処理層から送られるユーザ情報をセルに分割し、該セルを下位の通信処理層が通信の相手方に転送し、前記セル通信の受信方においては、下位の通信処理層から送られるセルを元のユーザ情報の形に再構成し、前記再構成されたユーザ情報を上位の通信処理層に引き渡すセル通信方式において、

ユーザ情報を送信する側では、

ユーザ情報をセルに分割した際に、送信するセルの順序を示すための順序番号をセルに割り振るステップと、

前記順序番号の最大値を表すのに必要なビット幅を持ち、現在セルに割り振られている順序番号値を保持するステップを有し、

前記ユーザ情報を送信する側のステップをふまえた上でユーザ情報を受信する側では、

前記セルに付加された順序番号を用いてセルが正常に受信されたか否かを調べるステップと、

連続して正常に受信されたセルの総数を数えるステップと、

前記正常受信を調べるステップによってセルの受信誤りが発見された場合には、上位の通信処理層に受信の障害の発生を通知するステップと、

該通知と同時に前記送信側に対して、前記保持されている正常受信セル総数値によって示される送信されてきたユーザ情報中のセル再送位置の情報を検討の上、正常受信できなかった回数が所定の回数以内のときには、前記再送位置以降のセルの再送を指示し、前記所定の回数を越えるときには、前記再送位置以降のセルの送信を中止する指示を出すステップを有し、

前記ユーザ情報を受信する側からの再送指示若しくは送信中止指示のステップをふまえた上でユーザ情報を送信する側において、

受信側から前記再送位置情報とともに再送の指示を受け取ったときには、前記再送位置以降のセルの再送を行い、セル送信中止の指示を受けたときには、前記再送位置以降のセルの送信を中止するステップを有することを特徴とするセル通信誤り時の再送制御方式。

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【請求項3】　ユーザ情報を受信する側のセルが正常に受信されたか否かをセルに付加された順序番号値を用いて調べる方法として、

前記順序番号値の最大を表すのに必要なビット幅以上のビット数を持った上で、前記順序番号値を含み前記下位の通信処理層から送られてきた正常に受信されたセルの総数値を保持するステップと、

あらたに到着したセルの順序番号が、前記保持されている受信セル総数中に含まれる順序番号の値より1つ大きな値であったときに、正常に受信したものと判断した上で前記保持されている順序番号の値を1つ増やし、そうでないときには正常に受信できなかったと判断するステップとを有することを特徴とする請求項2記載のセル通信誤り時の再送制御方式。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、ＡＴＭ（Asynchronous Transfer Mode：非同期通信モード）通信方式におけるＡＡＬ（ATM Adaptation Layer）層の機能に関し、特にセル通信誤り時の再送制御方式に関する。

【0002】

【従来の技術】転送する情報を全て固定長パケットのセルに分割し、高速なネットワークを用いて相手方に送るＡＴＭ通信方式では、上位の通信処理層から送られたデータを、セルに分割してネットワークに転送し、また、ネットワークを通して到着したセルを再び1つの情報に再構成する通信処理層（以下，ＡＡＬという。：ATMAdaptation Layer）を持っている。

【0003】ＡＡＬ層では、上位の通信層から送られてきたデータを、ＡＡＬ層の下位に位置する通信処理層（ＡＴＭ層）にマッピングする。このＡＡＬ層で提供されるサービス例としては、

1．転送エラーの処理

2．セル情報フィールドサイズによる量子化のための処理

3．損失および誤挿入セルの処理

4．フロー制御およびタイミング制御

等があげられる。

【0004】さて、ＡＡＬ層の機能は論理的に2つに分けることができる。1つは上位層からの情報をＡＴＭセルの形式に分解組立する機能（Segmentation and Reassembly sublayer：SAR副層）であり、もうひとつは上位層に対してＡＡＬ層のサービスを提供する機能（Convergence Sublayer：CS副層）である。さてＡＡＬ層によって上位層に提供されるサービスは図2のように分類することができる。これらの4つのクラスのサービスを提供す

るために，ＳＡＲとＣＳの機能の組み合わせから構成されるＡＡＬのプロトコルタイプとして３種類が考えられているが，標準化の詳細については現在，国際電信電話諮問委員会（ＣＣＩＴＴ）において検討中であり未定の部分も多い。以降，説明の簡単化のため，ＣＳ，ＳＡＲ副層の個々の動作ではなく，ＡＡＬ層の動作として説明を行うものとする。

【０００５】次にＡＡＬ層の動作の概要について図３を参照しつつ簡単に説明する。データの送信側のＡＡＬ層では，上位層から送られてきたユーザ情報をＡＡＬ－ＳＤＵとして受け取る。このユーザ情報をＡＴＭ層に送るためには，図４に示すようなＡＴＭ層におけるセルフォーマット中の情報フィールド部分にのせなければならないので，ユーザ情報を分割しヘッダ，トレイラを含む４８バイト単位のブロック（ＡＡＬ－ＰＤＵ）に分割する。この４８バイトのフォーマットは，前述のプロトコルタイプによって図５に示すような４種類に分けられる。本図においてＳＮはシーケンス番号である。なお，ＡＡＬタイプ３，４のＳＮ加算法はＡＡＬコネクションごとのフリーラン方式である。ＳＮＰはシーケンス番号保護であり，３ビット（x^3+x+1）＋１ビット（偶パリティ），ＩＴは情報タイプ（詳細未定），ＬＩはペイロード内有効情報長，ＣＲＣは巡回符号。なお，ＡＡＬタイプ３，４の巡回符号は$G(x)=1+x+x^4+x^5+x^9+x^{10}$，ＳＴはセグメントタイプ（セル分割識別子），Ｐは優先フィールド，ＭＩＤは多重化識別子，Ｂはバイト，ｂはビットである。ここで，シーケンス番号（ＳＮ）は分けられたブロックの順序を示す番号であり，４ビットから構成されているので０から１５までの数を繰り返してＡＡＬ－ＰＤＵに割り振られる。ただし，ＳＮの値が１５を越えたときは再び０から順に割り振られる。情報タイプ（ＩＴ）またはセグメントタイプ（セル分割識別子）（ＳＴ）は，分割されてできたＡＡＬ－ＰＤＵが，元のユーザ情報の先頭部分を含むか，末尾か，中間部か，または，１つのセルにこれらの全ての情報を含んでいるのかを示している。ＬＩ，ＳＮＰ，ＦＥＣ（Ｆｏｒｗａｒｄ ｅｒｒｏｒ ｃｏｒｒｅｃｔｉｏｎ，前方向誤り訂正），ＣＲＣ等は誤り訂正などのために用意されている。こうしてＡＴＭ層におけるセルのフォーマットに従うように分割されたユーザ情報は，順にＳＮの値を割り当てられてＡＡＬ－ＰＤＵとしてＡＴＭ層に送られたのち，ＡＴＭ層以下の通信ステップを用いて通信相手先に転送される。一方，通信の相手先では，ＡＴＭ層から送られてきたセルから，元のユーザ情報を再構成する。前述の末尾を示すセルの受信完了によってユーザ情報の再構成を終了し，上位層に引き渡す。

【０００６】次に，伝送路に何らかの障害が発生し，ＡＴＭ層からＡＡＬ層に送られてきたセルにビットエラーまたは，セルの抜けが有った場合の動作について説明する。現状では，伝送エラー時の制御については，ＣＣＩＴＴによる標準化勧告は行われていないが，使用が考えられている方式は２種類ある。第１の方式は，ＡＡＬ層ではセルを誤りなく正常に受信した場合には，あらかじめ保持しているその時点までに正常に受信しているセルのＳＮの値に１を加え，その数と受信したセルのＳＮとの比較をおこない，セルの到着抜けの有無を検査するものである。この方式は，ハード量をできるだけ少なくし，また送信の高速性を図ることを考慮している。したがって，もしセルの抜けが発見された場合には，受信側がセル受信エラーが発生し，情報の再構成を行うことができなかったことを上位の通信処理層に通知するか，この旨の通知すら行わない。そして，上位の通信処理層では，このエラー通知若しくは通知がないことを受けてその層で規定されている再送手順にしたがって，ユーザ情報の再送を行う。

【０００７】一方，第２の方式はＨＤＬＣ（Ｈｉｇｈ－ｌｅｖｅｌ Ｄａｔａ ＬｉｎｋＣｏｎｔｒｏｌ Ｐｒｏｃｅｄｕｒｅ，ハイレベル・データリンク制御手順）に類似した方式である。これは，通常時は，送信側はあらかじめ規定された数のセルを連続して送信し，受信側からの送達確認の到着を待ち，一方受信側では，正常に受信できたセルまでのＳＮを送信側に送達確認として送り，それを受けて送信側では次のセルの送信に移る。そして，もし受信側においてセルの到着抜けが発見された場合には，受信側は抜けたセルのＳＮを含む再送要求を送信側に送り，送信側では，この再送要求にしたがって再度セルの送信を行うものである。通常は，この様な手順にしたがってセルレベルでの再送を行うが，あらかじめ規定された回数を越えても正常に受信できなかった場合には，上位層に対して受信エラーを通知し，再送処理を上位層に任せる。

【０００８】

【発明が解決しようとする課題】以上説明したように，ＡＴＭ通信方式におけるＡＡＬ層は，上位層からの情報と下位層であるＡＴＭ層の間のマッピングを行い，更に上位層に対して転送エラー処理などのサービスを提供するものである。しかしながら，先に説明した第１の再送方式では，受信誤り時において，受信側は上位層に対してのみエラーの発生を通知し，送信側には何も知らせない。そのため，送信側が受信エラーセル以降のセルを引き続き送信し続けてしまい，ネットワークに無駄なセルを送り出すことになる。

【０００９】一方，第２の方式では，たとえセルの伝送が正常に行われていても数セルごとに受信側から送信側に送信確認のセルが送られ，これによってセルの送信が続けられることとなるが，ＡＴＭで用いられる通信路は高速な上に伝送誤り率そのものも非常に低いため，数セルに１回などのように頻繁に送信確認をやりとりするのは処理のオーバーヘッド（負荷呼数に無関係なルーチン

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作業）が大きくなる。しかるに、送信確認のセルの割合を少なくしようとしても、ＳＮは４ビット＝１６であり、送信確認の送信間隔は大きくても１６セルに１回となるのみであり、大きな改善は得られない。

【００１０】本発明は、以上の課題に鑑み、ＡＡＬ層において伝送障害の発生によるセルの誤り、またはセルの抜けが生じたような場合の再送手順を簡素化し、併せて不必要なセルの送信の減少を図ることを目的としてなされたものである。

【００１１】

【課題を解決するための手段】上記目的を達成するため、請求項１の発明においては、上位の通信処理層から送られるユーザ情報をセルに分割し、該セルを下位の通信処理層が提供する機能を用いて通信の相手方に転送し、前記セル通信の受信方においては、下位の通信処理層から送られるセルを元のユーザ情報の形に再構成し、前記再構成されたユーザ情報を上位の通信処理層に引き渡すセル通信方式において、送信側からのセル通信を正常に受信できなかった場合に、上位の通信処理層に受信の障害の発生を通知するステップと、該ステップと同時に、前記セル送信側に対して前記正常に受信できず欠落したセル以降のセルの送信を中止するように指示を出すステップと、セル送信側がセル通信の受信方から前記セルの送信中止の指示を受け取った場合には、セルの送信を中止するステップとを有することを特徴とするセル通信誤り時の再送制御方式としている。

【００１２】請求項２の発明においては、上位の通信処理層から送られるユーザ情報をセルに分割し、該セルを下位の通信処理層が通信の相手方に転送し、前記セル通信の受信方においては、下位の通信処理層から送られるセルを元のユーザ情報の形に再構成し、前記再構成されたユーザ情報を上位の通信処理層に引き渡すセル通信方式において、ユーザ情報を送信する側では、ユーザ情報をセルに分割した際に、送信するセルの順序を示すための順序番号をセルに割り振るステップと、前記順序番号の最大値を表すのに必要なビット幅を持ち、現在セルに割り振られている順序番号値を保持するステップを有し、前記ユーザ情報を送信する側のステップをふまえた上でユーザ情報を受信する側では、前記セルに付加された順序番号を用いてセルが正常に受信されたか否かを調べるステップと、連続して正常に受信されたセルの総数を数えるステップと、前記正常受信を調べるステップによってセルの受信誤りが発見された場合には、上位の通信処理層に受信の障害の発生を通知するステップと、該通知と同時に前記通信の相手側に対して、前記保持されている正常受信セル総数値によって示される送信されてきたユーザ情報中のセル再送位置の情報を検討の上、正常受信できなかった回数が所定の回数以内のときには、前記再送位置以降のセルの再送を指示し、前記所定の回数を越えるときには、前記再送位置以降のセルの送信を中止する指示を出すステップを有し、前記ユーザ情報を受信する側からの再送指示若しくは送信中止指示のステップをふまえた上でユーザ情報を送信する側において、受信側から前記再送位置情報とともに再送の指示を受け取ったときには、前記再送位置以降のセルの再送を行い、セル送信中止の指示を受けたときには、前記再送位置以降のセルの送信を中止するステップを有することを特徴とするセル通信誤り時の再送制御方式としている。

【００１３】請求項３の発明においては、ユーザ情報を受信する側のセルが正常に受信されたか否かをセルに付加された順序番号値を用いて調べる方法として、前記順序番号値の最大を表すのに必要なビット幅以上のビット数を持った上で、前記順序番号値をもち前記下位の通信処理層から送られてきた正常に受信されたセルの総数値を保持するステップと、あらたに到着したセルの順序番号が、前記保持されている受信セル総数中に含まれる順序番号の値より１つ大きな値であったときに、正常に受信したものと判断した上で前記保持されている順序番号の値を１つ増やし、そうでないときには正常に受信できなかったと判断するステップとを有することを特徴とする請求項２記載のセル通信誤り時の再送制御方式としている。

【００１４】

【作用】上記構成により請求項１の発明においては、セルの受信に際して正常に受信できないセルがあった場合に、上位の通信処理層に対して受信障害の発生を通知するとともに、通信の相手方に対してセルの送信を中止する指示を出す。また、請求項２の発明においては、通信の受信側において、すでに正常に受信されているセルの順序番号を保持するために、セルに付与される順序番号のビット幅以上のビット幅をもつ値を保持できるようにしている。セルを正常に受信した場合、受信したセルの順序番号が、現在保持している値よりも１大きい場合には、保持している値も１だけ増やす動作を行う。そして、セルに付与される順序番号が最大値を越えると再び０から繰り返される。しかしながら、受信側で動作する順序番号の保持値は、セルの持つ順序番号値の最大値を表すために必要なビット幅以上のビット幅を持っているため、順序番号の最大値を越えるような場合においても、引き続きカウントを続けることができる。そして、受信誤りが発見された時点ではじめてセルの受信確認についての情報を送信側に送り返す。その場合に、すでに正常に受信されているセルの順序番号を送信側に通知するが、セルに付加されている順序番号でなく前述の保持している値を送りかえす。

【００１６】請求項３の発明では、請求項２の発明におけるユーザ情報を受信する側のセルが正常に受信されたか否かをセルに付加された順序番号値を用いて調べる方法として、前記順序番号値の最大を表すのに必要なビット幅以上のビット数を持った上で、前記順序番号値を含

み前記下位の通信処理層から送られてきた正常に受信されたセルの総数値を保持し、あらたに到着したセルの順序番号が、前記保持されている受信セル総数中に含まれる順序番号の値より1つ大きな値であったときに、正常に受信したものと判断した上で前記保持されている順序番号の値を1つ増やし、そうでないときには正常に受信できなかったと判断する。

【0016】

【実施例】以下、本発明を実施例に基づいて説明する。なお、請求項1、同2、同3の各発明は実施するにあたり、主な構成要素（要件）が共通し、また実際問題として各請求項に係る発明を一体に組み込んだ通信処理装置が最も各請求項の発明の効果を発揮しえる。このため、実施例では各請求項の発明を一体に組み込んだ通信処理装置として同時に説明する。

【0017】図1に本願発明に係る通信方式を採用した通信装置の構成を示す。本図において、101は上位の通信処理層から到着するユーザ情報を保持する送信バッファ、102は送信AAL－SARヘッダトレイラ処理部、103は送信SN管理部、104は送信制御部、105は管理情報発生部、106は受信AAL－SARヘッダトレイラ処理部、107は誤り処理制御部、108は受信SN管理部、109は再構成用バッファ、110は受信制御部である。　次に、各部の動作について説明する。ここでは、簡単のため、ある1つのAAL－SAPから到着するユーザ情報の流れに着目して動作の説明を行う。

【0018】まず、ある1つのAAL－SAPから到着したユーザ情報は送信バッファ101に蓄積される。送信制御部104は、このAAL－SAPからのユーザ情報が、AALのどのサービスクラスに属するかを判断し、送信バッファ101に何バイトずつ読みだすかを指示する。その指示に基づいて送信バッファ101は、ユーザ情報の先頭から順に44、45または47バイト単位で取り出し、送信AAL－SARヘッダトレイラ処理部102に送る。

【0019】送信AAL－SARヘッダトレイラ処理部102では、AALのサービスクラスによって図5に示した各ヘッダ、トレイラを付加する。まず順序番号SNについて説明する。送信バッファ101から読み出された情報に対して先頭から順に0，1，2・・・とSNが割り振られる。しかしながら、SNは4ビットなので0から15までの範囲の値をとる。したがって、SNが15を越えることとなるときには、再び0から順に番号が割り振られる。すなわち、16を法とする剰余により管理されている。現在、割り振られているSNの値は送信SN管理部103に保持されており、ATM層に対して情報が正常に送り出された場合には、1つ増加される。ITおよびSTは、既述のごとく情報タイプおよびセグメントタイプを示している。送信バッファ101から読みだした情報が、元のユーザ情報の先頭の場合にはBOM、末尾の場合にはEOM、中間に位置する場合にはCOM、また、ユーザ情報が1つの読みだしたブロックに収まる場合にはSSMが識別子として割り振られる。MIDは多重化識別子であり、複数のAAL－SAPからのユーザ情報が1つのATM－SAPに多重される場合において、それらを区別するために用いられる。その他、各種のエラーチェック用の情報が付加され、ATM－SAPを通してAAL－PDUとしてATM層に送られる。

【0020】次に、受信側の動作について説明する。ある1つのATM－SAPから到着するセルは受信AAL－SARヘッダトレイラ処理部106に送られる。受信AAL－SARヘッダ部では、エラーチェック用のヘッダ、トレイラによってビット誤りがないか否かを調べる。ビット誤りがない場合には、さらにMID等によって着目しているAAL－SAPあてのデータか否かを識別する。そして着目しているAAL－SAPあての情報であった場合には、SNによる順序番号の確認を行う。このSNによる番号の確認について説明する。

【0021】受信SN管理部108が管理するビット列は8ビット幅を持っており、現時点において正常に受信されているセルのSN番号を、8ビットのうちの下位4ビットに保持している。（なお、請求項1の発明のみを採用する場合には、この下位4ビットのみ管理され、保持されることとなる。）そして、8ビット全体としては、先頭から現時点までの連続して正常に受信されたセルの総数を示している。受信AAL－SARヘッダトレイラ処理部106では、到着したセルのSNが、受信SN管理部108中の下位4ビットの値に1を加えた値と等しい場合には、正常にセルを受信したものと判断し、受信SN管理部に保持されている値に1加えるとともに、受信したセルのペイロードに含まれる情報を、再構成バッファ109に格納する。

【0022】このように受信したセルを順に再構成バッファ109に蓄積していく。そして、受信セルがEOMの識別子を持っていた場合には、すべてのユーザ情報を受信したことになるので、受信制御部110は再構成バッファ109に再構成終了の指示を出すとともに、パケットに再構成されたユーザ情報を上位の通信処理層に送り出す。

【0023】さてここで、受信AAL－SARヘッダトレイラ処理部106において、ビットエラーもしくはSN番号に誤りを発見した場合の動作について説明する。受信AAL－SARヘッダトレイラ処理部が何らかの誤りを発見した場合、誤り処理制御部107に誤りの見つかったセルのSNを通知する。誤り処理制御部107は、そのSNを持つセルが何度目の受信エラーを起こしたかを数えており、あらかじめ定められた数値以下の場合には、そのSNを持つセル以降のセルの再送要求を送

信側に送出するよう送信制御部１０４に通知する。この際、単にセルに付加される４ビットのＳＮ値ではなく、受信ＳＮ管理部が保持している値（８ビット分）を併せて通知する。この通知を受け取った送信制御部１０４では、再送要求であることを示す特別な管理用のセルを送り出すように、管理情報発生部１０５に指示を出す。

【００２４】前記の再送要求セルのペイロード部分には、前述の受信ＳＮ管理部１０８から通知された値が含まれている。この値は単に０から１５までのＳＮ値を示すものではなく、受信ＳＮ管理部１０８によってビット幅を拡張されたものなので、誤りのあったセルの位置を特定することができる位置情報といえる。また、上位の通信処理層に対しては、ユーザ情報の受信障害が発生したことを通知する。一方、その時点までに正常に受信され、再構成バッファに格納されているユーザ情報は廃棄せずにそのまま保持しておく。

【００２５】もし、前述の定められた数値以上の再送要求の後もそのＳＮを持つセルを正常に受信できなかった場合には、誤り処理制御部１０７は送信そのものに何等かの基本的に重要な障害があるものと判断し、今度はセル送信中止要求を通信の相手方に送るように、送信制御部１０４に指示する。この場合は請求項１の発明の場合と同様に、上位の通信処理層に対しては、ユーザ情報の受信障害が発生し、ユーザ情報が再構成できなかったことを通知する。そして、その時点までに正常に受信され、再構成バッファに格納されている情報を廃棄する。

【００２６】さて、この様な管理用セルを受け取った送信側では、受信制御部１１０からの通知により再構成バッファ１０９から送信制御部１０４に対して、管理用セルの内容を通知する。これがセル送信中止要求であった場合には、送信制御部１０４は、送信バッファ１０１からの読み出しとセルの送信を中止するとともに、送信バッファ内の当該ユーザ情報を廃棄し、それ以上無駄なセルの送信が継続されないようにする。しかる後、送信に際しての基本的に重要な障害の除去が検討される。そしてこれが解決された後、送信されるのは勿論である。

【００２７】また一方、前記の管理用セルの内容が再送要求であった場合には、送信制御部１０４は、受信側から管理用セルのペイロード部分に含まれて通知された再送信セルの位置番号によってユーザ情報全体の中で相手先に正確に受信されているセルの位置情報を認識し、この上で送信バッファ１０１から再送に必要な部分のユーザ情報を読みだす。そして、再送開始表示であることを示す管理用セルを作り出すように管理用情報発生部１０５に通知し、このセルを受信先にむけて送信し、更にそのセルに続いて、前記ユーザ情報の内のまだ正確に相手方に受信されていない部分のセル送信を行う。（なお、請求項１の発明のみ採用する場合においては、受信ＡＡＬ－ＳＡＲヘッダトレイラ処理部が何らかの誤りを発見した場合の誤り処理としては、誤りの見つかったセルのＳＮについての情報と送信中止要求とを示す特別な管理用のセルを送信側に送り出す。また、上位の通信処理層に対しては、ユーザ情報の受信障害が発生し、ユーザ情報を再構成できなかったことを通知する。そして、その時点までに正常に受信され、再構成バッファに格納されているユーザ情報を廃棄する。一方、このセル送信中止要求を示す管理用セルを受け取った送信側では、受信した管理用セルの内容を理解した上で送信バッファ１０１からの読み出しとセルの送信を中止するとともに、送信バッファ内の当該ユーザ情報を廃棄する。）そして受信側においては、前記の再送開始表示を示す管理セルを受信した後にすでに述べたものと同様の動作を行い、再構成バッファ１０９に保持されていたユーザ情報と併せて再構成を行い、最終的に正常に受信され再構成されたユーザ情報は上位の通信処理層に送られる。

【００２８】以上本発明を実施例に基づき説明してきたが、説明の簡単化のために、あるＩつのＡＡＬ－ＳＡＰからのユーザ情報に着目して本発明の機能構成と動作の説明を行った。しかし、実際には、複数のＡＡＬ－ＳＡＰや、ＡＴＭ－ＳＡＰから多くのユーザ情報やセルが多重化されて到着する。したがって、送信ＳＮ管理部１０３や受信ＳＮ管理部１０８などは、単一ではなくテーブルの形で構成されることはいうまでもない。

【００２９】

【発明の効果】以下に、本発明の効果について説明する。従来の技術によれば、セル受信エラーがあった場合、少なくとも、受信エラーセルを含むユーザ情報が全て再送される。本発明においては、正常に受信されたにもかかわらず、無駄になってしまうのは、受信エラーを起こしたセルの後、セル送信中止要求が受信側から送信側に送られて実際にセルの送信が中止するまでに、送信されてしまったセルだけである。特に高速通信を行うＡＴＭにおいては、送信中止要求が確認されるまでの時間も十分短く、無駄に送信されてしまうセルの数は多くないと考えられ、これによりネットワークを効率的に使用することができる。そして、このように受信エラー時の再送制御を上位層に任せ、下位層ではできるだけ再送手順を省略することによって、高速な処理が要求されるＡＴＭに容易に適応することができる。

【００３０】請求項２及び３の発明においては実施例で使用した数値を用いて言うならば、受信ＳＮ管理部のビット幅を８ビットとして、セルに付加されるＳＮのビット幅４ビットよりも大きくしている。４ビットでは、０から１５までの数値が繰りかえしセルのＳＮ値として付加される。すなわち１６個おきに同じＳＮ値を持つセルが存在する。しかしながら、受信側でのＳＮをカウントするビット幅を大きくしているので、受信エラーが発生したときに、受信エラーの発生したセルの位置を特定することが容易になる。また、上位層から送られるユーザ情報の最大長として、たとえばＦＤＤＩにおける最大パ

ケット長４５００バイトを考えると、これは約１００セル程度に分割される。したがって、受信ＳＮ管理部のビット幅としてＳビット＝２５６をとれば、十分であると考えられる。一方、汎用部品を用いる本方式実現においては、４ビット幅のビット列のデータ管理を行うことと８ビット幅のビット列のデータ管理を行うことによる負荷の増加はわずかである。このため、容易に実現しえる。

【００３１】また、送信側において、再送を始めるべきセルの位置を容易に特定することができるため、受信エラーがあったセル以降のセルから再送を行うことができ、エラーのあったセルを含む情報パケット全てを再送する必要性がなくなる。このため、ネットワークを請求項１の発明以上に効率的に利用できる。

【図面の簡単な説明】

【図１】本発明のステップ構成を示す図である。

【図２】ＡＡＬのサービスクラスの分類を示す図である。

【図３】ＡＡＬ層によってユーザ情報がどのようにセルに分解されるかを示す図である。

【図４】ＡＴＭのセルの構造を示す図である。

【図５】ＡＡＬ－ＰＤＵの構造を示す図である。

【符号の説明】

１０１　送信バッファ
１０２　送信ＡＡＬ－ＳＡＲヘッダトレイラ処理部
１０３　送信ＳＮ管理部
１０４　送信制御部
１０５　管理情報発生部
１０６　受信ＡＡＬ－ＳＡＲヘッダトレイラ処理部
１０７　誤り処理制御部
１０８　受信ＳＮ管理部
１０９　再構成バッファ
１１０　受信制御部

【図２】

パラメータ ＼ クラス	クラスA	クラスB	クラスC	クラスD
送受信端間のタイミング関係	必要		不要	
ビットレート	固定速度	可変速度		
コネクションモード	コネクション型			コネクションレス
具体的サービス例	サーキットエミュレーション 固定速度映像	可変速度映像 可変速度音声	コネクション型データ	コネクションレス型データ

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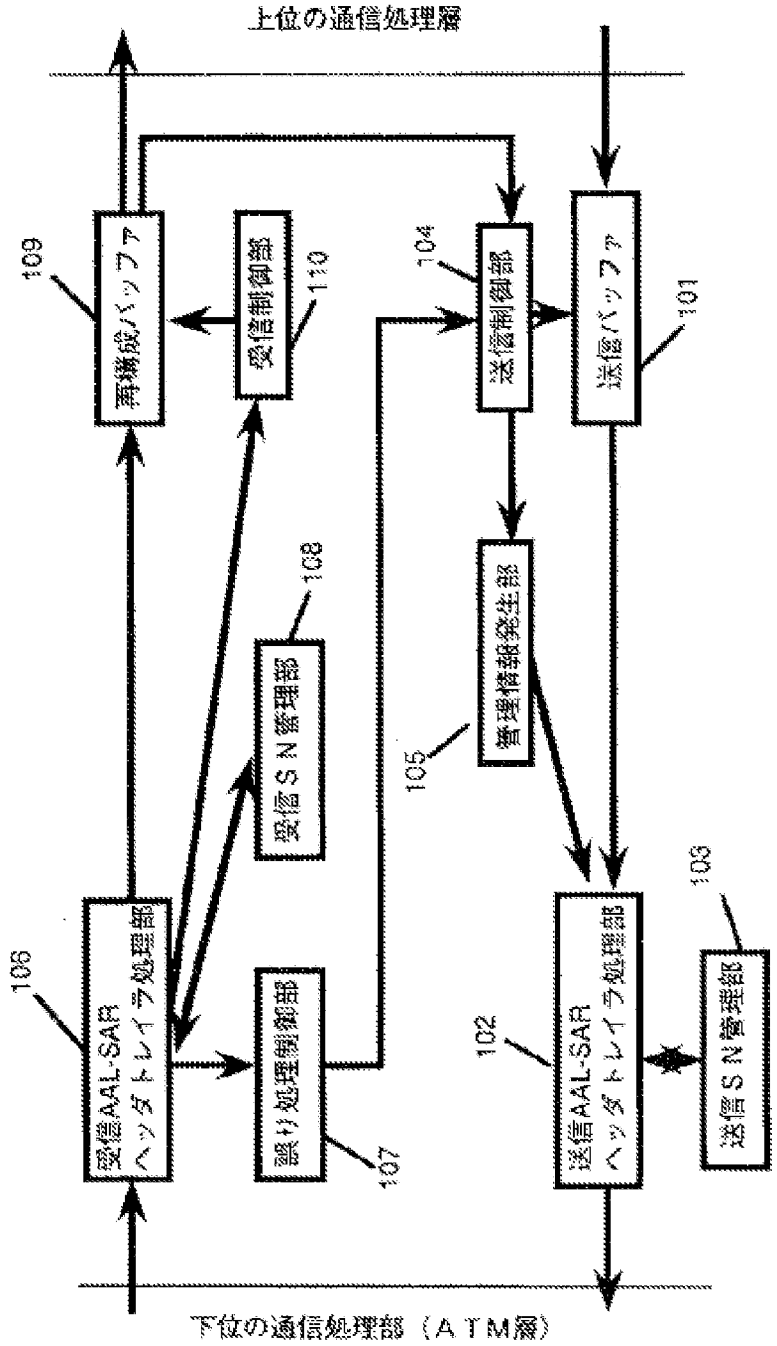
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再構成バッファ
109
受信制御部
110
送信制御部
104
送信バッファ
101
受信ＳＮ管理部
108
管理情報発生部
105
受信AAL-SAR
ヘッダトレイラ処理部
106
誤り処理制御部
107
送信AAL-SAR
ヘッダトレイラ処理部
102
送信ＳＮ管理部
103
下位の通信処理部（ＡＴＭ層）

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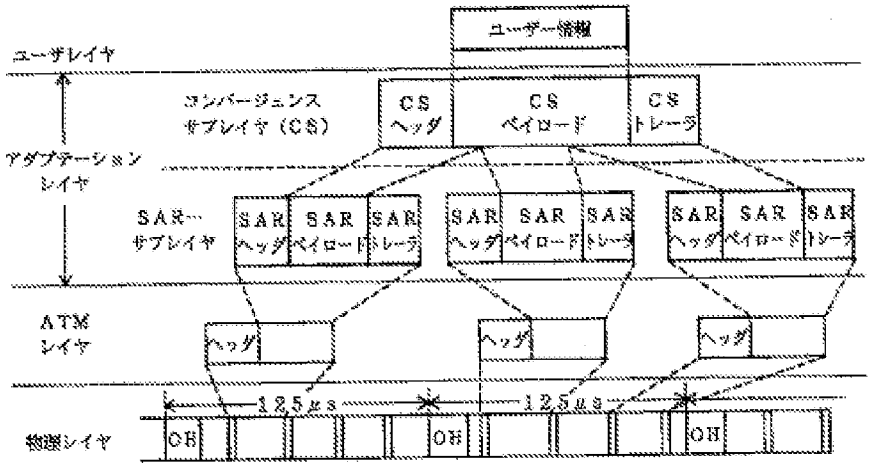
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ユーザレイヤ
コンバージェンス
サブレイヤ（CS）
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ヘッダ
CS
ペイロード
CS
トレーラ
アダプテーション
レイヤ
SAR…
サブレイヤ
SAR
ヘッダ
SAR
ペイロード
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ATM
レイヤ
ヘッダ
125μs
物理レイヤ
OH

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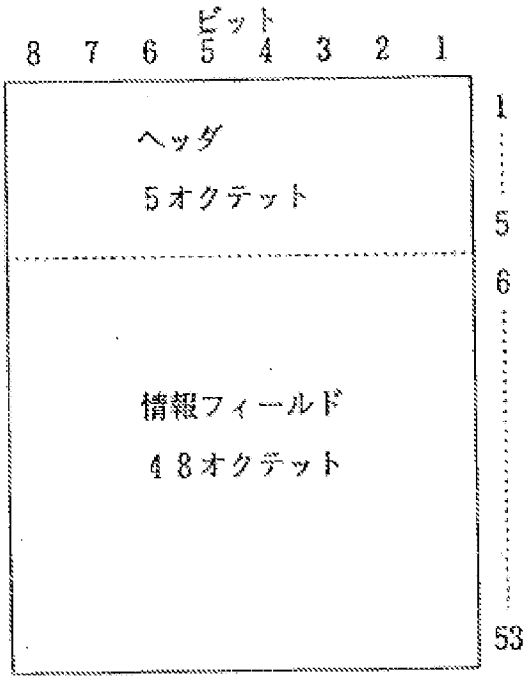
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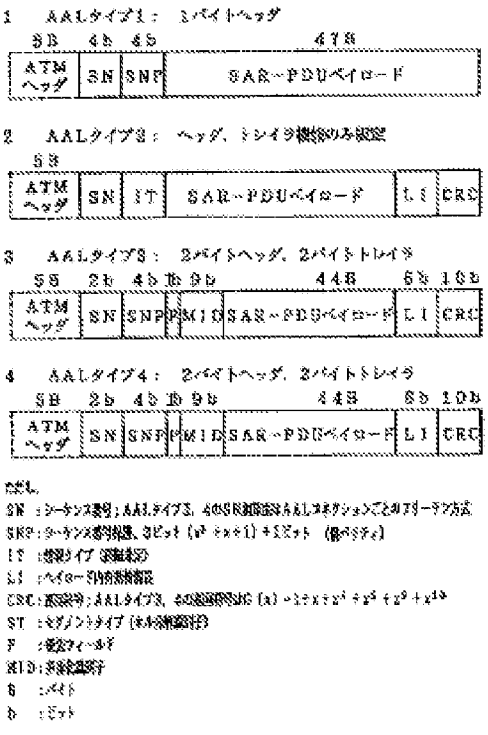
ヘッダ
5オクテット
情報フィールド
48オクテット
1
5
6
53

【図5】


1 AALタイプ1： 1バイトヘッダ
ATMヘッダ
SN
SNP
SAR-PDUペイロード
2 AALタイプ2： ヘッダ、トレイラ機能のみ規定
ATMヘッダ
SN
IT
SAR-PDUペイロード
LI
CRC
3 AALタイプ3： 2バイトヘッダ、2バイトトレイラ
ATMヘッダ
SN
SNP
PM
MID
SAR-PDUペイロード
LI
CRC
4 AALタイプ4： 2バイトヘッダ、2バイトトレイラ
ATMヘッダ
SN
SNP
PM
MID
SAR-PDUペイロード
LI
CRC

Electronic Patent Application Fee Transmittal

Application Number:	12159841
Filing Date:	22-Oct-2008
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Filer:	Harry Sung Lee/Diana Kim
Attorney Docket Number:	2101-3515

Filed as Large Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt

EFS ID:	11522271
Application Number:	12159841
International Application Number:	
Confirmation Number:	3203
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Customer Number:	35884
Filer:	Harry Sung Lee/Diana Kim
Filer Authorized By:	Harry Sung Lee
Attorney Docket Number:	2101-3515
Receipt Date:	01-DEC-2011
Filing Date:	22-OCT-2008
Time Stamp:	14:55:13
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	14280
Deposit Account	502290
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Information Disclosure Statement (IDS) Form (SB08)	2101-3515_112511_IDSForm1.pdf	612238 389d9bcf288308953c6d4fca83b9761f20b60fbb	no	4
Warnings:					
Information:					
A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.					
2	Information Disclosure Statement (IDS) Form (SB08)	2101-3515_112511_IDSForm2.pdf	612306 79e2c63100d6ad0c660d8536be6bb69ea2d3c18a	no	4
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Information:					
3	Foreign Reference	F1_CN1692661.pdf	2797709 1f0fcd12f0da13623f8aab6e8c8ad754d5c29c80	no	35
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Warnings:					
Information:					
			Total Files Size (in bytes):	5113322	

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	Cho, Un C.
Attorney Docket Number	2101-3515

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	1692661	CN		2005-11-02	Matsushita Electric Ind Co., Ltd.		☐
	2	06-121001	JP		1994-04-28	Matsushita Electric Ind Co., Ltd.		☐

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	Cho, Un C.
	Attorney Docket Number	2101-3515

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1		☐

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EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	Cho, Un C.
	Attorney Docket Number	2101-3515

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Harry S. Lee/	Date (YYYY-MM-DD)	2011-12-01
Name/Print	Harry S. Lee	Registration Number	56,814

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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United States Patent and Trademark Office
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P.O. Box 1450
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www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
12/159,841	10/22/2008	2617	1430	2101-3515	14	3

CONFIRMATION NO. 3203

CORRECTED FILING RECEIPT

35884
LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

Date Mailed: 11/23/2011

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Young Dae Lee, Gyeonggi-do, KOREA, REPUBLIC OF;
Sung Duck Chun, Gyeonggi-do, KOREA, REPUBLIC OF;
Myung Cheul Jung, Seoul, KOREA, REPUBLIC OF;
Sung Jun Park, Gyeonggi-do, KOREA, REPUBLIC OF;

Power of Attorney: The patent practitioners associated with Customer Number 35884

Domestic Priority data as claimed by applicant

This application is a 371 of PCT/KR2007/000078 01/05/2007
which claims benefit of 60/757,063 01/05/2006
and claims benefit of 60/783,250 03/16/2006
and claims benefit of 60/784,680 03/21/2006
and claims benefit of 60/797,402 05/02/2006

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
REPUBLIC OF KOREA 10-2007-0000936 01/04/2007

If Required, Foreign Filing License Granted: 05/20/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/159,841**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No

Title

METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM

Preliminary Class

455

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

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Title 37, Code of Federal Regulations, 5.11 & 5.15

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BIB DATA SHEET

CONFIRMATION NO. 3203

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/159,841	10/22/2008 RULE	455	2617	2101-3515

APPLICANTS

Young Dae Lee, Gyeonggi-do, KOREA, REPUBLIC OF;
Sung Duck Chun, Gyeonggi-do, KOREA, REPUBLIC OF;
Myung Cheul Jung, Seoul, KOREA, REPUBLIC OF;
Sung Jun Park, Gyeonggi-do, KOREA, REPUBLIC OF;

**** CONTINUING DATA ***************************

This application is a 371 of PCT/KR2007/000078 01/05/2007
which claims benefit of 60/757,063 01/05/2006
and claims benefit of 60/783,250 03/16/2006
and claims benefit of 60/784,680 03/21/2006
and claims benefit of 60/797,402 05/02/2006

**** FOREIGN APPLICATIONS ***************************

REPUBLIC OF KOREA 10-2007-0000936 01/04/2007

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****

05/20/2009

Foreign Priority claimed ☑ Yes ☐ No 35 USC 119(a-d) conditions met ☑ Yes ☐ No Verified and Acknowledged /UN C CHO/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		KOREA, REPUBLIC OF	8	14	3

ADDRESS

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017
UNITED STATES

TITLE

METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM

FILING FEE RECEIVED		
1430	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

BIB (Rev. 05/07).

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Address: COMMISSIONER FOR PATENTS
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/159,841	10/22/2008	Young Dae Lee	2101-3515	3203

35884 7590 11/23/2011

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

EXAMINER	
CHO, UN C	

ART UNIT	PAPER NUMBER
2617	

NOTIFICATION DATE	DELIVERY MODE
11/23/2011	ELECTRONIC

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Address : COMMISSIONER FOR PATENTS
P.O. Box 1450
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APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
12/159,841	22 October, 2008	LEE ET AL.	2101-3515

	EXAMINER	
LEE, HONG, DEGERMAN, KANG & WAIMEY 660 S. FIGUEROA STREET Suite 2300 LOS ANGELES, CA 90017	UN C. CHO	
	ART UNIT	PAPER
	2617	11202011

DATE MAILED:

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner for Patents

The IDSs submitted on 11/18/2011 have been placed in record and considered by the examiner.

/UN C. CHO/
Primary Examiner, Art Unit 2617

PTO-90C (Rev.04-03)

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20040184437		2004-09-23	Lee et al.	

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FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
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Receipt date: 11/18/2011	Application Number	12159841 12159841 - GAU: 2617
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2006025437	JP		2006-01-26	INTERDIGITAL TECH CORP		☐

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/159,841	10/22/2008	Young Dae Lee	2101-3515	3203

35884 7590 11/22/2011

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

EXAMINER	
CHO, UN C	

ART UNIT	PAPER NUMBER
2617	

NOTIFICATION DATE	DELIVERY MODE
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12/159,841	22 October, 2008	LEE ET AL.	2101-3515

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ART UNIT	PAPER
2617	11172011

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The IDSs filed on 11/16/2011 have been placed in record and considered by the examiner.

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Primary Examiner, Art Unit 2617

PTO-90C (Rev.04-03)

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	1	20040219920		2004-11-04	Love et al.	
	2	20090323646		2009-12-31	Ketchum et al.	

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Receipt date: 11/16/2011	Application Number	12159841 12159841 - GAU: 2617
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
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Examiner Signature	/Un Cho/	Date Considered	11/17/2011

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Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

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	1	2006/033552	WO		2006-03-30	SAMSUNG ELECTRONICS CO. LTD.		☐
	2	2005525066	JP		2005-08-18	LG ELECTRONICS INC.		☐

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Receipt date: 11/16/2011	Application Number	12159841 12159841 - GAU: 2617
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
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Customer No: 035884 Docket No. 2101-3515

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Young Dae LEE, et al.		Art Unit:	2617
Serial No:	12/159,841	Examiner:	CHO, Un C.
Filed:	October 22, 2008	Conf. No.:	3203
For:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM		

REQUEST FOR CORRECTED FILING RECEIPT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir or Madam:

We respectfully request the correction to two sections of the Corrected Filing Receipt dated November 18, 2011. Specifically, in the *Applicant(s)* section, the third inventor's first name was incorrectly listed as Meung instead of **My**ung, and in the *Domestic Priority* section, the four provisional Application Serial Nos. 60/757,063, 60/783,250 , 60/784,680 and 60/797,402 were removed. Enclosed please find the marked-up first page of the filing receipt reflecting the correction to the *Applicant(s)* and the *Domestic Priority* sections.

It is respectfully noted that inventor Myung Cheul JUNG and the four provisional application Serial Nos. 60/757,063, 60/783,250 , 60/784,680 and 60/797,402 were listed correctly on the Declaration/Power of Attorney and cover page of PCT Publication No. 2007/078172 as filed.

Please process the correction and forward us a corrected filing receipt at your convenience.

Respectfully submitted,

Lee, Hong, Degerman, Kang & Waimey

Date: November 21, 2011

By: /Harry S. Lee/
Richard C. Salfelder
Registration No. 56,814

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY DOCKET NO	TOT CLAIMS	IND CLAIMS
12/159,841	10/22/2008	2617	1430	2101-3515	14	3

CONFIRMATION NO. 3203

CORRECTED FILING RECEIPT

35884
LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

OC000000051013766

Date Mailed: 11/18/2011

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Young Dae Lee, Gyeonggi-do, KOREA, REPUBLIC OF;
Sung Duck Chun, Gyeonggi-do, KOREA, REPUBLIC OF;
Myung ~~Meung~~-Cheul Jung, Seoul, KOREA, REPUBLIC OF;
Sung Jun Park, Gyeonggi-do, KOREA, REPUBLIC OF;

Power of Attorney: The patent practitioners associated with Customer Number 35884

Domestic Priority data as claimed by applicant

This application is a 371 of PCT/KR2007/000078 01/05/2007 which claims benefit of 60/757,063 01/05/2006 and claims benefit of 60/783,250 03/16/2006 and claims benefit of 60/784,680 03/21/2006 and claims benefit of 60/797,402 05/02/2006

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
REPUBLIC OF KOREA 10-2007-0000936 01/04/2007

If Required, Foreign Filing License Granted: 05/20/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/159,841**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No

Electronic Acknowledgement Receipt

EFS ID:	11459117
Application Number:	12159841
International Application Number:	
Confirmation Number:	3203
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Customer Number:	35884
Filer:	Harry Sung Lee/Anna Tounian
Filer Authorized By:	Harry Sung Lee
Attorney Docket Number:	2101-3515
Receipt Date:	21-NOV-2011
Filing Date:	22-OCT-2008
Time Stamp:	20:38:30
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Corrected Filing Receipt	2101-3515-ReqCorrFR.pdf	78807 8321ca4de31ec32b76d8b852d9e12a846d03ef13	no	1

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2	Miscellaneous Incoming Letter	2101-3515-Marked-upFR.pdf	242742 0d3f18b1c9090498033d34ed4ec9b328deb65b42	no	1

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
12/159,841	10/22/2008	2617	1430	2101-3515	14	3

CONFIRMATION NO. 3203

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Date Mailed: 11/18/2011

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Sung Duck Chun, Gyeonggi-do, KOREA, REPUBLIC OF;
Meung Cheul Jung, Seoul, KOREA, REPUBLIC OF;
Sung Jun Park, Gyeonggi-do, KOREA, REPUBLIC OF;

Power of Attorney: The patent practitioners associated with Customer Number 35884

Domestic Priority data as claimed by applicant

This application is a 371 of PCT/KR2007/000078 01/05/2007

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REPUBLIC OF KOREA 10-2007-0000936 01/04/2007

If Required, Foreign Filing License Granted: 05/20/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/159,841**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No

Title

METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM

Preliminary Class

455

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PTO/SB/08a (01-10)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2006025437	JP		2006-01-26	INTERDIGITAL TECH CORP		☐

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

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☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/David Majdali/	Date (YYYY-MM-DD)	2011-11-18
Name/Print	David Majdali	Registration Number	53,257

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The information provided by you in this form will be subject to the following routine uses:

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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20040184437		2004-09-23	Lee et al.	

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Espacenet

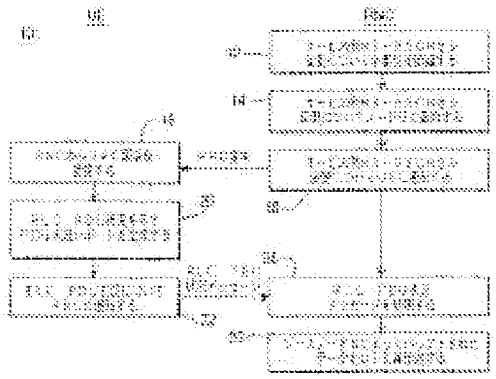
Bibliographic data: JP 2006025437 (A)

SYSTEM FOR EFFICIENTLY RECOVERING DATA BUFFERED IN NODE B AFTER CHANGING COMMON CHANNEL CELL OF HIGH-SPEED DOWNLINK ON SERVICE SIDE

Publication date:	2006-01-26
Inventor(s):	CHAO YI-JU; TERRY STEPHEN E +
Applicant(s):	INTERDIGITAL TECH CORP +
Classification:	- international: ***H04B1/69; H04B7/26; H04J3/00; H04L1/18; H04L12/56; H04W36/08; H04W36/38; H04W88/12***
	- European: H04L1/18R7; H04Q7/38H; H04W36/02
Application number:	JP20050200353 20050708
Priority number (s):	US20020370740P 20020405; US20020334489 20021230
Also published as:	• JP 4298682 (B2) • US 2003189909 (A1) • US 6717927 (B2) • US 2004165554 (A1) • WO 03087978 (A2) • more

Abstract of JP 2006025437 (A)

PROBLEM TO BE SOLVED: To shorten a waiting time during a changing procedure of an HS-DSCH cell on a service side, and potentially prevent the missing of transmission of packet data units. ; SOLUTION: In order to efficiently recover data buffered by a source node B, a new reference is introduced for UE that generates a status report about a PDU as soon as possible following notification about the changing of a cell which is indicated by an RRC procedure. A PDU status may be indicated about each wireless link controller related to an HS-DSCH transfer channel. Further, SRNC can wait for the PDU status report before the new transmission of data is started in a target cell depending on the change of the HS-DSCH cell on an intemode B service side. ; COPYRIGHT: (C) 2006,JPO&NCIPI



(19)日本国特許庁(JP)　(12)公開特許公報(A)　(11)特許出願公開番号
特開2006-25437
(P2006-25437A)
(43)公開日　平成18年1月26日(2006.1.26)

(51)Int.Cl.			F I			テーマコード（参考）
H04Q	7/22	(2006.01)	H04B	7/26	107	5K067
H04Q	7/38	(2006.01)	H04B	7/26	109M	

審査請求 未請求　請求項の数 6　OL　（全 9 頁）

(21)出願番号　特願2005-200353 (P2005-200353)
(22)出願日　平成17年7月8日 (2005.7.8)
(62)分割の表示　特願2003-584855 (P2003-584855)の分割
原出願日　平成15年4月2日 (2003.4.2)
(31)優先権主張番号　60/370,740
(32)優先日　平成14年4月5日 (2002.4.5)
(33)優先権主張国　米国 (US)
(31)優先権主張番号　10/334,489
(32)優先日　平成14年12月30日 (2002.12.30)
(33)優先権主張国　米国 (US)

(71)出願人　594164900
インターディジタル　テクノロジー　コーポレイション
ＩｎｔｅｒＤｉｇｉｔａｌ　Ｔｅｃｈｎｏｌｏｇｙ　Ｃｏｒｐｏｒａｔｉｏｎ
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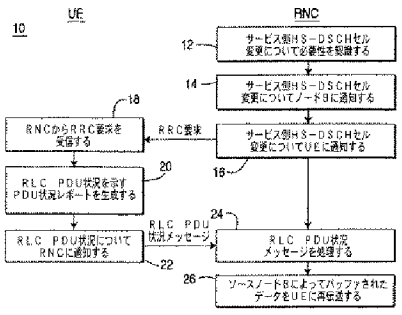
(74)代理人　100077481
弁理士　谷　義一
(74)代理人　100088915
弁理士　阿部　和夫

最終頁に続く

(54)【発明の名称】サービス側高速ダウンリンクの共用チャネルセル変更の後に、ノードＢにバッファされたデータを効率的に回復するシステム

(57)【要約】　（修正有）
【課題】サービス側ＨＳ－ＤＳＣＨセル変更手順の間に、待ち時間を低減し、潜在的にはパケットデータユニット伝送の喪失を防止する。
【解決手段】ソースノードＢによってバッファされたデータをより効率的に回復するために、ＲＲＣ手順によって示されたセル変更の通知に引き続いて、可能な限り早急にＰＤＵの状況レポートを生成するＵＥ向けに、新しい基準が導入される。ＰＤＵ状況は、ＨＳ－ＤＳＣＨ移送チャネルに関連付けられた各無線リンクコントローラについて示される可能性がある。さらに、インターノードＢサービス側ＨＳ－ＤＳＣＨセル変更に応じて、ＳＲＮＣは、ターゲットセル内で新しいデータの伝送を開始する前に、ＰＤＵ状況レポートを待つことができる。
【選択図】図１



【特許請求の範囲】
【請求項1】
高速ダウンリンク共用チャネル（ＨＳ－ＤＳＣＨ）のセル変更を容易にするシステムにおいて、少なくとも１つのノードＢに結合された遠隔ネットワークコントローラ（ＲＮＣ）を含み、前記少なくとも１つのノードＢは、少なくとも１つのユーザ機器（ＵＥ）にさらに結合されるシステムであって、
前記ＲＮＣ部に位置し、いつＨＳ－ＤＳＣＨセル変更が必要であるか判定するための、また、前記セル変更の通知を生成するための無線リソース制御（ＲＲＣ）ユニットと、
前記通知を受信し、各ＰＤＵの状況を示す状況メッセージを生成するための、また、前記状況メッセージを前記ＲＮＣに送信するための、前記ＵＥ内に位置する制御ユニットと、
前記状況メッセージを読み取り、そのような状況メッセージに基づいてＰＤＵを前記ＵＥに再伝送するための、前記ＲＮＣ部の制御ユニットとを備えることを特徴とするシステム。
【請求項2】
少なくとも１つのユーザ機器にさらに結合される少なくとも１つのノードＢに結合された遠隔ネットワークコントローラ（ＲＮＣ）を有するシステムにおける、高速ダウンリンク共用チャネル（ＨＳ－ＤＳＣＨ）セル変更のための方法であって、
前記ＲＮＣ部で、ＨＳ－ＤＳＣＨセル変更について必要性を検出すること、
前記セル変更について前記ＵＥに通知すること、
前記ＵＥ部で受信されたデータの状況を決定すること、
前記ＵＥ部でのデータの受信の前記状況に基づいて、状況レポートを生成すること、
前記ＵＥから前記ＲＮＣに前記状況レポートを伝送すること、
前記ＲＮＣ部で、前記状況レポートに基づいて、前記ＵＥに伝送すべきデータを決定することを含むことを特徴とする方法。
【請求項3】
ソースセルからターゲットセルへの高速ダウンリンク共用チャネル（ＨＳ－ＤＳＣＨ）セル変更を容易にするＵＥであって、
前記ＵＥ部で、いつセル変更が必要であるか判定するための手段と、
前記セル変更の前に、前記ＵＥに伝送されたデータの状況を決定するための手段と、
前記決定に基づいて、状況レポートを生成するための手段と、
前記データ状況レポートを伝送するための手段とを備えることを特徴とするＵＥ。
【請求項4】
前記データは、パケットデータユニット（ＰＤＵ）を含むことを特徴とする請求項３に記載のＵＥ。
【請求項5】
前記状況レポートは、状況ＰＤＵを含むことを特徴とする請求項４に記載のシステム。
【請求項6】
前記第１の決定手段は、ＨＳ－ＤＳＣＨセル変更を示す要求メッセージを受信するための手段を含むことを特徴とする請求項３に記載のシステム。

【発明の詳細な説明】
【技術分野】
【0001】
本発明は、ワイヤレス通信の分野に関する。より詳細には、本発明は、中間点からデータを配信するワイヤレスシステムにおいて、バッファされたデータをハンドオーバの後に効率的に回復することに関する。１つまたは複数のノードＢに結合された遠隔ネットワークコントローラ（ＲＮＣ）を有し、ノードＢは、複数のユーザ機器（ＵＥ）にワイヤレスで結合される第３世代（３Ｇ）システムであって、適応変調および符号化（ＡＭＣ）技法と、ハイブリッド自動再送要求（Ｈ－ＡＲＱ）技法とを使用する第３世代システムは、この種のシステムの一例にすぎない。

【背景技術】
【0002】
３G地上無線接続網（Ｕｎｉｖｅｒｓａｌ　Ｔｅｒｒｅｓｔｒｉａｌ　Ｒａｄｉｏ　Ａｃｃｅｓｓ　Ｎｅｔｗｏｒｋ：UTRAN）は、いくつかのRNCを備え、各RNCはいくつかのノードBに結合することができる。ノードBは、各々が１つまたは複数のセルについてトラフィックを管理する１つまたは複数の基地局を備えるエンティティである。
【0003】
一般に、３GのＦＤＤシステムとＴＤＤシステムは、ＲＮＣを使用し、ＵＥに対するデータ伝送をバッファしてスケジューリングを行う。しかし、３Ｇセルラシステムの高速チャネルの場合、データは、ノードBにより伝送するためバッファおよびスケジューリングが行われる。たとえば、これらの高速チャネルの１つは、高速ダウンリンクの共用チャネル（ＨＳ－ＤＳＣＨ）である。データはノードBによって配信されるため、ノードB内で伝送用にデータをバッファすることが必要である。このアーキテクチャを採用する結果、ＲＮＣは、パケットデータユニット（ＰＤＵ）の、ノードBによって制御された最新の伝送状況を有していない。したがって、セル間でハンドオーバする際、データ伝送のスケジューリングをセル変更にあわせることが必要となる。そうでないと、セル変更の後に伝送されたデータの喪失または重複を回避するため、データ伝送を再同期することが必要になってしまう。３Ｇネットワークでは、セル間のハンドオーバは、ＲＮＣによって制御される。そのＵＥが存在するセルを制御するＲＮＣが変わる可能性があるため、ハンドオーバの結果としてデータの損失、または重複のおそれがある。この問題は、各ＲＮＣに関連付けられたノードBのアーキテクチャによっては悪化することがある。ＵＥのセルハンドオーバの結果ＲＮＣが変更されるより、移動ＵＥがノードBの変更を必要とする可能性の方がはるかに高い。
【0004】
ＨＳ－ＤＳＣＨは、データの高速伝送を可能にするためにＡＭＣを、またデータの送達に成功する可能性を高めるためにＨ－ＡＲＱを使用する。サービス側ＨＳ－ＤＳＣＨセルは、サービス側ＨＳ－ＤＳＣＨ無線リンクの送受信を実行しているＵＴＲＡＮアクセスポイントに関連付けられたセルをＵＥが変更しなければならないとき変更される。サービス側ＨＳ－ＤＳＣＨセルの変更は、物理チャネル条件の改善、および／または物理的容量の改善が、代替のセル内で実現されたとき呼び出される。ＵＴＲＡＮ内のＲＮＣ部で終端する３Ｇネットワーク内の他のチャネルと異なり、ＨＳ－ＤＳＣＨはノードＢ部で終端する。
【0005】
ＨＳ－ＤＳＣＨセル変更には、２つのタイプがある。イントラノードＢ（Ｉｎｔｒａ－Ｎｏｄｅ　Ｂ）サービス側ＨＳ－ＤＳＣＨセル変更は、ＵＥが、同じノードBに関連付けられた２つのセル間で変わるときである。インターノードＢ（Ｉｎｔｅｒ－Ｎｏｄｅ　Ｂ）サービス側ＨＳ－ＤＳＣＨセル変更は、ＵＥが、異なるノードBに関連付けられた２つのセル間で変わるときである。インターノードBセル変更では、サービス側ＨＳ－ＤＳＣＨセル変更の前のノードBがソースノードBと呼ばれ、サービス側ＨＳ－ＤＳＣＨセル変更の後のノードBがターゲットノードBと呼ばれる。
【0006】
ＲＮＣにもＵＥにもピア無線リンク制御（ＲＬＣ）エンティティがあり、データの伝送用に自動再送要求（ＡＲＱ）機能を提供する。送信側ＲＬＣエンティティは、ＰＤＵヘッダ内でシーケンス番号（ＳＮ）を示し、シーケンス番号は、伝送時にＰＤＵを逸しないように受信側ＲＬＣエンティティによって使用される。ＰＤＵが乱れた順序で送達されたことによって伝送中に逸したＰＤＵがあると認識された場合、受信側ＲＬＣエンティティは、状況レポートＰＤＵを送信し、送信側ＲＬＣエンティティに逸したＰＤＵを通知する。状況レポートＰＤＵは、データ伝送の状況を述べるために使用される。状況レポートＰＤＵは、逸した、または受信されたＰＤＵのＳＮを識別する。ＰＤＵを逸した場合、送信側ＲＬＣエンティティは、逸したＰＤＵの複製を再伝送することになる。

【0007】
送信側ＲＬＣエンティティが、受信側ＲＬＣエンティティに状況レポートＰＤＵを求めてポーリングし、あるいは受信側ＲＬＣエンティティが状況レポートを定期的に生成することも可能である。ポーリング機能は、送信側ＲＬＣエンティティがＰＤＵ伝送の状況を要求するための機構を提供する。
【0008】
ノードＢのＨ－ＡＲＱ機能もまた、失敗した伝送の再伝送を可能にする。Ｈ－ＡＲＱは、いくつかの失敗した伝送を取り除き、およびデータの送達に成功する確率を高めるように機能するが、最終的に送達の成功を確保するのは、ＲＬＣプロトコル層である。
【0009】
伝播条件の動的な変化により、ＨＳ－ＤＳＣＨセル変更は、サービス品質を維持するため迅速に実行しなければならない。サービス側ＨＳ－ＤＳＣＨセル変更中、ソースノードＢ内に現在格納されているＰＤＵのすべてが成功裏に伝送される前に、ＵＥがソースセル内で送受信を停止する可能性がある。ソースノードＢがデータのスケジューリングおよびバッファを行うため、およびデータ転送速度が非常に速いため（たとえば、１０Ｍｂ／秒以上）、ＵＥが（特にインターノードＢハンドオーバのために）サービス側ＨＳ－ＤＳＣＨセル変更を実行するとき、ソースノードＢ内にバッファされているかなりの量のデータが失われる可能性がある。このようにデータが喪失する理由の１つは、ソースノードＢ部でバッファされたデータをターゲットノードＢに転送するための機構が、ＵＴＲＡＮアーキテクチャ内に存在しないことである。ＨＳ－ＤＳＣＨセル変更を行う際、ＲＮＣは、ノードＢデータ伝送スケジューリングについて、およびその伝送がＵＥによって肯定確認されるのに成功したかどうか通知されないため、ＲＮＣは、あったとしてもどれだけのデータが失われたかについて情報を有していない。したがって、データを喪失することなしに伝送を維持するため、サービス側ＨＳ－ＤＳＣＨセル変更の際、データがソースノードＢ内にバッファされていると、ＲＮＣ　ＲＬＣは、このデータを回復しなければならない。
【0010】
現在、従来技術のシステムがソースノードＢ部でバッファされたデータの回復を処理する２つの望ましい方法がある。ＨＳ－ＤＳＣＨセル変更の後に、１）ＲＮＣは、ＵＥに状況ＰＤＵを明示的に要求することができ、あるいは２）ＲＮＣは、ソースセル内で停止したところで単に伝送を開始することができ、ＵＥが認識している順序の乱れた送達によって状況ＰＤＵが生成されることになる。
【0011】
ＲＮＣがＵＥをポーリングすることによって、状況ＰＤＵを明示的に要求する第１の場合には、ＲＮＣはまず、新しいセル内で物理チャネルが確立されるまで待たなければならない。次いで、状況ＰＤＵ要求が送信され、ＵＥによって受信され、処理される。ＵＥは、状況ＰＤＵを生成し、それをＲＮＣに返し、ＲＮＣは、状況ＰＤＵを処理し、どのＰＤＵが再伝送を必要としているかを判定する。
【0012】
ＲＮＣが、ソースセル内で停止したところから単にＰＤＵを伝送するのを開始する第２の場合、ＵＥは、データが乱れた順序で送達されたことを認識し、ＲＮＣに返す状況ＰＤＵを生成する。ＲＮＣは、状況ＰＤＵを処理し、どのＰＤＵが再伝送を必要としているか学習する。
【発明の開示】
【発明が解決しようとする課題】
【0013】
これら２つの場合のどちらにおいても、ソースノードＢ内にバッファされているデータを回復することが必要とされる場合は状況ＰＤＵが処理されるが、ＵＥによって再伝送データが適切に受信されるのは、かなり遅れることになる。これは、ＵＥによって状況ＰＤＵが生成されるのが、また、ＲＮＣ内で状況ＰＤＵが受信されるのが遅れるためである。
【0014】

伝送がＲＬＣ肯定確認モードで実行されている場合、データの逐次送達が行われるまで、データは、より高い層に渡されない。したがって、ＵＥは、逸したＰＤＵを再伝送することができるまで、順序の乱れたデータをバッファすることを求められることになる。これは、伝送の遅延を引き起こすだけでなく、ソースノードＢ内に格納されたデータの送達に成功するまでデータをバッファするのに十分なメモリをＵＥが有していることが必要である。そうでない場合、有効なデータ伝送速度が低下し、それによりサービス品質に影響を及ぼすこととなる。メモリは非常にコストがかかるため、これは望ましくない設計制約である。

【0015】

したがって、ターゲットノードＢに転送する前に、ソースノードＢ内にバッファされているデータを回復する従来技術の方法は、非常に望ましくない結果をもたらす。ユーザのサービス品質要件を適切に維持するために、より少ない遅延で、より効率的にソースノードＢ内にバッファされているデータを回復することができるシステムおよび方法を有することが望ましい。

【課題を解決するための手段】

【0016】

本発明は、サービス側ＨＳ－ＤＳＣＨセル変更手順の間に待ち時間を低減し、潜在的にはＰＤＵ伝送の喪失を防止するため、一連の動作を実施する方法およびシステムである。ＲＬＣ　ＰＤＵの状況レポートをＵＥで生成するため、新しい基準が導入される。ソースノードＢによってバッファされたデータをより効率的に回復するために、ＵＥは、ＲＲＣハンドオーバ手順によって示されたＨＳ－ＤＳＣＨセル変更の通知に引き続いて、可能な限り早急にＰＤＵの状況レポートを独自に生成する。ＨＳ－ＤＳＣＨ移送チャネルに関連付けられた各肯定確認モード（ＡＭ）ＲＬＣインスタンスについてＰＤＵ状況を示すこともできる。

【発明を実施するための最良の形態】

【0017】

本発明の好ましい実施形態について図面を参照して説明するが、全体を通して同じ数字は同じ要素を表すものとする。

【0018】

ＲＮＣがＰＤＵの状況を取得して、ソースノードＢ内にバッファされているデータを回復するための待ち時間を低減するため、サービス側ＨＳ－ＤＳＣＨセル変更の後に、ＵＥは、ＲＲＣ手順によって示されたＨＳ－ＤＳＣＨセル変更の通知に引き続いて、ＰＤＵの状況をＲＮＣに自動的に送信する。ＨＳ－ＤＳＣＨ移送チャネルに関連付けられた各ＡＭＲＬＣインスタンスにＰＤＵ状況の生成を適用することができる。

【0019】

図１のフローチャートを参照すると、本発明のノードＢによってバッファされたデータを効率的に回復する方法１０が示されている。ＲＮＣは、サービス側ＨＳ－ＤＳＣＨセル変更の必要性を認識する（ステップ１２）。次いで、サービス側ＨＳ－ＤＳＣＨセル変更についてノードＢに通知する（ステップ１４）。ＲＲＣ要求メッセージを介して示されるサービス側ＨＳ－ＤＳＣＨセル変更についてＵＥに通知する（ステップ１６）。ステップ１４の前にステップ１６を呼び出すことも可能である。

【0020】

ステップ１８でＲＲＣ要求メッセージがＵＥによって受信された後に、ソースノードＢ内にバッファされているデータを回復する際の遅延を低減するため、ＵＥは、ＲＲＣ手順によって示されたＨＳ－ＤＳＣＨセル変更の通知に引き続いて、可能な限り早急にＲＬＣＰＤＵ状況を示す状況レポートを独自に生成する（ステップ２０）。ＵＥは、状況ＰＤＵを生成するためのいずれの従来技術のトリガ（たとえば、状況ＰＤＵを生成するためのＲＮＣによる要求、または、順序の乱れたデータの送達のＵＥによる検出）も待たない。

【0021】

ＵＥにおいては、サービス側ＨＳ－ＤＳＣＨセル変更の後にＰＤＵ状況レポートの生成

のトリガを引くためにＵＥが実装することができる多数の様々な代替方法がある。しかし、本明細書では、そのうちいくつかの例を提示する。第１の選択肢として、ＭＡＣ－ｈｓが、その再順序付けバッファがフラッシュされた後にＲＬＣに通知するのが望ましい。第２の選択肢は、ＲＲＣが、サービス側ＨＳ－ＤＳＣＨセル変更を示すレベル３（Ｌ３）ＲＲＣ手順についてＲＬＣに通知することである。第３に、物理層が、ターゲットセル内でのＨＳ－ＤＳＣＨ制御チャネルの受信についてＲＬＣに通知することができ、あるいは物理層が、ＨＳ－ＤＳＣＨ制御のターゲットセルへの切換えの際にＲＬＣに通知することができる。ＵＥからＲＮＣに送信すべきＲＬＣ　ＰＤＵ状況メッセージのトリガを引くための他の方法があり得ることを、当業者なら確実に理解できるであろう。こ手続きの結果として、ＰＤＵ状況は、あまり遅延せずに生成され、またＲＮＣに送信され（ステップ２２）、これにより、ソースノードＢによってバッファされたデータがより効率的に回復される。

【0022】

ステップ２２においては、ＵＥがＲＮＣにＰＤＵの状況レポートを送信するためのいくつかの代替の形態がある。状況ＰＤＵを送信するこれらの方法は、どのように状況ＰＤＵをＵＥからＲＮＣに示すことができるかという例であり、新しい基準に応じて状況ＰＤＵを生成することに関する本発明の最重要事項ではない。ＵＥは、ＨＳ－ＤＳＣＨ移送チャネルにマッピングされた各ＡＭ　ＲＬＣインスタンスについてＲＬＣ状況レポートを生成するのが望ましい。

【0023】

第２の代替の形態において、ＵＥは、状況レポートが得られたら直ちに、ＵＥからＲＮＣへの第１の既存のアップリンクメッセージを介してＰＤＵ状況レポートを送信する。イントラノードＢサービス側セル変更の場合（また、ＨＳ－ＤＳＣＨ移送チャネルおよび無線ベアラパラメータが変更されていないと仮定して）、メッセージは、ＤＣＣＨ上で「ＰＨＹＳＩＣＡＬ　ＣＨＡＮＮＥＬ　ＲＥＣＯＮＦＩＧＵＲＡＴＩＯＮ　ＣＯＭＰＬＥＴＥ（物理チャネル再構成完了）」である。ＨＳ－ＤＳＣＨ移送チャネルおよび無線ベアラパラメータが変更された場合、および／またはインターノードＢサービス側セル変更の場合、メッセージは、ＤＣＣＨ上で「ＴＲＡＮＰＳＯＲＴ　ＣＨＡＮＮＥＬ　ＲＥＣＯＮＦＩＧＵＲＡＴＩＯＮ　ＣＯＭＰＬＥＴＥ（移送チャネル再構成完了）」である。ＰＤＵ状況は、任意のＲＲＣシグナリングメッセージ内で識別することができる。次いで、ＲＮＣ　ＲＲＣエンティティは、ターゲットノードＢに対して伝送を再開するために、ＲＬＣにＰＤＵの状況を通知する。

【0024】

第３の代替形態において、ＵＥは、ＵＥからＲＮＣへのＤＣＣＨ上の新しいＬ３シグナリングメッセージ上で状況レポートを送信する。この新しいメッセージは、ＵＥの無線リソース制御（ＲＲＣ）層からＲＮＣのＲＲＣ層に送信される。次いで、ＲＮＣは、ターゲットノードＢに対して伝送を再開するために、ＲＬＣ層にＰＤＵの状況を通知する。この場合、図１に示されているＰＤＵ状況メッセージは、「ＲＲＣ完了（ＲＲＣ　Ｃｏｍｐｌｅｔｅ）」と「ＲＬＣ状況（ＲＬＣ　Ｓｔａｔｕｓ）」という２つの別個のメッセージを含むことができる。

【0025】

ＰＤＵの状況レポートの特定のフォーマットは変わる可能性があることに留意されたい。たとえば、ＰＤＵの状況レポートのフォーマットには、１）最後の成功裏に逐次送達されたＰＤＵのシーケンス番号（ＳＮ）、２）成功裏に受信されたＰＤＵの最大ＳＮ、３）成功裏に受信されたＰＤＵの最大ＳＮまで、受信するのに成功しなかったＰＤＵ（すなわち、逸したＰＤＵ）のＳＮ、または４）受信するのに成功したＰＤＵのＳＮのリストが含まれる。

【0026】

ＲＮＣがＰＤＵ状況を送信するメッセージを受信した後に、ＰＤＵ状況メッセージは、逸したＰＤＵを決定するため、ＲＮＣ　ＲＬＣによって処理される（ステップ２４）。セ

ル変更の結果、失われたデータは、今現在、ＲＮＣによって認識され、ＵＥに再伝送することができる（ステップ２６）。メッセージは、多数の代替の形態のものとすることができ、必ずしもＰＤＵ状況レポートを送信する形態だけに限定されないことに留意されたい。

【0027】

また、本発明のこの実施形態において、ＲＮＣは、ステップ１６と２４の間で、ターゲットセル内でＵＥに伝送するために引き続きデータを転送することができることに留意されたい。ソースノードＢによってバッファされたデータすべてが成功裏に送信された場合、データは順序が乱れることになるため、ＵＥは、より高い層に対する逐次送達を維持するために、データをバッファせざるを得なくなる。これは、ＵＥが、順序の乱れたＰＤＵを格納するために十分なメモリを有することを必要とする。連続データの喪失の後に、失われた連続データが成功裏に伝送されるまで、伝送がＵＥメモリ容量に制限される。

【0028】

図２のフローチャートを参照すると、本発明の一代替実施形態のノードＢによってバッファされたデータを効率的に回復する方法４０が示されている。この方法４０は、図１に示されている方法１０と同様であり、図１の場合と同じ符号が付けられている図２の諸ステップは、同一である。しかし、本発明の　本実施形態によれば、方法４０は、ステップ２４でＰＵＤ状況メッセージが処理されるまで、ＵＥに対するダウンリンクＨＳ－ＤＳＣＨ伝送すべてを中止する新しいステップ１７を含む。本実施形態は、ソースノードＢによってバッファされたデータを再伝送するための遅延を最小限に抑え、ＵＥ部でバッファしなければならないデータ量を制限する。

【0029】

遅延を最小限に抑えることに関連して、ノードＢはＲＬＣ伝送シーケンス番号を知らず、ノードＢ内の伝送スケジューリングは、ＦＩＦＯベースである。したがって、ＰＤＵ状況が処理される前に、データがターゲットセル内でＲＮＣによって転送される場合、データが先に送信されることになる。ノードＢにおけるこのデータキューイングは、ソースノードＢによってバッファされたデータの再伝送をさらに遅らせる可能性がある。

【0030】

本発明は、インターノードＢセル変更とイントラノードＢセル変更のＨＳ－ＤＳＣＨセル変更に共に適用することができる。イントラノードＢセル変更の場合には、内部設計問題により、ノードＢが、バッファされているＨＳ－ＤＳＣＨデータをターゲットセルに再指定することができない場合があり得るため、ＲＮＣは、どちらの場合についても、ＰＤＵ状況の生成の必要性を示すことができる。また、ＵＥは、インターノードＢセル変更とイントラノードＢセル変更を区別することができない可能性もあり、これもまた、インターとイントラのどちらの場合についても、ＰＤＵ状況を生成することになるであろう。そのような形で送信される状況ＰＤＵは、インターノードＢセル変更、またはバッファされているデータをターゲットセルに切り換えることができないイントラノードＢの場合において有用となる。

【0031】

以上、本発明について詳しく述べたが、本発明はそれに限定されないこと、また、特許請求の範囲によって規定される本発明の精神および範囲から逸脱することなしに、様々な変更を加えることができることを理解されたい。

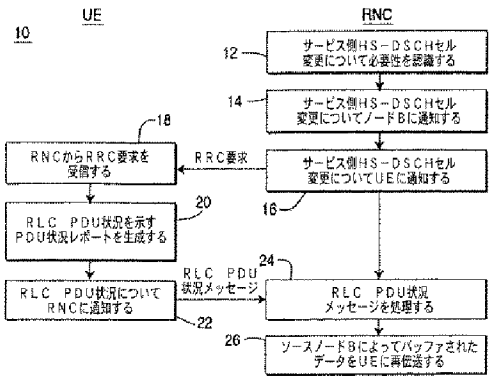
【図面の簡単な説明】

【0032】

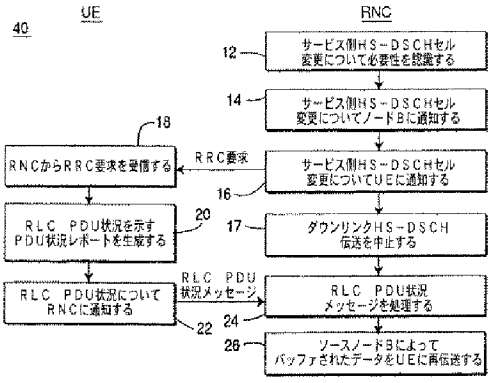
【図1】ＨＳ－ＤＳＣＨセル変更の後に、ノードＢによってバッファされたデータを効率的に回復するための、本発明による効率的な手順のフローチャートである。

【図2】ターゲットセル内で新しいデータの伝送を開始する前に、ＲＮＣが状況ＰＤＵを待つ代替方法のフローチャートである。

【図1】


UE
10
RNC
12
サービス側HS-DSCHセル変更について必要性を認識する
14
サービス側HS-DSCHセル変更についてノードBに通知する
18
RNCからRRC要求を受信する
RRC要求
サービス側HS-DSCHセル変更についてUEに通知する
16
20
RLC PDU状況を示すPDU状況レポートを生成する
24
RLC PDU状況メッセージ
RLC PDU状況について RNCに通知する
RLC PDU状況メッセージを処理する
22
26
ソースノードBによってバッファされたデータをUEに再伝送する

【図2】


UE
40
RNC
12
サービス側HS-DSCHセル変更について必要性を認識する
14
サービス側HS-DSCHセル変更についてノードBに通知する
18
RNCからRRC要求を受信する
RRC要求
サービス側HS-DSCHセル変更についてUEに通知する
16
20
RLC PDU状況を示すPDU状況レポートを生成する
17
ダウンリンクHS-DSCH伝送を中止する
RLC PDU状況メッセージ
RLC PDU状況について RNCに通知する
RLC PDU状況メッセージを処理する
22
24
26
ソースノードBによってバッファされたデータをUEに再伝送する

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Ｆターム(参考) 5K067 AA23 AA33 BB21 CC08 DD19 DD36 DD43 DD51 EE02 EE10
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Electronic Patent Application Fee Transmittal

Application Number:	12159841
Filing Date:	22-Oct-2008
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Filer:	David Gerard Majdali/Neeti Rajput
Attorney Docket Number:	2101-3515

Filed as Large Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt

EFS ID:	11446417
Application Number:	12159841
International Application Number:	
Confirmation Number:	3203
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Customer Number:	35884
Filer:	David Gerard Majdali/Neeti Rajput
Filer Authorized By:	David Gerard Majdali
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Information:					
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Warnings:					
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3	Foreign Reference	JP2006-025437.pdf	806369 a7f75b7f144679dd75fbda79d907db3ba2428bad	no	10
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

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	1	2006/033552	WO		2006-03-30	SAMSUNG ELECTRONICS CO. LTD.		☐
	2	2005525066	JP		2005-08-18	LG ELECTRONICS INC.		☐

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	Attorney Docket Number	2101-3515

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☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

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A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/David Majdali/	Date (YYYY-MM-DD)	2011-11-16
Name/Print	David Majdali	Registration Number	53,257

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	1	20040219920		2004-11-04	Love et al.	
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☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/David Majdali/	Date (YYYY-MM-DD)	2011-11-16
Name/Print	David Majdali	Registration Number	53,257

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

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METHOD FOR SCHEDULING TRANSMISSION OF MBMS DATA IN UMTS

Publication date:	2005-08-18	
Inventor(s):		
Applicant(s):		
Classification:	**- international:**	***H04B7/24; H04B7/26; H04L29/06; H04W4/06; H04W72/14;*** (IPC1-7): H04Q7/38
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- more

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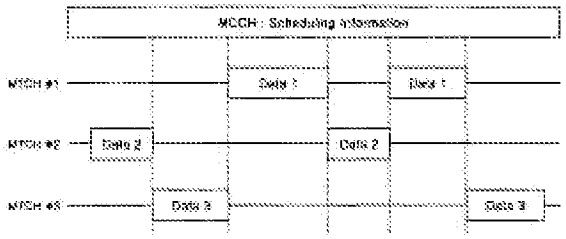
Abstract of corresponding document: WO 2004017540 (A1)



A multimedia service of a UMTS (Universal Mobile Telecommunications System) is disclosed. When UTRAN provides an MBMS service, it designates time at which each data for MBMS service is transmitted and transmits the corresponding time information to a terminal group which desires to receive a specific MBMS service. Accordingly, a terminal of the terminal group receives the MBMS service data during a section of the corresponding time information and also receives a control signal or other service than the MBMS service at other time.

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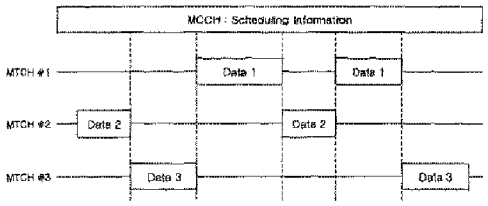
最終頁に続く

(54)【発明の名称】無線移動通信システムにおけるＭＢＭＳデータの伝送スケジューリング方法

(57)【要約】
本発明は、Ｕｎｉｖｅｒｓａｌ　Ｍｏｂｉｌｅ　Ｔｅｌｅｃｏｍｍｕｎｉｃａｔｉｏｎｓ　Ｓｙｓｔｅｍ（ＵＭＴＳ）のマルチメディアサービスに関し、ＵＴＲＡＮがＭＢＭＳサービスを提供する場合、ＭＢＭＳサービスデータが伝送される時間をＭＢＭＳサービス毎に指定して、該当の時間情報を、特定のＭＢＭＳサービスを受信しようとする端末グループに伝送する。従って、端末グループの端末は、該当の時間情報の区間の間ＭＢＭＳサービスデータを受信し、それ以外の時間には制御信号またはＭＢＭＳサービスを除いた他のサービスを受信する。



【特許請求の範囲】
【請求項1】
複数の端末により構成された端末グループにＭｕｌｔｉｍｅｄｉａ　Ｂｒｏａｄｃａｓｔ／Ｍｕｌｔｉｃａｓｔ　Ｓｅｒｖｉｃｅ（ＭＢＭＳ）を提供する無線通信システムにおいて、
ＭＢＭＳデータが伝送されるチャンネルの無線資源を独立的に指定する段階と、
指定された無線資源情報をＭＢＭＳ毎に端末グループに伝送する段階と、を含むことを特徴とする伝送スケジューリング方法。
【請求項2】
伝送された無線資源情報に基づいて、各端末グループの端末でマルチメディアサービスデータを受信する段階を更に含むことを特徴とする請求項１記載の伝送スケジューリング方法。
【請求項3】
前記チャンネルは、共通物理チャンネルであることを特徴とする請求項１記載の伝送スケジューリング方法。
【請求項4】
前記無線資源は、ＭＢＭＳサービスデータが伝送される時間情報であることを特徴とする請求項１記載の伝送スケジューリング方法。
【請求項5】
各ＭＢＭＳデータには、互いに異なる無線資源が割り当てられ、前記無線資源情報は、フレーム割当情報であることを特徴とする請求項１記載の伝送スケジューリング方法。
【請求項6】
前記無線資源は、ＵＴＲＡＮが特定のＭＢＭＳサービスのためのｒａｄｉｏ　ｂｅａｒｅｒ（ＲＢ）を設定または再設定する時に指定されることを特徴とする請求項１記載の伝送スケジューリング方法。
【請求項7】
前記フレームは、特定のＭＢＭＳのためのＲＢが設定されているとき、周期的または非周期的に割り当てられることを特徴とする請求項５記載の伝送スケジューリング方法。
【請求項8】
前記端末は、無線資源情報が指示する時間の間、ＭＢＭＳサービスデータを受信することを特徴とする請求項２記載の伝送スケジューリング方法。
【請求項9】
前記端末は、無線資源情報が指示する時間以外の時間の間、制御信号を受信するか、全てのサービスデータの受信を中断することを特徴とする請求項２記載の伝送スケジューリング方法。
【請求項10】
前記端末は、無線資源情報が指示する時間以外の時間の間、ＭＢＭＳサービスを除いた他のサービスデータを受信することを特徴とする請求項２記載の伝送スケジューリング方法。
【請求項11】
前記無線資源は、Ｒａｄｉｏ　ｒｅｓｏｕｒｃｅ　ｃｏｎｔｒｏｌ（ＲＲＣ）階層またはマルチメディア階層により指定されることを特徴とする請求項１記載の伝送スケジューリング方法。
【請求項12】
前記無線資源がＲａｄｉｏ　ｒｅｓｏｕｒｃｅ　ｃｏｎｔｒｏｌ（ＲＲＣ）階層により指定される場合、前記無線資源は、フレーム形態で伝送されることを特徴とする請求項１１記載の伝送スケジューリング方法。
【請求項13】
前記無線資源は、放送チャンネルまたは制御チャンネルを通じて端末グループに伝送さ

れることを特徴とする請求項１２記載の伝送スケジューリング方法。
【請求項14】
前記無線資源がマルチメディア階層により指定される場合、前記無線資源は、ＭＢＭＳスケジュールメッセージに含まれて伝達されることを特徴とする請求項１１記載の伝送スケジューリング方法。
【請求項15】
前記互いに異なるＭＢＭＳスケジュールメッセージは、互いに異なるチャンネルを通じて端末グループに伝達されることを特徴とする請求項１４記載の伝送スケジューリング方法。
【請求項16】
前記チャンネルは、共通トラフィックチャンネルであることを特徴とする請求項１５記載の伝送スケジューリング方法。
【請求項17】
前記ＭＢＭＳスケジュールメッセージは、次に放送またはマルチキャストされる予定である特定のＭＢＭＳデータのシーケンス番号（Ｓｅｑｕｅｎｃｅ　Ｎｕｍｂｅｒ）または識別子とスケジュール情報を含むことを特徴とする請求項１３記載の伝送スケジューリング方法。
【請求項18】
前記ＭＢＭＳスケジュールメッセージは、特定のＭＢＭＳサービスの間、周期的に複数回伝送されることを特徴とする請求項１７記載の伝送スケジューリング方法。
【請求項19】
前記ＭＢＭＳスケジュールメッセージは、該当のＭＢＭＳデータが最初の伝送であるか、または反復伝送であるかを示すことを特徴とする請求項１７記載の伝送スケジューリング方法。
【請求項20】
前記ＭＢＭＳスケジュールメッセージは、特定のＭＢＭＳサービスの間、非周期的に複数回伝送されることを特徴とする請求項１７記載の伝送スケジューリング方法。
【請求項21】
前記ＭＢＭＳスケジュールメッセージは、ＭＢＭＳスケジュール期間の長さ及び前記ＭＢＭＳスケジュール期間の開始点と終了間の長さを示すことを特徴とする請求項２０記載の伝送スケジューリング方法。
【請求項22】
複数のマルチメディアサービスをマルチキャストする無線システムにおいて、
各マルチメディアサービス毎に、データ伝送のスケジューリングを独立的に行うことを特徴とする伝送スケジューリング方法。
【請求項23】
複数の端末により構成された端末グループにマルチメディアサービスを提供する無線通信システムにおいて、
特定のマルチメディアサービスのためのフレームを割り当てる段階と、
フレーム割当情報を特定の端末グループに伝送する段階と、
フレーム割当情報に基づいて、各端末グループでマルチメディアサービスデータを受信する段階と、を含むことを特徴とするマルチメディアサービス提供方法。
【請求項24】
前記マルチメディアサービスは、Ｍｕｌｔｉｍｅｄｉａ　Ｂｒｏａｄｃａｓｔ／Ｍｕｌｔｉｃａｓｔ　Ｓｅｒｖｉｃｅ（ＭＢＭＳ）であることを特徴とする請求項２３記載のマルチメディアサービス提供方法。
【請求項25】
前記フレームは、特定のマルチメディアサービスデータが伝送される共通物理チャンネルのフレームであることを特徴とする請求項２３記載のマルチメディアサービス提供方法。

【請求項26】
互いに異なるマルチメディアサービスデータは、互いに異なるフレームに割り当てられることを特徴とする請求項２５記載のマルチメディアサービス提供方法。
【請求項27】
前記フレームは、特定のＭＢＭＳサービスのためのｒａｄｉｏ　ｂｅａｒｅｒ（ＲＢ）を設定または再設定する時に割り当てられることを特徴とする請求項２３記載のマルチメディアサービス提供方法。
【請求項28】
前記フレームは、特定のＭＢＭＳのためのＲＢが設定されているとき、周期的または非周期的に割り当てられることを特徴とする請求項２３記載のマルチメディアサービス提供方法。
【請求項29】
前記フレームは、Ｒａｄｉｏ　ｒｅｓｏｕｒｃｅ　ｃｏｎｔｒｏｌ（ＲＲＣ）階層により割り当てられることを特徴とする請求項２３記載のマルチメディアサービス提供方法。
【請求項30】
前記フレームは、特定のＭＢＭＳサービスデータが伝送される時間を示すことを特徴とする請求項２３記載のマルチメディアサービス提供方法。
【請求項31】
前記フレーム割当情報は、特定のＭＢＭＳサービスデータが伝送される時間間隔及びその時間間隔が繰り返される周期を示すことを特徴とする請求項２３記載のマルチメディアサービス提供方法。
【請求項32】
前記端末グループは、フレーム割当情報が指示する時間の間、ＭＢＭＳサービスデータを受信することを特徴をする請求項２３記載のマルチメディアサービス提供方法。
【請求項33】
前記端末グループは、フレーム割当情報が指示する時間以外の時間の間、制御信号を受信することを特徴とする請求項２３記載のマルチメディアサービス提供方法。
【請求項34】
前記端末グループは、フレーム割当情報が指示する時間以外の時間の間、全てのサービスデータの受信を中断することを特徴とする請求項２３記載のマルチメディアサービス提供方法。
【請求項35】
前記フレーム割当情報は、放送チャンネルまたは制御チャンネルを通じて伝達されることを特徴とする請求項２３記載のマルチメディアサービス提供方法。
【請求項36】
複数の端末により構成された端末グループにマルチメディアサービスを提供する無線通信システムにおいて、
マルチメディアサービス毎にデータ伝送スケジューリングを独立的に行う段階と、
スケジューリング情報を特定の端末グループに伝送する段階と、
伝送されたスケジューリング情報に基づいて、端末グループでマルチメディアサービスデータを受信する段階と、を含むことを特徴とするマルチメディアサービス提供方法。
【請求項37】
前記マルチメディアサービスは、Ｍｕｌｔｉｍｅｄｉａ　Ｂｒｏａｄｃａｓｔ／Ｍｕｌｔｉｃａｓｔ　Ｓｅｒｖｉｃｅ（ＭＢＭＳ）であることを特徴とする請求項３６記載のマルチメディアサービス提供方法。
【請求項38】
前記スケジューリングは、ＵＴＲＡＮが特定のマルチメディアサービスのためのｒａｄｉｏ　ｂｅａｒｅｒ（ＲＢ）を設定または再設定する時に行われることを特徴とする請求項３６記載のマルチメディアサービス提供方法。
【請求項39】

前記データ伝送スケジューリングは、独立的に行われ、前記スケジューリング情報は、マルチメディアサービス毎に伝送されることを特徴とする請求項３６記載のマルチメディアサービス提供方法。

【請求項40】

前記スケジューリング情報は、特定のマルチメディアサービスのためのｒａｄｉｏ　ｂｅａｒｅｒ（ＲＢ）が設定されている間、所定の周期または非周期的に複数回伝送されることを特徴とする請求項３６記載のマルチメディアサービス提供方法。

【請求項41】

前記スケジューリング情報は、互いに異なる共通トラフィックチャンネルを通じて伝達されることを特徴とする請求項３６記載のマルチメディアサービス提供方法

【請求項42】

前記スケジューリング情報は、特定のデータが伝送される時間情報であることを特徴とする請求項３６記載のマルチメディアサービス提供方法

【請求項43】

前記スケジューリング情報は、ＭＢＭＳスケジュールメッセージに含まれて伝送されることを特徴とする請求項３６記載のマルチメディアサービス提供方法

【請求項44】

互いに異なるＭＢＭＳサービスは、互いに異なるＭＢＭＳスケジュールメッセージを使用することを特徴とする請求項４３記載のマルチメディアサービス提供方法。

【請求項45】

前記互いに異なるＭＢＭＳスケジュールメッセージは、互いに異なるチャンネルを通じて端末グループに伝達されることを特徴とする請求項４４記載のマルチメディアサービス提供方法。

【請求項46】

前記ＭＢＭＳスケジュールメッセージは、次に放送またはマルチキャストされる予定である特定のＭＢＭＳデータのシーケンス番号（Ｓｅｑｕｅｎｃｅ　Ｎｕｍｂｅｒ）または識別子とスケジューリング情報を含むことを特徴とする請求項４３記載のマルチメディアサービス提供方法。

【請求項47】

前記ＭＢＭＳスケジュールメッセージは、該当のＭＢＭＳデータが最初の伝送であるか、または反復伝送であるかを示す情報を含むことを特徴とする請求項４３記載のマルチメディアサービス提供方法。

【請求項48】

前記ＭＢＭＳスケジュールメッセージは、特定のＭＢＭＳサービスの間、周期的に複数回伝送されることを特徴とする請求項４３記載のマルチメディアサービス提供方法。

【請求項49】

前記ＭＢＭＳスケジュールメッセージは、特定のＭＢＭＳサービスの間、非周期的に複数回伝送されることを特徴とする請求項４３記載のマルチメディアサービス提供方法。

【請求項50】

前記ＭＢＭＳスケジュールメッセージは、ＭＢＭＳスケジュール期間の長さ及び前記ＭＢＭＳスケジュール期間の開始点と終了間の長さを示すことを特徴とする請求項４９記載のマルチメディアサービス提供方法。

【請求項51】

前記スケジューリング情報は、ＵＴＲＡＮの放送及びマルチキャスト制御階層により生成されることを特徴とする請求項３６記載のマルチメディアサービス提供方法。

【請求項52】

前記放送及びマルチキャスト制御階層は、スケジュール情報を下位階層に伝達することを特徴とする請求項５１記載のマルチメディアサービス提供方法。

【請求項53】

前記スケジュール情報は、特定の端末グループの放送及びマルチキャスト制御階層に伝

達されることを特徴とする請求項３６記載のマルチメディアサービス提供方法。
【請求項54】
前記端末の放送及びマルチキャスト制御階層は、伝送されたスケジュール情報を下位階層に伝達することを特徴とする請求項５３記載のマルチメディアサービス提供方法。
【請求項55】
前記端末グループは、スケジューリング情報が指示する時間の間、マルチメディアサービスデータを受信することを特徴をする請求項３６記載のマルチメディアサービス提供方法。
【請求項56】
前記端末グループは、スケジューリング情報が指示する時間以外の時間の間、制御信号を受信することを特徴とする請求項３６記載のマルチメディアサービス提供方法。
【請求項57】
前記端末グループは、スケジューリング情報が指示する時間以外の時間の間、ＭＢＭＳサービスを除いた他のサービスデータを受信することを特徴とする請求項３６記載のマルチメディアサービス提供方法。
【請求項58】
前記スケジューリング情報が指示する時間以外の時間の間、全てのサービスデータの受信を中断することを特徴とする請求項３６記載のマルチメディアサービス提供方法。
【発明の詳細な説明】
【技術分野】
【0001】
本発明は、Ｕｎｉｖｅｒｓａｌ　Ｍｏｂｉｌｅ　Ｔｅｌｅｃｏｍｍｕｎｉｃａｔｉｏｎｓ　Ｓｙｓｔｅｍ（UMTS）のＭｕｌｔｉｍｅｄｉａ　Ｂｒｏａｄｃａｓｔ／Ｍｕｌｔｉｃａｓｔ　Ｓｅｒｖｉｃｅ（ＭＢＭＳ）サービスに関し、特に、ＭＢＭＳサービスデータの伝送スケジューリング方法に関する。
【背景技術】
【0002】
ＵＭＴＳ（Ｕｎｉｖｅｒｓａｌ　Ｍｏｂｉｌｅ　Ｔｅｌｅｃｏｍｍｕｎｉｃａｔｉｏｎｓ　Ｓｙｓｔｅｍ）は、ヨーロッパ式標準のＧＳＭ（Ｇｌｏｂａｌ　Ｓｙｓｔｅｍ　ｆｏｒ　Ｍｏｂｉｌｅ　Ｃｏｍｍｕｎｉｃａｔｉｏｎｓ）システムから進化した第３世代移動通信システムであって、ＧＳＭ核心網（Ｃｏｒｅ　Ｎｅｔｗｏｒｋ）及びＷＣＤＭＡ（Ｗｉｄｅｂａｎｄ　Ｃｏｄｅ　Ｄｉｖｉｓｉｏｎ　Ｍｕｌｔｉｐｌｅ　Ａｃｃｅｓｓ）接続技術を基盤として、より向上した移動通信サービスの提供を目標とする。
【0003】
図１は、一般のＵＭＴＳの網構造である。
【0004】
図１に示すように、ＵＭＴＳシステムは、大きく端末、ＵＴＲＡＮ及び核心網により構成される。ＵＴＲＡＮは、一つ以上の無線網サブシステム（Ｒａｄｉｏ　Ｎｅｔｗｏｒｋ　Ｓｕｂ－ｓｙｓｔｅｍｓ：ＲＮＳ）により構成され、各ＲＮＳは、一つの無線網制御器（Ｒａｄｉｏ　Ｎｅｔｗｏｒｋ　Ｃｏｎｔｒｏｌｌｅｒ：ＲＮＣ）と、そのＲＮＣにより管理される一つ以上のＮｏｄｅ　Ｂ（基地局）と、により構成される。
【0005】
Ｎｏｄｅ　Ｂは、ＲＮＣにより管理され、アップリンクでは端末の物理階層から伝送される情報を受信し、ダウンリンクでは端末にデータを伝送して端末に対するＵＴＲＡＮのアクセスポイント（Ａｃｃｅｓｓ　Ｐｏｉｎｔ）の役割を担当する。前記ＲＮＣは、無線資源の割当及び管理を担当し、核心網とのアクセスポイントの役割を担当する。
【0006】
ＵＴＲＡＮの主な機能は、端末と核心網間の通話のために無線アクセスベアラ（Ｒａｄｉｏ　Ａｃｃｅｓｓ　Ｂｅａｒｅｒ：ＲＡＢ）を構成及び維持することである。核心網は、終端間（ｅｎｄ－ｔｏ－ｅｎｄ）のサービス品質（Ｑｕａｌｉｔｙ　ｏｆ　Ｓｅｒｖｉｃｅ：ＱｏＳ）要求事項をＲＡＢに適用し、ＲＡＢは核心網が設定したＱｏＳ要求事項を

支援する。従って、ＵＴＲＡＮは、ＲＡＢを構成及び維持することで、終端間のＱｏＳ要求事項を充足させる。

【0007】

ＲＡＢサービスは、更に下位概念のＩｕ　ＢｅａｒｅｒサービスとＲａｄｉｏ　Ｂｅａｒｅｒサービスとに分けられる。ここで、Ｉｕ　Ｂｅａｒｅｒサービスは、ＵＴＲＡＮと核心網の境界ノード間で使用者データの信頼性のある伝送を担当し、Ｒａｄｉｏ　ＢｅａｒｅｒサービスはＵＥ、端末とＵＴＲＡＮ間で使用者データの信頼性のある伝送を担当する。

【0008】

ＵＭＴＳにおいて、トラフィックは、次のような特性、即ち、ｃｏｎｖｅｒｓａｔｉｏｎａｌ　ｃｌａｓｓ、ｓｔｒｅａｍｉｎｇ　ｃｌａｓｓ、ｉｎｔｅｒａｃｔｉｖｅ　ｃｌａｓｓ及びｂａｃｋｇｒｏｕｎｄ　ｃｌａｓｓの四つのＱｏＳタイプ（＝ｃｌａｓｓ）に分類される。前記ｃｏｎｖｅｒｓａｔｉｏｎａｌ　ｃｌａｓｓは、最小の固定遅延を要し、バッファリングが許容されず、保障されたビット率を提供する対称トラフィックタイプで、ｓｔｒｅａｍｉｎｇ　ｃｌａｓｓは、最小の可変遅延を要し、バッファリングが許容されず、保障されたビット率を提供する非対称トラフィックタイプである。また、ｉｎｔｅｒａｃｔｉｖｅ　ｃｌａｓｓは、適当な（ｍｏｄｅｒａｔｅ）可変遅延を要し、バッファリングが許容され、保障されたビット率を提供しない非対称トラフィックタイプで、ｂａｃｋｇｒｏｕｎｄ　ｃｌａｓｓは、大きな可変遅延を要し、バッファリングが許容され、保障されたビット率を提供しない非対称トラフィックタイプである。

【0009】

図２は、３ＧＰＰ無線アクセス網規格を基盤とした、端末とＵＴＲＡＮ間の無線プロトコルの構造である。

【0010】

図２を参照すると、無線プロトコルは、水平的に、物理階層、データリンク階層及びネットワーク階層からなり、垂直的には、データ情報を伝送するための使用者平面（Ｕｓｅｒ　Ｐｌａｎｅ）と、制御信号（Ｓｉｇｎａｌｉｎｇ）の伝達のための制御平面（Ｃｏｎｔｒｏｌ　Ｐｌａｎｅ）とに区分される。前記使用者平面は、音声やＩＰパケットのように使用者のトラフィック情報が伝達される領域で、前記制御平面は、網のインターフェースや呼の維持及び管理のような制御情報が伝達される領域を示す。

【0011】

図２に示す各プロトコル階層は、通信システムにおいて広く知られている開放型システム間相互接続（Ｏｐｅｎ　ｓｙｓｔｅｍ　ｉｎｔｅｒｆａｃｅ：ＯＳＩ）基準モデルの下位の三つの階層に基づいて、Ｌ１（第１階層）、Ｌ２（第２階層）、Ｌ３（第３階層）に区分することができる。

【0012】

Ｌ１階層（ＰＨＹ）は、多様な無線伝送技術を利用して上位階層に情報伝送サービスを提供する。前記Ｌ１階層は、伝送チャンネル（Ｔｒａｎｓｐｏｒｔ　ｃｈａｎｎｅｌ）を通じて上位の媒体アクセス制御（Ｍｅｄｉｕｍ　ａｃｃｅｓｓ　ｃｏｎｔｒｏｌ）階層と接続され、伝送チャンネルを通じてＭＡＣ階層と物理階層間のデータが移動する。

【0013】

媒体アクセス制御（Ｍｅｄｉｕｍ　ａｃｃｅｓｓ　ｃｏｎｔｒｏｌ：ＭＡＣ）階層は、無線資源の割当及び再割当のためのＭＡＣパラメーターの再割当サービスを提供し、論理チャンネル（Ｌｏｇｉｃａｌ　ｃｈａｎｎｅｌ）を通じて上位の無線リンク制御（Ｒａｄｉｏ　ｌｉｎｋ　ｃｏｎｔｒｏｌ：ＲＬＣ）階層と連結される。前記ＭＡＣには、伝送される情報の種類によって多様な論理チャンネルが提供されるが、一般に、制御平面の情報を伝送する場合は、制御チャンネル（Ｃｏｎｔｒｏｌ　ｃｈａｎｎｅｌ）を利用し、使用者平面の情報を伝送する場合は、トラフィックチャンネル（Ｔｒａｆｆｉｃ　ｃｈａｎｎｅｌ）を利用する。前記ＭＡＣは、管理する伝送チャンネルの種類によって、ＭＡＣ－ｂサブ階層（Ｓｕｂｌａｙｅｒ）、ＭＡＣ－ｄサブ階層及びＭＡＣ－ｃ／ｓｈサブ階層に区分される。前記ＭＡＣ－ｂサブ階層は、システム情報の放送を担当する伝送チャンネルの

ＢＣＨ（Ｂｒｏａｄｃａｓｔ　ｃｈａｎｎｅｌ）を管理し、ＭＡＣ－ｃ／ｓｈサブ階層は、他の端末と共通するＦＡＣＨ（Ｆｏｒｗａｒｄ　ａｃｃｅｓｓ　ｃｈａｎｎｅｌ）やＤＳＣＨ（Ｄｏｗｎｌｉｎｋ　ｓｈａｒｅｄ　ｃｈａｎｎｅｌ）のような共通伝送チャンネルを管理する。ＵＴＲＡＮのＭＡＣ－ｃ／ｓｈサブ階層は、Ｃｏｎｔｒｏｌ　ＲＮＣ（ＣＲＮＣ）に位置し、セル内の全ての端末が共有する各チャンネルを管理するので、各セルに対して一つずつ存在する。また、各端末にも一つずつのＭＡＣ－ｃ／ｓｈサブ階層が存在する。ＭＡＣ－ｄサブ階層は、特定の端末に対する専用伝送チャンネルのＤＣＨ（Ｄｅｄｉｃａｔｅｄ　ｃｈａｎｎｅｌ）の管理を担当する。従って、ＵＴＲＡＮのＭＡＣ－ｄサブ階層は、該当の端末を管理するＳｅｒｖｉｎｇ　ＲＮＣ（ＳＲＮＣ）に位置し、各端末にも一つずつのＭＡＣ－ｄサブ階層が存在する。

【0014】

無線リンク制御（Ｒａｄｉｏ　ｌｉｎｋ　ｃｏｎｔｒｏｌ：ＲＬＣ）階層は、信頼性のあるデータの伝送を支援し、上位階層からのＲＬＣサービスデータ単位（Ｓｅｒｖｉｃｅ　ｄａｔａ　ｕｎｉｔ：ＳＤＵ）の分割及び連結（Ｓｅｇｍｅｎｔａｔｉｏｎ　ａｎｄ　ｃｏｎｃａｔｅｎａｔｉｏｎ）機能を遂行する。上位から伝達されたＲＬＣ　ＳＤＵは、ＲＬＣ階層で処理容量に合わせて大きさが調節された後、ヘッダー（ｈｅａｄｅｒ）情報が加えられ、プロトコルデータ単位（Ｐｒｏｔｏｃｏｌ　ｄａｔａ　ｕｎｉｔ：ＰＤＵ）の形態でＭＡＣ階層に伝達される。ＲＬＣ階層には、上位からのＲＬＣ　ＳＤＵまたはＲＬＣ　ＰＤＵを保存するためのＲＬＣバッファが存在する。

【0015】

放送／マルチキャスト制御（Ｂｒｏａｄｃａｓｔ／ｍｕｌｔｉｃａｓｔ　ｃｏｎｔｒｏｌ：ＢＭＣ）階層は、核心網から伝達されたセル放送メッセージ（Ｃｅｌｌ　ｂｒｏａｄｃａｓｔ　ｍｅｓｓａｇｅ：ＣＢ）をスケジューリングし、特定セル（ら）に位置した各ＵＥにＣＢを放送する機能を遂行する。ＵＴＲＡＮの側面から見ると、上位から伝達されたＣＢメッセージは、メッセージＩＤ、シリアルナンバー、コーディングスキームなどの情報が加えられてＢＭＣメッセージの形態でＲＬＣ階層に伝達され、論理チャンネルのＣＴＣＨ（Ｃｏｍｍｏｎ　ｔｒａｆｆｉｃ　ｃｈａｎｎｅｌ）を通じてＭＡＣ階層に伝達される。この場合、論理チャンネル（ＣＴＣＨ）は、伝送チャンネルのＦＡＣＨ（Ｆｏｒｗａｒｄ　ａｃｃｅｓｓ　ｃｈａｎｎｅｌ）及び物理チャンネルのＳ－ＣＣＰＣＨ（Ｓｅｃｏｎｄａｒｙ　ｃｏｍｍｏｎ　ｃｏｎｔｒｏｌ　ｐｈｙｓｉｃａｌ　ｃｈａｎｎｅｌ）にマッピングされる。

【0016】

パケットデータ収束プロトコル（Ｐａｃｋｅｔ　ｄａｔａ　ｃｏｎｖｅｒｇｅｎｃｅ　ｐｒｏｔｏｃｏｌ：ＰＤＣＰ）階層は、ＲＬＣ階層の上位に位置し、ＩＰｖ４やＩＰｖ６のようなネットワークプロトコルを通じて伝送されるデータが、相対的に帯域幅の小さい無線インターフェース上で効率的に伝送されるようにする。このために、ＰＤＣＰ階層は、不要な制御情報を減らす機能を遂行するが、この機能をヘッダー圧縮（Ｈｅａｄｅｒ　ｃｏｍｐｒｅｓｓｉｏｎ）といい、ＩＥＴＦ（Ｉｎｔｅｒｎｅｔ　ｅｎｇｉｎｅｅｒｉｎｇ　ｔａｓｋ　ｆｏｒｃｅ）というインターネット標準化グループで定義するヘッダー圧縮技法のＲＦＣ２５０７及びＲＦＣ３０９５（Ｒｏｂｕｓｔ　ｈｅａｄｅｒ　ｃｏｍｐｒｅｓｓｉｏｎ：ＲＯＨＣ）を用いることができる。これらの方法は、データのヘッダー部分に必ず必要な情報のみを伝送するようにしてより少ない制御情報を伝送するので、伝送すべきデータ量を減らすことができる。

【0017】

Ｌ３の最下部に位置した無線資源制御（Ｒａｄｉｏ　Ｒｅｓｏｕｒｃｅ　Ｃｏｎｔｒｏｌ：ＲＲＣ）階層は、制御平面でのみ定義され、無線ベアラ（Ｒａｄｉｏ　ｂｅａｒｅｒ：ＲＢ）の設定、再設定及び解除に関連して、伝送チャンネル及び物理チャンネルを制御する。このとき、前記ＲＢは、端末とＵＴＲＡＮ間のデータ伝達のために第２階層により提供されるサービスを意味し、一般に、ＲＢが設定されるということは、特定のサービスを提供するために必要なプロトコル階層及びチャンネルの特性を規定し、それぞれの具体

的なパラメーター及び動作方法を設定する過程を意味する。

【0018】

以下、前記ＢＭＣ階層に関連するセル放送サービス（Ｃｅｌｌ　ｂｒｏａｄｃａｓｔ　ｓｅｒｖｉｃｅ：ＣＢＳ）について説明する。

【0019】

端末間、または端末とネットワーク間に、文字及び数字により構成されたメッセージを送受信するサービスを短文メッセージサービス（Ｓｈｏｒｔ　Ｍｅｓｓａｇｅ　Ｓｅｒｖｉｃｅ：ＳＭＳ）という。このようなＳＭＳは、更に一つ以上のセルに同じ短文メッセージを送るセル放送ＳＭＳ（Ｃｅｌｌ　ｂｒｏａｄｃａｓｔ　ｓｈｏｒｔ　ｍｅｓｓａｇｅ　ｓｅｒｖｉｃｅ：ＳＭＳ－ＣＢ）サービスと、点対点ＳＭＳ（Ｐｏｉｎｔ－ｔｏ－Ｐｏｉｎｔ　ＳＭＳ：ＳＭＳ－ＰＰ）サービスとに分けられる。ここで、ＣＢＳサービスは、前記ＳＭＳ－ＣＢサービスに該当し、特に、複数のＣＢＳメッセージを特定地域の全ての使用者に放送するサービスをいう。

【0020】

ＣＢＳメッセージは、セル放送地域（Ｃｅｌｌ　ｂｒｏａｄｃａｓｔ　ａｒｅａ）と呼ばれる地理学的地域に放送される。前記セル放送地域は、一つ以上のセルにより構成されるか、ＰＬＭＮ全体により構成され、各ＣＢＳメッセージは、情報提供者とＰＬＭＮ運営者間の相互契約により地理学的領域に放送される。

【0021】

ＢＭＣプロトコルで使用されるメッセージとしては、使用者情報を伝達するＣＢＳメッセージ、端末のＣＢＣメッセージの受信を容易にするためのスケジュールメッセージ、ＡＮＳＩ４１網で伝達する短文メッセージを伝達するＣＢＳ４１メッセージがある。全てのメッセージは、ＵＴＲＡＮから端末方向のみに伝送される。端末は、ＵＴＲＡＮが伝達するスケジュールメッセージの情報を利用して、不連続受信（Ｄｉｓｃｏｎｔｉｎｕｏｕｓ　ｒｅｃｅｐｔｉｏｎ：ＤＲＸ）機能を遂行することで、バッテリーの使用量を減らすことができる。

【0022】

ＢＭＣメッセージのスケジューリングは、第１及び第２レベルスケジューリングに区分される。第１レベルスケジューリングは、Ｃｏｍｍｏｎ　Ｔｒａｆｆｉｃ　Ｃｈａｎｎｅｌ（ＣＴＣＨ）チャンネルのデータが伝送されるフレームを決定（割当）するスケジューリングである。

【0023】

図３は、第１レベルスケジューリングの方式を説明するための図で、最初の列の数字は、Ｓｙｓｔｅｍ　Ｆｒａｍｅ　Ｎｕｍｂｅｒ（ＳＦＮ）値を示す。

【0024】

論理チャンネル（ＣＴＣＨ）は、伝送チャンネル（ＦＡＣＨ）を通じて物理チャンネル（Ｓ－ＣＣＰＣＨ）にマッピングされる。第１レベルスケジューリングは、データを伝送する前に、論理チャンネル（ＣＴＣＨ）のデータが伝送される物理チャンネルのフレームを予め指定することである。ＣＴＣＨを通じて伝達されるデータは、常に何れの連続的なＭ個のフレームがグループ伝送され、このようなフレームグループは、所定のフレームを周期（Ｎ）だけ繰り返す。例えば、図３に示すように、ＣＴＣＨを通じて伝達されるデータは、常に二つの連続的なフレーム区間の間伝送され、六つのフレームを周期に繰り返される。また、ＣＴＣＨデータを伝送するフレームグループは、ＳＦＮ値がＫの時に開始されて周期（Ｎ）だけ繰り返される。図３において、フレームグループは、ＳＦＮ値がＫ＝２の時に開始されて周期（６）だけ反復伝送される。

【0025】

第１レベルスケジューリングは、ＣＢＳの全てのサービスに対して同様に行われる。即ち、ＣＢＳの全てのサービスは、同じセルでは同じフレームが割り当てられる。第１レベルスケジューリングは、ＲＲＣ階層で行われ、前記Ｎ、Ｋ及びＭ値は、システム情報に含まれて端末に放送される。

【0026】
ＢＭＣの第２レベルスケジューリングは、第１レベルスケジューリングで割り当てられたフレームを、更にＣＢＳスケジュール期間（ＣＢＳ　Ｓｃｈｅｄｕｌｅ　Ｐｅｒｉｏｄ）に分けるスケジューリングである。第２レベルスケジューリングは、ＢＭＣ階層で行われ、端末は、ＢＭＣスケジュールメッセージを受信してＣＢＳスケジュール期間情報を獲得する。ＢＭＣスケジュールメッセージは、ＣＢＳスケジュール期間の長さ及びＣＢＳスケジュール期間の開始点情報を含む。ＣＢＳスケジュール期間の長さは、ＢＭＣスケジュールメッセージの次に開始されるＣＢＳスケジュール期間の開始と終了間の長さを示し、ＣＢＳスケジュール期間の開始点は、現在のＢＭＣスケジュールメッセージの伝送時点とＢＭＣスケジュールメッセージの次に開始されるＣＢＳスケジュール期間の開始時点との差値を示す。
【0027】
従って、ＣＢＳメッセージを受信する端末は、ＢＭＣスケジュールメッセージを受信することで、次のＣＢＳスケジュール期間がいつ開始されいつ終了するかが分かる。端末は、ＣＢＳスケジュール期間の間にＢＭＣスケジュールメッセージを受信して、次のＣＢＳスケジュール期間情報を獲得することができる。このような方式で、端末は、いつＢＭＣメッセージが伝送されないかを把握できるため、バッテリー節約のための不連続受信（ＤＲＸ）を行うことができる。
【0028】
図４に示すように、ＢＭＣスケジュールメッセージは、次のＣＢＳスケジュール期間の間に伝送される一つまたは複数のＢＭＣメッセージに対する情報を提供する。
【0029】
図４において、新規メッセージのビットマップパラメーターは、次のＣＢＳスケジュール期間の間に伝送される各ＢＭＣメッセージに対し、該当のメッセージが新たに放送されるメッセージであるか、以前に放送されたメッセージであるかを示す。また、メッセージの説明パラメーターは、次のＣＢＳスケジュール期間の間に伝送される各ＢＭＣメッセージの種類及びＩＤを示す。このとき、メッセージの種類は、ＣＢＳメッセージ、スケジュールメッセージ及びＣＢＳ４１メッセージの何れか一つを示す。
【0030】
しかし、一般にＣＢＳメッセージの最大長さは１２３０ｏｃｔｅｔに制限されているため、マルチメディアデータを放送またはマルチキャストする用途としては適当でない。また、前記ＣＢＳメッセージは、特定のセルの全ての端末に放送されるため、特定の端末グループのみにサービスを提供するマルチキャストが無線上で不可能である。従って、無線上でマルチメディアデータを特定の端末グループに放送またはマルチキャストするために、Ｍｕｌｔｉｍｅｄｉａ　Ｂｒｏａｄｃａｓｔ／Ｍｕｌｔｉｃａｓｔ　Ｓｅｒｖｉｃｅ（ＭＢＭＳ）と呼ばれる新しいサービスが提案された。
【0031】
以下、ＭＢＭＳについて説明する。
【0032】
ＭＢＭＳは、単方向点対多ベアラサービス（Ｐｏｉｎｔ－ｔｏ－Ｍｕｌｔｉｐｏｉｎｔ　Ｂｅａｒｅｒ　Ｓｅｒｖｉｃｅ）を利用して、オーディオ、ビデオ及び映像のようなマルチメディアデータを複数の端末に伝達するサービスである。ＭＢＭＳは、放送モードとマルチキャストモードとに分けられる。即ち、ＭＢＭＳサービスは、ＭＢＭＳ放送サービスとＭＢＭＳマルチキャストサービスとに分けられる。
【0033】
ＭＢＭＳ放送モードは、放送地域（Ｂｒｏａｄｃａｓｔ　ａｒｅａ）にいる全ての使用者にマルチメディアデータを伝送するサービスである。このとき、放送地域とは、放送サービスが可能な領域をいう。一つのＰＬＭＮ（Ｐｕｂｌｉｃ　ｌａｎｄ　ｍｏｂｉｌｅ　ｎｅｔｗｏｒｋ）内には、一つ以上の放送地域が存在し、一つの放送地域で一つ以上の放送サービスが提供され、且つ、一つの放送サービスが複数の放送地域に提供されることも

できる。

【0034】

ＭＢＭＳマルチキャストモードは、マルチキャスト地域（Ｍｕｌｔｉｃａｓｔ　ａｒｅａ）にいる特定の使用者グループのみにマルチメディアデータを伝送するサービスである。このとき、マルチキャスト地域とは、マルチキャストサービスが可能な領域をいう。一つのＰＬＭＮ内には、一つ以上のマルチキャスト地域が存在し、一つのマルチキャスト地域に一つ以上のマルチキャストサービスが提供される。且つ、一つのマルチキャストサービスが複数のマルチキャスト地域に提供されることもできる。

【0035】

ＭＢＭＳマルチキャストモードで、使用者は、特定のマルチキャストサービスを受信するため、マルチキャストグループ（Ｍｕｌｔｉｃａｓｔ　ｇｒｏｕｐ）に参加（Ｊｏｉｎｉｎｇ）するように要求される。このとき、マルチキャストグループとは、特定のマルチキャストサービスを受信する使用者集団をいい、参加とは、特定のマルチキャストサービスを受信しようと集まったマルチキャストグループに合流する行為をいう。

【0036】

二種類の論理チャンネル、即ち、ＭＢＭＳ　Ｃｏｎｔｒｏｌ　Ｃｈａｎｎｅｌ（ＭＣＣＨ）及びＭＢＭＳ　Ｔｒａｆｆｉｃ　Ｃｈａｎｎｅｌ（ＭＴＣＨ）がＭＢＭＳデータ伝送のために提供される。前記ＭＣＣＨチャンネルは、ＭＢＭＳ制御情報を各ＭＢＭＳ端末に伝送するために使用され、前記ＭＴＣＨは、特定のＭＢＭＳサービスデータを各ＭＢＭＳ端末に伝送するために使用される。従って、複数のＭＢＭＳサービスが一つのセルで利用されるためには、前記セルで複数のＭＴＣＨが構成されるべきである。しかし、マルチキャストモードの場合、ＭＴＣＨは特定のＭＢＭＳサービスに参加したＭＢＭＳ端末のみで構成される。

【0037】

ＭＡＣ階層は、伝達されたＭＢＭＳデータにＭＡＣヘッダーを付けた後、共通伝送チャンネルを通じて基地局の物理階層に伝達し、伝達されたＭＢＭＳデータは、物理階層で符号化及び変調などの過程を経た後、共通物理チャンネルを通じて端末に伝送される。このとき、共通伝送チャンネルは、Ｔｒａｎｓｍｉｓｓｉｏｎ　Ｔｉｍｅ　Ｉｎｔｅｒｖａｌ（ＴＴＩ）という所定時間単位でデータを伝送し、共通伝送チャンネルにマッピングされる各共通物理チャンネルは、フレーム単位で伝送される。

【0038】

通常、複数のチャンネルを通じて伝達される複数のサービスを同時に受信するためには、複数のチャンネルを同時に受信することが最も簡単であるが、このような方法は端末機を複雑にする。

【0039】

前記のような問題を解決するため、従来のＣＢＳサービスにおいては、特定のサービスが提供される時間区間を予め決めて知らせるスケジューリング方式を適用している。この方式は、ＭＢＭＳサービスと他のサービス、またはＭＢＭＳサービスと制御情報を同時に受信する場合も有効に利用することができる。また、ＭＢＭＳサービスを受信しない間に端末が不連続受信（ＤＲＸ）を行うことで、バッテリー浪費を防止することもできる。

【0040】

しかし、従来のＣＢＳサービスの場合は、一つのセルで一つのサービスのみを提供するため、一つのセルで同じスケジューリングパラメーターを設定するが、ＭＢＭＳサービスの場合は、一つのセルで多様なサービスが提供されるため、ＣＢＳのスケジューリングとは異なるスケジューリング方式が要求される。

【発明の開示】

【課題を解決するための手段】

【0041】

本発明の目的は、多様な特性を有する高速のデータを放送及びマルチキャストする無線アクセス網に適当な伝送スケジューリング方法を提供することにある。

【0042】
本発明の他の目的は、ＭＢＭＳサービス毎にデータの伝送時間を異なるように指定することで、特定のＭＢＭＳサービスデータが伝送されない時間に他のサービスまたはチャンネルを受信できるマルチメディアサービス提供方法を提供することにある。
【0043】
前記のような目的を達成するため、複数の端末により構成された端末グループにＭｕｌｔｉｍｅｄｉａ　Ｂｒｏａｄｃａｓｔ／Ｍｕｌｔｉｃａｓｔ　Ｓｅｒｖｉｃｅ（ＭＢＭＳ）を提供する無線通信システムにおいて、本発明に係るマルチメディアサービスデータのスケジューリング方法は、特定のＭＢＭＳサービスデータが伝送される無線チャンネルの無線資源を指定する段階と、指定された無線資源情報をＭＢＭＳサービス毎に端末グループに伝送する段階と、を含む。
【0044】
前記マルチメディアサービスデータのスケジューリング方法は、伝送された無線資源情報に基づいて、各端末グループの端末でマルチメディアサービスデータを受信する段階を更に含む。
【0045】
好ましくは、前記無線チャンネルは、共通物理チャンネルであることを特徴とする。
【0046】
好ましくは、前記無線資源は、ＭＢＭＳサービスデータが伝送される時間を示すスケジュール情報であることを特徴とする。
【0047】
好ましくは、互いに異なるＭＢＭＳサービスデータには、互いに異なる無線資源が割り当てられることを特徴とするマルチメディアサービス提供方法。
【0048】
好ましくは、前記無線資源は、ＵＴＲＡＮが特定のＭＢＭＳサービスのためのｒａｄｉｏ　ｂｅａｒｅｒ（ＲＢ）を設定または再設定する時に指定されることを特徴とする。
【0049】
好ましくは、前記フレームは、特定のＭＢＭＳのためのＲＢが設定されているとき、周期的または非周期的に割り当てられることを特徴とする。
【0050】
好ましくは、前記端末は、フレーム割当情報が指示する時間の間、ＭＢＭＳサービスデータを受信することを特徴をする。
【0051】
好ましくは、前記端末は、フレーム割当情報が指示する時間以外の時間の間、制御信号を受信することを特徴とする。
【0052】
好ましくは、前記端末は、フレーム割当情報が指示する時間以外の時間の間、全てのサービスデータの受信を中断することを特徴とする。
【0053】
好ましくは、前記端末は、スケジューリング情報が指示する時間以外の時間の間、ＭＢＭＳサービスを除いた他のサービスデータを受信することを特徴とする。
【0054】
好ましくは、前記無線資源は、Ｒａｄｉｏ　ｒｅｓｏｕｒｃｅ　ｃｏｎｔｒｏｌ（ＲＲＣ）階層またはマルチメディア階層により指定されることを特徴とする。
【0055】
好ましくは、前記無線資源がＲａｄｉｏ　ｒｅｓｏｕｒｃｅ　ｃｏｎｔｒｏｌ（ＲＲＣ）階層により指定される場合、前記無線資源は、フレーム形態で伝送されることを特徴とする。
【0056】
好ましくは、前記無線資源は、放送チャンネルまたは制御チャンネルを通じて端末グル

ープに伝送されることを特徴とする。
【0057】
好ましくは、前記無線資源がマルチメディア階層により指定される場合、前記無線資源は、ＭＢＭＳスケジュールメッセージに含まれて伝達されることを特徴とする。
【0058】
好ましくは、互いに異なるＭＢＭＳスケジュールメッセージは、互いに異なるチャンネルを通じて端末グループに伝達されることを特徴とする。
【0059】
好ましくは、前記チャンネルは、共通トラフィックチャンネルであることを特徴とする。
【0060】
好ましくは、前記ＭＢＭＳスケジュールメッセージは、次に放送またはマルチキャストされる予定である特定のＭＢＭＳデータのシーケンス番号（Ｓｅｑｕｅｎｃｅ　Ｎｕｍｂｅｒ）または識別子とスケジュール情報を含むことを特徴とする。
【0061】
好ましくは、前記ＭＢＭＳスケジュールメッセージは、特定のＭＢＭＳサービスの間、周期的に複数回伝送されることを特徴とする。
【0062】
好ましくは、前記ＭＢＭＳスケジュールメッセージは、該当のＭＢＭＳデータが最初の伝送であるか、または反復伝送であるかを示すことを特徴とする。
【0063】
好ましくは、前記ＭＢＭＳスケジュールメッセージは、特定のＭＢＭＳサービスの間、非周期的に複数回伝送されることを特徴とする。
【0064】
好ましくは、前記ＭＢＭＳスケジュールメッセージは、ＭＢＭＳスケジュール期間の長さ及び前記ＭＢＭＳスケジュール期間の開始点と終了間の長さを示すことを特徴とする。
【0065】
前記のような目的を達成するため、複数の端末により構成された端末グループにマルチメディアサービスを提供する無線通信システムにおいて、本発明に係るマルチメディアサービス提供方法は、特定のマルチメディアサービスのためのフレームを割り当てる段階と、フレーム割当情報を特定の端末グループに伝送する段階と、フレーム割当情報に基づいて、各端末グループでマルチメディアサービスデータを受信する段階と、を含む。
【0066】
好ましくは、前記マルチメディアサービスは、Ｍｕｌｔｉｍｅｄｉａ　Ｂｒｏａｄｃａｓｔ／Ｍｕｌｔｉｃａｓｔ　Ｓｅｒｖｉｃｅ（ＭＢＭＳ）であることを特徴とする。
【0067】
好ましくは、前記フレームは、特定のマルチメディアサービスデータが伝送される共通物理チャンネルのフレームであることを特徴とする。
【0068】
好ましくは、互いに異なるマルチメディアサービスデータは、互いに異なるフレームに割り当てられることを特徴とする。
【0069】
好ましくは、前記フレームは、特定のＭＢＭＳサービスのためのｒａｄｉｏ　ｂｅａｒｅｒ（ＲＢ）を設定または再設定する時に割り当てられることを特徴とする。
【0070】
好ましくは、前記フレームは、特定のＭＢＭＳのためのＲＢが設定されているとき、周期的または非周期的に割り当てられることを特徴とする。
【0071】
好ましくは、前記フレームは、Ｒａｄｉｏ　ｒｅｓｏｕｒｃｅ　ｃｏｎｔｒｏｌ（ＲＲＣ）階層により割り当てられることを特徴とする。

【0072】
好ましくは、前記フレームは、特定のＭＢＭＳサービスデータが伝送される時間を示すことを特徴とする。
【0073】
好ましくは、前記フレーム割当情報は、特定のＭＢＭＳサービスデータが伝送される時間間隔及びその時間間隔が繰り返される周期を示すことを特徴とする。
【0074】
好ましくは、前記端末グループは、フレーム割当情報が指示する時間の間、ＭＢＭＳサービスデータを受信することを特徴をする。
【0075】
好ましくは、前記端末グループは、フレーム割当情報が指示する時間以外の時間の間、制御信号を受信することを特徴とする。
【0076】
好ましくは、前記端末グループは、フレーム割当情報が指示する時間以外の時間の間、全てのサービスデータの受信を中断することを特徴とする。
【0077】
好ましくは、前記フレーム割当情報は、放送チャンネルまたは制御チャンネルを通じて伝達されることを特徴とする。
【0078】
前記のような目的を達成するため、複数の端末により構成された端末グループにマルチメディアサービスを提供する無線通信システムにおいて、本発明に係るマルチメディアサービス提供方法は、マルチメディアサービス毎にデータ伝送スケジューリングを独立的に行う段階と、スケジューリング情報を特定の端末グループに伝送する段階と、スケジューリング情報に基づいて、端末グループの各端末でマルチメディアサービスデータを受信する段階と、を含む。
【0079】
好ましくは、前記マルチメディアサービスは、Ｍｕｌｔｉｍｅｄｉａ　Ｂｒｏａｄｃａｓｔ／Ｍｕｌｔｉｃａｓｔ　Ｓｅｒｖｉｃｅ（MBMS）であることを特徴とする。
【0080】
好ましくは、前記スケジューリングは、ＵＴＲＡＮが特定のマルチメディアサービスのためのｒａｄｉｏ　ｂｅａｒｅｒ（ＲＢ）を設定または再設定する時に行われることを特徴とする。
【0081】
好ましくは、前記データ伝送スケジューリングは、独立的に行われ、前記スケジューリング情報は、マルチメディアサービス毎に伝送されることを特徴とする。
【0082】
好ましくは、前記スケジューリング情報は、特定のマルチメディアサービスのためのｒａｄｉｏ　ｂｅａｒｅｒ（ＲＢ）が設定されている間、所定の周期または非周期的に複数回伝送されることを特徴とする。
【0083】
好ましくは、前記スケジューリング情報は、互いに異なる共通トラフィックチャンネルを通じて伝達されることを特徴とする。
【0084】
好ましくは、前記スケジューリング情報は、特定のデータが伝送される時間情報であることを特徴とする。
【0085】
好ましくは、前記スケジューリング情報は、ＭＢＭＳスケジュールメッセージに含まれて伝送されることを特徴とする。
【0086】
好ましくは、互いに異なるＭＢＭＳサービスは、互いに異なるＭＢＭＳスケジュールメ

ッセージを使用することを特徴とする。
【0087】
好ましくは、互いに異なるＭＢＭＳスケジュールメッセージは、互いに異なるチャンネルを通じて端末グループに伝達されることを特徴とする。
【0088】
好ましくは、前記ＭＢＭＳスケジュールメッセージは、次に放送またはマルチキャストされる予定である特定のＭＢＭＳデータのシーケンス番号（Ｓｅｑｕｅｎｃｅ　Ｎｕｍｂｅｒ）または識別子とスケジューリング情報を含むことを特徴とする。
【0089】
好ましくは、前記ＭＢＭＳスケジュールメッセージは、該当のＭＢＭＳデータが最初の伝送であるか、または反復伝送であるかを示す情報を含むことを特徴とする。
【0090】
好ましくは、前記ＭＢＭＳスケジュールメッセージは、特定のＭＢＭＳサービスの間、周期的に複数回伝送される特徴とする。
【0091】
好ましくは、前記ＭＢＭＳスケジュールメッセージは、特定のＭＢＭＳサービスの間、非周期的に複数回伝送されることを特徴とする。
【0092】
好ましくは、前記ＭＢＭＳスケジュールメッセージは、ＭＢＭＳスケジュール期間の長さ及び前記ＭＢＭＳスケジュール期間の開始点と終了間の長さを示すことを特徴とする。
【0093】
好ましくは、前記スケジューリング情報は、ＵＴＲＡＮの放送及びマルチキャスト制御階層により生成されることを特徴とする。
【0094】
好ましくは、前記放送及びマルチキャスト制御階層は、スケジュール情報を下位階層に伝達することを特徴とする。
【0095】
好ましくは、前記スケジュール情報は、特定の端末グループの放送及びマルチキャスト制御階層に伝達されることを特徴とする。
【0096】
好ましくは、前記端末の放送及びマルチキャスト制御階層は、伝送されたスケジュール情報を下位階層に伝達することを特徴とする。
【0097】
好ましくは、前記端末グループは、スケジューリング情報が指示する時間の間、マルチメディアサービスデータを受信することを特徴をする。
【0098】
好ましくは、前記端末グループは、スケジューリング情報が指示する時間以外の時間の間、制御信号を受信することを特徴とする。
【0099】
好ましくは、前記端末グループは、スケジューリング情報が指示する時間以外の時間の間、ＭＢＭＳサービスを除いた他のサービスデータを受信することを特徴とする。
【0100】
好ましくは、前記スケジューリング情報が指示する時間以外の時間の間、全てのサービスデータの受信を中断することを特徴とする。
【発明を実施するための最良の形態】
【0101】
以下、本発明の実施例を詳細に説明する。
【0102】
本発明は、３ＧＰＰにより開発されたＵＭＴＳ（Ｕｎｉｖｅｒｓａｌ　ｍｏｂｉｌｅ　ｔｅｌｅｃｏｍｍｕｎｉｃａｔｉｏｎｓ　ｓｙｓｔｅｍ）のような移動通信システムで実

現される。しかし、本発明は、他の標準によって動作する通信システムにも適用されることができる。

【0103】

本発明は、共通無線チャンネルを通じて特定の端末グループにマルチメディアサービスを提供する無線通信システムにおいて、特定のマルチメディアサービスデータが伝送される共通無線チャンネルの無線資源を指定して、特定のマルチメディアサービス毎に端末グループに伝送する方式を提案する。

【0104】

また、本発明は、一つのセルに提供される互いに異なるＭＢＭＳサービスは、互いに異なるスケジューリングパラメーターを有するようにした。ここで、スケジューリングは、該当のＭＢＭＳサービスデータ（以下、ＭＢＭＳデータという）が伝送されるか、または伝送されないことを知らせることをいい、スケジューリングパラメーターは、該当のデータが伝送されるか、または伝送されない時間情報を含む。従って、互いに異なるＭＢＭＳサービスは、互いに異なる時間に重ならないようにデータを伝送できるようにする。即ち、一つの時間区間には、一つのＭＢＭＳサービスのみが提供されるようにする。

【0105】

本発明において、無線網は、ＭＢＭＳデータが伝送される時間をＭＢＭＳサービス毎に指定し、該当の時間情報を特定のＭＢＭＳサービスを受信しようとする端末グループに伝送する。従って、特定のＭＢＭＳデータが伝送されない時間に端末グループに属する各端末は、他のサービスまたはチャンネルを受信することができる。また、ＭＢＭＳデータが伝送されない時間に受信する、他のＭＢＭＳサービスやチャンネルがない場合、該当の端末グループに属する各端末が休止状態に入ることにより、端末のバッテリー浪費を防止することができる。

【0106】

本発明に係るＭＢＭＳデータの送受信方法は、制御平面で伝送区間を指定する方法と、使用者平面で伝送区間を指定する方法とに区分される。これらの方法は、独立的に適用されることもでき、ＣＢＳの第１レベル及び第２レベルスケジューリングのように共に適用されることもできる。ここで、二つの方法が共に適用される場合、制御平面で伝送区間を指定する方法は、ＣＢＳの第１レベルスケジューリングに該当し、使用者平面で伝送区間を指定する方法は、ＣＢＳの第２レベルスケジューリングに該当する。制御平面で伝送区間を指定する方法の場合、ＲＲＣのような第３階層プロトコルがＭＢＭＳデータの送受信または伝送区間の割当を制御する。使用者平面で伝送区間を指定する方法の場合、ＰＤＣＰ、ＲＬＣ、ＭＡＣのような第２階層プロトコルがＭＢＭＳデータの送受信または伝送区間の割当を制御する。

【0107】

一般に、ＭＢＭＳサービスは、ストリーミング（Ｓｔｒｅａｍｉｎｇ）タイプのサービスと、後先（Ｂａｃｋｇｒｏｕｎｄ）タイプのサービスとに分けられる。本発明においては、複数の後先タイプのＭＢＭＳサービスを提供するセルで、特定の下向ＭＢＭＳチャンネルが複数の後先タイプのＭＢＭＳサービスを互いに異なる時間に分けてサービスする方式を提案する。

【0108】

即ち、本発明において、ＵＴＲＡＮは、ストリーミングタイプ及び後先タイプのＭＢＭＳサービスを区分し、後先タイプのＭＢＭＳサービスを集めて、特定の下向ＭＢＭＳチャンネルに時間多重化（Ｔｉｍｅ　Ｍｕｌｔｉｐｌｅｘｉｎｇ）して下向伝送する。このとき、時間多重化される複数のサービスは、同じ時間に互いに重ならないようにする。また、特定の下向ＭＢＭＳチャンネルは、伝送チャンネルまたは物理チャンネルをいう。

【0109】

前記時間多重化して伝送される複数のサービスに対し、ＵＴＲＡＮは、各サービス毎に送受信を制御する。即ち、ＵＴＲＡＮは、各サービスデータが伝送される時間または伝送されない時間情報を、該当のサービスを受信しようとする各端末に伝送する。

【0110】
本発明において、ＭＢＭＳサービスのＱｏＳタイプ（＝ｃｌａｓｓ）が後先タイプに分類されると、ＵＴＲＡＮは、特定の物理チャンネルまたは特定の伝送チャンネルを通じて一つ以上のＭＢＭＳサービスを伝送することができる。従って、ＵＴＲＡＮは、一つのセルで各ＭＢＭＳサービスを設定する前に、各ＭＢＭＳサービスのＱｏＳタイプに基づいて、各ＭＢＭＳサービスの伝送を物理チャンネル／伝送チャンネルにスケジューリングするか否かを決定すべきである。若し、各ＭＢＭＳサービスのＱｏＳタイプ全てが後先タイプの場合、ＵＴＲＡＮは、他の伝送間隔で他のＭＢＭＳサービスを伝送する。
【0111】
図５は、本発明に係るＭＢＭサービス伝送方式を示す。ここで、一つのチャンネル上に後先タイプの複数のサービス（ＭＢＭＳ　Ｓｅｒｖｉｃｅ１及びＭＢＭＳ　Ｓｅｒｖｉｃｅ２）が時間多重化方式で伝送される。ここで、一つのチャンネルは、伝送チャンネルまたは物理チャンネルをいう。
【0112】
（制御平面を通じたＭＢＭＳデータの伝送区間の指定）
ＵＴＲＡＮの無線資源制御（ＲＲＣ）階層は、まず、特定のＭＢＭＳデータが伝送される時間を決定する。即ち、ＵＴＲＡＮのＲＲＣは、特定のＭＢＭＳデータが伝送される共通物理チャンネルのフレームを決定する。例えば、ＵＴＲＡＮのＲＲＣは、特定のマルチメディアサービスデータが連続的に伝送される時間間隔及びその時間間隔が繰り返される周期を決定する。ここで、時間間隔は、特定のマルチメディアサービスデータが伝送される連続的なフレームグループ内のフレーム数を示し、時間間隔の反復周期は、何れの連続的なフレームグループの開始と次の連続的なフレームグループの開始との間隔をフレームで表示したものである。
【0113】
前記方法は、従来のＣＢＳサービスの第１レベルスケジューリングと類似している。しかし、本発明に係るスケジューリングは、従来のスケジューリングと異なって、何れか一つのセルにサービスされる互いに異なるＭＢＭＳサービスに対し、互いに異なるスケジューリングパラメーターを設定した。
【0114】
図６は本発明に係るＭＢＭＳスケジューリングの一例である。
【0115】
図６を参照すると、ＭＢＭＳデータ（ＭＴＣＨ＃１、ＭＴＣＨ＃２及びＭＴＣＨ＃３）を伝送する各論理チャンネルは、後先タイプの互いに異なるＭＢＭＳサービスを提供する。各論理チャンネルは、各ＭＢＭＳサービスの使用者データを伝送する。ＭＢＭＳ制御情報を伝送する論理チャンネル（ＭＣＣＨ）は、互いに異なるＭＢＭＳサービスのスケジューリング情報を提供する。
【0116】
図６を参照すると、各論理チャンネル（ＣＴＣＨ１及びＣＴＣＨ２）は、互いに異なるＭＢＭＳサービスを提供する。ここで、最初の列の数字は、論理チャンネル（ＣＴＣＨ）がマッピングされる物理チャンネルのＳｙｓｔｅｍ　ｆｒａｍｅ　ｎｕｍｂｅｒ（ＳＦＮ）値を示す。図６は、０から１７までのＳＦＮに対し、論理チャンネル（ＣＴＣＨ）がどのように割り当てられるかを示している。図６に示すように、ＵＴＲＡＮは、互いに異なるＭＢＭＳサービスを提供するＣＴＣＨ１及びＣＴＣＨ２を互いに異なるフレームに重ならないように割り当てることができる。
【0117】
図６は、各ＭＴＣＨが無線フレームまたは伝送時間間隔にどのように割り当てられるかを示している。図６に示すように、ＵＴＲＡＮは、ＭＴＣＨ＃１のデータ１、ＭＴＣＨ＃２のデータ２及びＭＴＣＨ＃３のデータ３を互いに異なる無線フレームまたは伝送時間間隔に割り当てることができる。
【0118】

ＵＴＲＡＮは、前記割当が含まれたスケジューリング情報をＭＣＣＨを通じて各端末に伝送する。従って、各端末は、ＭＣＣＨを通じて前記スケジューリング情報を受信することで、サービスを受けようとする一つまたは複数のサービスデータが、ＭＴＣＨを通じていつ伝送されるかに対する情報を獲得することができる。

【0119】

その後、ＵＴＲＡＮの制御階層（ＲＲＣ）が特定のＭＢＭＳデータの伝送時間を決定して実際にデータ伝送を設定する過程は、下記のようである。

【0120】

図７は制御階層を通じてＭＢＭＳデータを伝送するための時間情報（スケジューリング情報）設定方法を示す図である。

【0121】

図７に示すように、ＵＴＲＡＮのＲＲＣは、まず、特定のＭＢＭＳデータが伝送される物理チャンネルのフレームを割り当てる（Ｓ１０）。即ち、ＵＴＲＡＮのＲＲＣは、特定のＭＢＭＳサービスのためのフレームを決定した後、該当のフレーム割当情報を下位階層（物理階層）に伝達する。

【0122】

また、ＵＴＲＡＮのＲＲＣは、前記フレーム割当情報を該当のＭＢＭＳサービスを受信しようとする端末グループのＲＲＣに伝達する（Ｓ１１）。この場合、前記フレーム割当情報は制御平面を利用し、放送チャンネル（ＢＣＣＨ）または制御チャンネル（ＣＣＣＨまたはＤＣＣＨ）を通じて伝達される。

【0123】

端末グループの端末のＲＲＣは、受信されたフレーム割当情報を各端末の物理階層に伝達し（Ｓ１２）、各端末の物理階層は、伝達されたフレーム割当情報を保存することで、制御階層を通じたＭＢＭＳデータの伝送時間情報の設定が完了する（Ｓ１３）。

【0124】

図７に示す時間情報設定過程は、ＵＴＲＡＮが特定のＭＢＭＳサービスのためにｒａｄｉｏ　ｂｅａｒｅｒ（ＲＢ）を設定または再設定する時に行われる。他の実施例により、前記時間情報設定過程は、特定のＭＢＭＳサービスのデータ伝送が進行される間、動的に行われる。即ち、特定のＭＢＭＳサービスのためのＲＢが設定されている間、無線システムは、時間情報設定過程を周期的または非周期的に複数回行うことが出きる。

【0125】

また、本発明の特定のＭＢＭＳサービスのデータを受信する端末は、他のＭＢＭＳサービスの信号及びデータ、またはＭＢＭＳ以外の他のサービスの信号及びデータを受信することができる。

【0126】

図８は特定のＭＢＭＳサービスのデータを受信する端末グループの所定の端末がＭＢＭＳデータを受信する間、ページング（Ｐａｇｉｎｇ）情報を受信する過程を示す一例である。前記過程は、図７の過程を通じて特定のＭＢＭＳサービスのためのフレームが既に割り当てられたことを前提にする。

【0127】

ＵＴＲＡＮの物理階層　は、上位階層から特定のＭＢＭＳサービスに対するＭＢＭＳデータを受信して伝送する（Ｓ２０、Ｓ２１）。このとき、ＵＴＲＡＮは、ＭＢＭＳデータが割り当てられたフレームのみで伝送されるように制御する。

【0128】

該当のＭＢＭＳサービスを受信する端末グループに属する端末の物理階層は、既に保存されたフレーム割当情報に該当するフレームからＭＢＭＳデータを受信し、使用者平面の上位階層に伝達する（Ｓ２２）。

【0129】

そして、既に保存されたフレーム割当情報に該当しないフレームの間、端末グループは特定のＭＢＭＳサービスのためのＭＣＴＣＨチャンネルを除いた他のチャンネルを受信す

ることができる。ＵＴＲＡＮのＲＲＣは、端末グループに属する何れの端末のＲＲＣにページング信号を伝達する。このとき、ＵＴＲＡＮは、端末が受信可能な時間区間、即ち、特定のＭＢＭＳサービスに割り当てられた時間区間を除いた他の時間にページング信号を伝達する（Ｓ２３）。ページング信号は、ＲＲＣの下位にあるＲＬＣ、ＭＡＣ及び物理階層のサービスを利用して送受信される。その後、特定のＭＢＭＳサービスに割り当てられた時間区間の間、端末グループの端末は、図８の段階（Ｓ２４～Ｓ２６）を繰り返してＭＢＭＳデータを受信する。

【0130】

このように特定のＭＢＭＳサービスに割り当てられた時間区間以外の区間で、端末は不連続受信（ＤＲＸ）を行うか、ページングのような制御信号または短文サービスのようなＭＢＭＳ以外のサービスを受信することができる。

【0131】

（制御平面を通じたＭＢＭＳデータの伝送区間の指定）

制御平面を通じてＭＢＭＳデータを伝送するとき、ＵＴＲＡＮのマルチメディア放送及びマルチキャスト制御階層（以下、マルチメディア階層という）は、特定のＭＢＭＳデータの伝送時間を決定する。即ち、マルチメディア階層は、特定のＭＢＭＳデータが伝送される共通物理チャンネルのフレームを決定し、従来のＢＭＣスケジュールメッセージと類似したＭＢＭＳスケジュールメッセージを構成する。

【0132】

この場合、従来のＢＭＣスケジュールメッセージは、一つのセル内に一つだけ生成されたが、本発明に係るＭＢＭＳスケジュールメッセージは、一つのセルで特定のＭＢＭＳサービス毎に複数個生成される。即ち、一つのセルにサービスされる互いに異なるＭＢＭＳサービスは、互いに異なるＭＢＭＳスケジュールメッセージを使用する。

【0133】

特定のＭＢＭＳサービスのためのＭＢＭＳスケジュールメッセージは、ＭＴＣＨを通じて端末グループに伝達される。従って、互いに異なるＭＢＭＳサービスのための互いに異なるＭＢＭＳスケジュールメッセージは、互いに異なるＭＴＣＨを通じて端末グループに伝達される。

【0134】

一つのＭＢＭＳスケジュールメッセージは、次に放送またはマルチキャストされる予定である特定のＭＢＭＳデータのシーケンス番号（Ｓｅｑｕｅｎｃｅ　Ｎｕｍｂｅｒ）または識別子、伝送時間情報を含んでいる。端末グループの端末は、ＭＢＭＳスケジュールメッセージを受信し、以後に伝送されるデータが如何なるデータであるか、どのフレームに伝送されるかを解析する。端末は、解析した情報に基づいて端末内部の受信プロセスを効率的に行うことができる。

【0135】

ＵＴＲＡＮは、ＭＢＭＳデータ伝送の信頼性を保障するために、同じデータを反復伝送するが、この場合、ＭＢＭＳスケジュールメッセージは、該当のＭＢＭＳデータが最初の伝送であるか、反復伝送であるかを知らせることもできる。特定のＭＢＭＳサービスの間、ＭＢＭＳスケジュールメッセージは、周期的または非周期的に複数回伝送される。この場合、伝送されるＭＢＭＳスケジュールメッセージの情報は毎回変わる。

【0136】

次は、ＭＢＭＳスケジュールメッセージの構成の一例である。

【0137】

特定のＭＢＭＳサービスのためのＲＢが設定されている間、ＭＢＭＳスケジュールメッセージは、一定の周期で複数回伝送される。先に伝送されるＭＢＭＳスケジュールメッセージ（Ｍ１）は、次のＭＢＭＳスケジュールメッセージ（Ｍ２）が伝送されるまでＭＢＭＳデータの伝送情報を伝達する。即ち、特定のＭＢＭＳサービスに対し、Ｍ１はＭ１及びＭ２の伝送時点間に伝送される各ＭＢＭＳデータの伝送情報を伝達する。

【0138】

端末グループは、周期的にＭＢＭＳスケジュールメッセージを受信し、次のスケジュールメッセージが伝送されるまで受信するデータがあるかを把握する。ＭＢＭＳスケジュールメッセージの周期は無線システムが決定し、ＭＢＭＳ　ＲＢの設定または再設定時に端末グループに伝達する。

【0139】

次は、ＭＢＭＳスケジュールメッセージの構成の他の実施例である。

【0140】

特定のＭＢＭＳサービスのためのＲＢが設定されている間、ＭＢＭＳスケジュールメッセージは非周期的に複数回伝送される。ＭＢＭＳスケジュールメッセージは、ＢＭＣスケジュールメッセージと同様に、ＭＢＭＳスケジュール期間の長さ及びＭＢＭＳスケジュール期間の開始点情報を含んでいる。ここで、スケジュール期間の長さは、ＭＢＭＳスケジュールメッセージの次に開始されるＭＢＭＳスケジュール期間の開始と終了間の長さを示し、ＭＢＭＳスケジュール期間の開始点は、現在のＢＭＣスケジュールメッセージの伝送時点と次のＭＢＭＳスケジュール期間の開始時点との差を示す。

【0141】

従って、ＭＢＭＳメッセージを受信する端末は、ＭＢＭＳスケジュールメッセージを受信することで、以後に開始されるＭＢＭＳスケジュール期間の開始と終了が分かる。端末は、ＭＢＭＳスケジュール期間の間、ＭＢＭＳスケジュールメッセージを受信し、次のＭＢＭＳスケジュール期間情報を獲得することができる。

【0142】

このように、ＵＴＲＡＮのマルチメディア階層が特定のＭＢＭＳサービスデータの伝送時間を決定して、実際のデータ伝送を設定する。

【0143】

図９は使用者平面を通じてＭＢＭＳデータを伝送するための時間情報設定方法を示す図である。

【0144】

図９に示すように、ＵＴＲＡＮのマルチメディア階層は、特定のＭＢＭＳサービスに対して特定のデータが伝送される時間情報を含むＭＢＭＳスケジュールメッセージを構成し（Ｓ３０）、該当のＭＢＭＳサービスを受信しようとする端末グループのマルチメディア階層にＭＢＭＳスケジュールメッセージを伝送する（Ｓ３１）。このとき、前記ＭＢＭＳスケジュールメッセージは、マルチメディア階層の下位階層サービスを通じて伝達される。

【0145】

端末のマルチメディア階層は、受信したＭＢＭＳスケジュールメッセージを解析する。端末のマルチメディア階層は、受信しようとする特定のデータが伝送される時間情報（スケジュール情報）をスケジュールメッセージから獲得し、獲得されたスケジュール情報を端末のＲＲＣに伝達する（Ｓ３２）。端末のＲＲＣは、スケジュール情報を端末の物理階層に伝達し（Ｓ３３）、端末の物理階層は、スケジュール情報を保存する（Ｓ３４）。前記保存されたスケジュール情報は、特定のＭＢＭＳデータの受信に使用される。

【0146】

図９に示す時間情報設定過程は、特定のＭＢＭＳデータ伝送が進行される間、動的に発生される。即ち、特定のＭＢＭＳサービスのためのＲＢが設定されている間、無線システムは、時間情報設定過程を周期的または非周期的に複数回行うことができる。

【0147】

本発明は、特定のＭＢＭＳサービスのデータを受信する端末が他のＭＢＭＳサービスの信号及びデータ、またはＭＢＭＳ以外の他のサービスの信号及びデータを受信させる。

【0148】

図１０は特定のＭＢＭＳデータを受信する端末グループに属する何れの端末がＭＢＭＳデータを受信する間、他のサービスを受信する過程を示す例である。前記過程は、特定のＭＢＭＳサービスのための時間情報を割り当てる図９の過程が既に行われたことを前提に

する。

【0149】

まず、ＵＴＲＡＮの物理階層　は、上位階層から特定のＭＢＭＳサービスに対するＭＢＭＳデータを受信し（Ｓ４０）、ＵＴＲＡＮの物理階層　は、受信したＭＢＭＳデータを伝送する（Ｓ４１）。このとき、ＵＴＲＡＮは、該当のサービスのＭＢＭＳデータをスケジュールメッセージの内容によって伝送させる。

【0150】

該当のＭＢＭＳサービスを受信する端末グループに属する端末の物理階層は、保存されたスケジュール情報が知らせるフレームからＭＢＭＳデータを受信し、上位階層に伝達する（Ｓ４２）。

【0151】

前記保存されたスケジュール情報に該当しないフレームの間、前記端末グループは、特定のＭＢＭＳサービスのためのＭＴＣＨチャンネルを除いた他のチャンネルを受信することができる。このために、ＵＴＲＡＮは、前記端末グループに属する何れの端末のＲＲＣに短文メッセージを伝送することができる（Ｓ４３）。ＵＴＲＡＮは、端末が受信可能な時間区間、即ち特定のＭＢＭＳサービスに割り当てられた時間区間を除いた他の時間に短文メッセージを伝達することが好ましい。

【0152】

その後、次の特定のＭＢＭＳサービスに割り当てられた時間区間の間、図１０の段階（Ｓ４４～Ｓ４６）を繰り返すことで、端末の物理階層はＭＢＭＳデータを受信する。特定のＭＢＭＳサービスに割り当てられた時間以外の区間に、端末は不連続受信（ＤＲＸ）を行うか、ページングのような制御信号または短文サービスのようなＭＢＭＳ以外のサービスを受信することができる。

【0153】

前述したように、図７に示す時間情報の設定は、特定のＭＢＭＳサービスに対するＲＢの設定または再設定時のみに行われる。ＲＢを設定または再設定した後、ＭＢＭＳデータ伝送中、図９に示す時間情報の設定が周期または非周期的に複数回行われる。このとき、図９で割り当てるフレームは、図７で割り当てられたフレームから再び選択的に割り当てられる。従って、図７に示す方法は、静的なスケジューリングに使用し、図９に示す方法は、動的なスケジューリングに使用する。ＵＴＲＡＮと端末は、データ伝送前に各端末グループ毎に図７及び図９の過程を行うべきである。

【0154】

図７及び図９の過程を行った後、図８及び図１０の過程のように、特定のＭＢＭＳサービスに割り当てられた時間区間には該当のＭＢＭＳデータを受信し、割り当てられない時間区間の間には、制御信号や短文メッセージのような特定のＭＢＭＳサービス以外のデータを受信する。

【0155】

前述したように、従来のＣＢＳのスケジューリング方式は、ＣＢＳサービスを受信しながら他の制御信号を受信するか、ＤＲＸを行うように考案された。このような方式は、ＭＢＭＳサービスにも適用されるべきである。しかし、従来の方式のように、一つのセルで同じスケジューリングパラメーターを設定する方式は、ＭＢＭＳサービスにそのまま適用されない。

【0156】

本発明は、データの伝送時間をＭＢＭＳサービス毎に異なるように指定した。このような方式により、ＣＢＳのスケジューリングと類似して特定のＭＢＭＳサービスデータが伝送されない時間には、端末グループに属する各端末が他のサービスまたは他のチャンネルを受信するようにした。また、ＭＢＭＳサービスのデータが伝送されない時間には、受信する他のサービスやチャンネルがない場合、該当の端末グループに属する各端末が休止状態に入ることで、端末のバッテリー浪費を防止するようにした。

【0157】

そして、本発明は、図面に示す実施例に基づいて説明されたが、これは例示的なものに過ぎず、本技術分野における通常の知識を有する者であれば、多様な変形及び均等な他の実施例が可能である。従って、本発明の真の技術的保護範囲は、添付された特許請求の範囲の技術的思想により決定されるべきである。

【図面の簡単な説明】

【0158】

【図1】図１は、一般のＵＭＴＳシステムの網構造。

【図2】図２は、３ＧＰＰ無線接続網規格を基盤とした、端末とＵＴＲＡＮ間の無線接続インターフェース（Ｒａｄｉｏ　Ａｃｃｅｓｓ　Ｉｎｔｅｒｆａｃｅ）プロトコルの構造を示す図。

【図3】図３は、第１レベルスケジューリングの方式を説明するための図。

【図4】図４は、ＣＢＳサービスのためのＢＭＣスケジューリングメッセージの構成を示す図。

【図5】図５は、本発明に係るＭＢＭＳサービス伝送方式を示す図。

【図6】図６は、本発明に係るＭＢＭＳスケジューリングの一例を示す図。

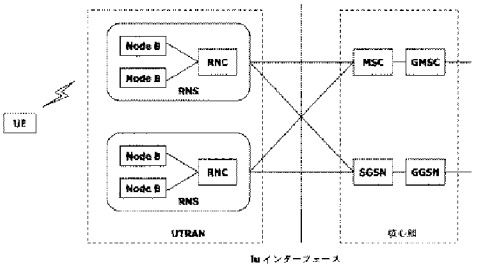
【図7】図７は、制御階層を通じてＭＢＭＳデータを伝送するための時間情報設定方法を示す図。

【図8】図８は、特定のＭＢＭＳサービスデータを受信する端末グループの所定の端末がＭＢＭＳデータを受信する間、制御信号を受信する過程を示す図。

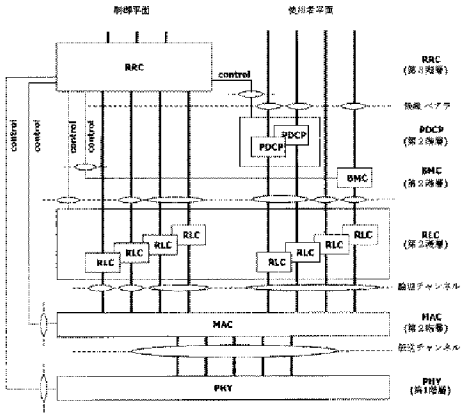
【図9】図９は、使用者階層を通じてＭＢＭＳデータを伝送するための時間情報設定方法を示す図。

【図10】図１０は、特定のＭＢＭＳデータを受信する端末グループに属する何れの端末がＭＢＭＳデータを受信する間、他のサービスを受信する過程を示す図。

【図1】

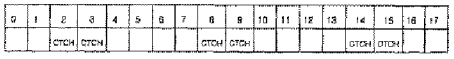


【図2】

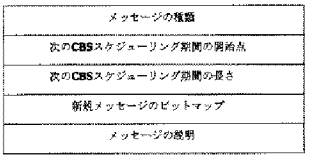


【図3】

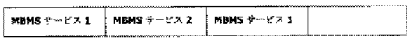
FIG.3



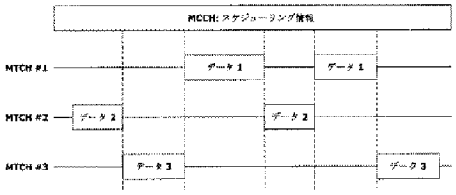
【図4】



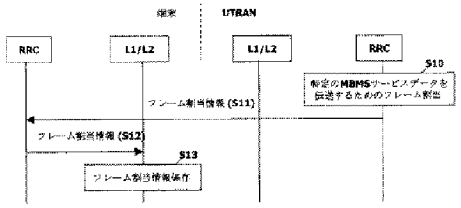
【図5】



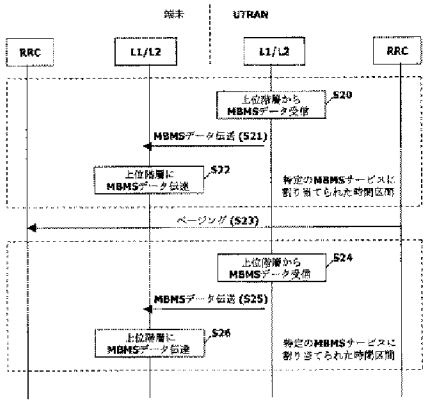
【図6】



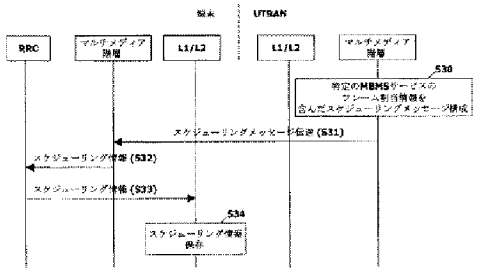
【図7】



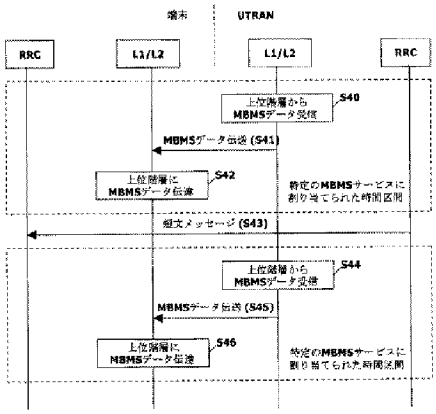
【図8】



【図9】



【図10】



INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
KIPONET (multi <or> broad) <and> cast <and> (radio <or> wireless) <and> resource

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 1020020044306 A (LG Electro.) MAY 15, 2002 see abstract and drawings	1-4
A	JP 13308856 A (NTT DOCOMO) NOV 2, 2001 see abstract and drawings	1-4
A	KR 1020000033183 A(Hyundai Electron) JUN 15, 2000 see abstract and drawings	1-4
A	KR 1020010096484 A(KIM YONG HWA) NOV 7,2001 see abstract and drawings	1-4
A	JP 13218245 A(NTT DOCOMO) AUG 10, 2001 see abstract and drawings	1-4

☐ Further documents are listed in the continuation of Box C.　　☐ See patent family annex.

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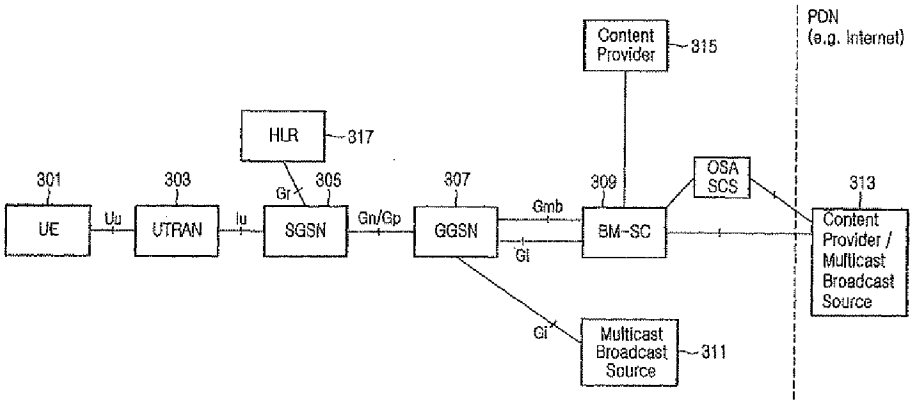
(54) Title: SIGNALLING METHOD OF RADIO BEARER INFORMATION AND THEREFOR NETWORK



(57) Abstract: In a cellular communication network comprising a plurality of cells, and further comprising one or more multicast/broadcast service providers arranged to provide a plurality of multicast/broadcast services over a radio interface to a mobile communication device located in a current cell, a method of providing radio bearer configuration information to enable the mobile communication device to receive a multicast/broadcast service, the method comprising the steps of: providing to a mobile communication device messages containing information associated with the radio bearer configuration, wherein each message is associated with a plurality of multicast/broadcast services that are available to be transmitted to the mobile communication device when in the current cell, and, periodically transmitting the messages to the mobile communication device within the current cell.

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SIGNALLING METHOD OF RADIO BEARER INFORMATION AND THEREFOR NETWORK

BACKGROUND OF THE INVENTION

The present invention relates to the transmission of multimedia broadcast multicast services (MBMS) radio bearer (RB) configuration information, and in particular to the transmission of such information to enable user equipment (UE) to receive a point-to-multipoint (p-t-m) multimedia session.

MBMS is a service that provides users of a cellular telecommunications system with information, such as the streaming of video and audio files, news updates, or the like. The service may be one single ongoing session, or consist of a number of successive individual sessions during which part of the data is transferred. The MBMS may be utilised in broadcast mode wherein information is broadcast to all users within a cell. Alternatively, multicast mode may be used wherein a subgroup of users within the cell are sent information they alone have requested, for example, football results. The multicast mode is useful for services that require a subscription.

It is planned to use MBMS with Universal Mobile Telecommunications System (UMTS) networks. Several 3GPP (3rd Generation Partnership Project) technical specifications are available providing information on the relevant specifications. The technical specifications can be found at http://www.3gpp.org/specs/specs.htm. Some examples relevant to this patent application are 3GPP TS 22.146, 3GPP TS 25.301, 3GPP TS 25.346, 3GPP TS 25.401 and 3GPP TS 25.246.

A typical UMTS radio network architecture is shown in Figure 1. A core network 101 is connected to one or more radio network subsystems 103 via the Iu interface. Within each radio network subsystem 103, a radio network controller 105 connects to one or more base stations via the Iub interface. In the case of Universal Terrestrial Radio Access Network (UTRAN), Node B 107 is the base station. Each radio network controller 105 may be interconnected to other radio network controllers 105 using the Iur interface.

Each Node B 107 can control one or more cells. Within each cell, there are numerous UEs some of which are able to receive MBMS services provided by

a Broadcast Multicast Service Centre (BM-SC) located in the core network 101. The MBMS services are either broadcast to all UEs within the cell or multicast to only a selected group of UEs that have subscribed to the particular service. The UEs are mobile communication devices, for example, mobile telephones and PDAs. The UE connects to the Node B 107 via a radio interface (Uu).

The type of transfer mode to be used for a data transfer session of a specific MBMS service, i.e. point-to-point (p-t-p) or point-to-multipoint (p-t-m), is chosen depending upon the number of UEs within the cell that are interested in receiving the particular service and/or session. The UTRAN decides which transfer mode is used. For example, if a limited number of UEs are within the cell (for example, less than four) the UTRAN makes a decision to transfer the information supplied by the MBMS over the radio interface using the p-t-p mode in order to consume a minimum amount of radio capacity. Alternatively, if more UEs are within the cell, the p-t-m transfer mode is used to utilise the available radio capacity more economically.

When the UTRAN makes the decision to transmit information supplied by the MBMS in p-t-m mode, radio bearer configuration information is provided within the MBMS control information. MBMS control information is transmitted on the MBMS control channel, known as the multicast control channel (MCCH) over the radio interface (Uu) to the UE. The radio bearer configuration information provided on MCCH in the current cell allows a UE to receive services provided in p-t-m mode that are available in the current cell and potentially available from neighbouring cells. For these services, the information provided includes the radio bearer configuration required for the UE to receive the MBMS data from the radio bearer in the current cell, as well as from the radio bearer in some neighbouring cells that are able to provide the same MBMS data p-t-m over a MTCH (Multicast-Traffic-Channel). The UE can combine the MBMS data received from the neighbouring cell radio bearer with the MBMS data received from the current cell radio bearer in order to improve the reception quality. Reception quality is improved by reducing the power required in each cell to provide sufficient coverage. The known signalling of the radio bearer configuration information is discussed in more detail below. That is, the UE can receive a time aligned MTCH transmission from a neighbouring cell without receiving the MCCH of that cell.

The RB configuration information associated with each service signalled on the MCCH is repeated a number of times with exactly the same content. This MCCH information is transmitted at the beginning of every repetition period within a set modification period. Referring to Figure 2, which shows scheduling of messages on the MCCH according to known systems, any messages that contain service specific MBMS RB information 201 that has changed since the last modification period are placed at the start of the repetition period, while any other messages containing unchanged service specific MBMS RB information 203 or unchanged Common RB information 205 are placed at a later time slot in the repetition period. That is, an MBMS notification is first transmitted giving information on each changed service. Subsequently information is transmitted in the form of one or more MBMS service p-t-m RB information messages or common RB information messages, including any changed RB configuration information associated with the MBMS services. The UTRAN then provides scheduling information indicating the final TTI (Transmission Time Interval) containing the changed information so that UEs that have previously received the RB configuration information are not required to read any further RB configuration information after the indicated TTI.

Each service provided by the MBMS typically corresponds with one radio bearer. The radio bearers are mapped onto a transport channel, Forward Access Channel (FACH) in the case of MBMS. One or more radio bearers are mapped to a single common FACH. The FACH provides the means to transfer data with a certain quality of service (QoS), for example, a certain data rate, residual error rate and delay. Therefore, any services that require the same quality of service are typically mapped to the same transport channel (FACH), whereas services that require lower or higher quality of services are mapped to other transport channels (FACH).

One or more transport channels (FACH) are mapped to a physical channel. In the case of MBMS, the secondary-common control physical channel (S-CCPCH). Each physical channel has certain characteristics, for example, type of power control, cell coverage, use of certain techniques e.g. transmit diversity.

In the known UMTS, signalling of the MBMS radio bearer configuration information is carried out using two messages.

Firstly, a "common RB info" message is used to hold and transmit RB configuration information that is either common between two or more services, or common between two or more cells.

This "common RB info" message may include either changed or unchanged information depending on whether or not the configurations of the radio bearers have changed since the previous modification period.

Secondly, for every service that is being provided using the p-t-m mode, a separate "service RB info" message is transmitted in order to specify how the radio bearer corresponding to the service is configured in the cell the UE is currently in, and also how the radio bearer is configured in any neighbouring cells that also provide the service over the MTCH of the neighbouring cell. This information provides the necessary configuration details for a UE to be able to receive one particular service.

Configuration information in the "common RB info" message can be used for any common configurations (either between cells or services). In other words, if there is configuration information common between services or cells, it would be transmitted in the "common RB info" message. The common configuration information is then not required in the "service RB info" message. The "service RB info" message is merely required to include a reference to the applicable common configurations within the "common RB info" message.

For each service available within a cell, information on the entire radio configuration is provided. This radio configuration information includes the radio bearer configurations of the actual radio bearers ("real" RB configurations), the transport channel (TrCh) configurations (FACH for MBMS) and physical channel (PhyCh) configurations (S-CCPCH for MBMS). Therefore, if either the "real" RB configurations or transport channel configurations are common between a number of services available in that cell, references to these common configurations are duplicated, thus causing increases in the signalling overhead on the MCCH. For example, if one MBMS service is provided by a first radio bearer, and a second MBMS service is provided by a second radio bearer, where the services require the same quality of service (QoS), the two services will be mapped to the same transport channel (FACH). As there will be a separate "service RB info" message for each service, references to the RB common configurations for the FACH within each of the "service RB info" messages will be duplicated.

The duplication is best illustrated by means of a further example. Assuming 5 services are provided in the current cell using the p-t-m transfer mode and assuming that for each service the p-t-m radio bearer configuration is provided for 6 neighbouring cells also, with the current state of the art, for each service a message is provided as shown in table 1.

Table 1 "Service RB Info" message – for service A

Cell	actual RB-common config	TrCh common config	PhyCh common config
Current	1	1	1
N-1	1	1	1
N-2	1	1	1
N-3	1	2	1
N-4	1	2	1
N-5	2	3	1
N-6	1	1	2

Table 1 depicts information that is transmitted in the 'Service RB info' message for one particular MBMS service. Inside this message are references to RB, TrCh and PhyCh common configuration information that is transmitted within the 'Common RB info' message. The 'Service RB info' message includes the configuration information for the current cell and all neighbouring cells (six in this example) for one particular MBMS service.

The first column indicates which cell the data is referring to, either the current cell, or one of the six neighbouring cells (N-1 to N-6). The numbers in the next three columns indicate the types of RB, TrCh and PhyCh configuration used in the relevant cell. Each of these numbers refers to a specific type of configuration as included in the "common RB info" message. The service A shown in the example covered by table 1, applies actual RB configuration type 1, TrCh configuration type 1 and PhyCh configuration type 1 in the current cell. The table also shows that, for this example, the common RB configuration includes at least 2 actual RB configurations, 3 TrCh configurations and 2 PhyCh configurations.

The case where all MBMS services in a cell are mapped to the same physical channel can be regarded as typical. The current state of the art, which involves a separate message per service, therefore has a reference to indicate the PhyCh configuration used in the concerned cell for each service. In the example case where five services are provided, there will be a reference to PhyCh configuration 1 indicated five times, i.e. one for each service. This produces a large amount of signalling, which merely provides the same information to the UE a number of times. Further, where it is chosen to include actual configuration information rather than references, the duplication of this configuration information substantially increases the signalling overhead.

When specifying the RB configuration per service, the UE is not required to read RB configuration information concerning services that it is not interested in i.e. non-active services. This helps to reduce the time the UE needs to read the MCCH and so reduces the UE power consumption. However, this comes at the cost of duplication (whether the information is comprised of actual configuration information or references to actual configuration information) of MBMS control information on MCCH as shown in the above example.

Thus, two conflicting requirements appear within the configuration of the known system. That is, in order for UE power consumption to be kept to a minimum, information needs to be duplicated in order to reduce the time required for the UE to acquire the MBMS control information on the MCCH. However, the duplication of information increases the signalling overhead. That is, the amount of MBMS control information is not kept within reasonable limits when compared with the MBMS data traffic.

SUMMARY OF THE INVENTION

The present invention aims to overcome or at least alleviate some or all of the aforementioned problems.

In one aspect, the present invention provides, in a cellular communication network comprising a plurality of cells, and further comprising one or more multicast/broadcast service providers arranged to provide a plurality of multicast/broadcast services over a radio interface to a mobile communication device located in a current cell, a method of providing radio bearer configuration information to enable the mobile communication device to receive a

multicast/broadcast service, the method comprising the steps of: providing to a mobile communication device messages containing information associated with the radio bearer configuration, wherein each message is associated with a plurality of multicast/broadcast services that are available to be transmitted to the mobile communication device when in the current cell, and, periodically transmitting the messages to the mobile communication device within the current cell.

In a further aspect, the present invention provides, in a terrestrial mobile cellular network comprising a core network and a radio access network, the core network comprising a broadcast multicast service centre, the radio access network comprising a radio network controller connected to at least one base station, said base station arranged to be connected via a radio interface to one or more mobile communication devices located in one cell, said network further arranged to provide multimedia broadcast multicast services from the broadcast multicast service centre to one of said mobile communication devices, a method of sending a radio bearer configuration information message on a multicast control channel over the radio interface, said radio bearer configuration information message being used to specify the radio bearer configuration in order to allow at least one multimedia broadcast multicast service to be received by the mobile communication device, the method comprising the steps of: periodically transmitting within each cell a respective radio bearer configuration information message, the radio bearer configuration message for each cell comprising radio bearer configuration information associated with a plurality of multimedia broadcast multicast services available for reception by the mobile communication device within that cell.

In yet a further aspect, the present invention provides, in a cellular communication network comprising a plurality of cells, and further comprising one or more service providers arranged to provide services over a radio interface to a current cell, a method of receiving information to enable a mobile communication device to receive at least one service, comprising the steps of: receiving messages associated with the radio bearer configuration of radio bearers adapted to transmit at least one of the services to the mobile communication device in the current cell, wherein each message is associated with a plurality of services that are available to be received by the mobile communication device from the current cell or from neighbouring cells, and

using said information to set up a communication link in order for the mobile communication device to receive at least one service.

The present invention provides the advantage of reducing the signalling overhead of the network by avoiding the duplication of information associated with the radio bearer common configuration, whether that information is the actual common configuration information or references to the actual common configuration information.

It further provides the advantage of reducing the duplication of reference information that is associated with common configuration information, and so provides a reduction in the signalling overhead.

BRIEF DESCRIPTION OF THE DRAWINGS

A specific embodiment of the present invention will now be described by way of example only, with reference to the accompanying drawings in which:

Figure 1 shows a network architecture for a known UMTS system.

Figure 2 shows a known system of scheduling known messages.

Figure 3 shows a layout of an MBMS UMTS for use with the method according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Figure 3 shows a layout of a known MBMS UMTS architecture, which is suitable for utilising the method according to the present invention.

UE 301 is connected to the UTRAN 303 via the radio interface (Uu). The UTRAN 303 is connected to the SGSN (serving GPRS support node) 305 via the Iu interface. Connected to the SGSN is the home location register (HLR) 317 via the Gr interface. Also connected to the SGSN 305 is the GGSN (Gateway GPRS Support Node) 307 via the Gn/Gp interfaces. A broadcast multicast service centre (BM-SC) 309 is connected to the GGSN 307 via a Gmb interface and Gi interface. Multicast broadcast sources 311 and 313 are also provided within the network. Finally, a content provider 315 is connected to the BM-SC 309.

When the UE 301 enters a cell, it checks to see if data is provided for one or mores of its active services. That is, any MBMS multi-cast services the UE is

subscribed to receive, or any broadcast services the UE has been enabled (for example, by the network) to receive. Also, at the start of a new data transfer session for one of the services, known as "session start", the UE 301 is informed of this new session.

At the start of a new data transfer session for a particular service (session start), the UE is informed, or notified, by the UTRAN. Before the UTRAN 303 provides any data to the UE, it is optional for the UTRAN to count the number of UEs in the cell in order to decide whether the data transfer should be carried out in point-to-point mode or point-to-multipoint mode.

If point-to-multipoint mode is selected, the details of the radio bearer configuration for all MBMS services available in the current and/or neighbouring cells are signalled to the UE 301 over the radio interface Uu on the MCCH. The UE 301 is then able to use the radio bearer configuration information provided to setup a data transmission channel with the radio bearers and so receive the data corresponding with the MBMS service.

The radio bearer configuration, also referred to as the entire radio configuration, comprises the "real" RB configuration, the transport channel configuration (TrCh) and the physical channel configuration (PhyCh).

In the present invention, the "common RB info" message of the known system is not used. A "MBMS common P-T-M RB information" message is used as an alternative, and works in a similar way to the previously described "common RB info" message.

The "service RB info" message, as used in known systems, is not used. Instead, new messages are used to provide the UE with radio bearer configuration information allowing the UE to receive all the MBMS services that are available to it. The MBMS services may be received either from a base station located in the UEs current cell, or from a base station located in a neighbouring cell. A first message type is specific to the current cell and provides RB configuration information for all services available from radio bearers located in that current cell. A second message type provides radio bearer configuration information for all services available from radio bearers located in neighbouring cells. Examples of each of these messages are described in more detail below.

MBMS Common P-T-M RB Information message

This message is transmitted periodically by UTRAN to inform UEs about the p-t-m RB configuration information that may be common between different

services, applicable in the current and/ or in neighbouring cells. The message content does not change within a modification period.

Logical channel: MCCH

Direction: UTRAN → UE

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
Message type	MP		Message Type		REL-6
RB information list	MP	1 to <maxMBMS-CommonRB>			REL-6
>RB identity	MP		MBMS Common RB identity 10.3.9a.3		REL-6
>PDCP info	MP		PDCP info 10.3.4.2		REL-6
>RLC info	MP		RLC info MBMS 10.3.4.23a		REL-6
TrCh information for each TrCh	MP	1 to <maxMBMS-CommonTrCh>			REL-6
>Transport channel identity	MP		MBMS Common TrCh identity 10.3.9a.4		REL-6
>TFS	MP		Transport format set		REL-6

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
			10.3.5.23		
TrCh information for each CCTrCh	MP	1 to <maxMBMS-CommonCCTrCh>			REL-6
>CCTrCH identity	MP		MBMS Common CCTrCh identity 10.3.9a.1		REL-6
>TFCS	MD		Transport format combination set 10.3.5.20	The default value of the TFCS is specified in subclause 14.10.1	REL-6
PhyCh information	MP	1 to <maxMBMS-CommonPhyCh>			REL-6
>PhyCh identity	MP		MBMS Common PhyCh identity 10.3.9a.2		REL-6
>Secondary CCPCH info MBMS	MP		Secondary CCPCH info MBMS 10.3.6.71a		REL-6

MBMS Current Cell P-T-M RB Information message

This message is transmitted periodically by UTRAN to inform UEs about the PTM RB configuration used in a cell, in the case where one or more MBMS service is provided using p-t-m radio bearers. The message content does not change within a modification period.

Logical channel: MCCH

Direction: UTRAN → UE

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
Message type	MP		Message Type	Current cell PTM RB info	REL-6
S-CCPCH list	OP	1 to <maxSCCPCH>		Absent in case MTCH are only mapped to the S-CCPCH(s) included in SIB type 5	REL-6
>S-CCPCH identity	OP		MBMS Current cell S-CCPCH identity 10.3.9a.5	When L1-combining applies, this identity is used to refer to this S-CCPCH within the NEIGHBOURING CELL P-T-M RB INFORMATION message	REL-6
>Secondary	MP		MBMS	Refers to a	REL-6

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
CCPCH info			Common PhyCh identity 10.3.9a.2	configuration in the common RB info	
>MBMS Soft Combining Timing Offset	CV-*Soft-FDD*		MBMS Soft Combining Timing Offset 10.3.9a.10a	Timing offset applied in the CFN calculation in sub-clause 8.5.15.5. The default value is 0 ms.	REL-6
>TrCh information common for all TrCh	MP		MBMS Common CCTrCh identity 10.3.9a.1	Refers to a (TFCS) configuration in the common RB info	REL-6
>TrCH information list	MP	1 to <maxTrChperSCCPCH>		List of FACH transport channels carrying one or more MTCH	REL-6
>>TrCh information	MP		MBMS Common TrCh identity 10.3.9a.4	Refers to a (TFS) configuration in the common RB info	REL-6
>>RB	OP	1 to		The IE is	REL-6

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
information list		<maxRBperTrCh>		absent if temporarily no RBs are mapped to this TrCh or if the TrCH only carries MSCH	
>>>RB information	MP		MBMS p-t-m RB information 10.3.9a.7a		REL-6
>>MSCH configuration information	OP		MSCH configuration information 10.3.9a.16		REL-6
S-CCPCH in SIB type 5	OP	1 to <maxSCCPCH>		Every S-CCPCH's included in SIB type 5 may carry MTCH	REL-6
>S-CCPCH identity			Integer (1..maxSCCPCH)	Index of the S-CCPCH within the list included in SIB type 5	REL-6
>TrCH information list	MP	1 to <maxFACHPCH>		List of FACH transport channels	REL-6

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
				carrying one or more MTCH	
>>TrCh identity	MP		Integer (1..maxFACHPCH)	Index of the FACH within the list of TrChs defined for that S-CCPCH as included in SIB type 5	REL-6
>>RB information list	OP	1 to <maxRBperTrCh>		The IE is absent if this TrCh only carries MSCH	REL-6
>>>RB information	MP		MBMS p-t-m RB information 10.3.9a.7a		REL-6
>>MSCH configuration information	OP		MSCH configuration information 10.3.9a.16	Included if the TrCH carries MSCH	REL-6

Condition	Explanation
Soft-FDD	This IE is used only for FDD. It is mandatory default for FDD if the IE "L1 combining" is included in MBMS NEIGHBOURING CELL P-T-M RB INFORMATION.

	Otherwise it is not needed.

MBMS Neighbouring Cell P-T-M RB Information message

This message type is transmitted periodically by UTRAN to inform UEs about the p-t-m RB configuration used in neighbouring cells, indicating the UE may perform selection and/ or soft combining of MBMS services. The message content does not change within a modification period.

Logical channel: MCCH

Direction: UTRAN → UE

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
Message type	MP		Message Type		REL-6
Neighbouring cell identity	MP		Integer (0..<maxCell Meas–1>)	Points to IE 'Cell Info' obtained from IE 'Intra-frequency Cell Info list' in SIB 11.	REL-6
Neighbouring cell's S-CCPCH list	MP	1 to <maxSCCPCH>			REL-6
>Secondary CCPCH info	MP		MBMS Common PhyCh identity 10.3.9a.2	S-CCPCH configuration used in neighbouring cell. Refers to a configuration in the common RB info	REL-6
>Secondary CCPCH	MD		Integer (-6, -3, 3, 6)	Difference (Pn – Of) between	REL-6

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
Power Offset Difference				the S-CCPCH power offset (Pn) of the neighboring cell S-CCPCH and an arbitrary offset (Of). An arbitrary offset(Of) is specific to the current cell and the same for all its neighbouring cells, in dB. Default value is 0. Note 3 and 4.	
>>L1 combining	OP			L2- combining applies if the IE is absent	REL-6
>>CHOICE *mode*	MP				REL-6
>>>FDD					REL-6
>>>>MBMS Soft Combining Timing Offset	MP		MBMS Soft Combining Timing Offset 10.3.9a.10a	Timing offset applied in the CFN calculation in subclause 8.5.15.5	REL-6

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
>>>>MBMS transmission time difference	MP		Integer (0..3)	Indicates the time difference between the TTIs on the current and the neighbouring cell's SCCPCH that can be L1-combined	REL-6
>>>>MBMS L1 combining schedule	OP		MBMS L1 combining schedule 10.3.9a.7	If included partial layer 1 combining applies, in which case this IE indicates when L1-combining applies. If the IE is absent, L1 combining applies continuously	REL-6
>>>TDD				(no data)	REL-6
>CHOICE L23 configuration	MP				REL-6
>>SameAs Current cell				Apart from the physical channel configuration and the MSCH	REL-6

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
				configuration information, the same configuration as for the indicated S-CCPCH used in the current cell applies	
>>>Current cell's S-CCPCH	MP		MBMS Current cell S-CCPCH identity 10.3.9a.5	Reference to the S-CCPCH in the current cell with which applies exactly the same configuration	REL-6
>>>MSCH configuration information	MP		MSCH configuration information 10.3.9a.16		REL-6
>>Different					REL-6
>>>TrCh information for common for all TrCh	MP		MBMS Common CCTrCh identity 10.3.9a.1	Refers to a (TFCS) configuration in the common RB info	REL-6
>>>TrCH information	MP	1 to <maxFACHPCH>			REL-6
>>>>TrCh	MP		MBMS	Refers to a	REL-6

Information Element/Group name	Need	Multi	Type and reference	Semantics description	Version
information			Common TrCh identity 10.3.9a.4	(TFS) configuration in the common RB info	
>>>>TrCh combining status	MP		BOOLEAN	Value TRUE means that TrCh combining is used for this transport channel (TDD only). Note 2.	REL-6
>>>>RB information list	OP	1 to <maxRBperTrCh>		The IE is only present for the radio bearers for which selection (FDD) or transport channel (TDD) combining applies.	REL-6
>>>>>RB information	MP		MBMS p-t-m RB information 10.3.9a.7a		REL-6
>>>>MSCH configuration information	OP		MSCH configuration information 10.3.9a.16	Included if the TrCH carries MSCH	REL-6

It should be noted that:

The signalling supports the option that UTRAN maps one service to L1 combining slots for some neighbours and to the L2 combining slots for other neighbours, i.e. the use of different combining schemes for different neighbours.

Transport combining can only be indicated when the complete L2 configuration is provided for the neighbouring cell (i.e. using L2 configuration choice "different"). Fortunately, a scenario in which the neighbouring cell configuration is different from the current cell is regarded as the typical scenario for using transport combining.

For FDD, an S-CCPCH power offset is defined as the offset between one S-CCPCH and the P-CPICH of a given cell (Ps-ccpch – Pp-cpich). For TDD, an S-CCPCH power offset is defined as the offset between one S-CCPCH and the P-CCPCH of a given cell (Ps-ccpch – Pp-ccpch).

The Secondary CCPCH Power Offset Difference IE gives the UE an indication of the S-CCPCH power on the neighbouring cells that may be used to complete the neighbouring cell ranking based on P-CPICH power for FDD or P-CCPCH for TDD.

The "MBMS common P-T-M RB information" message provides the UE with p-t-m RB configuration information that is common to different services that may be provided by p-t-m radio bearers in the current cell and/or in a neighbouring cell.

The MBMS cell P-T-M RB information message groups the references to the common configuration information stored in the MBMS common P-T-M RB information message per cell, rather than per service as in the prior art.

In a given cell e.g. cell A, there is one type of MBMS cell P-T-M RB information message containing RB configuration information for all p-t-m MBMS services available from radio bearers provided within that cell. This MBMS "current cell" P-T-M RB information message is transmitted to all UEs within the cell in which the radio bearer is provided.

Furthermore, in the given cell A there is another type of MBMS cell P-T-M RB information message transmitted, one for each relevant neighbouring cell, thus providing the corresponding RB configuration information applicable for that cell. This neighbouring cell information is signalled in the current cell so that

the UE only needs to acquire the MBMS control information from one cell, referred to as the current cell i.e. the cell the UE has selected to acquire the MBMS control information from.

For example, for a current cell with six relevant neighbouring cells, there will be seven MBMS cell P-T-M RB information messages, one for the current cell and six for the neighbouring cells. Likewise, neighbouring cells of cell A may provide RB configuration information for the current cell, cell A. This enables a UE to receive MBMS data for a particular service provided by radio bearers in the current cell and/or a neighbouring cell.

The MBMS "neighbouring cell" P-T-M RB information message is transmitted to all UEs within the cell. This message provides radio bearer configuration information required for a UE to receive all MBMS services available from within the current cell that are also provided by radio bearers from a neighbouring cell. That is, a UE located in cell A may receive any number of MBMS services provided by radio bearers in cell A. In addition, the UE can receive these same services provided by radio bearers in neighbouring cells. The RB configuration information in the 'neighbouring cell' message provides details of the radio bearer configuration required for the UE to receive these same services provided by radio bearers in neighbouring cells.

As the 'current cell' and 'neighbouring cell' RB configuration information messages are cell specific, and provide RB configuration information for all services available to the UE from its current location, the number of references in the messages to common configuration information is reduced. This reduction is depicted in Table No. 2 below.

Table 2 Cell RB Info – for 'current cell' message

Phy-Ch common config	TrCh- common config	RB common config	Service
1	1	1	1
		1	2
	2	1	3
		1	4
	3	2	5

This example shows that when the RB information is specified 'per cell', for each cell the PhyCh configuration is referenced only once rather than once per service. Likewise, the number of references for the TrCh configuration is reduced.

Although table 2 above shows 3 different configurations for the transport channel, it may be the case that the transport channel configurations are the same for all services. In which case, there would only be a single reference to the transport configuration in the RB information messages.

As each reference to the common configuration information stored within the MBMS common P-T-M RB information message uses up a number of bits within the signalling on the MCCH, grouping the radio bearer configuration information messages per cell reduces the signalling overhead on the MCCH.

The signalling overhead is reduced even further when compared to known systems where the actual details of the radio bearer configuration are included in the RB configuration information messages rather than just the references to common configurations.

In addition, not only does the UE receive messages containing RB configuration information associated with all services provided by radio bearer's in the current cell, the UE also receives messages containing RB configuration information associated with these services for radio bearers in neighbouring cells. Therefore, further signalling overhead gains are made on these messages.

When a mobile communication device receives the MBMS cell P-T-M RB configuration information messages, it uses the radio bearer configuration information contained therein to set up a p-t-m communication link. If the radio bearer configuration information within the MBMS "current cell" P-T-M RB information message (or "neighbouring cell" RB information message) merely refers to MBMS common P-T-M RB information, the information in the MBMS common P-T-M RB information message is used to set up a p-t-m communication link. The p-t-m communication link allows information provided in an MBMS service to be sent to, and received by, the user equipment.

Furthermore, if any radio bearer information within the newly defined MBMS Cell P-T-M RB configuration information messages has changed, the associated message is scheduled by UTRAN to be transmitted at the beginning of a repetition period over the MCCH. Any MBMS Cell P-T-M RB configuration information messages that only contain unchanged RB information are

transmitted towards the end of the repetition period. Also, the UTRAN provides scheduling information indicating the final TTI containing the change information, so the UE is aware of the end point of all messages that contain changed information. Therefore, UEs only need to read the beginning part of the MCCH information being provided during the repetition period in order to pick up any radio bearer information that has changed. This approach reduces the time the UE needs to read MCCH after having been notified that a change has occurred for one of its active services.

During the transmission of radio bearer information on the MCCH, the present invention groups the radio bearer information according to each cell rather than according to each service thus providing a reduction in the number of references to common RB configuration information and so reducing the signalling overhead on the MCCH.

Changed information is scheduled at the beginning of a repetition period on the MCCH, which reduces the UE battery consumption in certain scenarios.

It will be understood that the embodiment of the present invention described herein is by way of example only, and that various changes and modifications may be made without departing from the scope of the invention. For example, although the invention is described with reference to the UMTS radio interface, it is also applicable to other similar systems where it is required to transmit radio bearer configuration information to user equipment.

Also, it will be understood that, although the above embodiment provides RB configuration information "per cell" rather than "per service", that a combination of "per cell" and "per service" messages can be utilised in the system. That is, a predetermined parameter can be used to decide whether it is more efficient to use the "per cell" or "per service" message. One example is to calculate the signalling overhead of the "per cell" method, and if the signalling overhead exceeds a threshold, a switch is made to use the "per cell" message. In a further example, the UTRAN may switch from a "per cell" method to a "per service" method if the number of services available in a particular cell is reduced, and so it becomes more efficient to send the configuration information in this manner. In this particular embodiment the user equipment is able to use either of the 'per cell' type or 'per service' type messages in order to set up a p-t-m communication link to receive the service.

Further, it will be understood that the current cell and neighbouring cell RB P-T-M configuration data could be included in a single message transmitted by the radio bearer in each cell, rather than separately in a 'current cell' type message and a 'neighbouring cell' type message. That is, the configuration data set is grouped into a single set of data and transmitted in a single message.

CLAIMS

1. In a cellular communication network comprising a plurality of cells, and further comprising one or more multicast/broadcast service providers arranged to provide a plurality of multicast/broadcast services over a radio interface to a mobile communication device located in a current cell, a method of providing radio bearer configuration information to enable the mobile communication device to receive a multicast/broadcast service, the method comprising the steps of:

providing to a mobile communication device messages containing information associated with the radio bearer configuration, wherein each message is associated with a plurality of multicast/broadcast services that are available to be transmitted to the mobile communication device when in the current cell, and,

periodically transmitting the messages to the mobile communication device within the current cell.

2. The method of claim 1, wherein the messages include a first message type, said first message type being associated with the plurality of multicast/broadcast services that are available to be transmitted to the mobile communication device from the current cell.

3. The method of claim 1, wherein the messages include a second message type, said second message type being associated with the plurality of multicast/broadcast services that are available to be transmitted to the mobile communication device from a neighbouring cell.

4. The method of claim 3, wherein there is a single second message type for each neighbouring cell.

5. The method of claim 1, wherein the messages include a third message type, said third message type being associated with the plurality of multicast/broadcast services that are available to be transmitted to the mobile communication device from the current cell and from a neighbouring cell.

6. The method according to claim 1, further comprising the steps of:

determining whether a parameter value associated with the current cell is below a predetermined limit, and upon a positive determination, ceasing to provide the messages associated with the plurality of multicast/broadcast services, and

providing a fourth message type associated with one particular service that is available to be transmitted to the mobile communication device when located in the current cell, and, within the fourth message type,

providing information associated with the radio bearer configuration required for the mobile communication device to receive that particular service and no other from the current cell or one or more neighbouring cells, and

periodically transmitting the fourth message type within the current cell.

7. The method according to claim 6, the method further comprising the step of:

determining whether the parameter value is above a predetermined limit, and upon a positive determination,

ceasing to provide the fourth message type, and

providing messages associated with the plurality of multicast/broadcast services that are available to be transmitted to the mobile communication device when in the current cell, and,

periodically transmitting the messages within the current cell.

8. The method according to claim 1 wherein the information associated with the radio bearer configuration is the radio bearer configuration information.

9. The method according to claim 1 wherein the information associated with the radio bearer configuration is a reference to the radio bearer configuration information.

10. The method according to claim 8 or 9, wherein the radio bearer configuration information is information associated with the real radio bearer configuration, the transport channel configuration and the physical channel configuration.

11. The method according to claim 1, wherein the messages are sent at the beginning of a repetition period if the radio bearer configuration has changed since the last modification period.

12. The method according to claim 1 wherein at least one of the messages includes a single reference to any common configuration of physical channels required for the mobile communication device to receive the service.

13. The method according to claim 1 wherein at least one of the messages includes a single reference to any common configuration of transport channels required for the mobile communication device to receive the service.

14. In a terrestrial mobile cellular network comprising a core network and a radio access network, the core network comprising a broadcast multicast service centre, the radio access network comprising a radio network controller connected to at least one base station, said base station arranged to be connected via a radio interface to one or more mobile communication devices located in one cell, said network further arranged to provide multimedia broadcast multicast services from the broadcast multicast service centre to one of said mobile communication devices, a method of sending a radio bearer configuration information message on a multicast control channel over the radio interface, said radio bearer configuration information message being used to specify the radio bearer configuration in order to allow at least one multimedia broadcast multicast service to be received by the mobile communication device, the method comprising the steps of:

periodically transmitting within each cell a respective radio bearer configuration information message, the radio bearer configuration message for each cell comprising radio bearer configuration information associated with a plurality of multimedia broadcast multicast services available for reception by the mobile communication device within that cell.

15. In a cellular communication network comprising a plurality of cells, and further comprising one or more service providers arranged to provide services over a radio interface to a current cell, a method of receiving information to enable a mobile communication device to receive at least one service, comprising the steps of:

receiving messages associated with the radio bearer configuration of radio bearers adapted to transmit at least one of the services to the mobile communication device in the current cell, wherein each message is associated with a plurality of services that are available to be received by the mobile communication device from the current cell or from neighbouring cells, and

using said information to set up a communication link in order for the mobile communication device to receive at least one service.

16. A terrestrial mode cellular system arranged to carry out the method according to any preceding claim.

17. A radio network controller arranged to send messages by the method according to any of claims 1 to 15.

18. A mobile communication device specifically adapted to receive messages as sent by the method according to any of claims 1 to 15.

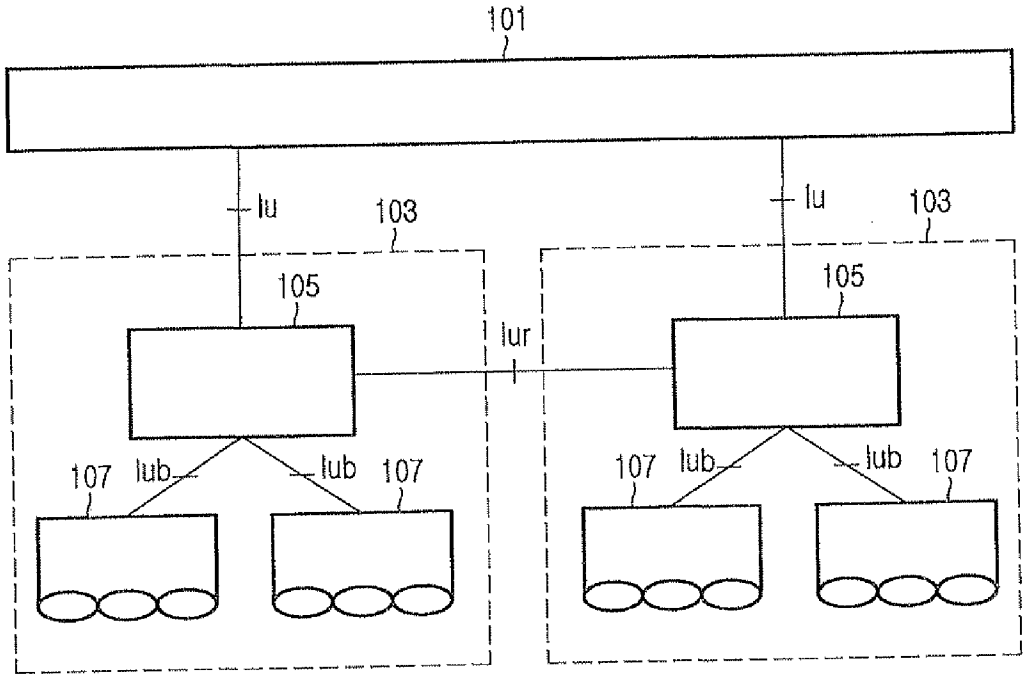

FIG.1

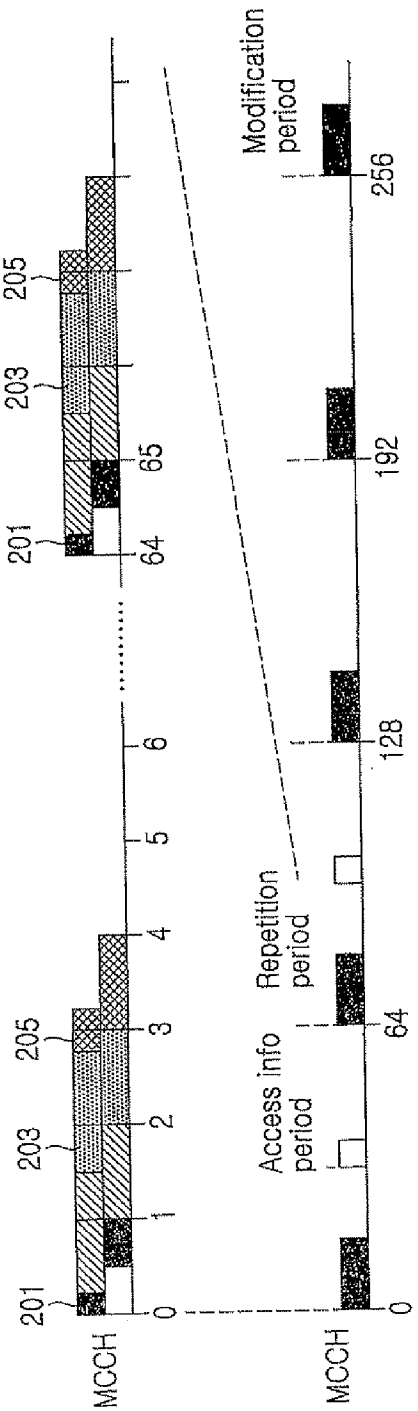
MCCH
201
203
205
0
1
2
3
4
5
6
64
65
MCCH
0
Access info period
Repetition period
64
128
192
256
Modification period

FIG.2

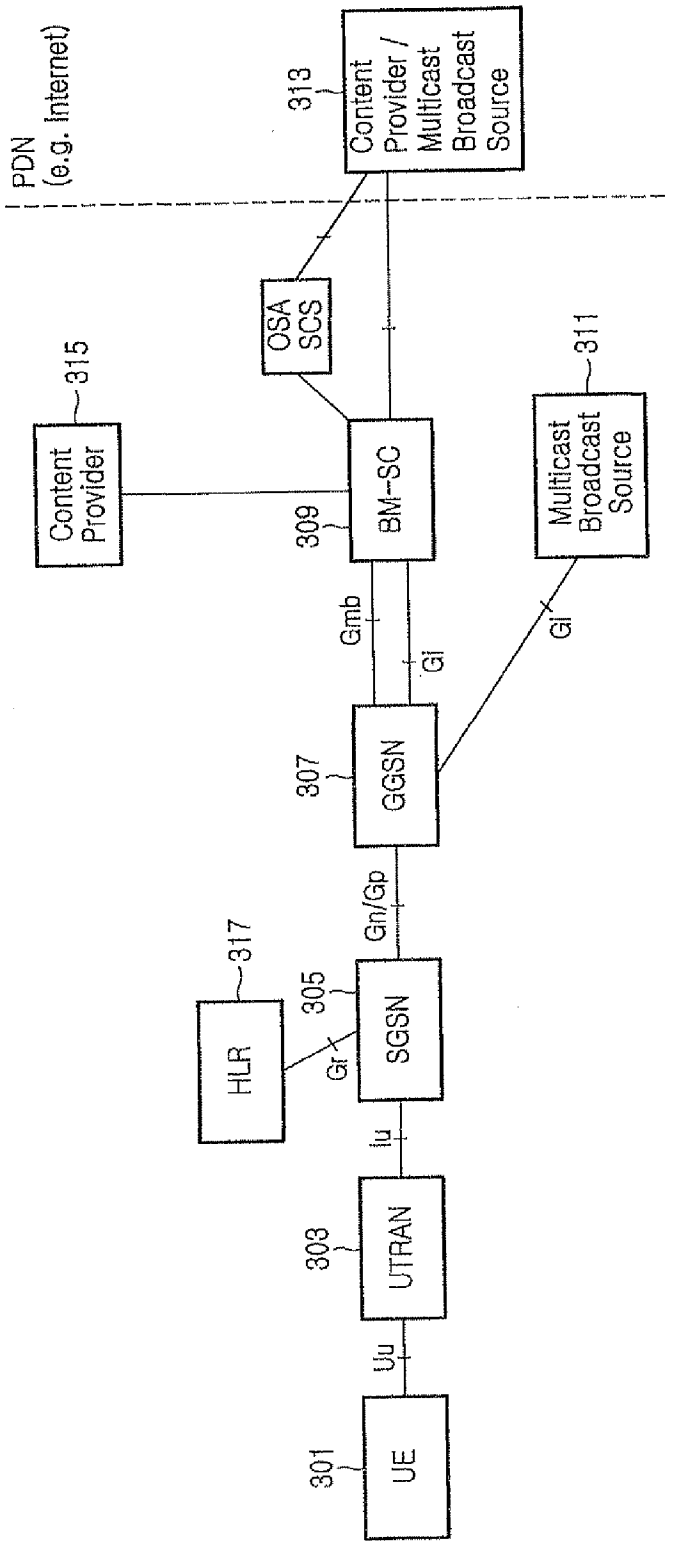
PDN
(e.g. Internet)
313
Content Provider / Multicast Broadcast Source
OSA SCS
315
Content Provider
309
BM-SC
311
Multicast Broadcast Source
Gmb
Gi
Gi
307
GGSN
Gn/Gp
317
HLR
305
Gr
SGSN
Iu
303
UTRAN
Uu
301
UE

FIG.3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2005/003138

A. CLASSIFICATION OF SUBJECT MATTER

H04B 7/26(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC8 H04B 7/26, H04J 3/24, H04L 12/56

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

KIPASS, DELPHION, ESPACENET & Keywords : MBMS, radio, bearer, set up, configuration, cell and similar terms.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US2004-146041 A (Lee et al.) 29 July 2004 * abstract, paragraphs[0055]-[0059], figure 3 *	1-18
A	JP2004-135293 A (SAMSUNG ELECTRONICS CO., LTD.) 30 April 2004 * abstract, paragraphs[39]-[48], figure 5 *	1-18
PA	US2005-177620 A (LG Electronics Inc.) 11 August 2005 * abstract, paragraphs[0055]-[0058], figure5 *	1-18

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
04 JANUARY 2006 (04.01.2006)	**04 JANUARY 2006 (04.01.2006)**

Name and mailing address of the ISA/KR	Authorized officer
Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	KIM, Sang Woo Telephone No. 82-42-481-8324

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR2005/003138

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US2004-146041 A	29.07.2004	NONE	
JP2004-135293 A	30.04.2004	AU2003235065A1	04.03.2004
		AU2003235065B2	04.03.2004
		CN1496138A	12.05.2004
		EP01392074A2	25.02.2004
		EP01392074A3	12.05.2004
		RU2003125333A	10.02.2005
		US20040087320A1	06.05.2004
US2005-177620 A	11.08.2005	NONE	

Electronic Patent Application Fee Transmittal

Application Number:	12159841
Filing Date:	22-Oct-2008
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Filer:	David Gerard Majdali/Neeti Rajput
Attorney Docket Number:	2101-3515

Filed as Large Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

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Application Number:	12159841
International Application Number:	
Confirmation Number:	3203
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Customer Number:	35884
Filer:	David Gerard Majdali/Neeti Rajput
Filer Authorized By:	David Gerard Majdali
Attorney Docket Number:	2101-3515
Receipt Date:	16-NOV-2011
Filing Date:	22-OCT-2008
Time Stamp:	19:40:25
Application Type:	U.S. National Stage under 35 USC 371

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Submitted with Payment	yes
Payment Type	Deposit Account
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RAM confirmation Number	6855
Deposit Account	502290
Authorized User	

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	2101-3515_111011_IDSform_FR.pdf	612313 9c28d5703a659d68c8f72b1f24bef13b9611b12e	no	4
Warnings:					
Information:					
A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.					
2	Information Disclosure Statement (IDS) Form (SB08)	2101-3515_111011_IDSform_US.pdf	612275 3e0eaaa09b44ac7ec7792520201a8fffadfefba5	no	4
Warnings:					
Information:					
3	Foreign Reference	JP2005525066.pdf	2232206 f1b4e62899c419a5f7950aaa3ae06f19d5032151	no	26
Warnings:					
Information:					
4	Foreign Reference	WO2006033552.pdf	2980670 bbb13b1fc8a3b487195b74a942c1c627341e1882	no	35
Warnings:					
Information:					
5	Fee Worksheet (SB06)	fee-info.pdf	30693 c18654b74f6f3cfa668327227de9062ac6b6d141	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	6468157		

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New International Application Filed with the USPTO as a Receiving Office

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/159,841	10/22/2008	Young Dae Lee	2101-3515	3203

35884 7590 11/03/2011

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660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

EXAMINER	
CHO, UN C	

ART UNIT	PAPER NUMBER
2617	

NOTIFICATION DATE	DELIVERY MODE
11/03/2011	ELECTRONIC

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APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
12/159,841	22 October, 2008	LEE ET AL.	2101-3515

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EXAMINER	
UN C. CHO	
ART UNIT	PAPER
2617	10282011

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/UN C. CHO/
Primary Examiner, Art Unit 2617

PTO-90C (Rev.04-03)

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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	2	7729719		2010-06-01	Bergstrom et al.	

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	2	20070081513		2007-04-12	Torsner	
	3	20050039101		2005-02-17	Torsner	
	4	20110038376		2011-02-17	Wiemann et al.	

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Receipt date: 10/27/2011	Application Number	12159841	12159841 - GAU: 2617
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	5	20090319850		2009-12-24	Baek et al.	
	6	20050249222		2005-11-10	van Kampen et al.	
	7	20060153232		2006-07-13	Shvodian	
	8	20080031253		2008-02-07	Kim et al.	
	9	20030131124		2003-07-10	Yi et al.	
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	Attorney Docket Number	2101-3515

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Signature	/David Majdali/	Date (YYYY-MM-DD)	2011-10-27
Name/Print	David Majdali	Registration Number	53,257

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(71) Applicant *(for all designated States except US)*: TELEFONAKTIEBOLAGET LM ERICSSON (PUBL) [SE/SE]; S-164 83 Stockholm (SE).

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(74) Agent: MAGNUSSON, Monica; Ericsson AB, Patent Unit Radio Networks, S-164 80 Stockholm (SE).

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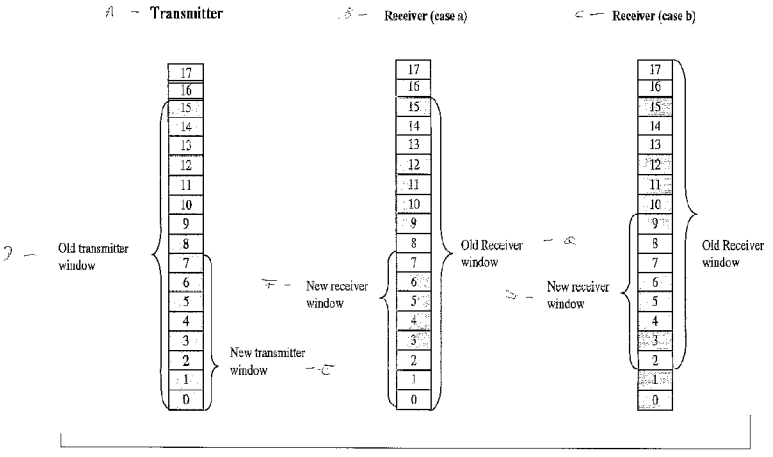
[Continued on next page]

(54) Title: RLC WINDOW SIZE RECONFIGURATION



(57) Abstract: A telecommunications device comprises a transceiver (33); a radio link control entity (50); and, a radio link control (RLC) buffer memory (150). The transceiver (33) which enables the device to communicate over an air interface (32). The radio link control entity (50) forms uplink RLC protocol data units (PDUs) for transmission over the air interface (32) and receives downlink RLC protocol data units (PDUs) over the air interface (32). The radio link control (RLC) huffer memory (150) is configured to include a transmitter buffer for storing the uplink RLC protocol data units (PDUs) and a receiver buffer for storing the downlink RLC protocol data units (PDUs). The radio link control entity includes RLC reconfiguration logic means (200) which reconfigures at least one of a size of a transmitter buffer window and a size of a receiver buffer window. In performing the reconfiguration, the RLC reconfiguration logic means implements a strategy for handling at least one of (1) downlink RLC protocol data units (PDUs) which are outside a new receiver huffer window; and (2) uplink RLC protocol data units (PDUs) which are either outside a new transmitter window or whose receipt by the radio access network has not been positively acknowledged.

WO 2004/091130 A1

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)*

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RLC WINDOW SIZE RECONFIGURATION

BACKGROUND

[0001] FIELD OF THE INVENTION

[0002] The present invention pertains to wireless telecommunications, and particularly to method and apparatus for reconfiguration of radio link control (RLC) parameters during a connection.

[0003] RELATED ART AND OTHER CONSIDERATIONS

[0004] In a typical cellular radio system, wireless user equipment units (UEs) communicate via a radio access network (RAN) to one or more core networks. The user equipment units (UEs) can be mobile stations such as mobile telephones ("cellular" telephones) and laptops with mobile termination, and thus can be, for example, portable, pocket, hand-held, computer-included, or car-mounted mobile devices which communicate voice and/or data with radio access network. Alternatively, the wireless user equipment units can be fixed wireless devices, e.g., fixed cellular devices/terminals which are part of a wireless local loop or the like.

[0005] The radio access network (RAN) covers a geographical area which is divided into cell areas, with each cell area being served by a base station. A cell is a geographical area where radio coverage is provided by the radio base station equipment at a base station site. Each cell is identified by a unique identity, which is broadcast in the cell. The base stations communicate over the air interface (e.g., radio frequencies) with the user equipment units (UE) within range of the base stations. In the radio access network, several base stations are typically connected (e.g., by landlines or microwave) to a radio network controller (RNC). The radio network controller, also sometimes termed a base station controller (BSC), supervises and coordinates various activities of the plural base stations connected thereto. The radio network controllers

are typically connected to one or more core networks. The core network has various service domains, with an RNC having an interface to these domains.

[0006] One example of a radio access network is the Universal Mobile Telecommunications (UMTS) Terrestrial Radio Access Network (UTRAN). The UMTS is a third generation system which in some respects builds upon the radio access technology known as Global System for Mobile communications (GSM) developed in Europe. UTRAN is essentially a radio access network providing wideband code division multiple access (WCDMA) to user equipment units (UEs). The Third Generation Partnership Project (3GPP) has undertaken to evolve further the UTRAN and GSM-based radio access network technologies.

[0007] The Universal Mobile Telecommunications (UMTS) Terrestrial Radio Access Network (UTRAN) accommodates both circuit switched and packet switched connections. There are several interfaces of interest in the UTRAN. The interface between the radio network controllers (RNCs) and the core network(s) is termed the "Iu" interface. The interface between a radio network controller (RNC) and its base stations (BSs) is termed the "Iub" interface. The interface between the user equipment unit (UE) and the base stations is known as the "air interface" or the "radio interface" or "Uu interface". An interface between radio network controllers (e.g., between a Serving RNC [SRNC] and a Drift RNC [DRNC]) is termed the "Iur" interface.

[0008] The radio network controller (RNC) controls the UTRAN. In fulfilling its control role, the RNC manages resources of the UTRAN. Such resources managed by the RNC include (among others) the downlink (DL) power transmitted by the base stations; the uplink (UL) interference perceived by the base stations; and the hardware situated at the base stations.

[0009] A UMTS Terrestrial Radio Access Network (UTRAN) responds to radio access service requests by allocating resources needed to support a communication with a user equipment unit (UE). A procedure for establishing a radio access bearer is described in Technical Specification 3GPP TS 25.931 v 5.1.0, which is incorporated herein by reference. A radio access bearer (RAB) is a logical connection with the user equipment unit (UE) through the UTRAN and over the radio air interface and corresponds to a single data stream. For example, one radio access bearer may support a speech

connection, another bearer may support a video connection, and a third bearer may support a data packet connection. Each radio access bearer is associated with quality of service (QoS) parameters describing how the UTRAN should handle the data stream. Although the term "radio access bearer" is sometimes used for purposes of the following description, the invention applies to any type of "connection," and is not limited to logical connections like RABs, a particular type of physical connection, etc.

[00010] To initiate a radio access bearer service, a request is transmitted to the UTRAN for communication with a user equipment unit (UE). One or more parameters accompany the radio access bearer service request. When establishing each bearer, the UTRAN "maps" or allocates the radio access bearer to physical transport and radio channel resources through the UTRAN and over the radio air interface, respectively. The mapping is based on one or more parameters associated with the radio access bearer service request.

[00011] In the Universal Mobile Telecommunications System (UMTS), a Radio Link Control (RLC) layer with its RLC protocol is interposed between a higher layer (such as an Internet Protocol (IP) Layer) and a Medium Access Control (MAC) layer. Radio link control (RLC) is a protocol layer that has various uses. The radio link control (RLC) has several modes of operation, including the transparent mode, the unacknowledged mode, and the acknowledged mode (AM). The RLC PDUs used in AM mode are called AMD PDUs (for RLC PDUs carrying user data. The mode of operation is selected according to the requirements of the higher layer. The radio link control (RLC) is used both for data flows and also for signaling flows.

[00012] Fig. 1 shows a Radio Link Control (RLC) layer 10 which transmits RLC PDUs (Protocol Data Units) to, and receives RLC PDUs from, the Medium Access Control (MAC) layer 11. In the illustrative example of Fig.1, the Medium Access Control (MAC) layer 11 functions as the "lower layer" relative to the RLC layer; the "higher layer" 12 can be a layer such as TCP/IP layer (e.g., IP layer). The Medium Access Control (MAC) layer 11 is responsible, e.g., for mapping between logical channels and transport channels, priority handling, and scheduling of data flows on transport channels.

[00013] A radio access bearer (RAB) is established for each service. For each radio access bearer at least one RLC entity is established in both the user equipment unit and in the UTRAN. In the case of AM RLC there is one entity established, in the case of UM and TM there may be one downlink and one uplink RLC entity (or only a single RLC entity in one direction.

[00014] Fig. 1, shows, for an AM mode, an RLC entity 10-UE is provided in a user equipment unit (UE) and a RLC entity 10-RAN is provided in the UTRAN. With respect to the lower layer (e.g., Medium Access Control (MAC) layer 11), each RLC entity has a transmitting side and a receiving side. With its RLC PDUs, the RLC protocol of the Radio Link Control (RLC) layer supports the in-sequence delivery of higher level Service Data Units (SDUs) (which, in the illustration of Fig. 1, are TCP/IP IP packets). The Radio Link Control (RLC) layer is described in more detail in 3GPP TS 25.322 V6.0.0 (2003-12), 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; RLC Protocol Specification (Release 6), which is incorporated herein by reference.

[00015] Some limited code-type error recovery capability (e.g., convolutional coding) is provided over the air interface (i.e., radio interface). Over the air interface, such error recovery is performed locally with a local retransmission protocol, wherein all data in a transmission buffer is cached until it has been successfully delivered. In this regard, for example, the Radio Link Control (RLC) protocol of the Radio Link Control (RLC) layer has its local retransmission protocol – the Automatic Repeat Request (ARQ) protocol.

[00016] Consider the scenario of a user equipment unit (UE) with UE reference class 384 kbps. According to Technical Specification 3GPP TS 25.306 v 5.70, which is incorporated herein by reference, typical RLC capabilities for this UE class feature 50 Kbyte UE memory and a maximum of six AM (acknowledge mode) RLC entities. Thus, this user equipment unit (UE) can potentially use three parallel packet switched (PS) RABs. But, for the sake of simplicity, in this present scenario assume that this user equipment unit (UE) operates with two simultaneous PS RABs, e.g. two parallel interactive RABs or one interactive and one streaming RAB.

[00017] For an RLC entity which operates in AM mode, a mechanism which functions like a sliding window is used to control the flow of RLC packet data units (PDUs). When the first PS RAB is setup for the user equipment unit (UE) of this scenario, the UTRAN can not yet know if a second (or even a third) PS RAB will be setup in the future. So if the RLC window size of the first PS RAB can not be reduced when a subsequent RAB is setup, then the UTRAN must take into account the memory usage of other RABs that may potentially be setup in the future. For example, to allow, e.g., two parallel PS RABs, UTRAN can only allocate half of its available UE memory for the first PS RAB.

[00018] In this scenario, if only the first PS RAB were to be setup, UTRAN could possibly allocate the whole remaining memory for the first PS RAB, e.g. a window size 512 in downlink and 256 in uplink, resulting in a total memory usage of 42 kbyte. But without the ability to reconfigure RLC window size, such ample memory allocation for the first PS RAB cannot occur. This is because the potential memory usage of a second PS RAB needs to be considered at the outset when the first PS RAB is setup (regardless of whether the second PS RAB will ever actually be setup). As a result, the RLC memory for the first RS RAB (and thus the RLC window size for the first PS RAB) can only be configured to, e.g., 256 in downlink and 128 in uplink. Naturally, this results in reduced performance, particularly before the second PS RAB is setup (which may never occur).

[00019] Especially for higher data rates, e.g. 384 kbps, the RLC window size has a significant impact on the performance in terms of delay/throughput. Since two parallel PS RABs may only be used in a fraction of the PS connections, this implies that a large amount of the UE memory is unused for most UEs and the throughput for PS connections unnecessarily low. The performance reduction is even more acute when cases of three parallel PS RABs are considered: the UTRAN can only allocate one third of the available UE memory when setting up the first PS RAB.

[00020] On the other hand, if the RLC window size could effectively be reduced at reconfiguration, the UTRAN could possibly allocate the whole memory for the first PS RAB. Then, if a second PS RAB is later setup, the window sizes could be reconfigured to suit the number of simultaneous RABs.

[00021] As it turns out, RRC signalling standards currently nominally support reconfiguration of RLC parameters during a connection, e.g. with a RADIO BEARER RECONFIGURATION message. The reconfiguration of RLC window size is ostensibly supported according to Technical Specification 3GPP TS 25.331 v 3.17.0 section 8.2.2.3 and 8.6.4.9, which is incorporated herein by reference.

[00022] However, the actions related to such a reconfiguration, particularly a reduction of the RLC window size, are not explicitly specified, e.g., neither in the above-mentioned Technical Specification 3GPP TS 25.322 nor in Technical Specification 3GPP TS 25.331. v 3.17.0, both which are incorporated herein by reference. Moreover, when the window size is decreased the UE actions are not unambiguous and potentially very problematic.

[00023] What is needed, therefore, and an object of the present invention, is an effective technique for implementing a decrease of the RLC window size.

BRIEF SUMMARY

A telecommunications device comprises a transceiver; a radio link control entity; and, a radio link control (RLC) buffer memory. The transceiver which enables the device to communicate over an air interface. The radio link control entity forms uplink RLC protocol data units (PDUs) for transmission over the air interface and receives downlink RLC protocol data units (PDUs) over the air interface. The radio link control (RLC) buffer memory is configured to include a transmitter buffer for storing the uplink RLC protocol data units (PDUs) and a receiver buffer for storing the downlink RLC protocol data units (PDUs). The radio link control entity includes RLC reconfiguration logic means which reconfigures at least one of a size of a transmitter buffer window and a size of a receiver buffer window. In performing the reconfiguration, the RLC reconfiguration logic means implements a strategy for handling at least one of (1) downlink RLC protocol data units (PDUs) which are outside a new receiver buffer window; and (2) uplink RLC protocol data units (PDUs) which are either outside a new transmitter window or whose receipt by the radio access network has not been positively acknowledged.

[00024] In a first example embodiment and mode of operation when the device is a user equipment unit, the radio link control (RLC) entity (A) discards any downlink RLC protocol data units (PDUs) which were received as being within the old receiver buffer window but which are outside the new receiver buffer window; and (B) retains in the radio link control (RLC) buffer memory any uplink RLC protocol data units (PDUs) whose receipt by the radio access network has not been positively acknowledged.

[00025] In the discarding of downlink RLC protocol data units (PDUs) which were received as being within the old receiver buffer window but which are outside the new receiver buffer window, the radio link control entity does not negatively acknowledge the discarded downlink RLC protocol data units. In view of the retaining of RLC protocol data units (PDUs) whose receipt by the radio access network has not been positively acknowledged, the radio link control can retransmit (after the reconfiguration) the uplink RLC protocol data units (PDUs) which were negatively acknowledged by the radio access network.

[00026] As a modification of the first embodiment and mode for the user equipment unit, the radio link control entity optionally may not require segmentation of a service data unit (SDU) received from a higher layer when, after the reconfiguration, the radio link control (RLC) buffer memory experiences a memory size constraint.

[00027] In a second example embodiment and mode of operation when the device is a user equipment unit, the radio link control (RLC) entity (A) retains all downlink RLC protocol data units (PDUs) stored in the receiver buffer even if outside the new receiver buffer window until the receiver buffer window can be advanced; (B) retains all downlink RLC protocol data units (PDUs) stored in the receiver buffer even if outside the new receiver buffer window.

[00028] In a variation thereof, the second example embodiment and mode optionally performs a check for capacity strain for the radio link control (RLC) buffer memory. In case of capacity strain, the RLC entity can optionally perform protective measures.

[00029] As a first example memory capacity check, the radio link control entity can check whether receipt of a Service Data Unit (SDU) from a high layer would exceed capacity of the radio link control (RLC) buffer memory and (if so) decide not to process

the SDU. The first example capacity memory check performed by the radio link control entity can comprise determining whether the buffer memory is sufficient to store acknowledge mode RLC protocol data units (AMD PDUs) having a sequence number SN which satisfies VT(A) < SN < VT(S) for acknowledge mode RLC entities. In this first example capacity memory check, VT(A) is a sequence number following the last in-sequence acknowledged AMD PDU; and VT(S) is a sequence number for a next AMD PDU to be transmitted for a first time.

[00030] As a second example capacity memory check, the radio link control entity can check whether receipt of a Protocol Data Unit (PDU) from the radio access network would exceed capacity of the radio link control (RLC) buffer memory and (if so) decide to ignore the PDU. The second example capacity memory check performed by the radio link control entity can comprise determining whether the buffer memory is sufficient to store acknowledge mode RLC protocol data units (AMD PDUs) having a sequence number SN which satisfies VR(R) < SN < VR(H) for all acknowledge mode RLC entities. In this second example capacity memory check, SN is the sequence number of the PDU; VR(R) is a sequence number following the last in-sequence AMD PDU received; and VR(H) is a sequence number following a highest sequence number of any received AMD PDU.

[00031] When the telecommunications device involved in the reconfiguration is a radio access network node, the RLC reconfiguration logic keeps all PDUs in the downlink at the reconfiguration. Similarly, on the transmitter side, upon reconfiguration all PDUs in the uplink are also kept since the user equipment unit may or may not discard uplink data upon reconfiguration.

BRIEF DESCRIPTION OF THE DRAWINGS

[00032] The foregoing and other objects, features, and advantages of the invention will be apparent from the following more particular description of preferred embodiments as illustrated in the accompanying drawings in which reference characters refer to the same parts throughout the various views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention.

[00033] Fig. 1 is a diagrammatic view of a telecommunications layer model and particularly showing a radio link control layer with two radio link control (RLC) entities situated between a higher layer and a medium access layer (MAC)..

[00034] Fig. 2 is diagrammatic view of example mobile communications system in which the present invention may be advantageously employed.

[00035] Fig. 3 is a simplified function block diagram of a portion of a UMTS Terrestrial Radio Access Network, including a user equipment unit (UE) station; a radio network controller; and a base station.

[00036] Fig. 4 is partially schematic, partially diagrammatic view of example radio link control (RLC) entity.

[00037] Fig. 5 is a diagrammatic view illustrating RLC window size reconfiguration for a transmitter and two cases of RLC window size reconfiguration for a receiver.

[00038] Fig. 6 is a flowchart depicting selected, basic, representative actions performed by a UE RLC entity in accordance with a first embodiment and first mode during a RLC reconfiguration operation.

[00039] Fig. 6A is a flowchart depicting selected, basic, representative actions performed by a UE RLC entity during a variation of the RLC reconfiguration operation of Fig. 6.

[00040] Fig. 7 is a flowchart depicting selected, basic, representative actions performed by a UE RLC entity in accordance with a second embodiment and second mode during a RLC reconfiguration operation.

[00041] Fig. 7A is a flowchart depicting selected, basic, representative actions performed by a UE RLC entity during a variation of the RLC reconfiguration operation of Fig. 7.

[00042] Fig. 8 is a flowchart depicting selected, basic, representative actions performed by a network node (RAN) RLC entity in accordance during a RLC reconfiguration operation.

[00043] DETAILED DESCRIPTION

[00044] In the following description, for purposes of explanation and not limitation, specific details are set forth such as particular architectures, interfaces, techniques, etc. in order to provide a thorough understanding of the present invention. However, it will be apparent to those skilled in the art that the present invention may be practiced in other embodiments that depart from these specific details. In other instances, detailed descriptions of well-known devices, circuits, and methods are omitted so as not to obscure the description of the present invention with unnecessary detail. Moreover, individual function blocks are shown in some of the figures. Those skilled in the art will appreciate that the functions may be implemented using individual hardware circuits, using software functioning in conjunction with a suitably programmed digital microprocessor or general purpose computer, using an application specific integrated circuit (ASIC), and/or using one or more digital signal processors (DSPs).

[00045] An illustrative, non-limiting example of the radio access network embodiment alluded to above is now described in the context of a universal mobile telecommunications (UMTS) 13 shown in Fig. 2. A representative, connection-oriented, external core network, shown as a cloud 14 may be for example the Public Switched Telephone Network (PSTN) and/or the Integrated Services Digital Network (ISDN). A representative, connectionless-oriented external core network shown as a cloud 16, may be for example the Internet. Both core networks are coupled to their corresponding core network service nodes. The PSTN/ISDN connection-oriented network 14 is connected to a connection-oriented service node shown as a Mobile Switching Center (MSC) node 18 that provides circuit-switched services. The Internet connectionless-oriented network 16 is connected to a General Packet Radio Service (GPRS) node 20 tailored to provide packet-switched type services which is sometimes referred to as the serving GPRS service node (SGSN).

[00046] Each of the core network service nodes 18 and 20 connects to a UMTS Terrestrial Radio Access Network (UTRAN) 24 over a radio access network (RAN) interface referred to as the Iu interface. UTRAN 24 includes one or more radio network controllers (RNCs) 26. For sake of simplicity, the UTRAN 24 of Fig. 2 is shown with only two RNC nodes, particularly RNC 26_1 and RNC 26_2. Each RNC 26 is connected to a plurality of base stations (BS) 28. For example, and again for sake of simplicity,

two base station nodes are shown connected to each RNC 26. In this regard, RNC 26_1 serves base station 28_{1-1} and base station 28_{1-2}, while RNC 26_2 serves base station 28_{2-1} and base station 28_{2-2}. It will be appreciated that a different number of base stations can be served by each RNC, and that RNCs need not serve the same number of base stations. Moreover, Fig. 2 shows that an RNC can be connected over an Iur interface to one or more other RNCs in the URAN 24. Further, it will be appreciated by those skilled in the art that base station nodes have, in some contexts, more recently become known as Node B or B-nodes.

[00047] In the illustrated embodiments, for sake of simplicity each base station 28 is shown as serving one cell. Each cell is represented by a circle which surrounds the respective base station. It will be appreciated by those skilled in the art, however, that a base station may serve for communicating across the air interface for more than one cell. For example, two cells may utilize resources situated at the same base station site.

[00048] A user equipment unit (UE), such as user equipment unit (UE) 30 shown in Fig. 2, communicates with one or more cells or one or more base stations (BS) 28 over a radio or air interface 32. Each of the radio interface 32, the Iu interface, the Iub interface, and the Iur interface are shown by dash-dotted lines in Fig. 2.

[00049] Preferably, radio access is based upon wideband, Code Division Multiple Access (WCDMA) with individual radio channels allocated using CDMA spreading codes. Of course, other access methods may be employed. WCDMA provides wide bandwidth for multimedia services and other high transmission rate demands as well as robust features like diversity handoff and RAKE receivers to ensure high quality. Each user mobile station or equipment unit (UE) 30 is assigned its own scrambling code in order for a base station 28 to identify transmissions from that particular user equipment unit (UE) as well as for the user equipment unit (UE) to identify transmissions from the base station intended for that user equipment unit (UE) from all of the other transmissions and noise present in the same area.

[00050] Fig. 3 shows selected general aspects of user equipment unit (UE) 30 and illustrative nodes such as radio network controller 26 and base station 28. The user equipment unit (UE) 30 shown in Fig. 3 includes a data processing and control unit 31 for controlling various operations required by the user equipment unit (UE). The UE's

data processing and control unit 31 provides control signals as well as data to a radio transceiver 33 connected to an antenna 35. The radio transceiver 33 is a function of the physical layer.

[00051] The example radio network controller 26 and base station 28 as shown in Fig. 3 are radio network nodes that each include a corresponding data processing and control unit 36 and 37, respectively, for performing numerous radio and data processing operations required to conduct communications between the RNC 26 and the user equipment units (UEs) 30. Part of the equipment controlled by the base station data processing and control unit 37 includes plural radio transceivers 38 connected to one or more antennas 39.

[00052] In the example of Fig. 2 and Fig. 3, one RLC entity of an entity pair is situated in the serving radio network controller (SRNC) 26_1 (i.e., radio link control (RLC) entity 50-RAN) while another RLC entity of the entity pair is situated in mobile station (MS) 30 (i.e., radio link control (RLC) entity 50-UE). Both the SRNC 26, being a telecommunications radio access network node, and the user equipment unit 30, are herein considered as examples of telecommunications "devices". Transmission of the RLC PDUs between radio link control (RLC) entity 50-UE and radio link control (RLC) entity 50-RAN is depicted by double-headed arrow 52 in Fig. 2 and Fig. 3.

[00053] While the radio link control (RLC) entity 50-RAN and radio link control (RLC) entity 50-UE are shown in Fig. 2 and Fig. 3 as being realized in the respective data processing and control units, it should be understood that the functionalities of radio link control (RLC) entity 50 can be provided in various ways. For example, the functions of a radio link control (RLC) entity 50 may be implemented using individual hardware circuits, using software functioning in conjunction with a suitably programmed digital microprocessor or general purpose computer, using an application specific integrated circuit (ASIC), and/or using one or more digital signal processors (DSPs).

[00054] Fig. 4 shows functional aspects of radio link control (RLC) entity 50 for an acknowledged mode (as opposed to the unacknowledged mode or the transparent mode). As shown in Fig. 4, radio link control (RLC) entity 50 has both a sending side (which sends or transmits RLC PDUs to the lower level medium access control (MAC)

layer) and a receiving side (which receives RLC PDUs from the lower level medium access control (MAC) layer). Both the sending side and the receiving side are governed and supervised by a RLC control logic 102.

[00055] Functions associated with the sending side of radio link control (RLC) entity 50 are shown on the left hand side of Fig. 4. Line 104 depicts the sending side of radio link control (RLC) entity 50 receiving service data units (SDUs) from the higher layer(s). Recall that the radio link control (RLC) entity 50 treats packets obtained from the higher layer 104 (e.g., an IP layer) as SDUs. As indicated by block 106, the SDUs are segmented and/or concatenated to form protocol data units (PDUs) of fixed length. If several SDUs fit into one PDU, those SDUs are concatenated and the appropriate length indicators are inserted into the beginning of the PDU.

[00056] As reflected by block 108, a RLC header is generated for each RLC PDU. In accordance with the present invention, radio link control (RLC) entity 50 has a port manager 110 which works in conjunction with the add RLC header control 108. After header generation for the RLC PDU, it is placed in a retransmission buffer as indicated by block 114.

[00057] The receiving side of radio link control (RLC) entity 50 receives RLC PDUs through an appropriate one(s) of the logical channels from the MAC layer. The receiving side includes a demultiplexing (DEMUX)/routing function represented by block 130. Deciphering is performed as indicated by block 132. As indicated by block 134, the RLC headers are removed and potential piggy backed status information is extracted. The PDUs are initially held in common receiver buffer 136 until a complete SDU has been received. When necessary, the control element for the common receiver buffer 136 requests retransmissions of AMD PDUs by sending negative acknowledgements to a peer radio link control (RLC) entity (by a signal depicted by line 140). After RLC PDU headers are removed at block 134, and after all segments of the SDU as carried by one or more RLC PDUs are received, the completed SDU is reassembled by reassembly block 142 and sent to the higher layer as indicated by line 160 in Fig. 4.

[00058] Thus the functions reflected by Fig. 4 are performed for each RLC entity established. As indicated above, in the case of a user equipment unit (UE) using plural

radio access bearers (RABs), plural RLC entities may be established. Regardless of the number of RLC entities established, the RLC entities must all share the same memory allocation of the user equipment unit (UE). Fig. 3 illustrates UE memory 150 as being separate and distinct from data processing and control unit 31, but the memory 150 could be realized in various media and many alternative ways, including as part of data processing and control unit 31. In the case of a UE reference class 384 kbps, the UE has a memory of 50 Kbytes and affords a maximum of six AM RLC entities.

[00059] To this end, upon setup for both reception and transmission each RAB is afforded a portion or "window" in the user equipment unit (UE) memory 150, and for each direction a certain "window size" is ascribed to the associated RAB. In fact, the user equipment unit (UE) is provided with certain RLC capability information which includes: (1) the total RLC AM buffer size; (2) maximum number of AM RLC entities; and (3) the maximum RCL AM window size. *See*, for example, 3GPP TS 25.322 V6.0.0 (2003-12), 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; RLC Protocol Specification (Release 6), Section 10.3.3.34. For example, for each RLC entity the user equipment unit (UE) is provided with a parameter Configured_Tx_Window_Size which specifies the window size for its transmitting side and a parameter Configured_Rx_Window_Size which specifies the window size for its receiving side.

[00060] For sake of handling the (for example, 50K or so) portion of memory 150 of the user equipment unit (UE) allocated to the RLC entities, for each RLC entity the RLC control logic utilizes a set of "state variables". These state variables are defined in 3GPP TS 25.322 V6.0.0 (2003-12), 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; RLC Protocol Specification (Release 6), Section 9.4. In format, the names of these state variables: (1) begin with the letter "V"; (2) have a second letter of "R" when referring to the receiving side of the RLC entity and a second letter of "T" when referring to the transmitting side of the RLC entity; and (3) have a parenthetical argument. For sake of convenience, several pertinent state variables are listed in Table 1.

[00061] Table 1: RLC STATE VARIABLES

State Variable Name	Description
VT(S)	Send State Variable: Contains the "sequence number" of the next AMD PDU to be transmitted for the first time (i.e., excluding retransmitted PDUs). The VT(S) is updated, e.g., after the aforementioned AMD PDU is transmitted.
VT(A)	Acknowledge State Variable: Contains the "sequence number" following the "sequence number" of the last in-sequence acknowledged AMD PDU. This forms the lower edge of the transmission window of acceptable acknowledgements.
VT(WS)	Transmission Window Size State Variable: Contains the size that shall be used for the transmission window. The initial value of this variable is Configured_Tx_Window_Size.
VT(MS)	Maximum Send State Variable: Contains the "sequence number" of the first AMD PDU that can be rejected by the peer receiver, VT(MS) = VT(A) + VT(WS). This value represents the upper edge of the transmission window. VT(MS) is updated when VT(A) or VT(WS) is updated.
VR(R)	Receive State Variable: Contains the "sequence number" following that of the last in-sequence AMD PDU received. It is updated upon receipt of the AMD PDU with "sequence number" equal to VR(R).
VR(H)	Highest Expected State Variable: Contains the "sequence number" following the highest "sequence number" of any received AMD PDU. When an AMD PDU is received with "sequence number" x such that VR(H) $\leq$ x < VR(MR), VR(H) shall be set equal to x +1.
VR(MR)	Maximum Acceptable Receive Sate Variable: Contains the "sequence number" of the first AMD PDU that shall be rejected by the receiver, i.e., VR(MR) = VR(R) + Configured_Rx_Window_Size.
VR(US)	Receiver Send Sequence State Variable: Contains the "sequence number" following that of the last UMD PDU received.

[00062] As mentioned above, current standards ostensibly permit the window size for a RLC entity to be reconfigured, but do not address certain problems which could occur during window size configuration. In Fig. 5 an example of a RLC window size reconfiguration is shown where the window size is reduced from sixteen to eight. Fig. 5 shows the RLC window size being reduced in a transmitter side of a RLC entity, as well as two cases (case a and case b) of RLC window size reduction in a receiver side of a corresponding peer RLC entity. In Fig. 5, the shaded blocks correspond to PDUs which are actually transmitted (in the case of the transmitter) or received (in the case of

the receiver), while the unshaded blocks correspond to PDUs which are not yet transmitted (in the case of the transmitter) or not yet received (in the case of the receiver).

[00063] In case (a) of Fig. 5, the transmitter and receiver windows cover the same sequence number range. By contrast, in case (b) of Fig. 5 the receiver window is advanced further than the transmitter window due to the fact that a status message acknowledging PDUs 0 and 1 has not yet been sent, or has been sent but lost over the air interface.

[00064] As illustrated in Fig. 3 and Fig. 4, the RLC entities 50 and especially the UE RLC entity 50-UE are advantageously provided with RLC reconfiguration logic 200 which provides constructive and practical ways of reconfiguring the RLC window size during an RLC reconfiguration operation. By virtue of RLC reconfiguration logic 200, the radio link control entity(ies) 50 is/are arranged, when so requested during a RLC reconfiguration procedure, to reconfigure at least one of (1) a size of a transmitter buffer window to form a new transmitter buffer window having a transmitter buffer window size smaller than an old transmitter buffer window; and (2) a size of a receiver buffer window to form a new receiver buffer window having a receiver buffer window size smaller than an old receiver buffer window. The RLC reconfiguration logic 200 may essentially simultaneously implement reconfiguration of the size of the transmitter buffer window and the size of the receiver buffer window, or may implement these two reconfigurations at different times.

[00065] The RLC reconfiguration logic 200 may be implemented as a part of RLC control logic 102 in the manner shown in Fig. 3 and Fig. 4, with RLC control logic 102 being either part of or distinct from the data processing and control unit. For example, the RLC reconfiguration logic 200 can comprise a set of instructions and/or data which is executed by one or more processors comprising the data processing and control unit. Alternatively, RLC reconfiguration logic 200 may be implemented separately as, e.g., a separate processor, circuit, controller, or state machine, for example.

[00066] FIRST EXAMPLE EMBODIMENT/MODE FOR UE

[00067] In a first example embodiment and mode of operation, the radio link control (RLC) entity 50-UE through its RLC reconfiguration logic 200-UE: (A) discards any downlink RLC protocol data units (PDUs) which were received as being within the old receiver buffer window but which are outside the new receiver buffer window; and (B) retains in the radio link control (RLC) buffer memory any uplink RLC protocol data units (PDUs) whose receipt by the radio access network has not been positively acknowledged.

[00068] Rationale for the first embodiment/mode is based on considerations of effects in reducing the window both on the receiver side and the transmitter side. Concerning reduction of the receiver window, when the receiver window is reduced, some of the PDUs received in the old receiver window may end up being outside the new receiver window. In order to free memory in the first embodiment these PDUs are discarded in the UE and treated as not being received. This implies that UTRAN needs to retransmit these PDUs after the reconfiguration but this is considered to have little impact on the performance.

[00069] Concerning reduction of the transmitter window, when the transmitter window is decreased, some of the PDUs transmitted in the old transmitter window may end up being outside the new transmitter window. Flippant discard of these PDUs from the transmitter in order to free memory can result in undesirable consequences.

[00070] A first such consequence on the transmitter side of the RLC entity is permanent data loss. If these PDUs are discarded, they can not be retransmitted, which would lead to a permanent data loss. This could potentially be acceptable for radio bearers (RBs) but would mean that it is not possible to reduce the window size for signalling radio bearers (SRBs). A radio bearer (RB) is used for user data and an signalling radio bearer (SRB) is used for control data. As discussed in relation to the default configurations used at handover from GSM it would be beneficial to be able to reduce the window size from the value 128 used in the default configuration to a lower value to free memory.

[00071] A second such consequence on the transmitter side is potential errors in protocol operation. The discarding of PDUs in the transmitter side may lead to protocol errors. Consider case (b) in Fig. 5 above. If the transmitter would discard PDUs outside the new transmitter window it means that PDUs 8-15 are discarded and can not be retransmitted. However, due to that the receiver window in case (b) is advanced further than the transmitter window, a PDU with SN=8 is within the new receiver window. If this PDU can not be retransmitted the RLC protocol has stalled.

[00072] Therefore, in the first embodiment all PDUs that are not positively acknowledged are kept in the buffer. This implies that if UTRAN negatively acknowledges some of the PDUs 8-15 in the example after the reconfiguration, the UE must be prepared to retransmit the PDUs.

[00073] In view of the foregoing, Fig. 6 illustrates selected, basic, representative actions performed by a RLC entity 50-UE, and RLC reconfiguration logic 200-UE in particular, in accordance with the first embodiment and first mode during a RLC reconfiguration operation. Fig. 6 shows actions performed both on a transmitter side and a receiver side of the UE RLC entity 50-UE.

[00074] Action 6-1 shows the UE RLC entity 50-UE checking to determine whether it has received any indication that a RLC reconfiguration operation is necessary. For user equipment unit 30, such indication can be provided, for example, by a message received from the radio access network. If no such indication has been received, UE RLC entity 50-UE continues to operate with the previously configured RLC parameters (as reflected by action 6-2). But if an indication has been received that an RLC reconfiguration operation is to be performed, as shown by action 6-3 both the receiver side and the transmitter side of UE RLC entity 50-UE begin to utilize the reconfigured parameters.

[00075] It is assumed in the RLC reconfiguration operation of Fig. 6 and of the other embodiments and modes described herein that the RLC reconfiguration operation involves reconfiguration of the transmitter buffer window (e.g., to form a new transmitter buffer window having a transmitter buffer window size smaller than an old transmitter buffer window) and of the receiver buffer window (e.g., to form a new receiver buffer window having a receiver buffer window size smaller than an old

receiver buffer window).

[00076] On the receiver side, as action 6-R4 the RLC reconfiguration logic 200-UE checks the received RLC protocol data units (PDUs), e.g. checks the sequence numbers or other sequence/order identifiers of the received RLC protocol data units (PDUs). As action 6-R5 the RLC reconfiguration logic 200-UE determines whether the serial numbers of any RLC protocol data units (PDUs) which have thus far been received are outside of the new receiver buffer window but yet outside of the old receiver buffer window. If the determination of action 6-R5 is affirmative with respect to any already-received PDU, that/those PDU(s) is/are discarded as action 6-R6 without a negative acknowledgement. The received PDUs which are inside the new receiver buffer window are acknowledged as necessary and processed as action 6-R7. After either the discard of action 6-R6 or the processing of action 6-R7, as action 6-R10 the receiver window is advanced as appropriate. Such advancing at action 6-R10 can involve, e.g., the updating of the state variables VR(MR) and VR(H). In accordance with the advancement of the receiver buffer window, the receiver continues to process RLC protocol data units (PDUs) as they are received, to acknowledge and process the received RLC protocol data units (PDUs), and further advance the receiver buffer window until the transmission is completed.

[00077] On the transmitter side, upon reconfiguration as action 6-T4 the state variable VT(WS) is set to the value of Configured_Tx_Window_Size which has been provided to the UE RLC entity 50-UE. As action 6-T5, the RLC reconfiguration logic 200 requires that the transmitter side not discard any PDU(s) in the receiver buffer due to the RLC reconfiguration operation, even if the sequence or serial number of the PDU is greater than VT(MS). It will be recalled that VT(MS) is the Maximum Send State Variable and, as such, contains the "sequence number" of the first AMD PDU that can be rejected by the peer receiver, VT(MS) = VT(A) + VT(WS), and thus represents the upper edge of the transmission window. Then, as action 6-T6, the transmitter side sends to the receiver of the peer entity the RLC protocol data units (PDUs) in the new transmitter buffer window. As action 6-T7 the transmitter side handles the acknowledgements received from the peer receiver entity; retransmits PDUs when necessary in accordance with the acknowledgements so handled; and advances the transmitter buffer window as appropriate.

[00078] It is possible that, as a result of the RLC reconfiguration operation of Fig. 6, the RLC buffer memory required for the reconfigured RLC entity momentarily can be as high as the old RLC window indicates. This could potentially mean that there is not enough free memory to segment all incoming SDUs for all RLC entities. In such case the RLC reconfiguration operation of Fig. 6A can be utilized as a variation of the RLC reconfiguration operation of Fig. 6. In the RLC reconfiguration operation of Fig. 6A, if and when the memory capability (e.g., UE memory 150) of the user equipment unit (UE) is exceeded, the user equipment unit (UE) does not need to segment SDUs received from upper layers. By not requiring segmentation of SDUs received from upper layers, the memory required for all transmitter buffers in the UE will not require more memory than needed to support the configured RLC windows at any time.

[00079] The basic actions of the RLC reconfiguration operation Fig. 6A which are similar to those of the RLC reconfiguration operation of Fig. 6 are similarly numbered. The RLC reconfiguration operation of Fig. 6A essentially differs from the RLC reconfiguration operation of Fig. 6 by checking as action 6-R8 whether there are any memory constraints caused by the RLC reconfiguration operation. If memory constraints do exist, then as action 6-R9 the RLC reconfiguration logic 200 sets a SDU segmentation waiver flag so that subsequently RLC control logic 102 will know that it is not required to perform segmentation of SDUs received from the higher layers. Although not shown in Fig. 6A, when the memory constraint is alleviated the SDU segmentation waiver flag can be cleared to permit continuation of the SDU segmentation.

[00080] The interaction between RLC and higher layers when data can not be transmitted (e.g. due to that the RLC window is full or the RLC entity is suspended) is not specified herein, it being understood that some form of flow control must exist also in, e.g., existing 3GPP TS UE implementations, to prohibit a higher layer application from submitting further data to the RLC in these situations.

[00081] The first embodiment and first mode are generally very advantageous, but might not work well if the in-sequence delivery is not configured. If, for example, an SDU is present in PDUs 11-12 in case (b) of Fig. 5, this SDU may already be delivered to higher layer when the reduction of the RLC window size occurs. After the reconfiguration these PDUs will be retransmitted by the peer entity and consequently a

duplicate of the SDU will be delivered to higher layers. The retransmission of PDUs with sequence numbers outside the old transmitter window also cause additional delay. A second embodiment and second mode, described below, address this and other considerations.

[00082] SECOND EXAMPLE EMBODIMENT/MODE FOR UE

[00083] In some regards a second example embodiment and mode of operation is more sophisticated than the first embodiment/mode. In the second example embodiment and mode of operation, the radio link control (RLC) entity through its RLC reconfiguration logic 200-UE: (A) retains all downlink RLC protocol data units (PDUs) stored in the receiver buffer, even if outside the new receiver buffer window until the receiver buffer window can be advanced; and (B) retains all uplink RLC protocol data units (PDUs) stored in the transmitter buffer even if outside the new transmitter buffer window.

[00084] In view of the foregoing, Fig. 7 illustrates selected, basic, representative actions performed by a RLC entity 50, and RLC reconfiguration logic 200-UE in particular, in accordance with the second embodiment and second mode during a RLC reconfiguration operation. In similar manner as with the preceding RLC reconfiguration operation of Fig. 6, as action 7-1 the UE RLC entity 50-UE checks to determine whether it has received any indication that a RLC reconfiguration operation is necessary. If no such indication has been received, UE RLC entity 50-UE continues to operate with the previously configured RLC parameters (as reflected by action 7-2). But if an indication has been received that an RLC reconfiguration operation is to be performed, as shown by action 7-3 both the receiver side and the transmitter side of UE RLC entity 50-UE begin to utilize the reconfigured parameters.

[00085] In the second embodiment/mode, when the receiver window is reduced (e.g., as part of a RLC reconfiguration operation), all PDUs in the receiver buffer are kept, even if these PDUs are outside the new receiver window (action 7-R4) . As action 7-R5, the receiver buffer window is advanced according to the normal rules (e.g., those described in 3GPP TS 25.322, for example) .

[00086] Similarly, the second embodiment/mode addresses reduction of the transmitter window size. Specifically, when the transmitter window is reduced, all PDUs in the

transmitter buffer are kept, even if these PDUs are outside the new transmitter window (action 7-T4). As action 7-T5 the transmitter window is advanced according to the normal rules (e.g., those described in 3GPP TS 25.322, for example).

[00087] Since all PDUs are kept in the RLC buffers at reconfiguration in accordance with this second embodiment/mode, it is possible that PDUs transmitted and/or received on the new RAB may temporarily cause the capacity or capability of the UE RLC buffer 150 capability to be exceeded. Accordingly, the RLC reconfiguration operation of Fig. 7A is a variation of the RLC reconfiguration operation of Fig. 7 and can be alternatively implemented to handle the possibility that the UE buffer memory may not be sufficient to handle all AMD PDUs during an initial time after the reconfiguration.

[00088] As described in example fashion below, the RLC reconfiguration operation of Fig. 7A optionally performs a check for capacity strain for the radio link control (RLC) buffer memory. In case of capacity strain, the RLC entity can optionally perform protective measures.

[00089] Many of the actions of the RLC reconfiguration operation of Fig. 7A are common to those of the RLC reconfiguration operation of Fig. 7, and therefore are not discussed again. The RLC reconfiguration operation of Fig. 7A basically differs from the RLC reconfiguration operation of Fig. 7 by checking, before a SDU received from upper layers is processed or a received AMD PDU is stored, whether the RLC buffer memory is sufficient to store certain PDUs.

[00090] As a first example memory capacity check, the radio link control entity can check whether receipt of a Service Data Unit (SDU) from a high layer would exceed capacity of the radio link control (RLC) buffer memory and (if so) decide not to process the SDU. On the transmitter side the RLC reconfiguration operation of Fig. 7A basically differs from the RLC reconfiguration operation of Fig. 7 by including further action 7-T6, action 7-T7, action 7-T8, action 7-T9, and action 7-T10. The action 7-T6 shows the transmitter side receiving a SDU from higher layer(s), which is followed at action 7-T7 by the RLC reconfiguration logic 200 checking whether storage of the SDU(s) received as action 7-T6 would cause an over-allocation in UE memory 150.

[00091] In particular, as action 7-T7 the RLC reconfiguration logic 200 checks whether the RLC buffer memory is sufficient to process AMD PDUs with SN in the interval [VT(A)< SN< VT(S)] for all RLC AM entities. In this first example capacity memory check, SN is the sequence number of the PDU; VT(A) is a sequence number following the last in-sequence acknowledged AMD PDU; and VT(S) is a sequence number for a next AMD PDU to be transmitted for a first time.

[00092] If it is determined at action 7-T7 that the processing of a SDU received from upper layer leads to over-allocation of the UE buffer memory according to the signalled UE capability, the SDU is not processed (as reflected by action 7-T8). Otherwise, the SDU contemplated at action 7-T6 is processed as action 7-T9. Then, after either action 7-T8 or action 7-T9, as action 7-10 the transmitter side performs such routine matters as handling any acknowledgements which may be appropriate at this time; retransmitting PDUs to its peer RLC entity (e.g., in the RAN); and advancing the transmitter buffer window as appropriate.

[00093] The RLC reconfiguration operation of Fig. 7A provides a mechanism whereby UE always can receive AMD PDUs with SN in the interval [VR(R)< SN< VR(H)] for all RLC AM entities (i.e. retransmissions), which is needed to prevent potential deadlock situations. If this is not guaranteed it is possible that the UE ignores all received PDUs and it is not possible to get out of a stall situation.

[00094] As a second example capacity memory check of the RLC reconfiguration operation of Fig. 7A , the radio link control entity can check whether receipt of a Protocol Data Unit (PDU) from the radio access network would exceed capacity of the radio link control (RLC) buffer memory and (if so) decide to ignore the PDU. This is primarily accomplished on the receiver side, where the RLC reconfiguration operation of Fig. 7A basically differs from the RLC reconfiguration operation of Fig. 7 by including further action 7-R6, action 7-R7, action 7-R8, action 7-R9, and action 7-R10. The action 7-R6 shows the receiver side receiving the PDU. As action 7-R7 the RLC reconfiguration logic 200 of the Fig. 7A embodiment checks whether storage of the PDU(s) received as action 7-R6 would cause an over-allocation in UE memory 150.

[00095] In particular, as action 7-R7 the RLC reconfiguration logic 200 checks whether the RLC buffer memory is sufficient to store AMD PDUs which have a sequence

number (SN) in the interval [VR(R)< SN< VR(H)] for all RLC AM entities. In this capacity memory check, SN is the sequence number of the PDU; VR(R) is a sequence number following the last in-sequence AMD PDU received; and VR(H) is a sequence number following a highest sequence number of any received AMD PDU

[00096] If the buffer memory as checked as action 7-R7 is not sufficient, those PDUs are ignored as action 7-R8 (without generating any acknowledgements). (The check of action 7-R8 only needs to be performed if the SN of the received PDU causes VR(H) to be increased).

[00097] Otherwise, if action 7-R8 is not performed, as action 7-R9 the received RLC protocol data units (PDUs) are processed. Then, subsequent to action 7-R9 or action 7-R8, as action 7-R10 the receiver side generates any necessary acknowledgements (if only for other PDUs), and advances the receiver buffer window as appropriate.

[00098] Thus, for a user equipment unit, two embodiments/modes for handling the reduction of the configured RLC window size have been described above. The first embodiment/mode is straightforward but only works if the in-sequence delivery is configured. The first embodiment/mode also requires that the PDUs outside the new RLC window are retransmitted after the reconfiguration which implies a larger delay for the user data. The second embodiment/mode requires more advanced memory handling but handles also the case where in-sequence delivery is not configured and avoids retransmissions of PDUs after the reconfiguration.

[00099] EXAMPLE EMBODIMENT FOR NETWORK NODE

[000100] For a network node, Fig. 8 illustrates selected, basic, representative actions performed by a RLC entity 50-RAN, and RLC reconfiguration logic 200-RAN in particular, in accordance during a RLC reconfiguration operation. Fig. 8 shows actions performed both on a transmitter side and a receiver side of the RLC entity 50-RAN.

[000101] Action 8-1 shows the RLC entity 50-RAN checking to determine whether it has received any indication that a RLC reconfiguration operation is necessary. If no such indication has been received, RLC entity 50-RAN continues to operate with the previously configured RLC parameters (as reflected by action 8-2). But if an indication has been received that an RLC reconfiguration operation is to be performed, as shown

by action 8-3 both the receiver side and the transmitter side of RLC entity 50-RAN begin to utilize the reconfigured parameters.

[000102] It is assumed in the RLC reconfiguration operation of Fig. 8 and of the other embodiments and modes described herein that the RLC reconfiguration operation involves reconfiguration of the transmitter buffer window (e.g., to form a new transmitter buffer window having a transmitter buffer window size smaller than an old transmitter buffer window) and of the receiver buffer window (e.g., to form a new receiver buffer window having a receiver buffer window size smaller than an old receiver buffer window). As indicated previously, the reconfiguration of the receiver buffer window and transmitter buffer window can be either performed at the same time, or at separate times. In either event, the illustration of Fig. 8 is illustrative.

[000103] On the receiver side, as action 8-R4 the RLC reconfiguration logic 200-RAN keeps all PDUs in the downlink at the reconfiguration. Similarly, on the transmitter side, upon reconfiguration as action 8-T4 all PDUs in the uplink are also kept since the user equipment unit 30 may or may not discard uplink data upon reconfiguration.

[000104] While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not to be limited to the disclosed embodiment, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

WHAT IS CLAIMED IS:

1. A telecommunications device comprising:

a transceiver (33) which enables the device (30, 26) to communicate over an air interface (32);

a radio link control entity (50) which forms uplink RLC protocol data units (PDUs) for transmission over the air interface (32) and which receives downlink RLC protocol data units (PDUs) over the air interface (32);

a radio link control (RLC) buffer memory (150) configured to include a transmitter buffer for storing the uplink RLC protocol data units (PDUs) and a receiver buffer for storing the downlink RLC protocol data units (PDUs); and

characterized by:

RLC reconfiguration logic means which is arranged to reconfigure at least one of a size of a transmitter buffer window and a size of a receiver buffer window by implementing a strategy for handling at least one of (1) downlink RLC protocol data units (PDUs) which are outside a new receiver buffer window; and (2) uplink RLC protocol data units (PDUs) which are either outside a new transmitter window or whose receipt by the radio access network has not been positively acknowledged.

2. The apparatus of claim 1, wherein the telecommunications device is a user equipment unit, and wherein the RLC reconfiguration logic means is arranged to implement the strategy of:

(A) discarding any downlink RLC protocol data units (PDUs) which were received as being within old receiver buffer window but which are outside the new receiver buffer window;

(B) retaining in the radio link control (RLC) buffer memory (150) any uplink RLC protocol data units (PDUs) whose receipt by the radio access network has not been positively acknowledged.

3. The apparatus of claim 2, wherein the radio link control entity (50) is further arranged to retransmit after the reconfiguration the uplink RLC protocol data units (PDUs) which were negatively acknowledged by the radio access network.

4. The apparatus of claim 2, wherein the radio link control entity (50) is further arranged not to require segmentation of a service data unit (SDU) received from a

higher layer when, after the reconfiguration, the radio link control (RLC) buffer memory (150) experiences a memory size constraint.

5. The apparatus of claim 2, wherein the radio link control entity (50) does not negatively acknowledge the downlink RLC protocol data units (PDUs) that were received in the old receiver buffer window but which are outside the new receiver buffer window.

6. The apparatus of claim 1, wherein the telecommunications device is a user equipment unit, and wherein the RLC reconfiguration logic means is arranged to implement the strategy of:

(A) retaining all downlink RLC protocol data units (PDUs) stored in the receiver buffer even if outside the new receiver buffer window until the receiver buffer window can be advanced;

(B) retaining any uplink RLC protocol data units (PDUs) stored in the transmitter buffer, whose receipt by the radio access network has not been positively acknowledged, even if outside the new transmitter buffer window.

7. The apparatus of claim 6, wherein the radio link control entity (50) is further arranged to check whether receipt of a Service Data Unit (SDU) from a high layer would exceed capacity of the radio link control (RLC) buffer memory (150).

8. The apparatus of claim 7, wherein the radio link control entity (50) is further arranged to check for acknowledge mode RLC entities whether the buffer memory is sufficient to store acknowledge mode RLC protocol data units (AMD PDUs) having a sequence number SN which satisfies $VT(A) < SN < VT(S)$, wherein VT(A) is a sequence number following the last in-sequence acknowledged AMD PDU; and VT(S) is a sequence number for a next AMD PDU to be transmitted for a first time.

9. The apparatus of claim 6, wherein the radio link control entity (50) is further arranged to check whether receipt of a Protocol Data Unit (PDU) from the radio access network would exceed capacity of the radio link control (RLC) buffer memory (150).

10. The apparatus of claim 9, wherein the radio link control entity (50) is further arranged to check for acknowledge mode RLC entities whether the buffer

memory is sufficient to store acknowledge mode RLC protocol data units (AMD PDUs) having a sequence number SN which satisfies VR(R) < SN < VR(H), wherein VR(R) is a sequence number following the last in-sequence AMD PDU received; and VR(H) is a sequence number following a highest sequence number of any received AMD PDU.

11. The apparatus of claim 1, wherein the telecommunications device is a radio access network node, and wherein the RLC reconfiguration logic means is arranged to implement the strategy of:

(A) retaining all downlink RLC protocol data units (PDUs) upon reconfiguration;

(B) retaining all uplink RLC protocol data units (PDUs) upon reconfiguration.

12. A method of operating a user equipment unit (30) which communicates over an air interface (32) with a radio access network, the method comprising:

using a radio link control entity (50) to form uplink RLC protocol data units (PDUs) for transmission over the air interface (32) and to receive downlink RLC protocol data units (PDUs) over the air interface (32);

storing the uplink RLC protocol data units (PDUs) in a transmitter buffer of a radio link control (RLC) buffer memory (150);

storing the downlink RLC protocol data units (PDUs) in a receiver buffer of the radio link control (RLC) buffer memory (150);

during a RLC reconfiguration wherein the user equipment unit (30) is directed to reconfigure at least one of (1) a size of a transmitter buffer window to form a new transmitter buffer window having a transmitter buffer window size smaller than an old transmitter buffer window; and (2) a size of a receiver buffer window to form a new receiver buffer window having a receiver buffer window size smaller than an old receiver buffer window, the method being characterized by:

(A) discarding any downlink RLC protocol data units (PDUs) that were received as being within the old receiver buffer window but which are outside the new receiver buffer window;

(B) retaining in the radio link control (RLC) buffer memory (150) any uplink RLC protocol data units (PDUs) whose receipt by the radio access network has not been positively acknowledged.

13. The method of claim 12, further comprising the radio link control entity (50) retransmitting after the reconfiguration the uplink RLC protocol data units (PDUs) which were negatively acknowledged by the radio access network.

14. The method of claim 12, further comprising the radio link control entity (50) not requiring segmentation of a service data unit (SDU) received from a higher layer when, after the reconfiguration, the radio link control (RLC) buffer memory (150) experiences a memory size constraint.

15. The method of claim 12, further comprising the radio link control entity (50) not negatively acknowledging the downlink RLC protocol data units (PDUs) that were received in the old receiver buffer window but which are outside the new receiver buffer window.

16. A method of operating a user equipment unit (30) which communicates over an air interface (32) with a radio access network, the method comprising:

using a radio link control entity (50) to form uplink RLC protocol data units (PDUs) for transmission over the air interface (32) and to receive downlink RLC protocol data units (PDUs) over the air interface (32);

storing the uplink RLC protocol data units (PDUs) in a transmitter buffer of a radio link control (RLC) buffer memory (150);

storing the downlink RLC protocol data units (PDUs) in a receiver buffer of the radio link control (RLC) buffer memory (150);

during a RLC reconfiguration wherein the user equipment unit (30) is directed to reconfigure at least one of (1) a size of a transmitter buffer window to form a new transmitter buffer window having a transmitter buffer window size smaller than an old transmitter buffer window; and (2) a size of a receiver buffer window to form a new receiver buffer window having a receiver buffer window size smaller than an old receiver buffer window, the method being characterized by:

(A) retaining all downlink RLC protocol data units (PDUs) stored in the receiver buffer even if outside the new receiver buffer window until the receiver buffer window can be advanced;

(B) retaining any uplink RLC protocol data units (PDUs) stored in the transmitter buffer, whose receipt by the radio access network has not been positively acknowledged, even if outside the new transmitter buffer window.

17. The method of claim 16, further comprising the radio link control entity (50) checking whether receipt of a Service Data Unit (SDU) from a high layer would exceed capacity of the radio link control (RLC) buffer memory (150).

18. The method of claim 17, further comprising the radio link control entity (50) checking for acknowledge mode RLC entities whether the buffer memory is sufficient to store acknowledge mode RLC protocol data units (AMD PDUs) having a sequence number SN which satisfies VT(A) < SN < VT(S), wherein VT(A) is a sequence number following the last in-sequence acknowledged AMD PDU; and VT(S) is a sequence number for a next AMD PDU to be transmitted for a first time.

19. The method of claim 16, further comprising the radio link control entity (50) checking whether receipt of a Protocol Data Unit (PDU) from the radio access network would exceed capacity of the radio link control (RLC) buffer memory (150).

20. The method of claim 19, further comprising the radio link control entity (50) checking for acknowledge mode RLC entities whether the buffer memory is sufficient to store acknowledge mode RLC protocol data units (AMD PDUs) having a sequence number SN which satisfies VR(R) < SN < VR(H), wherein VR(R) is a sequence number following the last in-sequence AMD PDU received; and VR(H) is a sequence number following a highest sequence number of any received AMD PDU.

21. A method of operating a radio access node (26) of a radio access network which communicates over an air interface (32) with a user equipment unit (30), the method comprising:

using a radio link control entity (50) to form uplink RLC protocol data units (PDUs) for transmission over the air interface (32) and to receive downlink RLC protocol data units (PDUs) over the air interface (32);

storing the uplink RLC protocol data units (PDUs) in a transmitter buffer of a radio link control (RLC) buffer memory (150);

storing the downlink RLC protocol data units (PDUs) in a receiver buffer of the radio link control (RLC) buffer memory (150);

during a RLC reconfiguration, reconfiguring at least one of a size of a transmitter buffer window and a size of a receiver buffer window by:

(A) retaining all downlink RLC protocol data units (PDUs) upon reconfiguration;

(B) retaining all uplink RLC protocol data units (PDUs) upon reconfiguration.

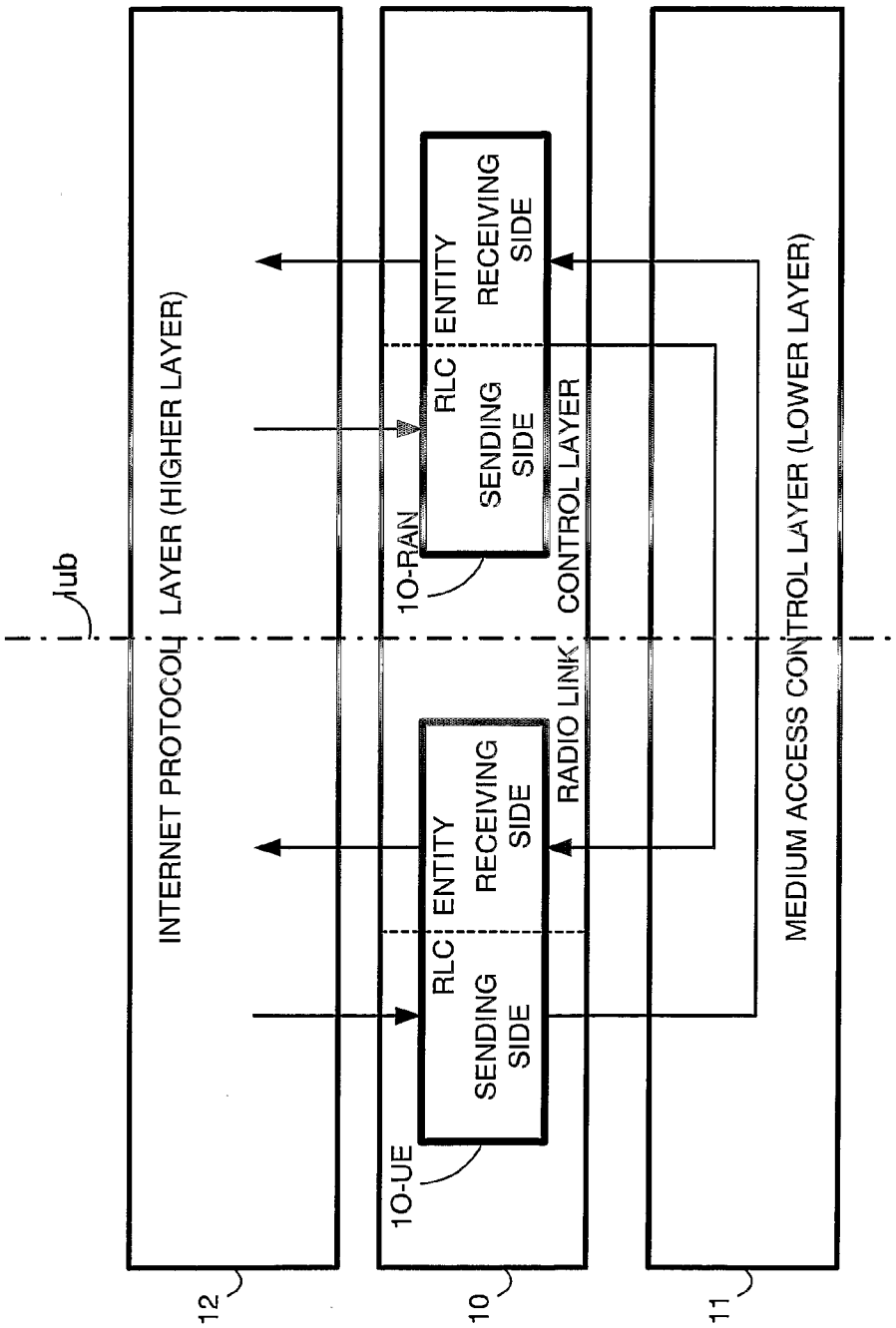

Iub
INTERNET PROTOCOL LAYER (HIGHER LAYER)
10-RAN
RLC ENTITY
SENDING SIDE
RECEIVING SIDE
CONTROL LAYER
RADIO LINK
10-UE
RLC ENTITY
SENDING SIDE
RECEIVING SIDE
MEDIUM ACCESS CONTROL LAYER (LOWER LAYER)
12
10
11

Fig. 1

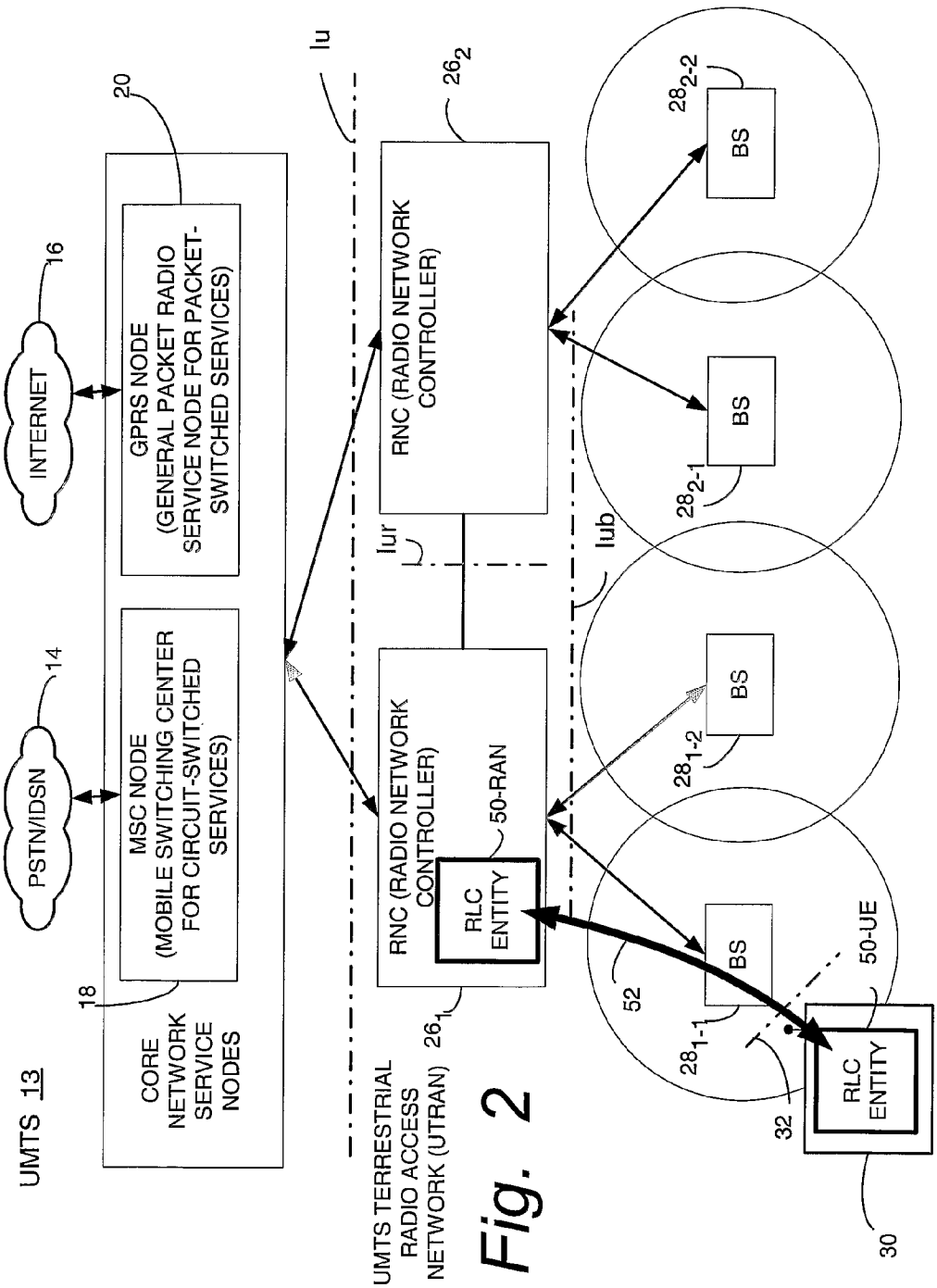

UMTS 13
CORE NETWORK SERVICE NODES
18
MSC NODE (MOBILE SWITCHING CENTER FOR CIRCUIT-SWITCHED SERVICES)
PSTN/IDSN
14
GPRS NODE (GENERAL PACKET RADIO SERVICE NODE FOR PACKET-SWITCHED SERVICES)
INTERNET
16
20
Iu
UMTS TERRESTRIAL RADIO ACCESS NETWORK (UTRAN)
RNC (RADIO NETWORK CONTROLLER)
RLC ENTITY
50-RAN
26_1
RNC (RADIO NETWORK CONTROLLER)
26_2
Iur
Iub
BS
28_{1-1}
28_{1-2}
28_{2-1}
28_{2-2}
52
32
RLC ENTITY
50-UE
30

Fig. 2

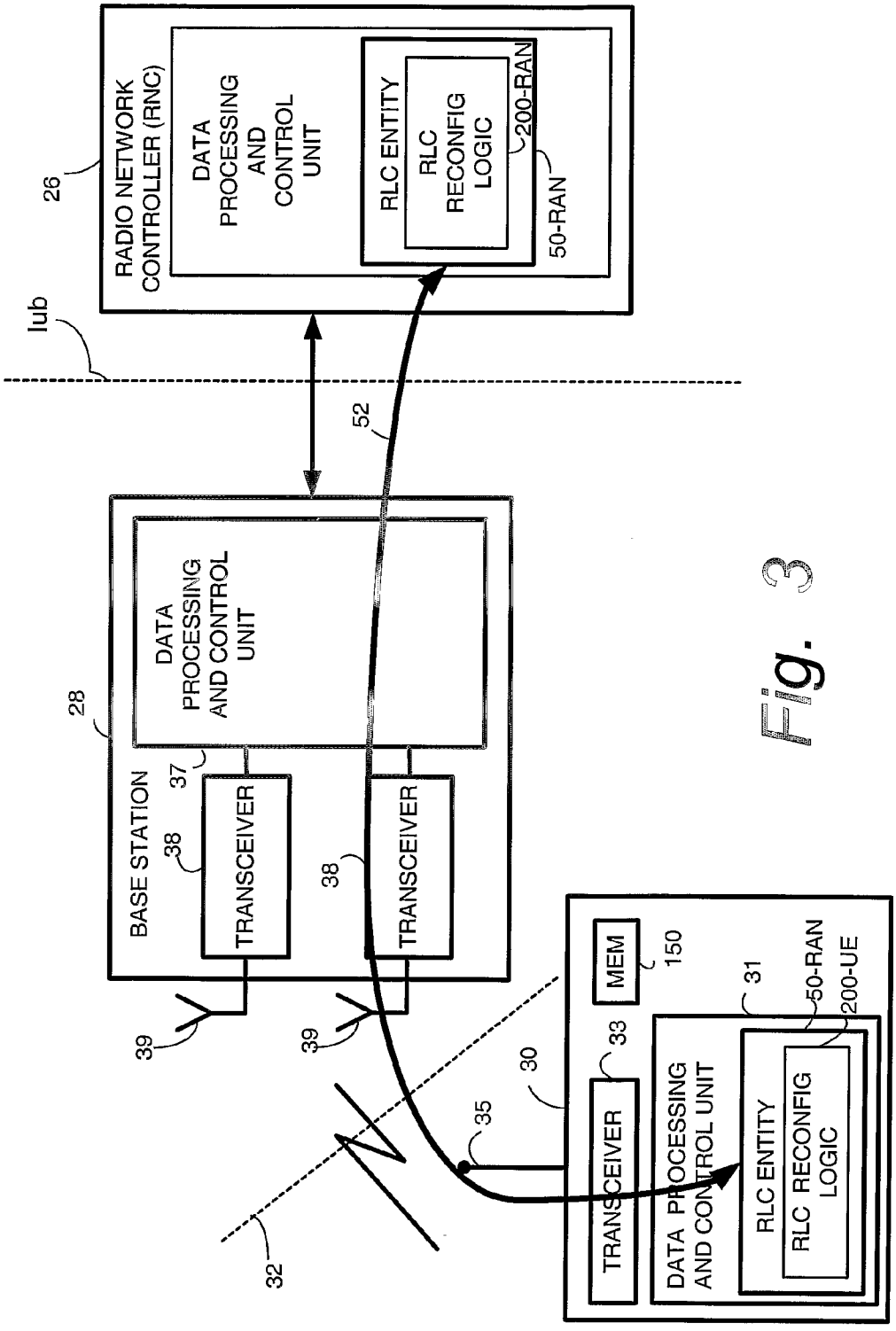
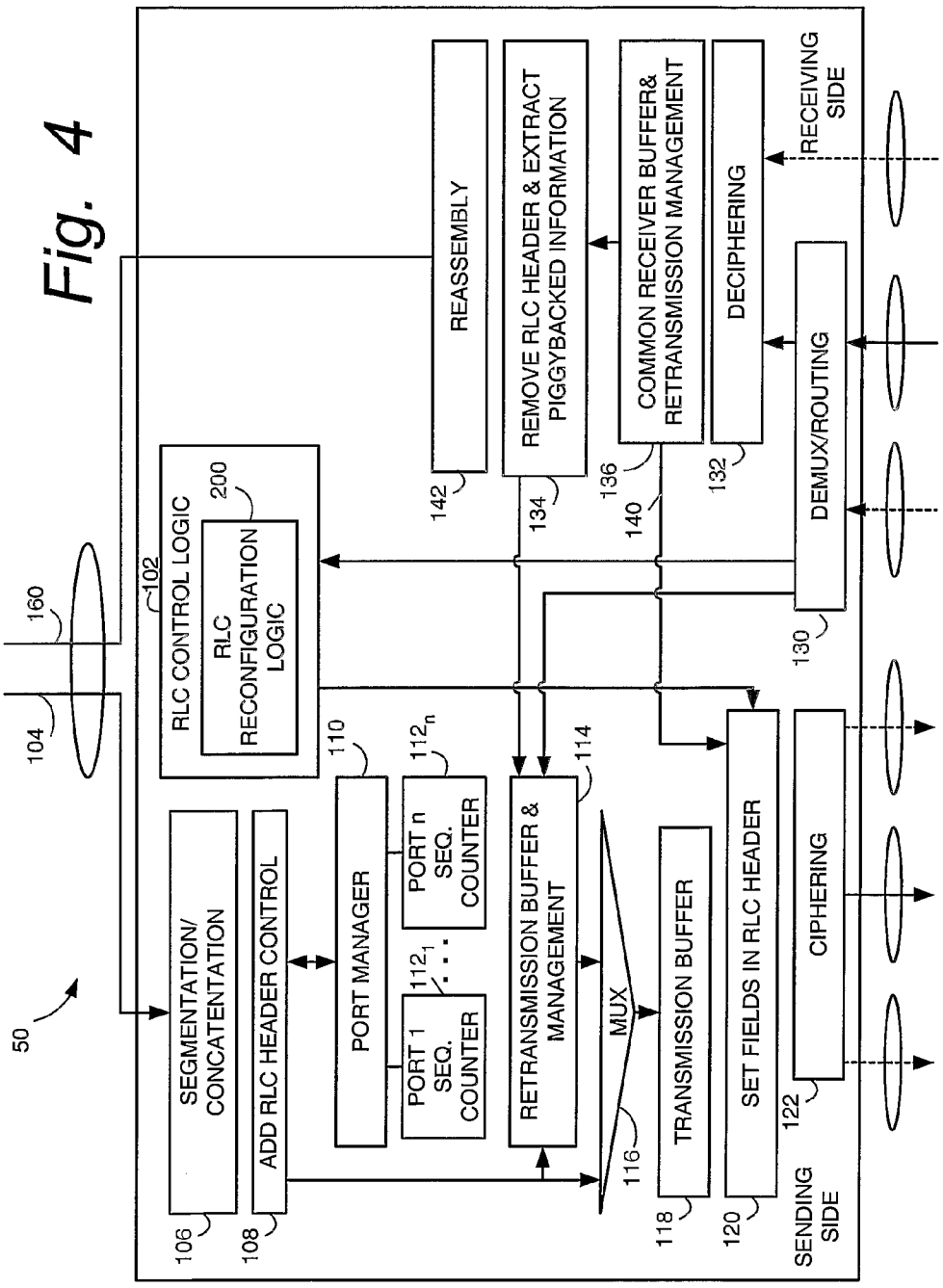

RADIO NETWORK CONTROLLER (RNC)
26
DATA PROCESSING AND CONTROL UNIT
RLC ENTITY
RLC RECONFIG LOGIC
200-RAN
50-RAN
Iub
52
BASE STATION
28
DATA PROCESSING AND CONTROL UNIT
37
TRANSCEIVER
38
TRANSCEIVER
38
39
39
MEM
150
31
50-RAN
200-UE
33
30
35
TRANSCEIVER
DATA PROCESSING AND CONTROL UNIT
RLC ENTITY
RLC RECONFIG LOGIC
32

Fig. 3

Fig. 4


50
160
104
RLC CONTROL LOGIC
102
RLC RECONFIGURATION LOGIC
200
SEGMENTATION/ CONCATENTATION
106
ADD RLC HEADER CONTROL
108
PORT MANAGER
110
PORT 1 SEQ. COUNTER
112_1
PORT n SEQ. COUNTER
112_n
RETRANSMISSION BUFFER & MANAGEMENT
114
MUX
116
TRANSMISSION BUFFER
118
SET FIELDS IN RLC HEADER
120
CIPHERING
122
SENDING SIDE
REASSEMBLY
142
REMOVE RLC HEADER & EXTRACT PIGGYBACKED INFORMATION
134
COMMON RECEIVER BUFFER& RETRANSMISSION MANAGEMENT
136
140
DECIPHERING
132
DEMUX/ROUTING
130
RECEIVING SIDE

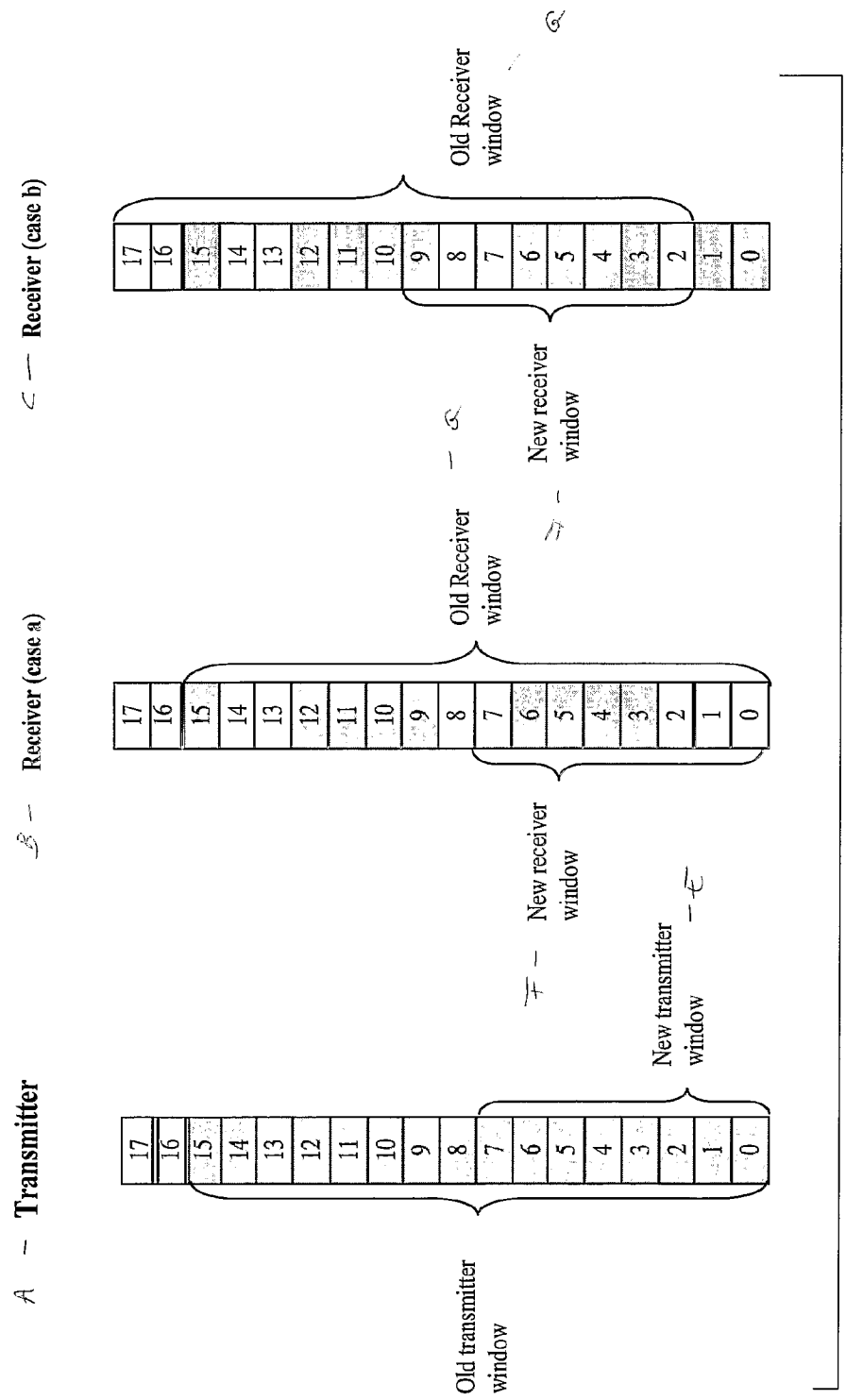

A – Transmitter
B – Receiver (case a)
C – Receiver (case b)
Old transmitter window
New transmitter window
E – New receiver window
Old Receiver window
F – New receiver window
Old Receiver window
G

Fig. 5

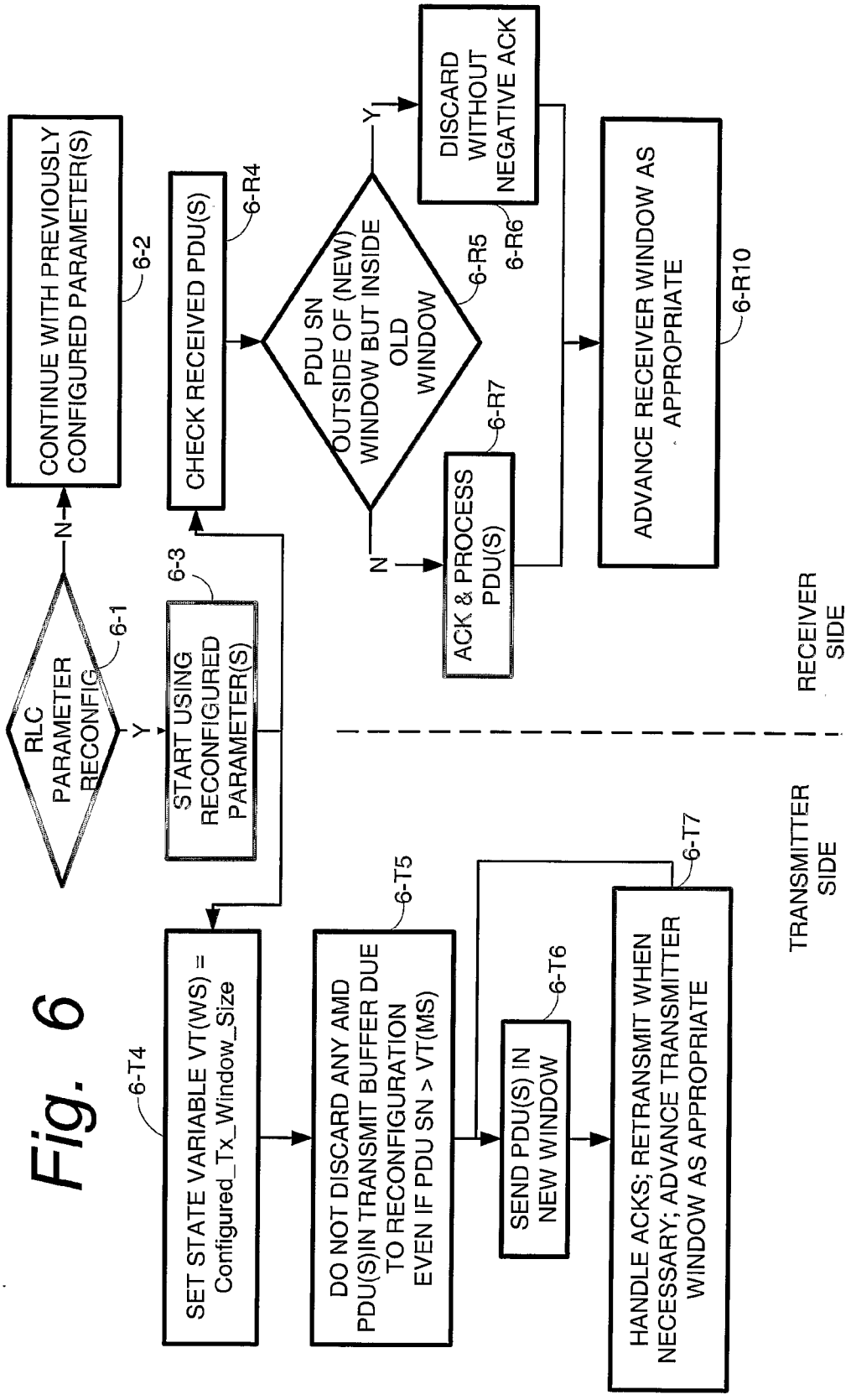

RLC PARAMETER RECONFIG
6-1
N
Y
CONTINUE WITH PREVIOUSLY CONFIGURED PARAMETER(S)
6-2
START USING RECONFIGURED PARAMETER(S)
6-3
CHECK RECEIVED PDU(S)
6-R4
PDU SN OUTSIDE OF (NEW) WINDOW BUT INSIDE OLD WINDOW
6-R5
Y
DISCARD WITHOUT NEGATIVE ACK
6-R6
N
ACK & PROCESS PDU(S)
6-R7
ADVANCE RECEIVER WINDOW AS APPROPRIATE
6-R10
RECEIVER SIDE
TRANSMITTER SIDE
SET STATE VARIABLE VT(WS) = Configured_Tx_Window_Size
6-T4
DO NOT DISCARD ANY AMD PDU(S)IN TRANSMIT BUFFER DUE TO RECONFIGURATION EVEN IF PDU SN > VT(MS)
6-T5
SEND PDU(S) IN NEW WINDOW
6-T6
HANDLE ACKS; RETRANSMIT WHEN NECESSARY; ADVANCE TRANSMITTER WINDOW AS APPROPRIATE
6-T7

Fig. 6

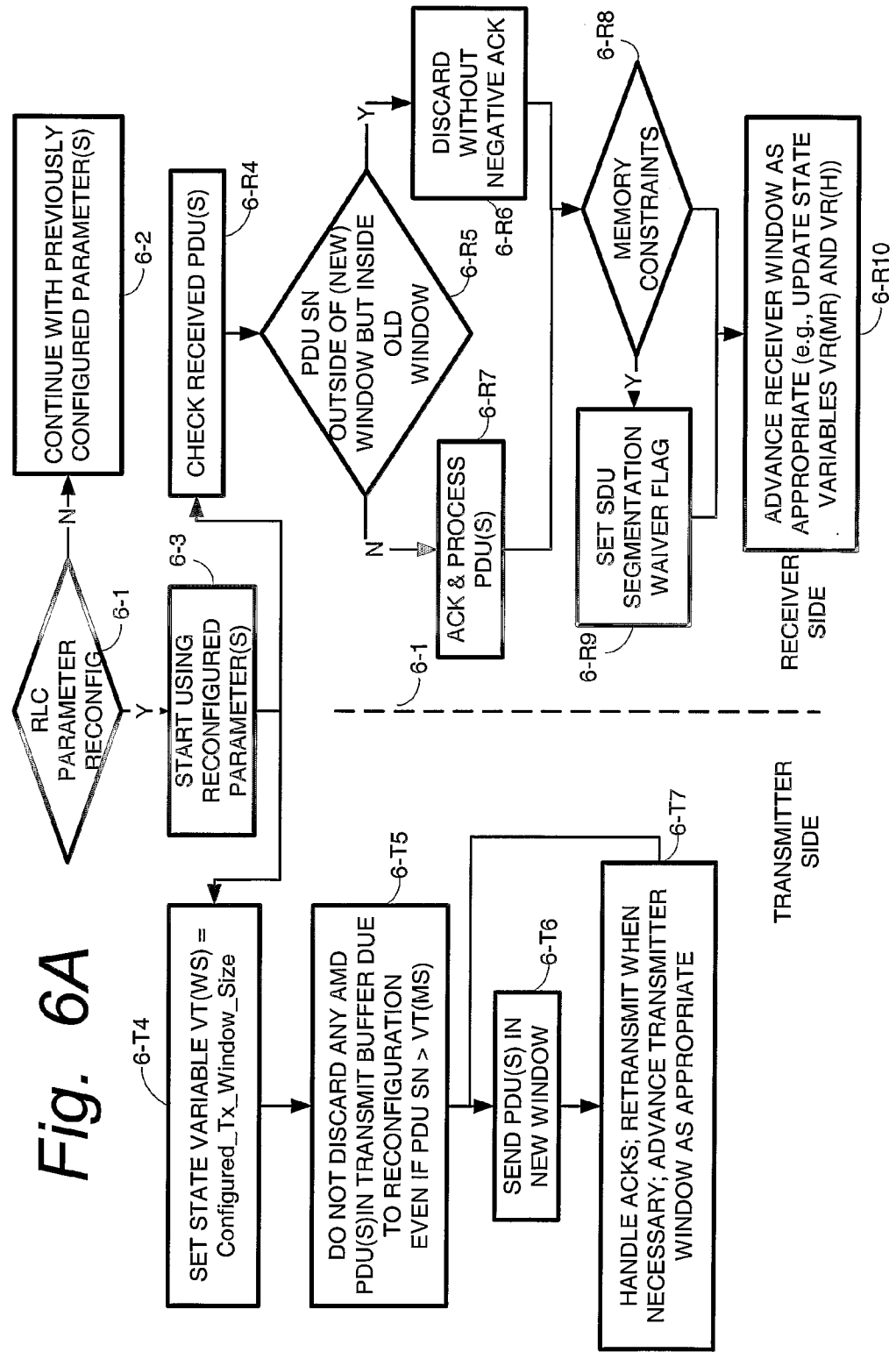

RLC PARAMETER RECONFIG
6-1
N
Y
CONTINUE WITH PREVIOUSLY CONFIGURED PARAMETER(S)
6-2
START USING RECONFIGURED PARAMETER(S)
6-3
CHECK RECEIVED PDU(S)
6-R4
PDU SN OUTSIDE OF (NEW) WINDOW BUT INSIDE OLD WINDOW
6-R5
Y
N
DISCARD WITHOUT NEGATIVE ACK
6-R6
ACK & PROCESS PDU(S)
6-R7
MEMORY CONSTRAINTS
6-R8
Y
SET SDU SEGMENTATION WAIVER FLAG
6-R9
ADVANCE RECEIVER WINDOW AS APPROPRIATE (e.g., UPDATE STATE VARIABLES VR(MR) AND VR(H))
6-R10
RECEIVER SIDE
6-1
TRANSMITTER SIDE
SET STATE VARIABLE VT(WS) = Configured_Tx_Window_Size
6-T4
DO NOT DISCARD ANY AMD PDU(S)IN TRANSMIT BUFFER DUE TO RECONFIGURATION EVEN IF PDU SN > VT(MS)
6-T5
SEND PDU(S) IN NEW WINDOW
6-T6
HANDLE ACKS; RETRANSMIT WHEN NECESSARY; ADVANCE TRANSMITTER WINDOW AS APPROPRIATE
6-T7

Fig. 6A

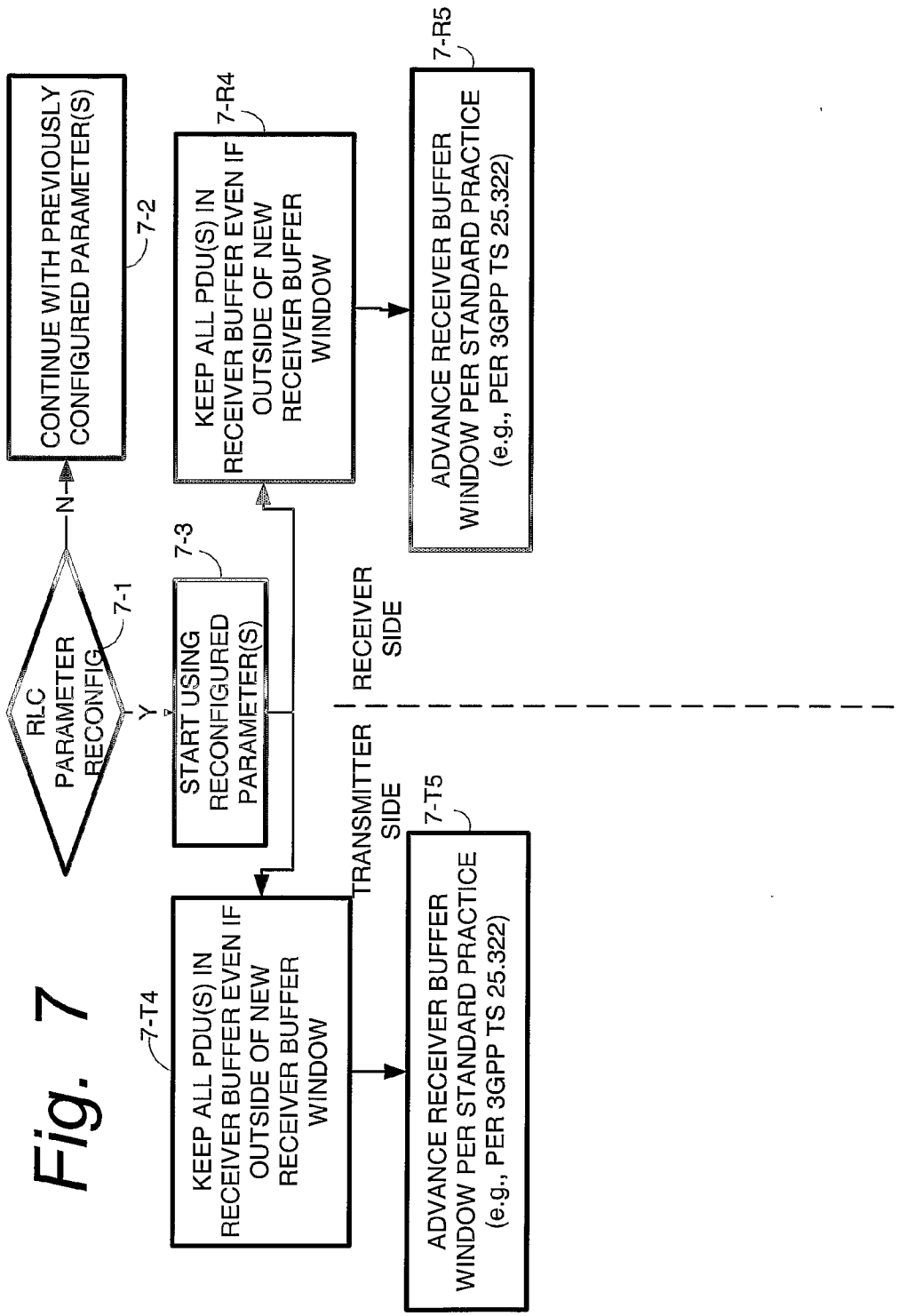

RLC PARAMETER RECONFIG
7-1
N
Y
CONTINUE WITH PREVIOUSLY CONFIGURED PARAMETER(S)
7-2
START USING RECONFIGURED PARAMETER(S)
7-3
KEEP ALL PDU(S) IN RECEIVER BUFFER EVEN IF OUTSIDE OF NEW RECEIVER BUFFER WINDOW
7-T4
ADVANCE RECEIVER BUFFER WINDOW PER STANDARD PRACTICE (e.g., PER 3GPP TS 25.322)
7-T5
TRANSMITTER SIDE
RECEIVER SIDE
KEEP ALL PDU(S) IN RECEIVER BUFFER EVEN IF OUTSIDE OF NEW RECEIVER BUFFER WINDOW
7-R4
ADVANCE RECEIVER BUFFER WINDOW PER STANDARD PRACTICE (e.g., PER 3GPP TS 25.322)
7-R5

Fig. 7

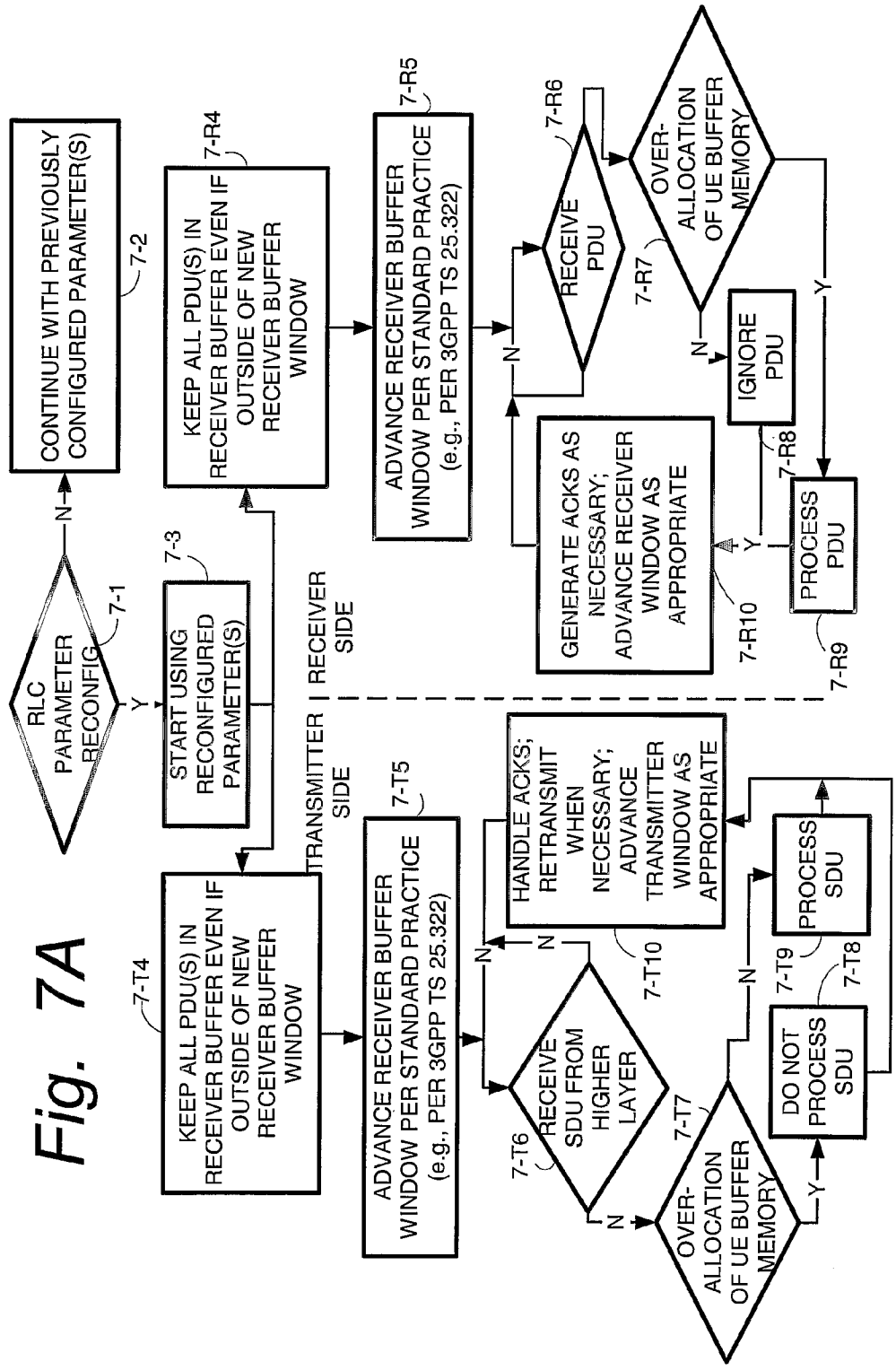

RLC PARAMETER RECONFIG
7-1
N
Y
CONTINUE WITH PREVIOUSLY CONFIGURED PARAMETER(S)
7-2
START USING RECONFIGURED PARAMETER(S)
7-3
KEEP ALL PDU(S) IN RECEIVER BUFFER EVEN IF OUTSIDE OF NEW RECEIVER BUFFER WINDOW
7-R4
ADVANCE RECEIVER BUFFER WINDOW PER STANDARD PRACTICE (e.g., PER 3GPP TS 25.322)
7-R5
RECEIVE PDU
7-R6
OVER-ALLOCATION OF UE BUFFER MEMORY
7-R7
IGNORE PDU
7-R8
PROCESS PDU
7-R9
GENERATE ACKS AS NECESSARY; ADVANCE RECEIVER WINDOW AS APPROPRIATE
7-R10
RECEIVER SIDE
TRANSMITTER SIDE
KEEP ALL PDU(S) IN RECEIVER BUFFER EVEN IF OUTSIDE OF NEW RECEIVER BUFFER WINDOW
7-T4
ADVANCE RECEIVER BUFFER WINDOW PER STANDARD PRACTICE (e.g., PER 3GPP TS 25.322)
7-T5
RECEIVE SDU FROM HIGHER LAYER
7-T6
HANDLE ACKS; RETRANSMIT WHEN NECESSARY; ADVANCE TRANSMITTER WINDOW AS APPROPRIATE
7-T10
OVER-ALLOCATION OF UE BUFFER MEMORY
7-T7
DO NOT PROCESS SDU
7-T8
PROCESS SDU
7-T9

Fig. 7A

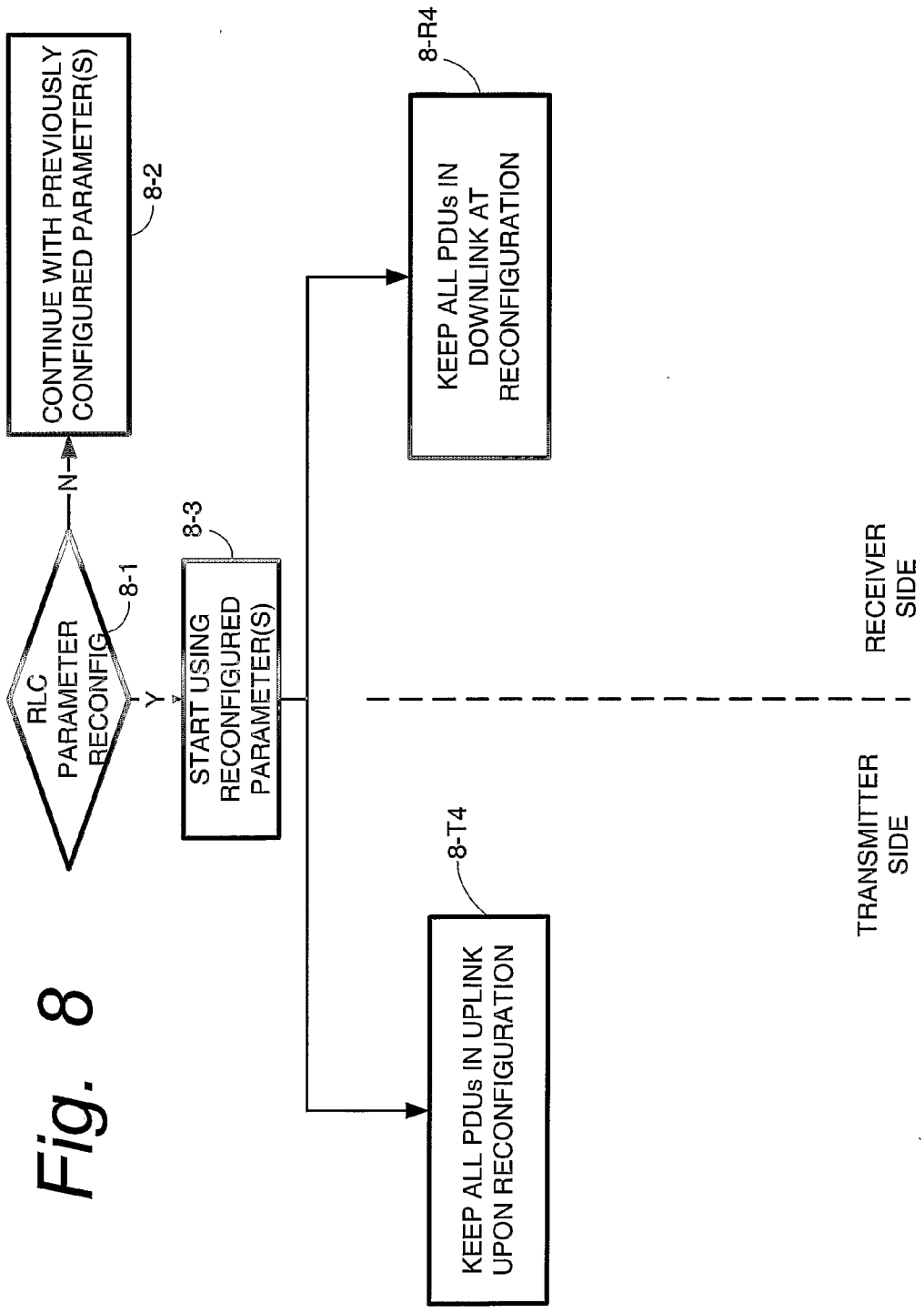

RLC PARAMETER RECONFIG
8-1
N
Y
CONTINUE WITH PREVIOUSLY CONFIGURED PARAMETER(S)
8-2
START USING RECONFIGURED PARAMETER(S)
8-3
KEEP ALL PDUs IN DOWNLINK AT RECONFIGURATION
8-R4
KEEP ALL PDUs IN UPLINK UPON RECONFIGURATION
8-T4
TRANSMITTER SIDE
RECEIVER SIDE

Fig. 8

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04L 1/18, H04L 29/08, H04L 12/56
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ, INSPEC, INTERNET

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	US 2004047331 A1 (JANG,S-K), 11 March 2004 (11.03.2004), whole document ---	1-21
A	US 20020977809 A1 (JIANG, S S-S), 25 July 2002 (25.07.2002), [0006]; [0012]-[0017]; [0026]; [0028]-[0029], figures 3,4, claims 1-15, abstract --- ---	1-21

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
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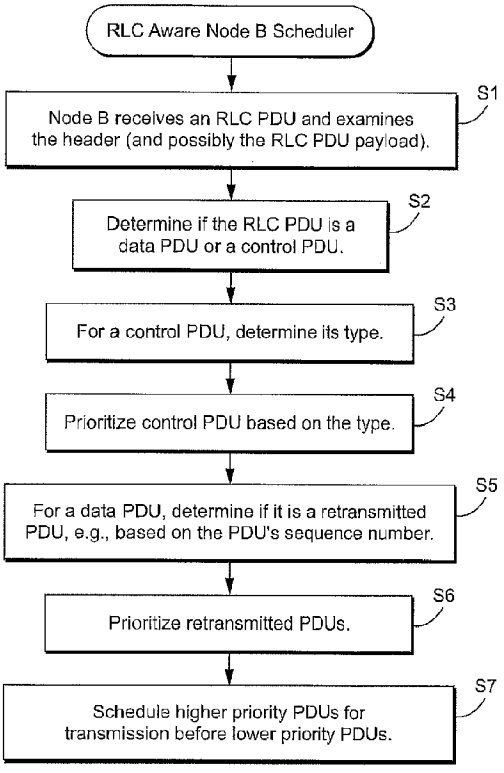
[Continued on next page]

(54) Title: MEDIUM ACCESS CONTROL PRIORITY-BASED SCHEDULING FOR DATA UNITS IN A DATA FLOW



(57) Abstract: A data communication having at least one data flow is established over a wireless interface between a radio network and a user equipment node (UE). A medium access control (MAC) layer located in a radio network node receives data units from a higher radio link control (RLC) layer located in another radio network node. Some or all of a header of a RLC data units associated with the one data flow is analyzed at the MAC layer. Based on that analysis, the MAC layer determines a priority of the data unit relative to other data units associated with the one data flow. The MAC layer schedules transmission of higher priority data units associated with the one data flow before lower priority data units associated with the one data flow. The priority determination does not require extra priority flags or signaling.

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SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)*

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MEDIUM ACCESS CONTROL PRIORITY-BASED SCHEDULING FOR DATA UNITS IN A DATA FLOW

TECHNICAL FIELD OF THE INVENTION

The present invention relates to a wireless communication system, and more particularly, to packet transmission scheduling of the High Speed Downlink Packet Access (HSDPA) system operated in a Universal Mobile Telecommunications System (UMTS) terrestrial radio access network (UTRAN).

BACKGROUND

The Universal Mobile Telecommunications System (UMTS) is a third generation mobile communication system, which evolved from the Global System for Mobile Communications (GSM), and is intended to provide improved mobile communication services based on a GSM core network (CN) and Wideband Code Division Multiple Access (WCDMA) access technology. Figure 1 illustrates a UMTS terrestrial radio access network (UTRAN) defined in the third generation mobile communications standard 3GPP.

As shown in FIG. 1, the UTRAN 110 includes one or more radio network sub-systems (RNSs) 120 and 130. Each RNS 120,130 includes Radio Network Controller RNC 121, 131 and one or more Node Bs 122, 123, 132, 133 (the Node B is

similar to a radio base station). For example, Node B 122 is managed by RNC 121, and receives information transmitted from the physical layer of the user equipment (UE) 150 (sometimes called a mobile terminal) through an uplink channel and transmits a data to the UE 150 through a downlink channel. The Node B acts as an access point of the UTRAN from the UE's point of view. The RNCs 121 and 131 allocate and manage radio resources of the UMTS and are connected to a suitable the core network depending on types of services provided to users. For example, the RNCs 121 and 131 are connected to a mobile switching center (MSC) 141 for a circuit-switched communication, such as a voice call service, and are connected to a Serving GPRS Support Node (SGSN) 142 for packet switched communication such as a wireless Internet service. The RNC in charge of a direct management of the Node B is called a Control RNC (CRNC). The CRNC manages common radio resources. On the other hand, the RNC that manages dedicated radio resources for a specific UE is called a Serving RNC (SRNC). The CRNC and the SRNC can be co-located in the same physical node. However, if the UE has been moved to an area of a new RNC that is different from SRNC, the CRNC and the SRNC may be located at physically different places.

The UMTS includes interfaces that operate as a communication path between various network elements. For example, the interface between a Node B and a RNC is called an Iub interface, and the interface between RNCs is called an Iur interface. The interface between the RNC and the core network is called an Iu interface.

As wireless Internet services have become popular, various services require higher data rates and higher capacity. Although UMTS has been designed to support multi-media wireless services, the maximum data rate is not enough to satisfy the required quality of services. Therefore, the 3GPP is conducting research directed to providing an enhanced data rate and radio capacity. One result of the research is the High Speed Downlink Packet Access (HSDPA). The purpose of the HSDPA system is to provide a maximum data rate of 10 Mbps and to improve the radio capacity in the downlink.

Various techniques in the HSDPA system include Link Adaptation (LA) and Hybrid Automatic Repeat reQuest (HARQ). In the LA method, the UTRAN can choose the appropriate modulation and coding scheme (MCS) according to the channel condition. For example, if the channel condition is good, LA uses 16 Quadrature Amplitude Modulation (QAM) to increase the throughput. If a channel condition is not as good, however, LA uses Quadrature Phase Shift Keying (QPSK) to increase the probability of success.

The HARQ method retransmits lost packets, but the exact operation is different than the retransmission method in the RLC layer. If one packet is corrupted during transmission, HARQ transmits another packet that contains the additional information for recovery. The retransmitted packet and the original packet are combined in the receiver. The retransmitted packet may contain the same information as that of the previously transmitted data, or may contain any additional supplementary information for data recovery.

Since the HSDPA system is an evolutional form of the UMTS system, the UMTS network needs to be maintained as much as possible to support backward compatibility and to reduce the cost of network deployment. To reduce the impact of the changes, most of the HSDPA features are supported in Node B so that other parts of the UMTS network will not be affected. Accordingly, some functions in Node B need to be changed and some MAC functions are transferred from the RNC. The MAC functionalities constitute a new MAC sublayer in Node B and it is called "MAC-hs" sublayer. The MAC-hs sublayer is placed above the physical layer, and performs packet scheduling and various other functions (including HARQ and LA). In addition, the MAC-hs sublayer manages a transport channel called an HSDPA--Downlink Shared Channel (HS-DSCH), which is used to deliver data from the MAC-hs sublayer to the physical layer.

Figure 2 illustrates a protocol structure of a radio interface protocol defined in the 3GPP. The radio interface protocol horizontally includes a physical layer, a data link layer, and a network layer, and is vertically divided into a control plane for transmission of control information (signaling) and a user plane for transmission of data information. The user plane is a region through which user traffic such as voice information or IP (Internet Protocol) packets is transmitted, and the control plane is a region through which control information required for network maintenance and management is transmitted.

The protocol layer structure 200 includes a Radio Link Control (RLC) layer 210, a Medium Access Control (MAC) layer 220, and a physical layer 230. The physical layer (PHY) handles transmission of data using a wireless physical channel between the UE and the UTRAN. The typical functions of the physical layer include data multiplexing, channel coding, spreading, and modulation. The physical layer exchanges information with the Medium Access Control (MAC) layer through a transport channel. A transport channel is classified as a dedicated transport channel or a common transport channel depending on whether its use is dedicated to one UE or whether it is shared among several UEs.

The MAC layer is further partitioned onto a MAC-d sublayer 222 and a MAC-hs sublayer 224. The MAC-d sublayer performs a set of functions that includes (1) mapping logical channels to common and dedicated transport channels, (2) multiplexing one or more logical channels onto one transport channel (C/T MUX), (3) ciphering/deciphering, and so on. The MAC-d sublayer 222 provides data flows to a MAC-hs sublayer 224 described further below, with each data flow being associated with certain scheduling attributes. The MAC layer transmits data by using a suitable mapping between logical channels and transport channels. The MAC-d sub-layer manages the dedicated transport channel, and a MAC-c/sh sub-layer which manages the common transport channel. The MAC-d sub-layer is located in the SRNC, and the MAC-c/sh sub-layer is located in the CRNC.

The radio link control (RLC) layer is responsible for reliable transmission of RLC protocol data units (PDUs). The RLC may segment or concatenate RLC service data units (SDUs) delivered from the higher layer. If the RLC PDUs are ready, they are delivered to the MAC layer and transmitted sequentially to the other node (UE or UTRAN). Sometimes, the RLC PDU can be lost during the transmission. In this case, the lost PDU can be retransmitted. The retransmission function of the RLC layer is called an Automatic Repeat reQuest (ARQ).

The RLC layer may include several RLC entities. Each of them performs an independent radio link control function. The operation mode of each RLC entity is one of a transparent mode (TM), an unacknowledged mode (UM), and an acknowledged mode (AM) depending on the adopted functions. In the RLC layer, data is processed as belonging to logical channels. There are various kinds of logical channels according to what kind of information the channel carries. The logical channel can be divided into two channels. One logical channel is a control channel for transmission of the control plane information and the other is a traffic channel for transmission of the user plane information.

The Packet Data Convergence Protocol (PDCP) layer is positioned over the RLC layer and efficiently transmits data of network protocols such as IPv4 or IPv6. For example, a header compression method in which header information of a packet is reduced can be used. The PDCP layer may include several independent PDCP entities like the RLC layer. The Broadcast/Multicast Control (BMC) layer is responsible for transmitting broadcast messages from a

Cell Broadcast Center (CBS) positioned at a core network. The primary function of BMC is to schedule and transmit cell broadcast messages destined for a UE. The BMC layer, in general, uses an RLC entity operated in the unacknowledged mode in order to transmit broadcast messages. The Radio Resource Control (RRC) layer is a layer defined in the control plane. The RRC performs functions of establishment, reestablishment, and release of radio resources. In addition, the RRC layer can exchange control information between UE and UTRAN using RRC messages.

Figure 3 illustrates a radio interface protocol for the HSDPA system. The MAC-hs sublayer is placed over the physical layer (PHY) in the Node B. In both the UE and UTRAN, the MAC-hs sublayer transfers data to the upper layer through MAC-c/sh and MAC-d sublayers. The MAC-c/sh and the MAC-d sublayers are located in the CRNC and the SRNC. A HS-DSCH Frame Protocol (FP) delivers the HSDPA data on the Iub or the Iur interface.

Radio link control (RLC) is typically operated in an acknowledged mode (AM) when used with HS-DSCH so that retransmissions are performed (when needed) between the radio network controller (RNC) and the user equipment (UE). Retransmission on MAC-hs level is also performed between the Node B and the UE for downlink data traffic. Since the Node B serves a large number of users, data to a particular UE for a particular priority data flow may need to be buffered in the Node B until it can be transmitted to that UE. If that UE uses several radio data flows with different

priorities, low priority data may be buffered a significant period of time if higher priority data is available for transmission.

Because scheduling decisions are made at the Node-B in HSDPA, the Node-B must buffer data before transmission. The amount of data buffered can be negotiated with the RNC using a credit scheme. Of course, there is a certain delay associated with this negotiation procedure. The Node-B must send a capacity allocation message, which has to be processed by the RNC, and the associated data to be transmitted. This negotiation delay is referred to as "credit round-trip-time" (cRTT).

At any one time, the Node-B needs to store for each UE data flow enough data to satisfy all its transmissions that can take place during such a cRTT. Although it is possible to buffer enough data across all data flows for all data flows for all the UEs in the cell, this may lead to sub-optimal scheduling decisions driven by data availability rather than by channel conditions. If there is sufficient memory, better over-the-air performance is achieved if the Node-B distributes enough credits for all data waiting at the RNC.

Acknowledged Mode (AM) RLC relies on retransmissions to achieve a desired residual frame error rate. Re-transmissions are triggered by sending feedback information on the status of each packet. The amount of buffering required in order to avoid "stalling", i.e. the transmit and re-transmit buffers are full and cannot accept more data, is proportional to the over-the-air throughput and to the re-transmission round-trip-time (rRTT). The rRTT is the

time between the time when a "hole" in the packet sequence numbers is detected by the receiver and the time when the packet is re-transmitted. It is desirable to reduce the rRTT to reduce the RLC buffer size or to improve RLC performance at equal RLC buffer size.

Currently, the Frame Protocol (FP) used between the HS-DSCH in Node B and in the RNC does not identify the type of RLC packet being sent down, i.e., whether the packet is a first time transmitted packet or a re-transmitted packet. This means that in addition to the status report transmission delay, the rRTT will also include buffering delays at the Node-B. The larger the amount of data sitting in the Node-B buffer, the longer the rRTT.

The buffering delay in Node B affects the RLC retransmission round trip time (rRTT) and negatively impacts the RLC performance in terms of delay and throughput. The rRTT is reduced by introducing different priorities for different types of RLC packet data units (PDUs) in a single data flow. For example, "status" PDUs, i.e. ARQ feedback information transmitted in the downlink direction to the UE, have a high priority. For uplink traffic, performance is improved by transmitting the RLC status PDUs as quickly as practical in the Node B. As another example, "retransmitted" PDUs are given a higher priority than PDUs transmitted for the first time. For downlink traffic, prioritizing retransmitted PDUs over PDUs transmitted for the first time permits faster delivery of UE data to higher protocol layers. Because AM RLC uses in-order delivery, data is delivered in the same order it was transmitted from the RNC RLC entity. If an RLC PDU is

missing, all PDUs with higher sequence numbers are buffered until the missing PDU is received. Thus, a missing PDU causes delay for all subsequent data. Performance is improved by assuring that the missing PDUs, i.e. retransmissions, are prioritized.

SUMMARY OF THE INVENTION

The priority levels for different types of RLC PDUs in a data flow could be signaled over the Iub interface as part of the frame handling protocol. For example, a 2-bit field indicating the PDU priority could be sent between the RNC and the Node B. But this approach requires additional signaling from the RNC to the Node B. That extra signaling is avoided by the Node B autonomously classifying RLC PDUs based on content in the RLC PDU header. Even though the node B normally does not contain any RLC "awareness," that RLC awareness is implemented in the Node B to allow the Node B to check some or all of each RLC PDU header and/or RLC payload, if desired.

The above-identified technology relates to transferring data in a wireless communication system over a wireless interface between a radio network and a user equipment node (UE). A communication is established with the UE having at least one data flow. A medium access control layer located in a radio network node receives data units from a higher radio link control layer located in another node. Some or all of a header of a radio link control data unit associated with the one data flow is analyzed at the medium

access control layer. Based on that analysis, the medium access control layer determines a priority of the data unit relative to other data units associated with the one data flow. The medium access control layer schedules transmission of higher priority data units associated with the one data flow before lower priority data units associated with the one data flow. The priority may be determined based on radio link control unit header information that does not explicitly indicate a priority for the data unit relative to other data units associated with that data flow.

In one non-limiting example implementation, a determination is made whether the data unit is a control type of data unit or a data type of data unit, and the priority determination is based on the determined data unit type. In another non-limiting example implementation, retransmission of a previously-transmitted data unit associated with the one data flow is prioritized over an original transmission of a data unit associated with the one data flow. One non-limiting example way of determining retransmission data units is to determine a highest sequence number of multiple data units associated with the one data flow and then determine which of the other data units is a retransmission based on the determined highest sequence number.

Data units associated with the one data flow are preferably stored in memory at the medium access control layer so that higher priority data units are accessed for transmission before lower priority data units. In one non-limiting example implementation, duplicate data packets are removed

from the memory to reduce delay and increase efficiency. If desired, payload information of the radio link control data unit may be analyzed and used in prioritizing the data unit. For example, if a polling bit is set in a first data unit associated with the one data flow, the polling bit in the header of a second data unit associated with the one data flow with a priority higher than that of the first data unit may be set to initiate an earlier polling.

In a non-limiting example implementation, the radio network node is a Node B in a UMTS type system, which is coupled to a radio network controller. The medium access control layer is a high speed-down link shared channel (HS-DSCH) medium access control layer implemented in the Node B. One of the benefits of the above-described approach is that it does not rely on priority-specific signaling from the RNC to the Node B to perform the data unit priority determination. In that way, there is no need to modify the RNC to insert priority type information in the data unit headers or to send explicit priority- based control signaling to the Node B. By making the Node B "RLC aware" the Node B can make the priority determination from existing information in the RLC PDU.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 illustrates in block format a UMTS type system.

Figure 2 illustrates 3 protocol layers used in the UMTS system shown in Figure 1.

Figure 3 is a protocol layer diagram that applies specific protocols to particular nodes in the system shown in Figure 1.

Figure 4 is a function block diagram of an acknowledge mode RLC entity in the RNC.

Figure 5 illustrates various formats of PDUs and packets that radio link control and medium access control protocol layers.

Figure 6 illustrates an acknowledge mode radio link control packet data unit header.

Figure 7 illustrates an acknowledge mode radio link control status packet data unit.

Figure 8 illustrates an example procedures for an "RLC aware" Node B PDU scheduler.

Figure 9 illustrates a non-limiting example implementation in a Node B scheduler for a high speed downlink shared channel.

Figure 10 illustrates a complementary diagram of the various medium access control layer entities for receiving high speed downlink shared channel transmissions at a UE.

DETAILED DESCRIPTION

The following description sets forth specific details, such as particular implementations, procedures, techniques, etc. for purposes of explanation and not limitation. It will be appreciated by one skilled in the art that other implementations may be employed a part from these specific details. For example, although the following description is facilitated using non-limiting UMTS examples, the present invention may be employed in any mobile communications network that supports data services. In some instances, detailed descriptions of well-known methods, interfaces, circuits and signaling are omitted so as to not obscure the description with unnecessary detail. Moreover, individual blocks are shown in the figures. Those skilled in the art will appreciate that the functions of those blocks may be implemented using individual hardware circuits, using software programs and data in conjunction with a suitably programmed digital microprocessor or general purpose computer, using application specific circuitry (ASIC), and/or using one or more digital signal processors (DSPs).

Building on the description of the UMTS system shown in Figure 1 and the RLC, MAC, and physical layer protocols

shown in Figures 2 and 3, Figure 4 illustrates a model of an acknowledged mode (AM) entity 250 contained in the radio network controller (RNC) and focuses on the transmitting side of the AM/RLC entity which transmits RLC packet data units (PDUs). The word "transmitted" in the context of Figure 4 includes submitting to a lower protocol layer. The AM RLC entity 250 is shown configured to use one logical channel to send or receive PDUs (although more than one logical channel could be used). RLC entity 250 receives RLC service data units (SDUs) from upper protocol layers through an AM-service access point (SAP). The RLC SDUs are segmented and/or concatenated 252 into acknowledged mode data (AMD) PDUs of a fixed length. The segmentation is performed if the received RLC SDU is larger than the length of available space in the AMD PDU.

After segmentation/concatenation 252, the RLC header is added 254, and the RLC PDUs are placed in a retransmission buffer 256 and provided to multiplexer 258. RLC PDUs buffered in the retransmission buffer 256 are deleted or retransmitted based on a status report included a status PDU that comes from the receiving side, and ultimately from the UE, or piggybacked status PDUs sent by a peer RLC entity. The status report may contain positive or negative acknowledgements of individual RLC PDUs. The multiplexer 258 multiplexes RLC PDUs from the retransmission buffer 256 that need to be retransmitted and newly-generated RLC PDUs delivered from the add RLC header block 254. The output of the multiplexer is provided to a transmission buffer 260, from which buffer PDUs are delivered to a function that completes the PDUs RLC PDU header, e.g., set poll bits, and

potentially replaces padding with piggybacked status information (see block 262). If required, block 266 also multiplexes control PDUs received from the RLC control unit 274 (e.g., reset and reset acknowledged PDUs) and from the reception 268 (e.g., piggybacked status and status PDUs) with the data PDUs. Optional ciphering may occur in block 262. The RLC PDUs are transmitted to the lower MAC layer through a dedicated control channel (DCCH) or a dedicated traffic channel (DTCH).

On the receiving side of the RLC entity 250, a demultiplexer/routing block 264 receives data and control PDUs through configured logical channel from the lower protocol layer. Data PDUs are routed to the deciphering unit 266, if ciphering was used, and delivered to a session buffer 268. Those PDUs are held in the buffer 268 until the complete RLC SDU has been received. The receiver acknowledges successful reception or request retransmission of the missing data PDUs by sending one or more status PDUs to its transmitting side as shown in Figure 4. If a piggybacked status PDU is found in a PDU, it is delivered to the retransmission buffer 256 on the transmitting side in order to purge the buffer 256 of positively acknowledged PDUs and to indicate which PDUs need to be transmitted. Once a complete RLC SDU has been received, the RLC header is removed and piggyback information is extracted in block 270, and the associated AMD PDUs are reassembled by reassembly unit 272 and delivered to upper protocol layers through the AM-service access point. Reset and reset acknowledge PDUs are delivered to the RLC control unit 374

for processing. Received status PDUs are delivered to the retransmission buffer 256 in order to purge the buffer positively acknowledged AMD PDUs and to indicate which AMD PDUs need to be retransmitted. More details of the RLC layer can be found in the Technical Specification 3GPP TS25.322 "Radio Link Control Protocol Specification" by the 3rd Generation Partnership Project.

Figure 5 shows a diagram illustrating the data encapsulation performed by a Node B for transmission on the HS-DSCH. In W-CDMA, data to be transmitted on the downlink is provided by the RLC layer in RLC protocol data units (RLC PDUs), each of which includes a sequence number (SN) and data. The MAC-d sublayer receives the RLC PDUs for one or more logical channels and, for each RLC PDU, inserts a (C/T) field to form a corresponding MAC-d PDU. The C/T field identifies the logical channel associated with the RLC PDU.

The MAC-hs sublayer receives the MAC-d PDUs and forms MAC-hs PDUs. Each MAC-d flow may include data for one or more logical channels at the RLC layer, and may be associated with a particular priority. Since data is transmitted based on priority and available resources, data flows with different priorities are stored in different data flow priority queues within the MAC-hs sublayer. Thereafter, data is retrieved from the proper priority queue, as needed, and further processed for transmission on the HS-DSCH.

To form a MAC-hs PDU, the MAC-hs sublayer first receives and serially concatenates one or more MAC-d PDUs from a

particular data flow priority queue to form the payload for the MAC-hs PDU. Padding bits may be added as necessary to fill out the payload. The MAC-hs sublayer then adds a header with the payload to form the MAC-hs PDU.

The MAC-hs header includes (1) a size index ID (SID) field indicative of the length of each MAC-d PDU in the MAC-hs PDU, (2) an N field indicative of the number of MAC-d PDUs included in the MAC-hs PDU, (3) a transmission sequence number (SN) assigned to and used to uniquely identify the MAC-hs PDU, and (4) a Queue ID (QID) field indicative of the specific priority queue from which the MAC-d PDUs included in the MAC-hs PDU were retrieved. The SN allows the UE to identify MAC-hs PDUs that have been recovered and is used to provide MAC-d PDUs in-order to the RLC layer, which expects data to be delivered to it in the correct sequence. MAC-hs PDUs are generated on the fly as they are needed. Each MAC-hs PDU is transmitted in a 2 msec transmission time interval (TTI), which is the transmission unit on the HS-DSCH.

Control information is concurrently transmitted on the shared HS-SCCH along with each packet transmission. This control information includes (1) an HARQ process ID (HID), (2) a New Data indicator, (3) information identifying the specific UE to which the control information and the corresponding data transmission are intended, and (4) other information. The HID indicates the specific HARQ process used for the packet. Each packet may be transmitted and possibly retransmitted one or more times until (1) the UTRAN receives an ACK feedback on the HS-DPCCH for the

packet, or (2) the transmitter decides to abandon the transmission of the packet. Each packet is associated with a specific HARQ process, which is an instance of a stop-and-wait (SAW) protocol used to control the transmission/retransmission of that packet. Since three bits are defined for the HID, up to eight packet transactions may be pending at any given moment. The eight HARQ processes may thus be viewed as eight "HARQ channels" that may be used to transmit packets, with each HARQ channel being associated with and identified by a specific HID value.

An AM RLC PDU format is shown in Figure 6. The data/control (D/C) field indicates whether the RLC PDU is an acknowledged mode data (AMD) PDU (data PDU) or a control PDU. For a control PDU format shown in Figure 7, the PDU type field indicates if the PDU is a STATUS PDU, a RESET PDU, or a RESET ACK PDU.

Reference is now made to the "RLC aware" Node B scheduler flow chart in Figure 8. Node B receives an RLC PDU from the RNC. Normally, the node B does not examine the contents of any data unit received from an upper protocol layer such as the RLC layer. But the RLC aware Node B examines all or part of the RLC PDU header (step S1). The Node B may also examine the contents of parts or all of the RLC PDU payload depending on the application and the type of priority decision making desired. A determination is made whether the RLC PDU is a data type PDU or control type PDU (step S2). For a control PDU, the specific type of control PDU is determined (step S3), and the control PDU is

prioritized based on that determined type (step S4). For example, all status PDUs can be given a higher priority than data PDUs which improves the performance of uplink data traffic. Data PDUs with the poll bit set to one "1" may also be prioritized over other data PDUs. For a data PDU, a determination is made whether it is a retransmitted PDU or an originally-transmitted PDU (step S5). Although any technique may be used to determine if a PDU is transmitted, one example, non-limiting technique makes that determination based on the PDU's sequence number. The highest received sequence number is stored, and all PDUs with lower sequence numbers are considered to be retransmissions. In making this decision, the modulo nature of the sequence numbers should be considered. Retransmitted PDUs are prioritized over originally-transmitted PDUs (step S6). The Node B schedules higher priority PDUs one data flow for transmission before lower priority PDUs one data flow (step S7).

For a particular data flow, transmitting PDUs with high priority before PDUs with lower priority results in a lower average delay for the high priority PDUs. More generally, this priority scheduling for PDUs associated with one data flow decreases the various delays described in the background and the application and improves the performance of the data transmission. Reducing the round trip time for selected RLC PDUs associated with a data flow improves performance in terms of delay and throughput. Advantageously, the scheme does not rely on explicit signaling from the RNC to the Node B and can be implemented with current 3GPP specifications.

If the Node B analyzes the payload contents of RLC signals in addition to the RLC header, it may perform other performance enhancing functions. For example, if the same RLC PDU is present more than once in the buffer, (e.g., due to RLC level retransmissions), the Node B removes duplicate PDUs and only transmits the first instance of the PDU. Moreover, if the polling bit is set in a first RLC PDU in the buffer, the Node B can modify the header of a second RLC PDU located earlier in the data flow buffer and set the poll bit in that second RLC PDU instead, (and if desired remove the poll bit from the first PDU), thus reducing the time until the poll is received in the UE.

Figure 9 is a diagram of the MAC-hs entity 224 which handles data transmitted on the HS-DSCH and manages physical resource allocation for HSDPA. The UTRAN MAC-hs entity includes a scheduling/priority handling entity 410, an HARQ entity 420, and an TFRC selection entity 430. The TFRC entity 430 selects the appropriate transport format and resources for the data to be transmitted on the HS-DSCH. The scheduling/priority handling entity 410 manages the data flows from the MAC-d entity according to their priorities, determines the data flow priority queue 414 for each MAC PDU being processed, and determines the transmission/retransmission of PDUs. The Node B scheduler 410 also includes an RLC analyzer and PDU scheduler 416 for processing PDUs per flow from that flow's priority queue 414. The RLC analyzer and PDU scheduler 416 includes a PDU buffer 418 in which higher priority PDUs are stored for

earlier transmission than lower priority PDUs. The RLC analyzer and PDU scheduler 416 performs additional priority analysis over and above what is normally performed in the scheduler 410 for data flow priority. As one example, it may implement the procedures described above in Figure 8 based upon the analysis of the RLC PDU header, and if desired, the payload of the RLC PDU. One HARQ 420 entity is provided to handle HARQ functionality for each UE. The HARQ entity performs transmission and (if necessary) retransmissions of packets to ensure reliable delivery of these packets to the UE. Retransmissions of packets are performed based on ACK/NAK feedback from the UE.

Figure 10 is a diagram of a MAC-hs entity 224 for the UE side. The MAC-hs entity 224 handles HSDPA specific function and includes an HARQ entity 440, a re-ordering queue distribution entity 450, and one set of re-ordering buffer 462, re-ordering entity 464, and de-assembly entity 466 for each Queue ID configured at the UE. One re-ordering buffer 462 is thus provided for and is associated with each priority queue used for the UE. The UE HARQ entity 440 handles all tasks required for HARQ (e.g., generates the required ACK/NAK for each received packet transmission). The re-ordering queue distribution entity provides recovered packets to the proper re-ordering buffer based on the Queue ID sent for the packet. The reordering entity for each re-ordering buffer reorders the recovered packets in the buffer according to the SN assigned to each packet. Each priority queue is associated with its own sequence of SNs. The reordering entity then provides packets with

consecutive SNs, as they are recovered, to the de-assembly entity. The packets are not delivered to the de-assembly entity (i.e., "stalled") if packets with lower SNs are missing. The de-assembly entity associated with each re-ordering buffer de-assembles the packets by removing the header in each packet to obtain the MAC-hs payload, extracting the MAC-d PDUs included the MAC-hs payload, and discarding padding bits (if any). The de-assembly entity then provides the MAC-d PDUs to higher layers via the MAC-d sublayer.

While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not to be limited to the disclosed embodiment, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the scope of the appended claims.

CLAIMS

1. A method for transferring data in a wireless communications system over a wireless interface between a radio network and a user equipment node (UE), including the steps of establishing a communication with the UE having at least one data flow and receiving at a medium access control layer data units from a higher radio link control layer, the method characterized by the further steps of:

analyzing at the medium access control layer some or all of a header of a radio link control data unit associated with the one data flow;

based on the analysis, determining at the medium access control layer a priority of the data unit relative to other data units associated with the one data flow; and

scheduling at the medium access control layer transmission of higher priority data units associated with the one data flow before lower priority data units associated with the one data flow.

2. The method in claim 1, wherein the analyzing step includes determining the priority based on radio link control data unit header information that does not explicitly indicate a priority for the data unit.

3. The method in claim 1, wherein the determining step further comprises:

determining whether the data unit is a control type of data unit or a data type of data unit, and

determining the priority based on the determined data unit type.

4. The method in claim 1, wherein the determining step further comprises:

prioritizing retransmission of a previously-transmitted data unit associated with the one data flow over an original transmission of a data unit associated with the one data flow.

5. The method in claim 1, wherein the determining step further comprises:

determining a sequence number for the data unit, and

determining the priority based on the determined sequence number.

6. The method in claim 5, wherein the determining step further comprises:

determining a highest sequence number of multiple data units associated with the one data flow, and

determining which of the other data units associated with the one data flow is a retransmission based on the determined highest sequence number.

7. The method in claim 6, wherein the determining step further comprises:

taking into account a modulo sequence numbering in determining which data units are retransmissions.

8. The method in claim 2, wherein the determining step further comprises:

determining a type of control data unit, and

determining the priority based on the determined type of control data unit.

9. The method in claim 2, further comprising:

storing data units associated with the one data flow in a memory at the medium access control layer so that higher priority data units are accessed for transmission before lower priority data units.

10. The method in claim 9, further comprising:

removing duplicate data packets from the memory.

11. The method in claim 9, wherein the analysis further comprises:

analyzing information in a payload portion of the radio link control data unit.

12. The method in claim 11, wherein the determining step further comprises:

if a polling bit is set in a first data unit associated with the one data flow, setting the polling bit in the header of a second data unit associated with the one data flow with a priority higher than that of the first data unit.

13. The method in claim 1, wherein the radio network includes a node B coupled for communication with a

radio network controller (RNC), and wherein the higher radio link layer is a radio link control (RLC) layer implemented in the RNC and the medium access control layer is a high speed-downlink shared channel (HS-DSCH) medium access control layer implemented in the node B.

14. The method in claim 13, wherein the method does not rely on priority-specific signaling from the RNC to the node B to perform the determining step.

15. A node in a radio network for use in facilitating a communication including at least one data flow over a wireless interface with a user equipment node (UE), where the node includes a medium access controller for receiving data units from a higher radio link controller included in a radio network controller (RNC), the medium access controller being further characterized by:

means for analyzing some or all of a header of a radio link control data unit associated with the one data flow;

means for determining, based on the analysis, a priority of the one data unit relative to other data units associated with the one data flow; and

means for scheduling transmission of higher priority data units associated with the one data flow before lower priority data units associated with the one data flow.

16. The node in claim 15, wherein the means for analyzing includes means for determining the priority based on radio link control data unit header information that does not explicitly indicate a priority for the data unit.

17. The node in claim 15, wherein the means for determining is configured to:

determine whether the data unit is a control type of data unit or a data type of data unit, and

determine the priority based on the determined data unit type.

18. The node in claim 15, wherein the means for determining is configured to:

prioritize retransmission of a previously-transmitted data unit associated with the one data flow over an original transmission of a data unit associated with the one data flow.

19. The node in claim 15, wherein the means for determining is configured to:

determine a sequence number for the data unit, and

determine the priority based on the determined sequence number.

20. The node in claim 19, wherein the means for determining is configured to:

determine a highest sequence number of multiple data units associated with the one data flow, and

determine which of the other data units associated with the one data flow is a retransmission based on the determined highest sequence number.

21. The node in claim 20, wherein the means for determining is configured to:

take into account a modulo sequence numbering in determining which data units are retransmissions.

22. The node in claim 16, wherein for a control type of data unit, the means for determining is configured to:

determine a type of control data unit, and

determine the priority based on the determined the type of control data unit.

23. The node in claim 16, further comprising:

means for storing data units associated with the one data flow at the medium access control layer so that higher priority data units are accessed for transmission before lower priority data units.

24. The node in claim 23, wherein the means for analyzing is configured to:

analyze information in a payload portion of the radio link control data unit.

25. The node in claim 24, wherein the means for determining is configured to:

determine if a polling bit is set in a first data unit associated with the one data flow, and

if so, set the polling bit in the header of a second data unit associated with the one data flow with a priority higher than that of the first data unit.

26. The node in claim 15, wherein the node is a node B and the medium access control layer is a high speed-downlink shared channel (HS-DSCH) medium access control layer implemented in the node B.

27. The node in claim 26, wherein the means for analyzing and means for determining do not rely on priority-specific signaling from the RNC to the node B.

28. A mobile radio communications system including the node in claim 15.

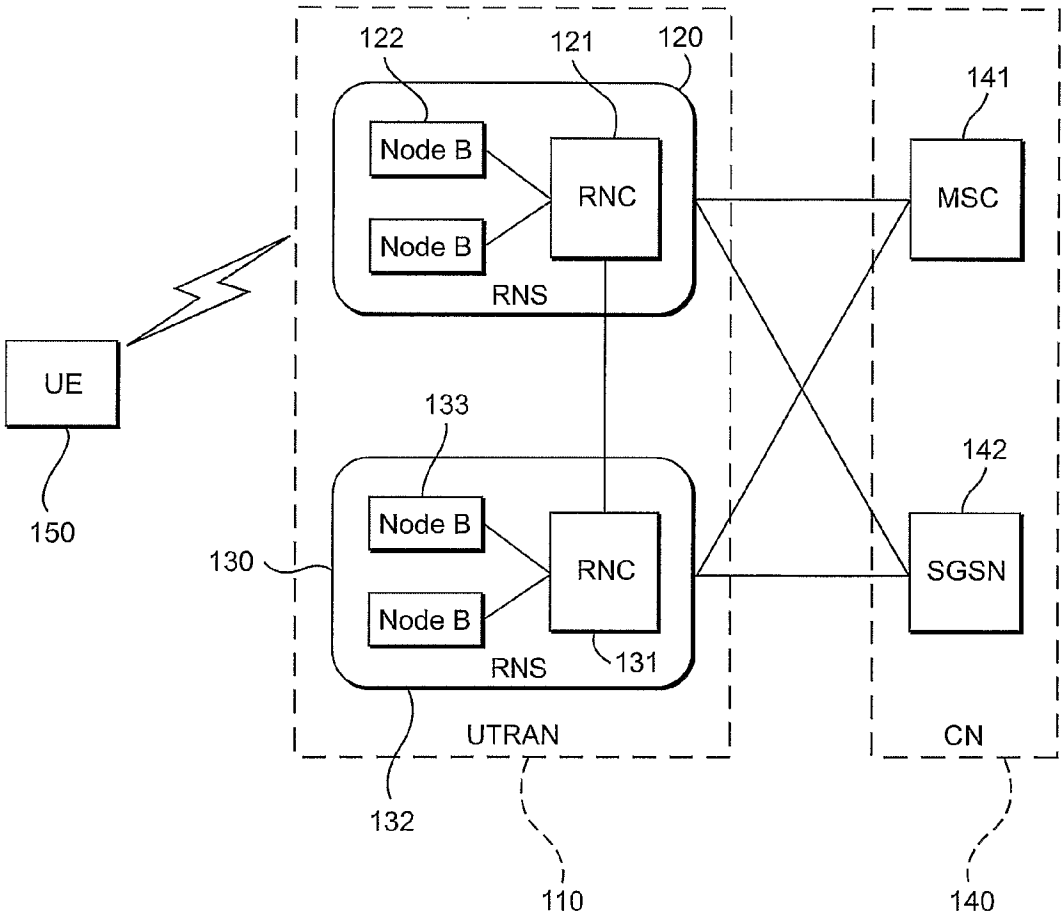
122
121
120
141
Node B
Node B
RNC
MSC
RNS
UE
133
142
Node B
Node B
RNC
SGSN
130
RNS
131
150
UTRAN
CN
132
110
140

Fig. 1

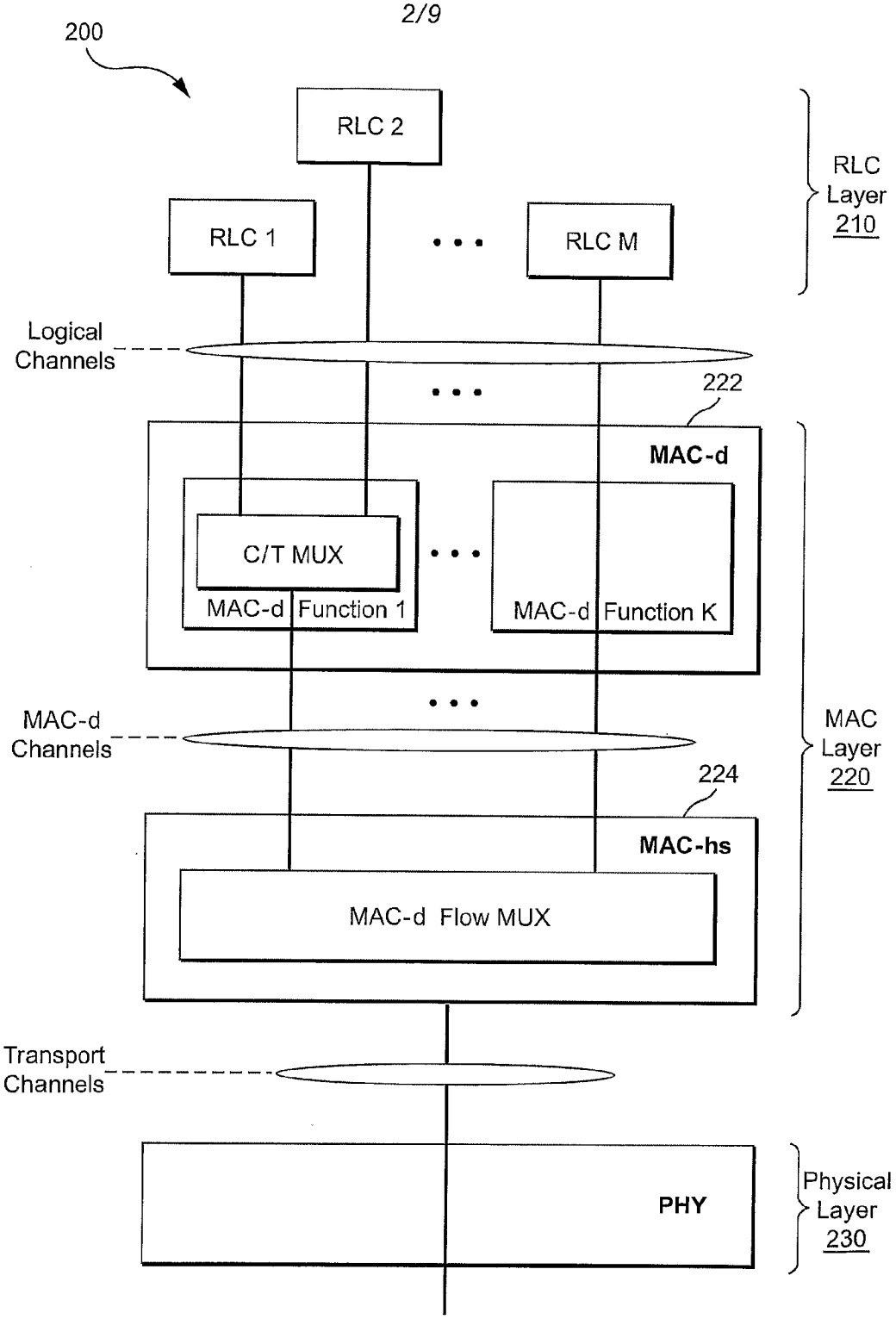
200
RLC 2
RLC 1
RLC M
RLC Layer 210
Logical Channels
222
MAC-d
C/T MUX
MAC-d Function 1
MAC-d Function K
MAC-d Channels
MAC Layer 220
224
MAC-hs
MAC-d Flow MUX
Transport Channels
PHY
Physical Layer 230

Fig. 2

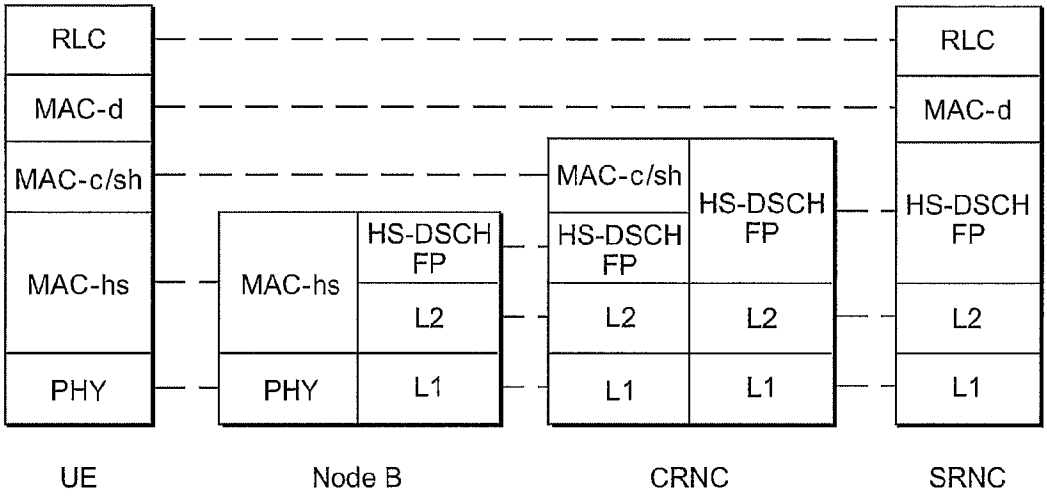
RLC
MAC-d
MAC-c/sh
MAC-hs
PHY
MAC-hs
HS-DSCH FP
L2
PHY
L1
MAC-c/sh
HS-DSCH FP
L2
L1
HS-DSCH FP
L2
L1
RLC
MAC-d
HS-DSCH FP
L2
L1
UE
Node B
CRNC
SRNC

Fig. 3

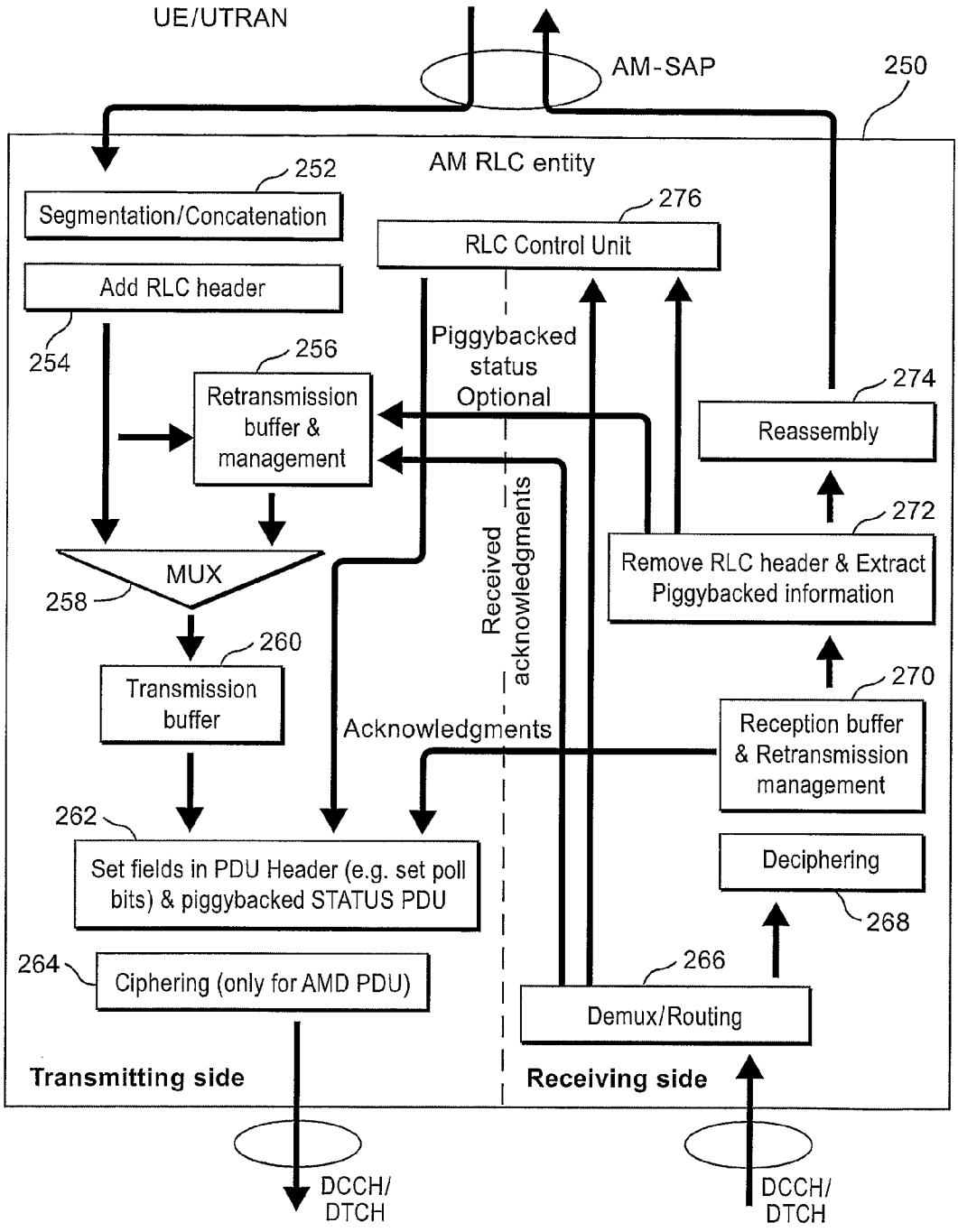
UE/UTRAN
AM-SAP
250
AM RLC entity
252
Segmentation/Concatenation
276
RLC Control Unit
Add RLC header
254
256
Retransmission buffer & management
Piggybacked status Optional
274
Reassembly
MUX
258
Received acknowledgments
272
Remove RLC header & Extract Piggybacked information
260
Transmission buffer
270
Reception buffer & Retransmission management
Acknowledgments
262
Set fields in PDU Header (e.g. set poll bits) & piggybacked STATUS PDU
Deciphering
268
264
Ciphering (only for AMD PDU)
266
Demux/Routing
Transmitting side
Receiving side
DCCH/ DTCH
DCCH/ DTCH

Fig. 4

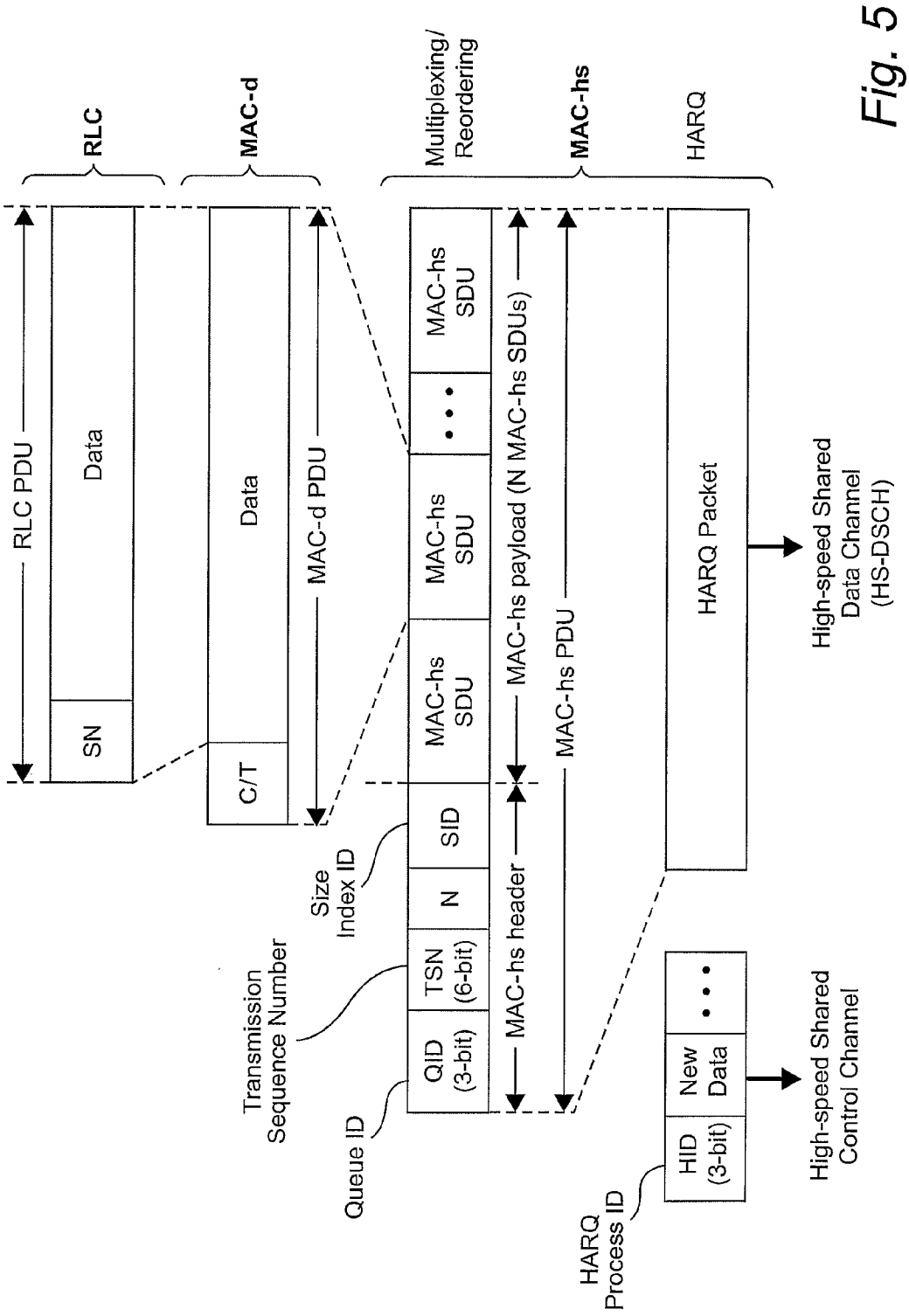
RLC
MAC-d
Multiplexing/ Reordering
MAC-hs
HARQ
RLC PDU
Data
SN
Data
C/T
MAC-d PDU
MAC-hs SDU
MAC-hs SDU
MAC-hs SDU
MAC-hs payload (N MAC-hs SDUs)
MAC-hs PDU
HARQ Packet
High-speed Shared Data Channel (HS-DSCH)
Size Index ID
SID
N
TSN (6-bit)
QID (3-bit)
Transmission Sequence Number
Queue ID
MAC-hs header
HID (3-bit)
New Data
HARQ Process ID
High-speed Shared Control Channel

Fig. 5

AM RLC PDU Header

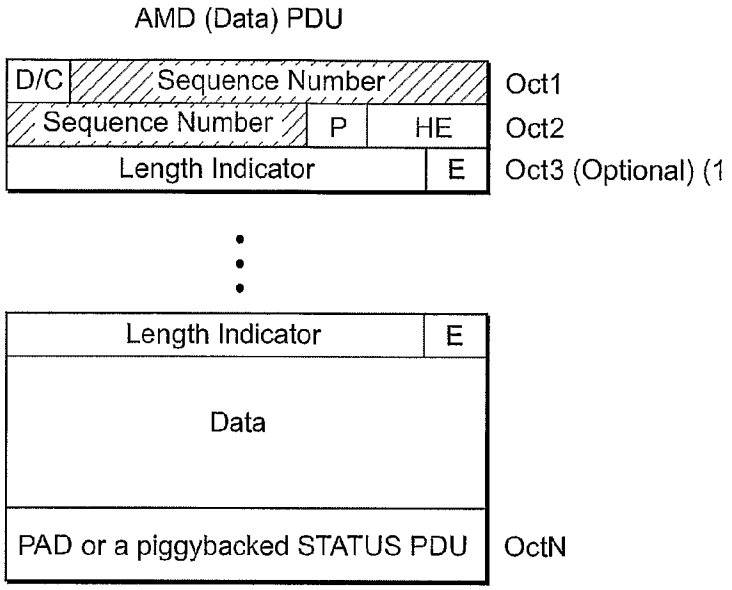

Fig. 6

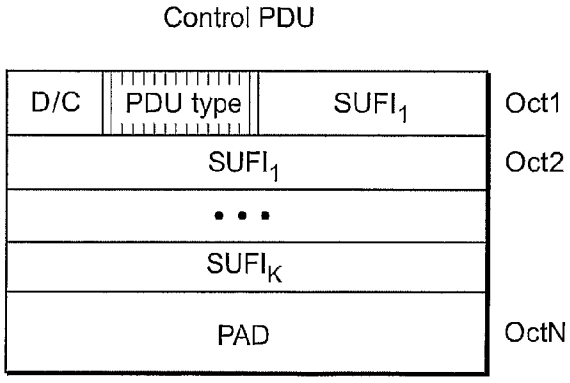

Fig. 7

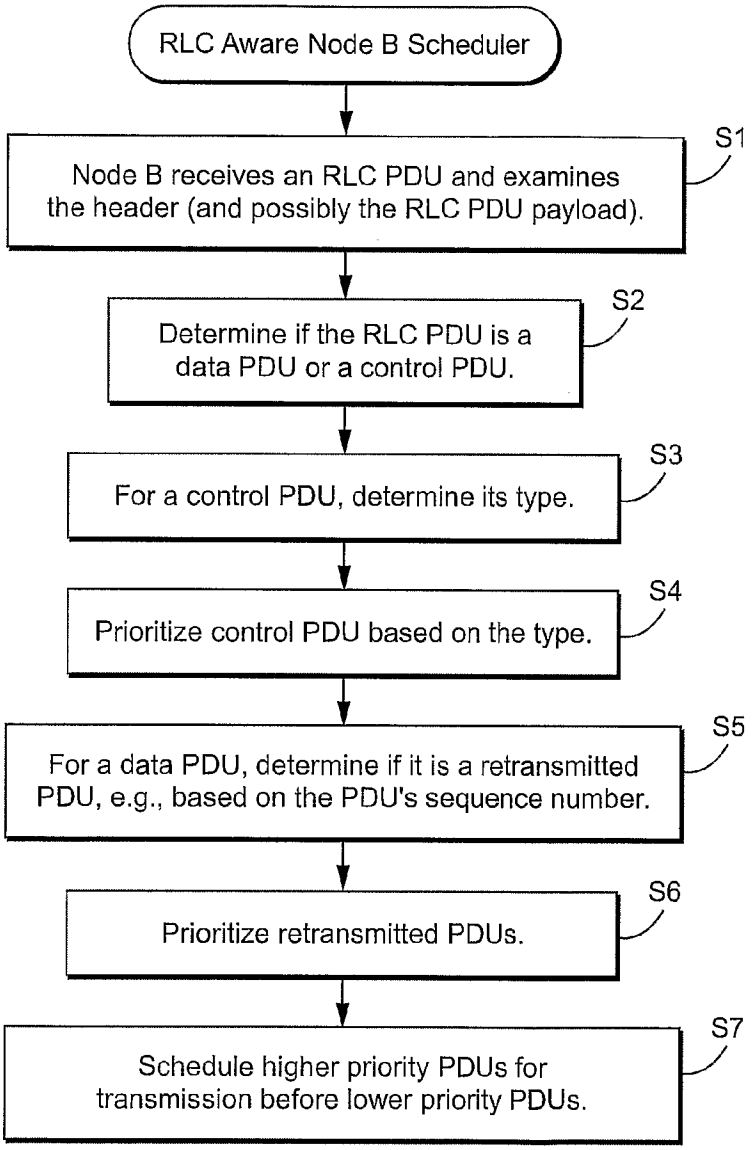
RLC Aware Node B Scheduler
Node B receives an RLC PDU and examines the header (and possibly the RLC PDU payload).
S1
Determine if the RLC PDU is a data PDU or a control PDU.
S2
For a control PDU, determine its type.
S3
Prioritize control PDU based on the type.
S4
For a data PDU, determine if it is a retransmitted PDU, e.g., based on the PDU's sequence number.
S5
Prioritize retransmitted PDUs.
S6
Schedule higher priority PDUs for transmission before lower priority PDUs.
S7

Fig. 8

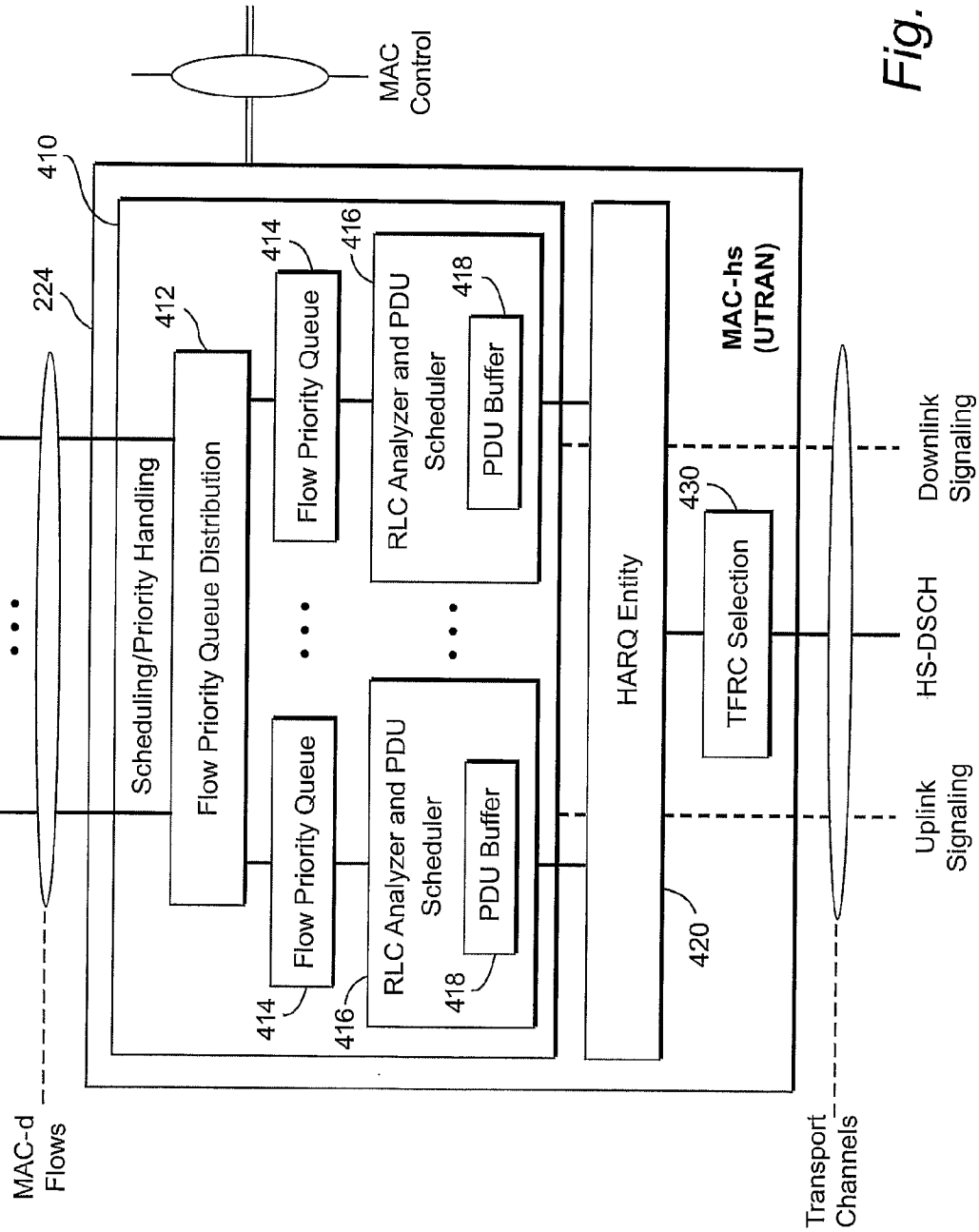
MAC Control
410
224
412
414
416
418
Scheduling/Priority Handling
Flow Priority Queue Distribution
Flow Priority Queue
RLC Analyzer and PDU Scheduler
PDU Buffer
HARQ Entity
MAC-hs (UTRAN)
430
TFRC Selection
420
MAC-d Flows
Transport Channels
Uplink Signaling
HS-DSCH
Downlink Signaling

Fig. 9

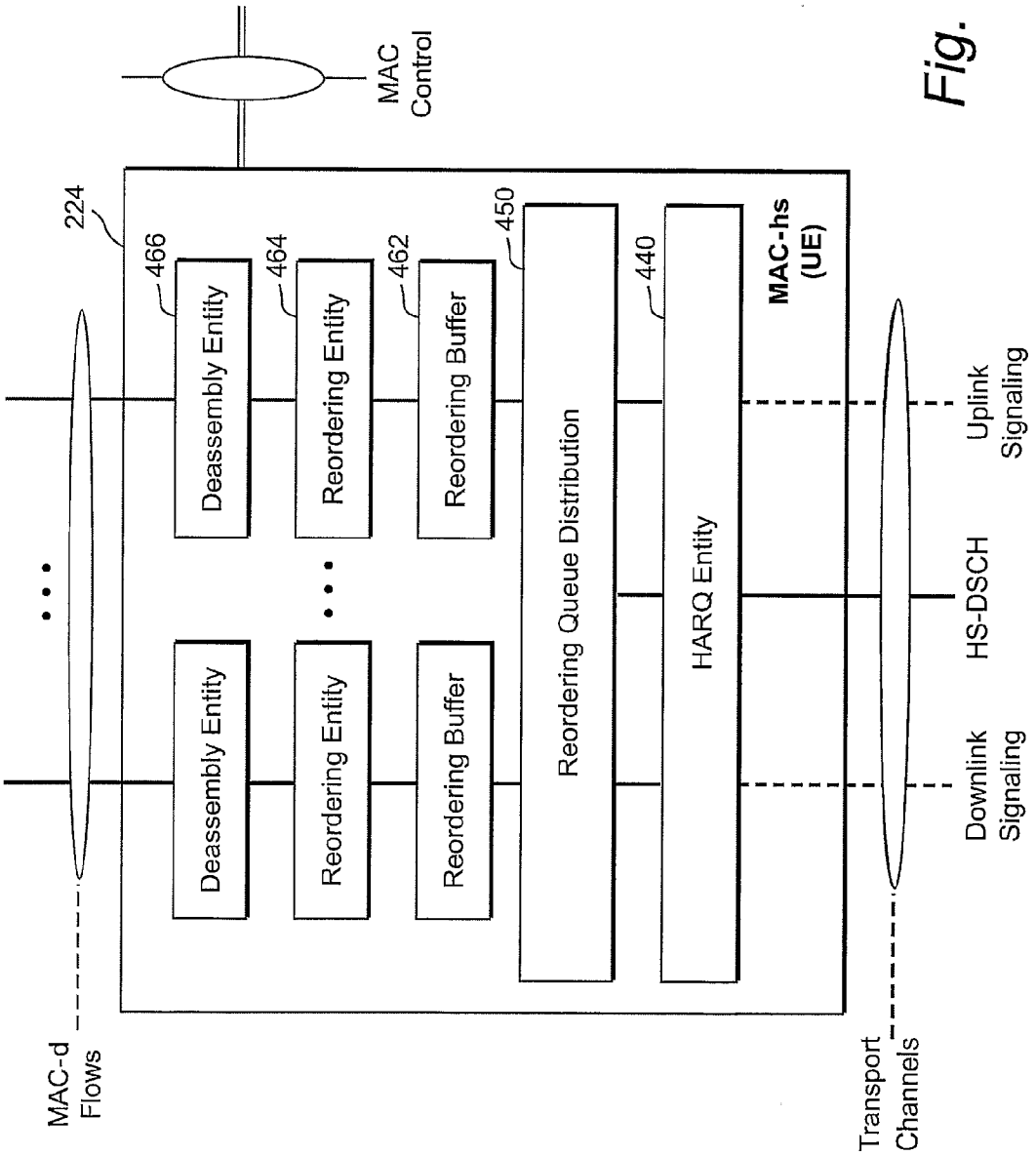
MAC Control
224
466
464
462
450
440
MAC-hs (UE)
Deassembly Entity
Reordering Entity
Reordering Buffer
Reordering Queue Distribution
HARQ Entity
Deassembly Entity
Reordering Entity
Reordering Buffer
MAC-d Flows
Transport Channels
Downlink Signaling
HS-DSCH
Uplink Signaling

Fig. 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 2004/001438

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04L 1/18, H04L 12/56
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04L, H04Q, H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 02096044 A1 (TELEFONAKTIEBOLAGET L M ERICSSON (PUBL)), 28 November 2002 (28.11.2002), page 6, line 8 - page 7, line 7; page 11, line 8 - line 19	1-28
	--	
A	US 20030153323 A1 (HWANG, W), 14 August 2003 (14.08.2003), paragraphs [0004]-[0005]	1-18
	--	
P,A	WO 2004057810 A2 (NOKIA CORPORATION), 8 July 2004 (08.07.2004), page 4, line 1 - page 5, line 16, abstract	1-28
	--	

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

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Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,A	WO 03096617 A2 (INTERDIGITAL TECHNOLOGY CORP), 20 November 2003 (20.11.2003), paragraphs [0045]-[0048], abstract --	1-28
P,A	EP 1361689 A1 (SAMSUNG ELECTRONICSCO, LTD), 12 November 2003 (12.11.2003), figure 3, claims 1, 3, abstract -- --------	1-28

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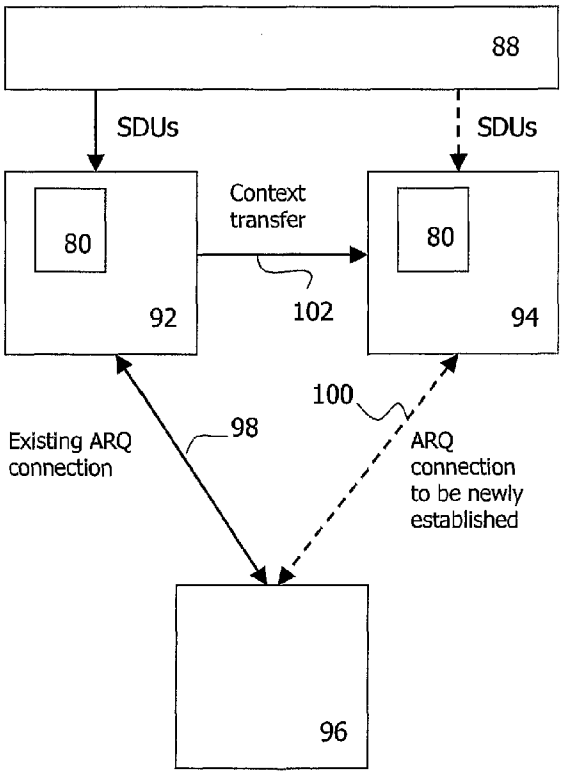
(54) Title: TECHNIQUE FOR CONFIGURING LINK LAYER ENTITIES FOR A HANDOVER



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(57) Abstract: A technique of configuring link layer entities for a handover is described. In a method embodiment, the technique includes receiving from a recipient of protocol data units a supplemental status report for an existing ARQ connection in context with an imminent handover, determining service data units corresponding to buffered protocol data units taking into account information included in the supplemental report, and transferring the determined service data units to a link layer entity which is to establish a new ARQ connection to the recipient. The forced status synchronisation that is based on the supplemental report prevents the transfer of service data units that have already been successfully received at the recipient.

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Technique for configuring link layer entities for a handover

Field of the Invention

The present invention generally relates to the field of handovers in mobile communication networks. In particular, the invention relates to handovers between link layer entities having control of retransmission mechanisms.

Background of the invention

Retransmission mechanisms, also known as automatic repeat request (ARQ) techniques, constitute an approach that addresses the loss of data on its way to the intended recipient. Such data loss can be the result of unfavourable physical conditions such as interference, noise, or multipath propagation.

ARQ techniques are based on status reports that are transmitted from a recipient of the data to indicate to the transmitter that individual data units have either been successfully received (positive acknowledgement) or lost (negative acknowledgement). Generally, the recipient generates the status reports event-based, timer-based or poll-based according to specifications of the respective ARQ protocol. Status reports may for example be scheduled after receipt of a predetermined number of data units or at predefined points in time.

The transmitter evaluates the received status reports and then decides about the retransmission of individual data units that have not or not correctly been received at the recipient. Some ARQ techniques provide for an automatic retransmission of a data unit for which no positive acknowledgement has been received within a predetermined time interval after the first transmission of the data unit.

With regard to the open systems interconnection (OSI) layer model, ARQ techniques are usually implemented on the data link layer (layer 2 or L2). The data link layer is located between the physical layer (layer 1 or L1) and the network layer (layer 3 or L3) as indicated by the protocol stack 10 shown on the left-hand side of Fig. 1.

The physical layer L1 defines the electrical and physical specifications for the network components involved in the data transfer. The data link layer L2 provides the mechanisms to transfer data between the individual network components and to detect and possibly correct errors that may occur in the physical layer L1. The network layer L3 performs network routing, flow control, segmentation/desegmentation, and error control functions. The best known example of a L3 protocol is the Internet protocol (IP).

Usually, there are one or more additional layers on top of the network layer L3. In the example shown on the left-hand side of Fig. 1, these additional layers include a transport layer L4 configured according to the transmission control protocol (TCP) and an application layer L7 configured according to the file transfer protocol (FTP). While not part of the official OSI model, additional protocols may operate between the data link layer L2 and the physical layer L1. These protocols are sometimes referred to as "layer 2.5" protocols.

In the exemplary configuration shown in Fig. 1, the data link layer L2 is divided into two sub-layers, the radio link control (RLC) layer and the medium access control (MAC) layer, respectively. The ARQ techniques are in most cases implemented within the RLC sub-layer as will now be explained in more detail with reference to the right-hand side of Fig. 1.

In the configuration shown in Fig. 1, the RLC sub-layer includes a first buffer 12 interfacing the network layer L3 and a second buffer 14 interfacing the MAC sub-layer. The first buffer 12 is provided for storing incoming service data units (SDUs) such as IP packets 16 generated within the network layer L3. The SDUs stored in the first buffer 12 are read out by a segmentation engine 18 that segments the SDUs 16 into RLC protocol data units (PDUs) 20. The PDUs 20 are on the one hand forwarded to the MAC sub-layer for transmission to the intended recipient and, on the other hand, stored in the second buffer 14 for a possible re-transmission under the regime of an ARQ protocol.

At a certain point in time, a recipient of the PDUs may require a handover from a first network component (with a link layer entity having an RLC configuration as shown in Fig. 1) to a second network component (with a similar link layer entity). In the following, some possible handover scenarios will exemplarily be described with particular reference to processes occurring on the data link layer.

In principle, the handover from a currently serving link layer entity to a new link layer entity can occur without previous buffer synchronisation as shown in Fig. 2. In this case, when the handover is to be performed between two link layer entities, the stream of SDUs is switched from the previously serving link layer entity to the new link layer entity, and the content of the buffers 12, 14 of the previously serving link layer entity is simply discarded. It is evident that the resulting loss of buffered content will slow down the operation of higher layers and can result in a temporal degradation of the service quality.

According to an alternative handover scenario shown in Fig. 3, the handover can be performed such that before switching the SDU stream from the currently serving link layer entity to the new link layer entity, the content of the SDU buffer 12 of the currently serving link layer entity is transferred to the SDU buffer 12' of the new link layer entity. This process is sometimes also called L3 context transfer. In this case, only the content of the PDU buffer 14 of the previously serving link layer entity is discarded. US 2004/0146033 A1 illustrates an exemplary technique for such an L3 context transfer.

One drawback of the handover approach illustrated in Fig. 3 is the fact that the data loss resulting from discarding the content of the PDU buffer 14 can still lead to a service degradation. Furthermore, the data loss may trigger higher layer protocol interactions, for example with TCP in the transport layer L4. Such higher layer protocol interactions are illustrated in Fig. 4. As can be gathered from the TCP trace shown in Fig. 4, several TCP segments are lost at the handover instant (see dark vertical line). The lost TCP segments will have to be retransmitted by TCP after the handover has occurred, which leads to a slow transmission start after the handover.

Additionally, the loss of TCP segments at the handover instant may result in a TCP timeout. Accordingly, frequent handovers may lead to the situation that a TCP sender is unable to attain a sufficiently high sending rate, thus leading to a radio link underutilization. Such a underutilization scenario is shown by the trace of the TCP congestion window CWND illustrated in Fig. 5.

One solution to avoid the problems illustrated in Figs. 4 and 5 would be to make the handover actually lossless. To this end, all data currently being transmitted (and stored in the link layer PDU buffer) may be reconstructed. The SDUs reconstructed

from the content of the PDU buffer may then be transferred to the new link layer entity in addition to the transfer of the SDU buffer content as shown in Fig. 3.

However, it has been found that such a reconstruction approach can cause unintentional data duplication as shown in the TCP trace of Fig. 6. This data duplication is a result of the fact that some of the reconstructed SDUs have already been successfully delivered to the recipient, but the corresponding PDUs have not yet been deleted from the PDU buffer.

The duplication shown in Fig. 6 tends to interfere with higher layer protocols such as TCP. TCP rejects two duplicate data packets with sending a TCP duplicate acknowledgement back to the TCP sender, which leads to TCP error recovery. The duplicate acknowledgement leads to a behaviour of the TCP congestion window CNWD as shown in Fig. 7. This behaviour indicates that the radio link is not fully utilized most of the time. Obviously, such an underutilization constitutes a waste of available resources.

Therefore, there is a need for an improved handover technique on a link layer level that is more compatible with ARQ protocols.

Summary of the Invention

According to a first aspect, a method of configuring link layer entities for a handover is provided, with the link layer entities receiving service data units from a higher functional layer, converting the service data units into protocol data units, and buffering the protocol data units for transmission to a recipient under the regime of an ARQ protocol with status reports, wherein the status reports are indicative of receipt of one or more protocol data units at the recipient. The method comprises the steps of receiving from a recipient of protocol data units a supplemental status report for an existing ARQ connection in context with an imminent handover, determining service data units corresponding to buffered protocol data units taking into account information included in the supplemental status report, and transferring the determined service data units to a link layer entity which is to establish a new ARQ connection to the recipient.

This approach may be implemented in context with any ARQ technique, including sliding window ARQ, go-back (n) ARQ, range-based ARQ, and stop-and-wait ARQ.

The supplemental status reports may be constituted by positive acknowledgements, negative acknowledgements, or any other ARQ messages including information about the current status of the recipient in relation to previously transmitted protocol data units.

The supplemental status report allows for an ARQ synchronisation between a link layer sender and a link layer recipient just before the handover is performed. In some cases, the supplemental status report may be considered as an unscheduled report because it may be generated by the recipient in addition to the status reports that are generated in a regular transmission scenario, i.e. in a transmission scenario excluding a handover procedure.

In some cases, the method may comprise the further step of the suspending transmission of service data units and/or protocol data units. This suspension preferably takes place in a close temporal relationship with receipt of the supplemental status report. According to a first option, transmission of protocol data units is suspended in response to receipt of the supplemental status report. According to another option, the transmission of protocol data units is suspended already before receipt of the supplemental status report, for example in response to receipt of a notification relating to the imminent handover.

The method may additionally comprise the step of requesting the supplemental status report from the recipient. If this requesting step is performed by the link layer entity requiring the supplemental status report, transmission of the protocol data units may be suspended in close temporal relationship (e.g. immediately before or after) the supplemental status report is requested from the recipient. In one scenario, the step of requesting the supplemental status report is initiated upon receipt of a notification relating to the imminent handover.

The supplemental status report may be requested from the recipient in various ways. The request for the supplemental status report may for example be included in a dedicated link layer message that is sent to the recipient. Additionally, or in the alternative, the supplemental status report may be requested via one or more radio resource management (RRM) messages. Alternatively, or in addition, the supplemental status report may be received via one or more RRM control messages.

According to one variation, the step of requesting the supplemental status report comprises sending a request instructing the recipient to unconditionally generate and transmit the supplemental status report. If such a request is received by the recipient, the recipient has to disregard any conditions potentially preventing or delaying the generation of a status report, such as a running status prohibit timer.

The step of determining the service data units preferably excludes such service data units that correspond to protocol data units correctly received at the recipient (as indicated in the supplemental status report). To this end, the successfully transmitted protocol data units may be deleted within the PDU buffer before initiating reconstruction. Thus, a more up-to-date reconstruction becomes possible because of the supplemental status report and the resulting enforced ARQ synchronisation immediately preceeding an imminent handover.

According to a first option, the step of determining the service data units comprises reconstructing service data units from buffered protocol data units taking into account the information included in the supplemental status report. According to another option, the step of determining the service data unit comprises selecting buffered service data units corresponding to buffered protocol data units taking into account the information included in the supplemental status report. The service data units may be selected from the conventional SDU buffer (that is filled with the service data units received from the higher functional layer, such as the SDU buffer 12 shown in Fig. 1) or from a separate SDU buffer including only such service data units that have already been or are about to be segmented into protocol data units.

As previously mentioned, the service data units received from the higher functional layer may be buffered in a link layer buffer. In such a scenario, a data context may be created from all determined service data units (e.g. those service data units that have been reconstructed from protocol data units) and, additionally, from all conventionally buffered service data units. The transferred data context will therefore also include the service data units reconstructed or otherwise determined taking into account the information included in the supplemental status report. The data context thus created may then be transferred to the link layer entity which is to establish (or has already been established) the new ARQ connection to the recipient.

The present invention may be practised in the form of a software solution, by one or more hardware components, or as a combined software/hardware approach. Accord-

ing to a software aspect, a computer program product is provided. The computer program product comprises program code portions for performing the process steps when the computer program product is run on one or more computing devices. The computer program product may be stored on a computer readable recording medium.

As for a hardware aspect, a device for configuring link layer entities for a handover is provided, the link layer entities receiving service data units from a higher functional layer, converting the service data units into protocol data units, and buffering the protocol data units for transmission to a recipient under the regime of an ARQ protocol with status reports, wherein the status reports are indicative of receipt of one or more protocol data units at the recipient. The device comprises a first interface adapted to receive from a recipient of protocol data units a supplemental status report for an existing ARQ connection in context with an imminent handover, a mechanism adapted to determine service data units corresponding to buffered protocol data units taking into account information included in the supplemental status report, and a second interface adapted to transfer the determined service data units to a link layer entity which is to establish a new ARQ connection to the recipient.

The device may be part of a system which additionally comprises a recipient having a reporting mechanism adapted to generate supplemental status reports for the existing ARQ connection. The device may be integrated in or otherwise communicate with one or more link layer entities. The link layer entities may in turn be incorporated in network components that can comprise one or more further functional layers.

Brief Description of the Drawings

In the following, the invention will be described with reference to exemplary embodiments illustrated in the drawings, wherein:

Fig. 1 is a schematic diagram illustrating on the left-hand side a protocol stack with a data link layer and on the right-hand side a various mechanisms performed in the data link layer;

Fig. 2 is a schematic diagram illustrating a first handover procedure between two link layer entities;

Fig. 3 is a schematic diagram illustrating a second handover procedure between two link layer entities;

Fig. 4 shows a diagram illustrating data loss resulting from the handover procedure illustrated in Fig. 3;

Fig. 5 is a diagram illustrating the timeout behaviour resulting from the data loss illustrated in Fig. 5;

Fig. 6 is a diagram illustrating data duplication resulting from unnecessarily reconstructed SDUs;

Fig. 7 is a diagram illustrating a TCP behaviour in response to duplicate acknowledgements resulting from the data duplication illustrated in Fig. 6;

Fig. 8 is a schematic diagram illustrating an embodiment of a configuration device according to an embodiment of the present invention;

Fig. 9 is a schematic diagram illustrating a system embodiment and a handover procedure under control of the device of Fig. 8;

Fig. 10 is a schematic flow chart illustrating a method embodiment of the present invention;

Fig. 11 is a schematic diagram illustrating a further embodiment of the present invention; and

Fig. 12 is a diagram illustrating an improved TCP behaviour resulting from an implementation of the present invention.

Detailed Description of the Preferred Embodiments

In the following description, for purposes of explanation and not limitation, specific details are set forth, such as particular sequences of process steps, individual ARQ scenarios, and specific system configurations in order to provide a thorough understanding of the present invention. It will be apparent to one skilled in the art that the present invention may be practised in other embodiments that depart from these

specific details. In particular, while the embodiments will be described in a TCP/IP context, with regard to specific ARQ mechanisms, and in relation to a data link layer having a certain configuration, it is to be understood that the invention can also be implemented in context with other protocols and configurations.

Moreover, those skilled in the art will appreciate that the functions explained herein below may be implemented using software functioning in conjunction with a programmed microprocessor or general purpose computer, and/or using an application specific integrated circuit (ASIC). It will also be appreciated that while the current invention is primarily described in the form of methods and devices, the invention may also be embodied in a computer program product as well as in a system comprising a computer processor and a memory coupled to the processor, wherein the memory is encoded with one or more programs that may perform the functions disclosed herein.

Fig. 8 shows an embodiment of a device 80 for configuring link layer entities for a handover. The device 80 includes a first interface 82 that is adapted to receive (in context with an imminent handover) a supplemental status report from a recipient of protocol data units. Thus, the supplemental status report is tied to the handover procedure. The status report pertains to an existing ARQ connection stretching between a first link layer entity and the recipient. The supplemental status report can be received via the first interface 82 in addition to regular status reports generated by the recipient in accordance with a conventional ARQ protocol.

The device 80 further comprises a mechanism 84 adapted to determine (e.g. reconstruct or select) service data units corresponding to buffered protocol data units based on information included in the supplemental status report. This information can be indicative of successful and/or failed receipt of one or more protocol data units at the recipient. The supplemental status report thus allows for a synchronization between the recipient and the first link layer entity in communication with the recipient via the existing ARQ connection. This synchronization helps to avoid the transfer of service data units that correspond to buffered protocol data units already successfully received by the recipient but not yet acknowledged by way of "regular" status reports.

Additionally, the device 80 includes a second interface 86 adapted to transfer the service data units determined by the mechanism 84 to a second link layer entity that is to establish a new ARQ connection to the recipient in context with the handover.

This handover will now be explained in more detail with reference to Fig. 9.

Fig. 9 shows a network system 90 comprising two link layer entities 92, 94, a (common) controller 88 for the link layer entities 92, 94, and a recipient 96. Each of the two link layer entities 92, 94 and the recipient 96 have a protocol stack with a data link layer that can be similar to the one shown in Fig. 1. Further, each of the link layer entities 92, 94 comprises a device 80 as shown in Fig. 8 for implementing the required handover configurations.

In one exemplary realization, the link layer entities 92, 94 are included in base stations or nodes B in accordance with the universal mobile telecommunications system (UMTS) standard. The controller 88 can be configured as a UMTS radio network controller (RNC). In the UMTS context, the recipient 96 may take the form of a user equipment (UE) such as a mobile telephone. Alternatively, the link layer entities 92, 94 may be integrated together with the controller 88 into a single RNC component.

It should be noted that the device 80 and the link layer entities 92, 94 could be implemented either on the terminal side such as within an UE (uplink) or on the network side (downlink). In a terminal scenario, the two link layer entities 92, 94 may for example constitute two different PCMCIA cards coupled to one and the same terminal such as a portable computer. Alternatively, the two link layer entities 92, 94 could be integrated in a dual mode terminal operative according to at least two wireless communication standards such as UMTS and GSM (Global System for Mobile Communications).

As can be seen from Fig. 9, there exists an ARQ connection 98 stretching between the first link layer entity 92 and the recipient 96. The ARQ connection 98 constitutes a data and/or control channel with ARQ functionalities. Due to a possible mobility of the recipient 96 or other circumstances, a handover between the first link layer entity 92 and the second link layer entity 94 may be required at a certain point in time. In the course of the handover, a new ARQ connection 100 will be established between the second link layer entity 94 and the recipient 96. After (or, in an alternative embodiment, before) the new ARQ connection 100 has been established, the existing

ARQ connection 96 between the first link layer entity 92 and the recipient 96 may be terminated. In the course of the handover procedure, a data context will be transferred between the first network entity 92 and the second link layer entity 94 as indicated by the arrow 102. The data context may be transferred between the link layer entities 92, 94 directly or via the controller 88.

In the following, the communication between the four network components 88, 92, 94, 96 shown in Fig. 9 will be described with reference to the flow chart 1000 of Fig. 10, and from the perspective of the first link layer component 92.

The first link layer entity 92 constantly receives service data units from a higher functional layer, such as a network layer L3, arranged in the controller 88 or any other network component. The link layer entity 92 converts these service data units into protocol data units and buffers the protocol data units for transmission under the regime of an ARQ protocol to the recipient 96. The ARQ protocol specifies regular status reports indicative of receipt of one or more protocol data units at the recipient 96.

Referring now to Fig. 10, the first link layer entity 92 receives in a first step 1010 from the recipient 96 a supplemental status report for the existing ARQ connection 98 in context with an imminent handover of the recipient 96 from the first link layer entity 92 to the second link layer entity 94.

In a second step 1020, the first link layer entity 92 determines (e.g. reconstructs or selects) service data units corresponding to buffered protocol data units taking into account status information included in the supplemental status report received from the recipient 96.

In a further step 1030, the first link layer entity transfers a data context including at least the service data units determined in step 1020 to the second link layer entity 94 as indicated by arrow 102. Additionally, the controller 88 will switch the service data unit stream from the first link layer entity 92 to the second link layer entity 94. The second link layer entity 94 will then start to transmit protocol data units via the new ARQ connection 100 to the recipient 96 taking into account the data context received from the first link layer entity 92.

In the following, a further embodiment of the invention will be described with reference to the schematic diagram shown in Fig. 11. The embodiment shown in Fig. 11 can be combined with any one of the embodiments described with reference to Figs. 8 to 10.

The process schematically illustrated in Fig. 11 is initiated when detecting (e.g. by the controller 88 shown in Fig. 9) that a recipient of a PDU stream requires a handover from a currently serving link layer entity (left-hand side of Fig. 11) to a new link layer entity (right-hand side of Fig. 11). In this case the currently serving link layer entity is immediately notified of the imminent handover. This notification triggers a state synchronisation between the currently serving link layer entity and the PDU recipient (not shown in Fig. 11). The state synchronisation can be performed in various ways.

In one embodiment, the currently serving link layer entity (e.g. the RLC sub-layer) sends a newly defined link layer message (in the following called Super-Poll Request) to the PDU recipient. The PDU recipient replies to the Super-Poll Request with generation of a supplemental status report and with transmission of this status report to the currently serving link layer entity. What differentiates a Super-Poll Request from a regular link layer poll is the fact that the Super-Poll Request instructs the recipient to generate and transmit the status report in any case (e.g. even if the local status prohibit timer is running).

In order to reduce the overall messaging, the handover-related Super-Poll Request may be substituted by a "default request" included as an additional setting of the handover procedure (that is typically performed via RRM messages of a radio resource control (RRC) protocol). In this case, the supplemental status report may automatically be generated and transmitted from the recipient that has been notified of the imminent handover within a dedicated or a handover-related RRM message. Accordingly, the status report for a link layer connection that is to be migrated can be included in a RRM message instead of sending it (e.g. as in the Super-Poll Request scenario discussed above) as a separate link layer message.

In context with receiving the handover notification and/or in context with generating and sending a supplemental status request, the currently serving link layer entity may optionally suspend PDU transmission to the recipient. In addition, or alterna-

tively, the transmission of SDUs to the currently serving link layer entity may be suspended.

In response to receipt of the supplemental status report from the recipient, the currently serving link layer entity updates its transmission state. This updating step may include deleting or discarding any PDUs in the PDU buffer 14 shown in Fig. 11 that are positively acknowledged in the supplemental status report.

In a next step, the currently serving link layer entity reconstructs SDUs from the updated PDU buffer 14 for context transfer. It should be noted here that the reconstruction is only started after the content of the supplemental status report has been considered. In an alternative embodiment, the SDUs are not reconstructed from the updated PDU buffer 14, but selected from the SDU buffer 12 (in which case the SDUs read from the SDU buffer 12 for segmentation will be appropriately marked but not deleted from the SDU buffer 12), or selected from a dedicated SDU buffer (not shown) in which the SDUs which have been read out for segmentation are temporarily stored for the generation of a handover-related data context. In the selection scenario, those SDUs that are acknowledged in the supplemental status report will not be selected for data context generation.

In the reconstruction scenario, the currently serving link layer entity creates a data context from all SDUs that are stored in the SDU buffer 12 and additionally from those that have been reconstructed from the updated PDU buffer 14. The data context including the buffered and reconstructed SDUs is then forwarded to the new link layer entity as indicated by the two arrows in Fig. 11. At the new link layer entity, the SDUs included in the data context are stored in the local SDU buffer 12'. Consequently, this SDU buffer 12' will also include SDUs corresponding to PDUs reconstructed from the updated PDU 14 of the currently/previously serving link layer entity.

In a final step, the SDU stream is switched to the new link layer entity as shown in Fig. 11, and the new link layer entity starts to transmit PDUs to the original recipient via a newly established ARQ connection.

As has become apparent from the above description, the embodiments allow for a lossless handover without duplication of SDUs that have already been successfully transmitted. As a consequence, negative interactions with higher layer protocols such

as TCP can be avoided as illustrated in the diagram of Fig. 12. As can be gathered from Fig. 12, the congestion window CWND is only throttled by SDU buffer overflow, but no interference with TCP due to unintentional data duplications at handovers can be noticed.

It should be noted that the present invention is applicable to a wide variety of handover scenarios. These scenarios include intra-system handovers, inter-system handovers between different radio technologies (e.g. access switches), handovers between different access gateways in the long term evolution (LTE) project of the third generation partnership project (3GPP), and handovers between 3GPP LTE release 7 and pre-release 7 3GPP access. Additionally, the serving radio network system (SRNS) relocation mechanism within 3GPP networks can be improved for inter-RNC handovers.

It will be appreciated by those skilled in the art that the above-described embodiments may be adapted or extended in various ways. While the foregoing description thus makes reference to preferred embodiments, the scope of the invention is defined solely by the claims that follow and the elements recited therein.

Claims

1. A method of configuring link layer entities (92, 94) for a handover, the link layer entities (92, 94) receiving service data units from a higher functional layer, converting the service data units into protocol data units and buffering the protocol data units for transmission to a recipient (96) under the regime of an ARQ protocol having status reports, the status reports being indicative of receipt of one or more protocol data units at the recipient (96), the method comprising the steps of:
   - receiving from a recipient (96) of protocol data units a supplemental status report for an existing ARQ connection (98) in context with an imminent handover;
   - determining service data units corresponding to buffered protocol data units taking into account information included in the supplemental status report; and
   - transferring the determined service data units to a link layer entity (94) which is to establish a new ARQ connection (100) to the recipient (96).

2. The method of claim 1, further comprising the step of suspending transmission of protocol data units in a close temporal relationship with receipt of the supplemental status report.

3. The method of claim 1 or 2, further comprising the step of requesting the supplemental status report from the recipient (96).

4. The method of claim 3, wherein the step of requesting the supplemental status report is initiated upon receipt of a notification relating to the imminent handover.

5. The method of claim 3 or 4, wherein the step of requesting the supplemental status report includes sending a dedicated link layer request message to the recipient (96).

6. The method of one of claims 3 to 5, wherein the step of requesting the supplemental status report is implemented as a handover setting on the side of the recipient (96).

7. The method of one of claims 3 to 6, wherein at least one of the steps of requesting and receiving the supplemental status report is performed via one or more radio resource management messages.

8. The method of one of claims 1 to 7, wherein the step of determining service data units excludes such service data units that correspond to protocol data units correctly received at the recipient (96).

9. The method of one of claims 1 to 7, wherein the step of determining service data units corresponding to buffered protocol data units comprises reconstructing service data units from the buffered protocol data units.

10. The method of one of claims 1 to 8, wherein the step of determining service data units corresponding to buffered protocol data units comprises selecting service data units from a buffer.

11. The method of one of claims 3 to 10, wherein the step of requesting the supplemental status report comprises generating a request instructing the recipient (96) to unconditionally generate the supplemental status report.

12. The method of one of claims 1 to 11, further comprising the step of buffering the service data units prior to conversion.

13. The method of claim 12, further comprising the steps of:
- creating a data context from all buffered service data units and all determined service data units; and
- transferring the data context to the link layer entity (94) which is to establish the new ARQ connection (100) to the recipient (96).

14. A computer program product comprising program code portions for performing the steps of one of claims 1 to 13 when the computer program product is run on a computing device.

15. The computer program product of claim 14, stored on a computer readable recording medium.

16. A device (80) for configuring link layer entities (92, 94) for a handover, the link layer entities (92, 94) receiving service data units from a higher functional, converting the service data units into protocol data units, and buffering the protocol data units for transmission to a recipient (96) under the regime of an ARQ protocol having status reports, the status reports being indicative of receipt of one or more protocol data units at the recipient (96), the device (80) comprising:
    - a first interface (82) adapted to receive from a recipient (96) of protocol data units an supplemental status report for an existing ARQ connection (98) in context with an imminent handover;
    - a mechanism (84) adapted to determine service data units corresponding to buffered protocol data units taking into account information included in the supplemental status report; and
    - a second interface (86) adapted to transfer the determined service data units to a link layer entity (94) which is to establish a new ARQ connection (100) to the recipient.

17. A system (90) comprising the device (80) of claim 16 in communication with one or more link layer entities (92, 94), and a recipient (96) having a reporting mechanism adapted to generate supplemental status reports.

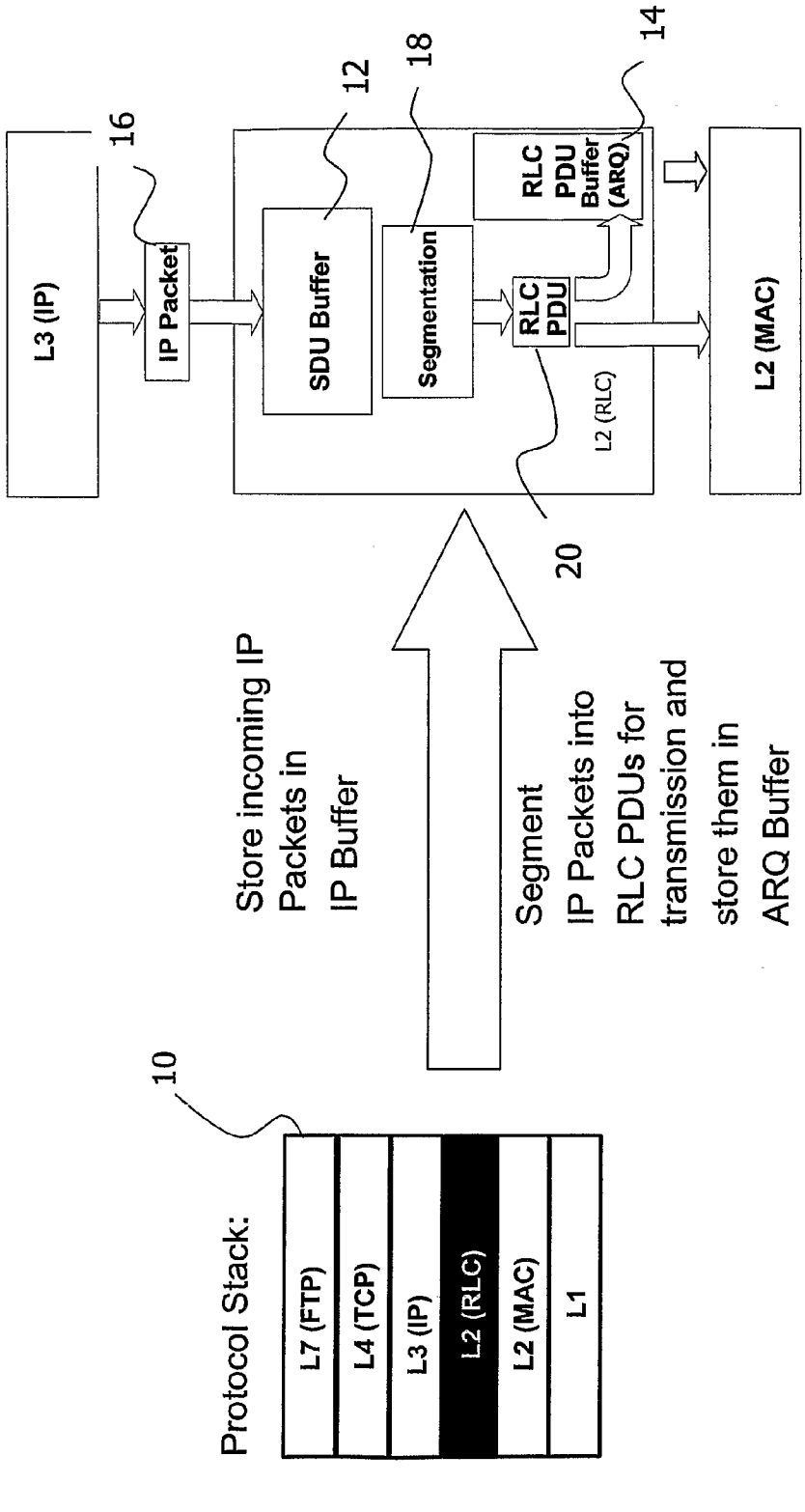
L3 (IP)
16
IP Packet
12
SDU Buffer
18
Segmentation
14
RLC PDU Buffer (ARQ)
RLC PDU
L2 (RLC)
L2 (MAC)
20
Store incoming IP Packets in IP Buffer
Segment IP Packets into RLC PDUs for transmission and store them in ARQ Buffer
10
Protocol Stack:
L7 (FTP)
L4 (TCP)
L3 (IP)
L2 (RLC)
L2 (MAC)
L1

Fig. 1

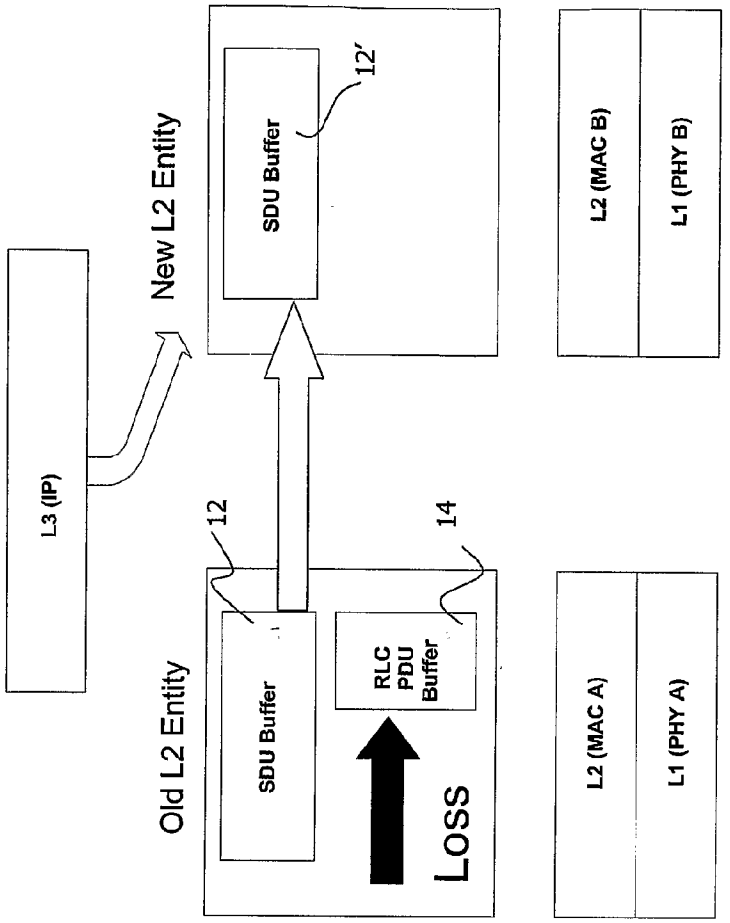
Layer 3 Context Transfer
L3 (IP)
New L2 Entity
SDU Buffer
12'
L2 (MAC B)
L1 (PHY B)
Old L2 Entity
12
SDU Buffer
RLC PDU Buffer
14
Loss
L2 (MAC A)
L1 (PHY A)

Fig. 3

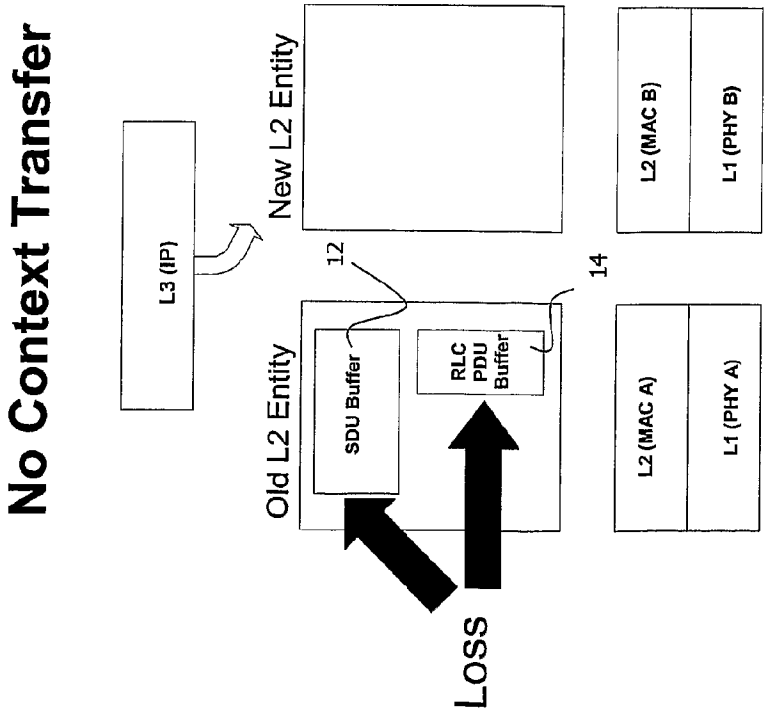
No Context Transfer
L3 (IP)
New L2 Entity
L2 (MAC B)
L1 (PHY B)
Old L2 Entity
12
14
SDU Buffer
RLC PDU Buffer
L2 (MAC A)
L1 (PHY A)
Loss

Fig. 2

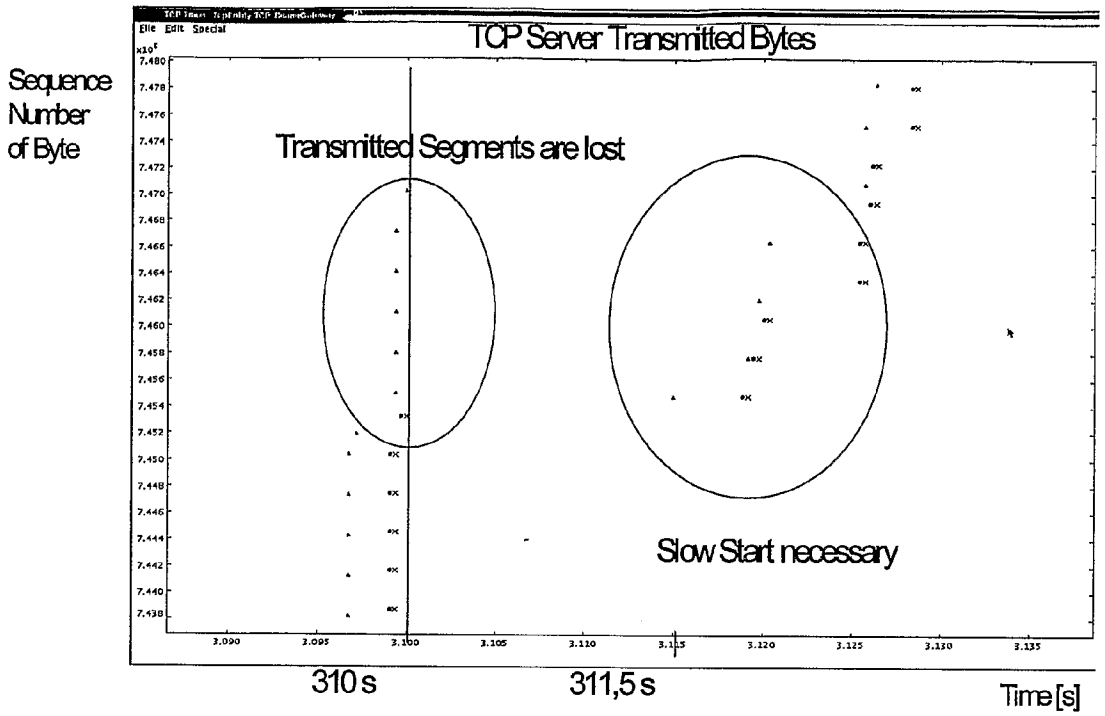
TCP Server Transmitted Bytes
Sequence Number of Byte
Transmitted Segments are lost
Slow Start necessary
310 s
311,5 s
Time [s]

Fig. 4

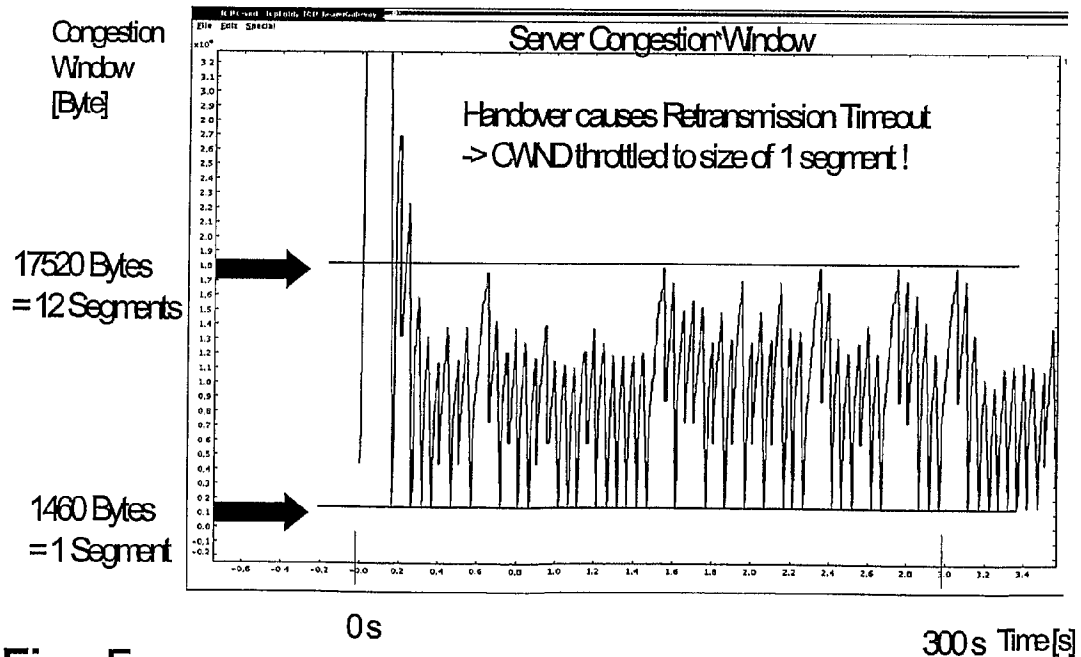
Server Congestion Window
Congestion Window [Byte]
Handover causes Retransmission Timeout
-> CWND throttled to size of 1 segment !
17520 Bytes = 12 Segments
1460 Bytes = 1 Segment
0s
300 s Time [s]

Fig. 5

L2 IP Reconstruction

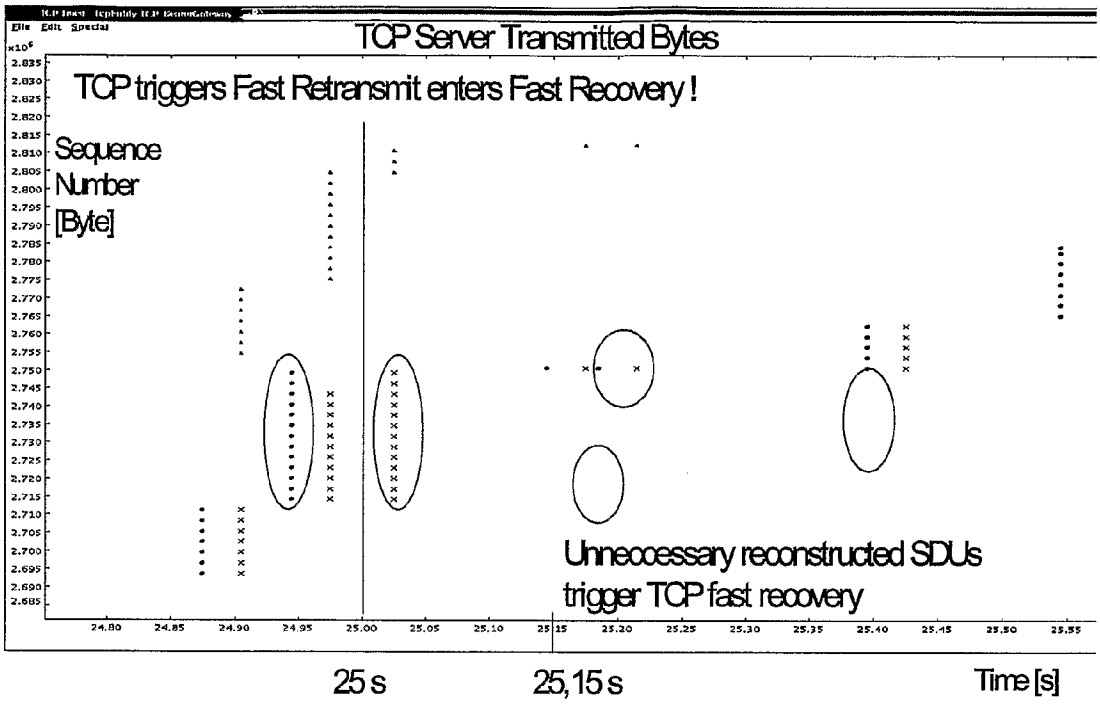

Fig. 6

CWND L2 IP Reconstruction

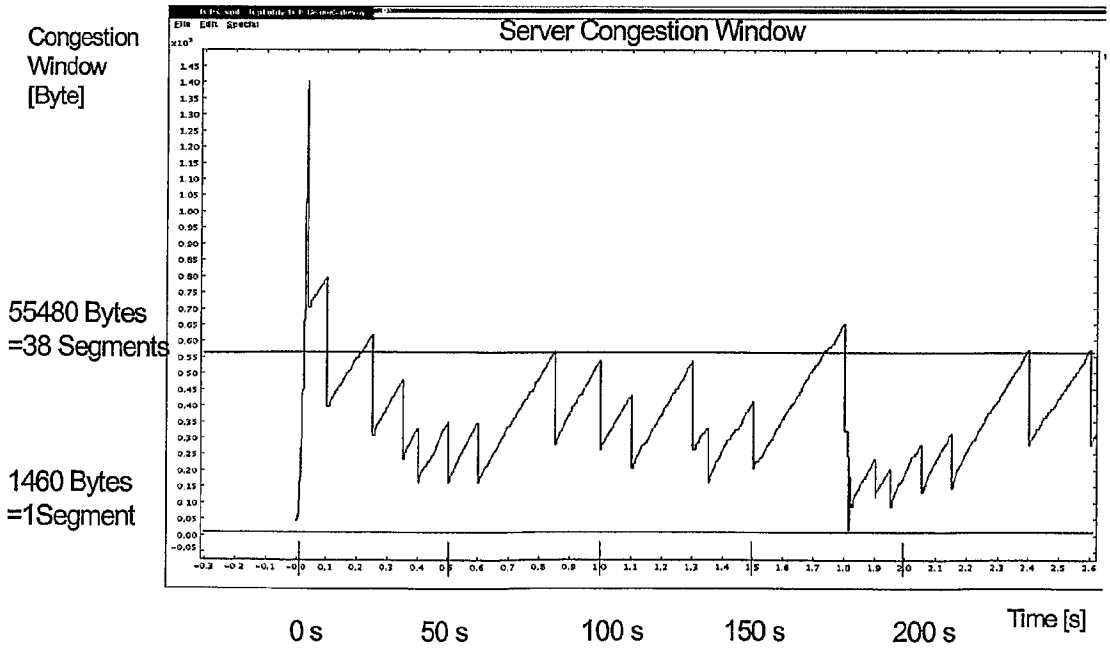

Fig. 7

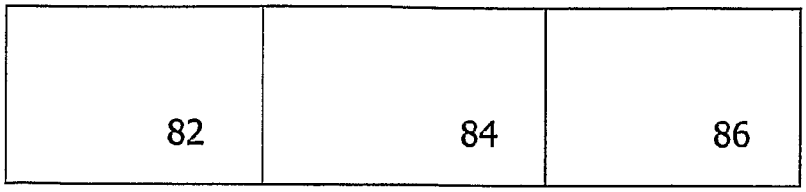
82
84
86
80

Fig. 8

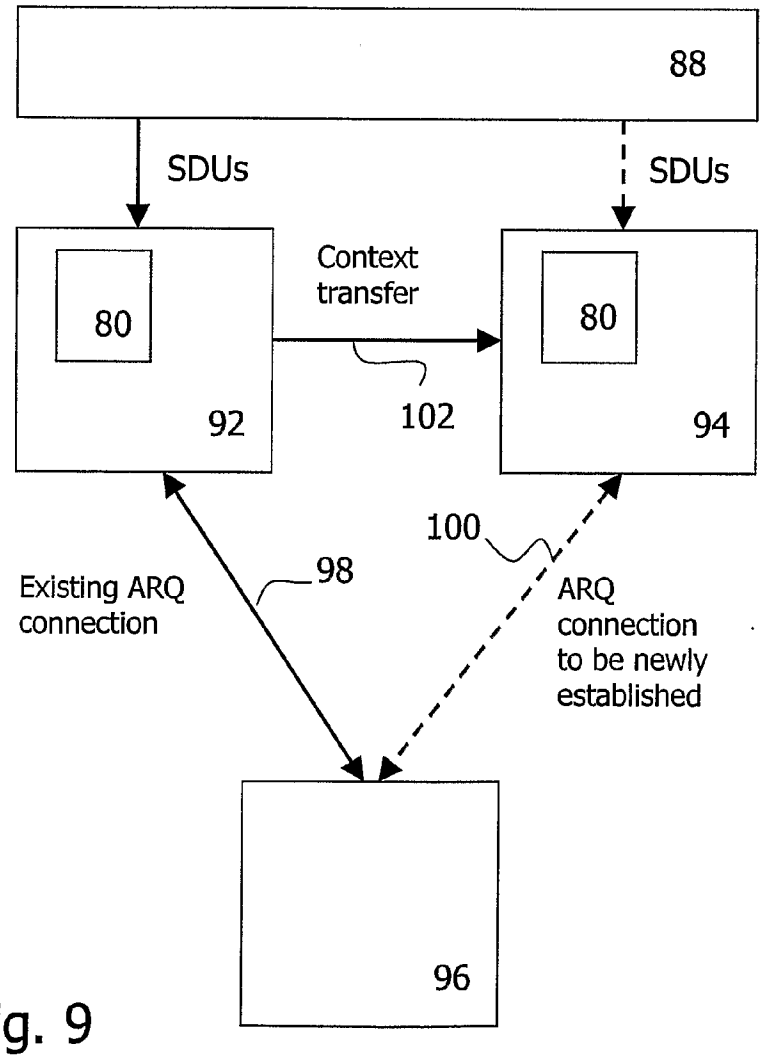
88
SDUs
SDUs
80
92
Context transfer
102
80
94
100
98
Existing ARQ connection
ARQ connection to be newly established
96
90

Fig. 9

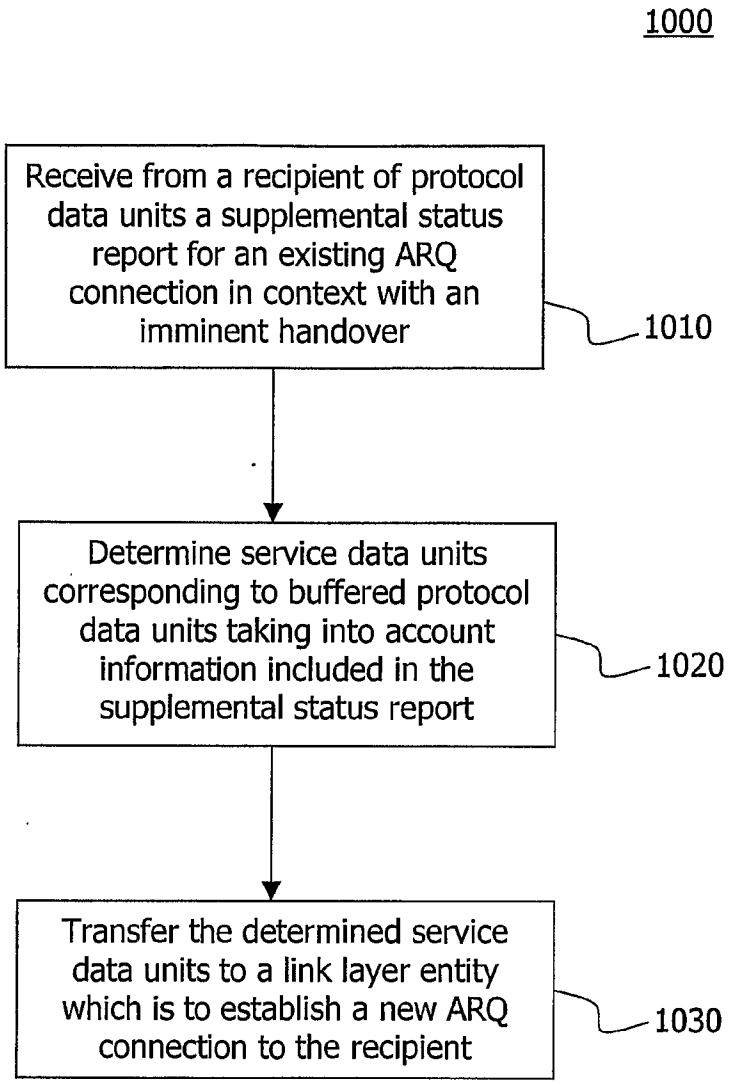
1000
Receive from a recipient of protocol data units a supplemental status report for an existing ARQ connection in context with an imminent handover
1010
Determine service data units corresponding to buffered protocol data units taking into account information included in the supplemental status report
1020
Transfer the determined service data units to a link layer entity which is to establish a new ARQ connection to the recipient
1030

Fig. 10

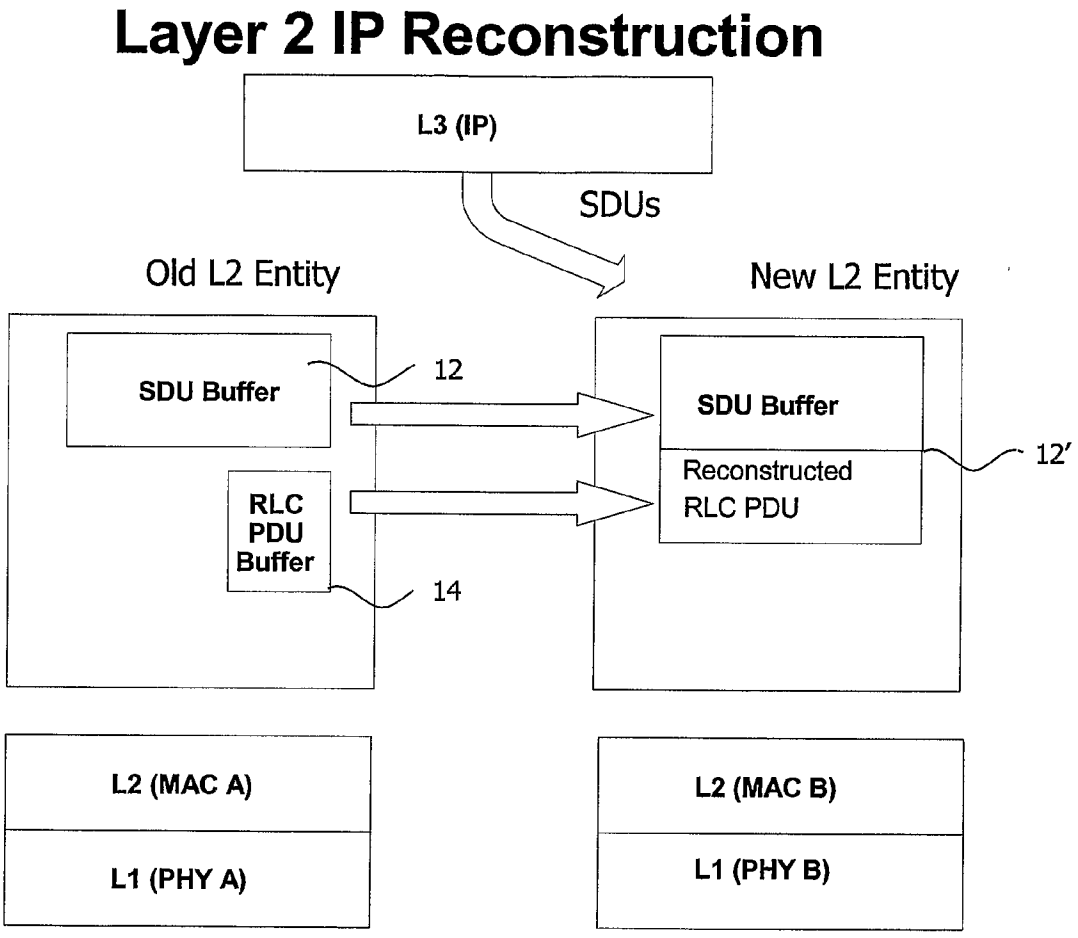
Layer 2 IP Reconstruction
L3 (IP)
SDUs
Old L2 Entity
New L2 Entity
SDU Buffer
12
SDU Buffer
Reconstructed
RLC PDU
12'
RLC
PDU
Buffer
14
L2 (MAC A)
L1 (PHY A)
L2 (MAC B)
L1 (PHY B)

Fig. 11

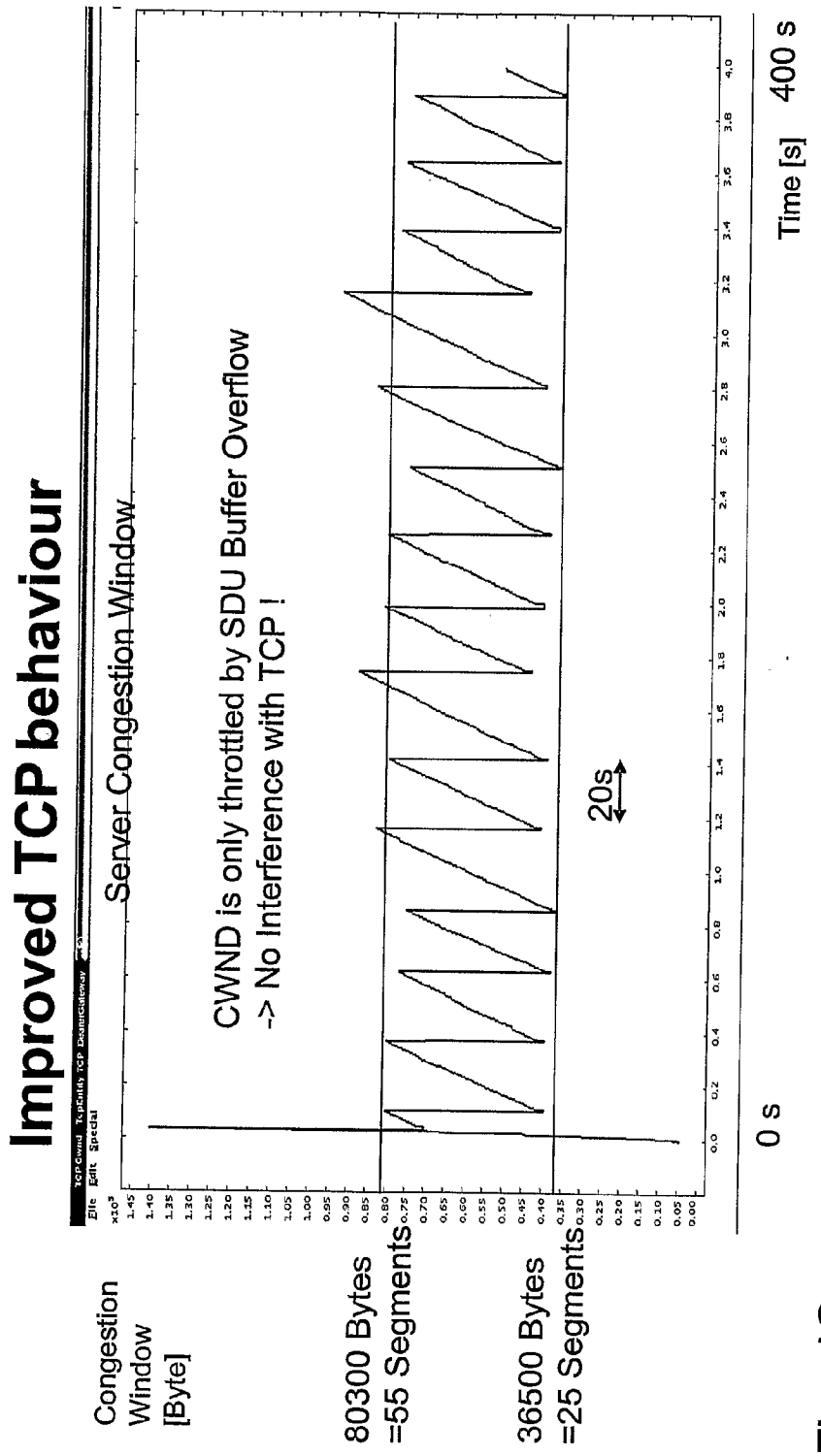
Improved TCP behaviour
Server Congestion Window
CWND is only throttled by SDU Buffer Overflow
-> No Interference with TCP !
Congestion Window [Byte]
80300 Bytes =55 Segments
36500 Bytes =25 Segments
20s
0 s
Time [s] 400 s

Fig. 12

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2006/001695

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04Q7/38 H04L1/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04Q H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 1 056 258 A (ERICSSON TELEFON AB L M [SE]) 29 November 2000 (2000-11-29) abstract page 3, paragraph 17 - page 4, paragraph 25 page 5, paragraph 36 - page 6, paragraph 39 page 7, paragraph 46 - paragraph 49 page 8, paragraph 55	1-17
Y	EP 0 777 396 A (NOKIA MOBILE PHONES LTD [FI]; NOKIA TELECOMMUNICATIONS OY [FI]) 4 June 1997 (1997-06-04) column 2, line 5 - line 10 column 8, line 40 - line 46	1-17

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
3 November 2006	10/11/2006

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	BLANCO CARDONA, P

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2006/001695

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1056258 A	29-11-2000	AU 4758000 A	18-12-2000
		CN 1528077 A	08-09-2004
		WO 0074341 A1	07-12-2000
		JP 2003501888 T	14-01-2003
		US 6816471 B1	09-11-2004
EP 0777396 A	04-06-1997	AU 716622 B2	02-03-2000
		AU 7042396 A	05-06-1997
		CN 1156945 A	13-08-1997
		FI 955812 A	02-06-1997
		JP 9186704 A	15-07-1997
		NO 965020 A	02-06-1997
		US 5940371 A	17-08-1999

Electronic Patent Application Fee Transmittal

Application Number:	12159841
Filing Date:	22-Oct-2008
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Filer:	David Gerard Majdali/Neeti Rajput
Attorney Docket Number:	2101-3515

Filed as Large Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt

EFS ID:	11285215
Application Number:	12159841
International Application Number:	
Confirmation Number:	3203
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Customer Number:	35884
Filer:	David Gerard Majdali/Neeti Rajput
Filer Authorized By:	David Gerard Majdali
Attorney Docket Number:	2101-3515
Receipt Date:	27-OCT-2011
Filing Date:	22-OCT-2008
Time Stamp:	19:51:12
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	6794
Deposit Account	502290
Authorized User	
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	2101-3515_102111_IDSform.pdf	612802 532fb97776a7dfd015a95ed55f098b3c08ca7caa	no	5
Warnings:					
Information:					
2	Foreign Reference	WO2004091130.pdf	6480919 c4dc318abf4d8bc0199797c5ec5397f2e3cbffa6	no	45
Warnings:					
Information:					
3	Foreign Reference	WO2005034418.pdf	4597893 efad8acf98630f402413449a44dd03b175678a79	no	44
Warnings:					
Information:					
4	Foreign Reference	WO2007095966.pdf	3707469 00397a87d1676a279efdc969cbc220abef994dd1	no	29
Warnings:					
Information:					
5	Fee Worksheet (SB06)	fee-info.pdf	30692 6dde54332eedc3deb55bca2a167d2d26bf9cd239	no	2
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/159,841	10/22/2008	Young Dae Lee	2101-3515	3203

35884 7590 10/14/2011

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

EXAMINER	
CHO, UN C	

ART UNIT	PAPER NUMBER
2617	

NOTIFICATION DATE	DELIVERY MODE
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APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
12/159,841	22 October, 2008	LEE, YOUNG DAE	2101-3515

		EXAMINER	
LEE, HONG, DEGERMAN, KANG & WAIMEY 660 S. FIGUEROA STREET Suite 2300 LOS ANGELES, CA 90017		UN C. CHO	
		ART UNIT	PAPER
		2617	10042011

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Commissioner for Patents

The IDS filed on 9/27/2011 and 9/28/2011 have been placed in record and considered by the examiner.

/UN C. CHO/
Primary Examiner, Art Unit 2617

PTO-90C (Rev.04-03)

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	7590089		2009-09-15	Park et al.	

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Receipt date: 09/28/2011	Application Number	12159841 12159841 - GAU: 2617
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

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Examiner Signature	/Un Cho/	Date Considered	10/04/2011

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /U.C./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6934550		2005-08-23	Kearney et al.	

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	1315121	CN		2001-09-26	NOKIA NETWORKS OY		☐
	2	1430359	CN		2003-07-16	HUAWEI TECH CO LTD		☐
	3	1565140	CN		2005-01-12	SIEMENS AG		☐

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /U.C./

Receipt date: 09/27/2011	Application Number	12159841 12159841 - GAU: 2617
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	3rd Generation Partnership Project (3GPP), "Universal Mobile Telecommunications System (UMTS); Radio Resource Control (RRC) protocol specification (3GPP TS 25.331 version 6.8.0 Release 6)," ETSI TS 125 331, December 2005.	☐

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EXAMINER SIGNATURE

Examiner Signature	/Un Cho/	Date Considered	10/04/2011

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20010046864		2001-11-29	Bhatoolaul et al.	
	2	20020028690		2002-03-07	McKenna et al.	
	3	20060292982		2006-12-28	Ye et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
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Receipt date: 09/27/2011	Application Number	12159841 12159841 - GAU: 2617
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

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	1	20030003920		2003-01-02	Sebastian	
	2	20030043741		2003-03-06	Mukai, et al.	
	3	20030054829		2003-03-20	Moisio	
	4	20040002334		2004-01-01	Lee, et al.	
	5	20040125772		2004-07-01	Wu, et al.	

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Receipt date: 07/20/2011	Application Number	12159841	12159841 - GAU: 2617
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2008-10-22	
	First Named Inventor	Young Dae Lee	
	Art Unit	2617	
	Examiner Name	Cho, Un C	
	Attorney Docket Number	2101-3515	

	6	20040147266		2004-07-29	Hwang, et al.	
	7	20040229626		2004-11-18	Yi, et al.	
	8	20050197134		2005-09-08	McKenna, et al.	
	9	20060045047		2006-03-02	Choi, et al.	
	10	20050054368		2005-03-10	Amerga	
	11	20070099619		2007-05-03	Parekh, et al.	
	12	20040097192		2004-05-20	Schiff	
	13	20040127223		2004-07-01	Li, et al.	
	14	20050118947		2005-06-02	Ames, et al.	

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	Examiner Name	Cho, Un C
	Attorney Docket Number	2101-3515

	1	98/49857	WO		1998-11-05	Telefonaktiebolaget LM Ericsson		☐
	2	01/05068	WO		2001-01-18	SAMSUNG ELECTRONICS CO LTD		☐
	3	2004312771	JP		2004-11-04	SAMSUNG ELECTRONICS CO LTD		☐
	4	2005217743	JP		2005-08-11	HITACHI LTD		☐
	5	03/055142	WO		2003-07-03	Qualcomm Inc.		☐
	6	2005/018269	WO		2005-02-24	LG Electronics Inc.		☐
	7	2005/036917	WO		2005-04-21	Qualcomm Inc.		☐
	8	2006/012946	WO		2006-02-09	Matsushita Electric Industrial Co., Ltd.		☐

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Art Unit	2617
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Attorney Docket Number	2101-3515

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	7590089		2009-09-15	Park et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Filing Date	2008-10-22
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	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

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Examiner Signature		Date Considered	

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	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

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☐ See attached certification statement.

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SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Harry Lee/	Date (YYYY-MM-DD)	2011-09-28
Name/Print	Harry Lee	Registration Number	56,814

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Electronic Patent Application Fee Transmittal

Application Number:	12159841
Filing Date:	22-Oct-2008
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Filer:	Harry Sung Lee/Neeti Rajput
Attorney Docket Number:	2101-3515

Filed as Large Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
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Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt

EFS ID:	11069620
Application Number:	12159841
International Application Number:	
Confirmation Number:	3203
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Customer Number:	35884
Filer:	Harry Sung Lee/Neeti Rajput
Filer Authorized By:	Harry Sung Lee
Attorney Docket Number:	2101-3515
Receipt Date:	28-SEP-2011
Filing Date:	22-OCT-2008
Time Stamp:	15:57:10
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	2512
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1	Information Disclosure Statement (IDS) Form (SB08)	2101-3515_092611_IDSform.pdf	612250 f0808a4c00fd24d042c79f0966e6332eac16b60c	no	4
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30631 70a400dd67467012a218ca197860f71b5e410c0c	no	2
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6934550		2005-08-23	Kearney et al.	

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	1	1315121	CN		2001-09-26	NOKIA NETWORKS OY		☐
	2	1430359	CN		2003-07-16	HUAWEI TECH CO LTD		☐
	3	1565140	CN		2005-01-12	SIEMENS AG		☐

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	1	3rd Generation Partnership Project (3GPP), "Universal Mobile Telecommunications System (UMTS); Radio Resource Control (RRC) protocol specification (3GPP TS 25.331 version 6.8.0 Release 6)," ETSI TS 125 331, December 2005.	☐
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Signature	/Sevan Savsa/	Date (YYYY-MM-DD)	2011-09-27
Name/Print	Sevan Savsa	Registration Number	61,718

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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PTO/SB/08a (01-10)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Sevan Savsa/	Date (YYYY-MM-DD)	2011-09-27
Name/Print	Sevan Savsa	Registration Number	61,718

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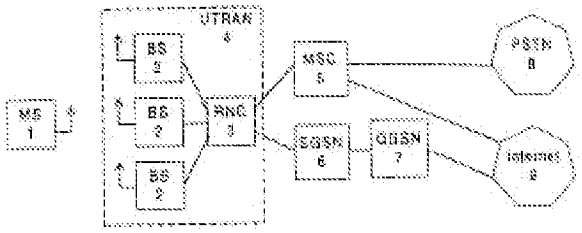
Espacenet

Bibliographic data: CN 1315121 (A)

Paging control method and apparatus

Publication date:	2001-09-26
Inventor(s):	VIALEN JUKKA [FI]; FLYTSTROM TUOMO [FI] +
Applicant(s):	NOKIA NETWORKS OY [FI] +
Classification:	**- international:** ***H04M3/42; H04W68/00;*** (IPC1-7): H04Q7/38 **- European:** H04Q7/38P; H04W68/00
Application number:	CN19988014267 19981006
Priority number(s):	WO1998EP06360 19981006
Also published as:	• CN 1174654 (C) • WO 0021318 (A1) • US 2002019241 (A1) • US 7089023 (B2) • JP 2002527965 (A) • more

Abstract not available for CN 1315121 (A)
Abstract of corresponding document: WO 0021318 (A1)



A paging method and apparatus for a mobile communication network to which at least two non-coordinated core networks are connected is disclosed, wherein a service state of a mobile station is checked, when a request for a paging message to the mobile station has been received from one of the non-coordinated core networks. Then, a multicall paging message is transmitted using an existing signalling link of the mobile station and/or mobile station location information known in a radio access network, when the mobile station is already connected to another one of the non-coordinated core networks. The checking is preferably performed by a radio network controller which is connected to the non-coordinated core networks. Thus, a paging request received from a non-coordinated core network can be supplied to a mobile station, although the paged mobile station is already connected to another non-coordinated core network.

Last updated: 26.04.2011 Worldwide Database 5.7.23.1; 92p

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[51]Int. Cl[7]
H04Q 7/38

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[71]申请人 诺基亚网络有限公司
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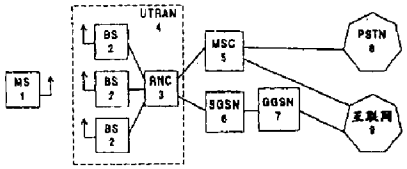
[74]专利代理机构 中国国际贸易促进委员会专利商标事务所
代理人 张 维

权利要求书3页 说明书9页 附图页数3页

[54]发明名称 寻呼控制方法和装置

[57]摘要

披露了一种用于连接了至少两个非一致核心网的移动通信网中的 寻呼控制方法和装置,其中,当从非一致核心网之一已经收到对移动 台的寻呼消息的请求时,则检查移动台的服务状态。然后,当移动台 已经连接到另外一个非一致核心网上时,在一个无线接入网中使用一存在的信号链路和/或已知的移动台位置信息来发射一个群呼寻呼消 息。最好由连接到非一致核心网上的无线网络控制器来执行该检查。因此,从一个非一致核心网收到的寻呼请求可以提供到一个移动台,即使该被寻呼的移动台已经连接到另外一个非一致核心网上。



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权 利 要 求 书

1. 一种用于连接了至少两个非一致核心网的移动通信网中的寻呼控制方法，包括步骤:

a)当从所述非一致核心网之一已经收到对所述移动台的寻呼消息的请求时，检查移动台的服务状态； 和

b)当所述移动台已经连接到另外一个所述非一致核心网上时，在一个无线接入网中使用一存在的信号链路和/或已知的移动台位置信息发射一个群呼寻呼消息。

2. 一种如权利要求 1所述的寻呼控制方法，其中，由所述移动通信网的无线网络控制器通过确定所述移动台是否已经具有一个连接来执行所述检查步骤，其中，当移动台没有连接时，执行通过使用寻呼信道的一个正常寻呼操作。

3. 一种如权利要求 1或 2所述的寻呼控制方法，其中，在根据所述移动台的服务状态所选择的信道上发射所述群呼寻呼消息。

4. 一种如权利要求 3所述的寻呼控制方法，其中，当所述移动台是在专用信道工作状态中时，则在专用信道上发射所述群呼寻呼消息。

5. 一种如权利要求 4所述的寻呼控制方法，其中，所述群呼寻呼消息包含一信息，该信息定义被请求的载体、寻呼模式以及核心网标识。

6. 一种如权利要求 3所述的寻呼控制方法，其中，当所述移动台是在 RACH/FACH状态中时，则在 FACH信道上发射所述群呼寻呼消息。

7. 一种如权利要求 6所述的寻呼控制方法，其中，所述群呼寻呼消息包括一信息，该信息定义被请求的载体、核心网标识以及寻呼模式。

8. 一种如权利要求 7所述的寻呼控制方法，其中，所述群呼寻呼消息包括一信息，该信息定义移动台不得不启动来用于发信号的专用信道。

9. 一种如权利要求 3所述的寻呼控制方法，其中，当移动台是在 RACH/PCH状态中时，则在 PCH信道上发射所述群呼寻呼消息。

10. 一种如权利要求 9所述的寻呼控制方法，其中，所述群呼寻呼消息包括一信息，该信息定义被请求的载体、核心网标识以及无线网络临时身份。

11. 一种如权利要求 5、 7或 10所述的寻呼控制方法，其中，所述移动台检查创建被请求的载体的可能性并且利用一个包括关于是否可以创建该被请求的载体的信息和一适当的协议信息在内的群呼寻呼响应消息来响应。

12. 一种用于连接了至少两个非一致核心网（5，6）的移动通信网中的寻呼控制装置，包括:

a）当从一个所述非一致核心网已经收到对所述移动台（1）的寻呼消息的请求时，用于检查移动台（1）的服务状态的装置（3）; 和

b）当所述移动台已经连接到另外一个所述非一致核心网上时，在一个无线接入网中使用一存在的信号链路和/或已知的移动台位置信息用于发射一个群呼寻呼消息的装置（3）。

13.一种如权利要求 12所述的寻呼控制装置，其中，所述寻呼控制装置包括所述移动通信系统的无线网络控制器（3）。

14. 一种如权利要求 12或 13所述的寻呼控制装置，其中，所述非一致核心网包括在移动交换中心（5）和服务 GPRS支持节点（6）之间没有 Gs接口的一个 GSMGPRS核心网。

15. 一种如权利要求 12到 14的任一个所述的寻呼控制装置，其中，所述移动通信网包括 GSM网。

16. 一种如权利要求 12到 15的任一个所述的寻呼控制装置，其中，所述非一致核心网包括一个 GSM网，一个 GPRS网，一个基于 GSM的 UNTS，一个基于 GPRS的 UMTS或者任意其他电路和/或分组交换核心网络节点。

17. 一种如权利要求 16所述的寻呼控制装置，其中，所述非一致

核心网之一包括一个移动交换中心（5）并且其中所述非一致核心网的所述另外一个包括一个服务 GPRS支持节点（6），或者，反之亦然。

18.一种如权利要求 17所述的寻呼控制装置，其中，所述移动交换中心是一个基于 GSM的 UMTS移动交换中心并且其中所述服务 GPRS支持节点是一个基于 GPRS的 UMTS SGSN。

说　明　书

寻呼控制方法和装置

本发明涉及一种用于诸如 UTRAN（ UMTS无线接入网)系统之类的移动通信网络的寻呼控制方法和装置，诸如 GPRS (通用分组无线业务 General Packet Radio Service)的 SGSN (服务 GPRS支持节点 Serving GPRS Support Node)和 GSM (全球移动通信系统 Global System for Mobile Communications)的 MSC (移动交换中心 Mobile switching Center)或者他们在 UMTS (通用移动电信系统 Universal Mobile Telecommunications System)中的等价物之类的至少两个非一致（ non-coordinated）的核心网节点连接到其上。

寻呼系统是一种单向的 (有线线路到移动)数字传输系统。消息寻呼系统将随着电子邮件服务的发展而发展，其中，消息通信几乎不打断被呼叫的人。

移动通信系统的移动台（ MS)具有三个状态，即空闲，等待，和工作状态。只有在移动台在工作状态时才可以在移动台和移动通信网之间发射数据。在工作状态中，对移动通信网来说移动台的网孔位置是已知的。

查看 MS－UTRAN级，一个 MS基本上仅仅具有从更高层观察来看的两个服务状态 (在下面归为 UTRAN业务状态)，即空闲和连接的 RRC。连接的 RRC状态具有进一步的子状态，其对更高层和/或核心网实体来说是不可见的。这些子状态是基于当前的信道分配情形的并且被称作专用信道（ DCH)工作状态和公共信道状态。根据 MS的数据动作级来在这两状态之间 (以及在这两状态的子状态内部，在下面解释)移动 MS。

根据专用信道当前配置的无线载体的类型把 DCH工作状态进一步分成两个子状态，并被称作用户数据工作状态（ User Data Active state）和控制状态（ Control Only state）。

根据在 UTRAN中知道一个 MS位置的那个精度来把公共信道状态进一步分成两个子状态，其同时直接地与可用于与该 MS通信的下行链路公共信道的类型相关。这些子状态被称作 RACH/FACH状态和 RACH/PCH状态。

根据在此状态内部了解该 MS位置的精度把 RACH/PCH状态进一步分成两个子状态。这些状态被称作单个网孔 PCH状态和 URA (UTRAN登记区域)状态。

在空闲状态中，MS不具有激活的逻辑网络环境或者任何已分配的相应的地址。在这个状态中，MS只可接收可由任何 MS接收的广播消息。由于移动通信网不知道 MS的位置，所以从外部网络发送消息到该 MS是不可能的。

如果多个非一致核心网连接到移动通信网的一个无线接入网 (例如 UTRAN)上并且核心网之一与一个 MS进行一工作的连接，而一 "非工作的 "核心网启动对该 MS的寻呼，则需要一个特定的程序来把寻呼消息传送给该移动台，因为 MS在工作状态期间通常不收听寻呼信道。

在一 GSM - GPRS系统中，如果缺少移动交换中心 (MSC)和 SGSN (服务 GPRS支持节点)之间的一个 Gs接口的话，只有类别 A的移动台 (能够同时收听 GSM和 GPRS控制信道)可以被寻呼。如果 Gs接口存在并且该 MS被附加到 GPRS，则利用 GPRS频道可以从电路交换方 (GSM)寻呼到它。如果一个 GPRS数据信道是有效的，则可以通过那个数据信道路由电路交换寻呼。

然而，针对如果一个电路交换呼叫是有效的并且一个寻呼请求从非一致分组交换网络到达时执行的寻呼控制方法，还没有解决方案被建议。

而且，对于 UMTS系统，在此即使两个独立的核心网实体连接到同一 UTRAN上时在 UTRAN中也仅有一组控制信道是可用的，所以需要一个新方法用于寻呼控制。

因此，本发明的目的是提供一种寻呼控制方法和装置，其允许从

一个非一致网络到一有效的移动台的寻呼。

通过一种用于连接了至少两个非一致核心网的移动通信网中的寻呼控制方法来达到此目的，该方法包括步骤:

当从一个所述非一致核心网已经收到对所述移动台的寻呼消息的一个请求时，检查移动台的服务状态；并且

当所述移动台已经连接到另外一个所述非一致核心网上时，在一个无线接入网中使用一存在的信号链路和/或已知的移动台位置信息发射一个群呼寻呼消息。

另外，通过一种用于连接了至少两个非一致核心网的移动通信网中的寻呼控制装置实现上面的目的，包括:

当从一个所述非一致核心网已经收到对移动台的寻呼消息的一个请求时，检查所述移动台的服务状态的装置； 以及

当所述移动台已经连接到另外一个所述非一致核心网上时，在一个无线接入网中使用一存在的信号链路和/或已知的移动台位置信息发射一个群呼寻呼消息的装置。

因此，通过执行上面的检查步骤，一存在的 RRC连接可以被确定并用于把一个群呼寻呼消息发射到该移动台。从而，不管移动台的工作状态就可把该寻呼请求发射到移动台。通常，应该理解，该群呼寻呼消息不同于空闲方式中用于寻呼移动台的一个正常寻呼消息并且不同于在等待状态（即当前 UMTS术语中的RACH/PCH状态）中用于查找移动台的一个分组寻呼消息。最好由所述移动通信网的无线网络控制器通过确定所述移动台是否已经具有一 RRC连接来执行该检查步骤，其中，当移动台没有 RRC连接时，执行使用一个 PCH信道的正常寻呼操作。因此，由于 RNC只必须检查对被寻呼的移动台的一 RRC连接的条件（ provision），所以可以以一种容易的方式执行该检查步骤。

该检查步骤自然也要求 RNC可以与由两个独立的核心网实体用于寻呼同一 MS的可能不同的 MS身份关联。这里有如何可以实现这一点的至少两个方法。在核心网 - RNC接口中一个通用标识（ id)总是

被加到寻呼请求中 (例如 IMSI)或者 MS告诉 RNC所有可能的寻呼身份。

群呼寻呼消息最好可以在根据该移动台的 UTRAN服务状态所选择的信道上发射。如果移动台是在 DCH工作状态中，则群呼寻呼消息可以在一个专用信道上发射并且可以包括定义被请求的载体、寻呼方式和核心网标识的一信息。

如果移动台是在 RACH/FACH状态中，则该群呼寻呼消息可以在一 FACH信道上发射。如果该移动台是在 RACH/PCH状态中，则该群呼寻呼消息可以在一 PCH信道上发射。

在移动台的上面的 RACH/FACH状态的情况下，该群呼寻呼消息最好可以包括一信息，该信息定义被请求的载体、核心网标识和寻呼方式。应该注意，因为 MS的带内识别包括在携带该群呼寻呼消息的较低层的消息的报头中，所以在此状态中不需要 MS身份，即使是在一个通用下行链路信道 (FACH)上发送消息时。

在移动台的上面的 RACH/PCH状态的情况下，该群呼寻呼消息最好可以包括一信息，该信息定义被请求的载体、核心网标识、寻呼模式和无线网络临时身份(RNTI).

移动台最好检查创建被请求的载体的可能性并且利用包括关于是否可以创建该被请求的载体的一信息和一适当的协议信息在内的一个群呼寻呼响应消息进行响应。

因此，在无线接入网和移动台之间可以交换用于执行该被请求的寻呼所必需的信息，以使无线接入网的无线网络控制器可以发射一个寻呼响应到请求的非一致核心网实体。

在下面，参考附图根据一优选实施例将更详细地叙述本发明，附图中:

图 1表示连接到一个电路交换网络和一个分组交换网络上的移动通信网的原理方框图，

图 2表示如果被寻呼移动台已经具有与一个核心网 CN1的至少一个信号连接，则其表明根据本发明的优选实施例的一个寻呼信息流的

原理图，

图 3表示如果被寻呼移动台已经具有与一个核心网 2的至少一个信号连接，则其表明根据本发明的优选实施例的一个寻呼信息流的原理图，

图 4表示根据本发明的优选实施例的一种寻呼控制方法的流程图。

在下面，当无线接入网（UTRAN）连接到基于 GPRS的核心网和基于 GSM的核心网上时，在诸如 UNTS系统之类的移动通信系统的基础上将叙述根据本发明的寻呼控制方法的一种优选实施例。

根据图 1，移动台（MS）1被无线连接到至少一个基站（BS）2上，该至少一个基站连接到 UTRAN的无线网络控制器（RNC）3上。在基于 CDMA的系统中，由于宏观变化 MS 1可以同时地连接到好几个 BS 2上。

RNC 3连接到 UMTS或者 GSM核心网的移动交换中心（MSC），其提供对诸如公共交换电话网络（PSTN）8之类的电路交换网络的接入或者对诸如互联网 9之类的分组交换网络的接入。

另外，RNC 3连接到 UMTS或者 GPRS核心网的 SGSN 6. SGSN 6连接到提供对互联网 9的接入的网关 GPRS支持节点（GGSN）.

因此，RNC 3连接到两个非一致核心网，其二者都可以与 MS 1建立一有效的连接。

在下面参考图 2和 3描述了两种情况，其中，上面的核心网之一具有与 MS 1的有效的连接而另外一个核心网启动对 MS 1的寻呼。

图 2表示如果被寻呼移动台已经具有与一个核心网 CN1的至少一个信号连接，则其表明根据本发明的优选实施例的一个寻呼信息流的原理图，其中核心网 CN1例如可以是 GPRS核心网或者基于 GPRS的分组交换 UMTS核心网或者任意其他分组交换 UMTS核心网或者 GSM核心网或者基于 GSM的电路交换 UMTS核心网或者任意其他电路交换 UMTS核心网。

按照图 2，通过 UTRAN建立介于 MS 1和 CN1实体（例如

SGSN 6)之间的一个信号连接。在 UTRAN中的 RNC 3接收来自第二核心网 CN2的 CN2实体 (例如 MSC 5)的一个寻呼请求 101。RNC 3在收到来自 CN2实体的寻呼请求 101后检测被寻呼的 MS 1已经具有一 RRC连接 (在这种情况下应归于与 CN1的信号连接)。因此，RNC 3通过使用该存在的 RRC连接把一个群呼寻呼消息 102发射到 MS 1。

MS 1收到该群呼寻呼消息后，利用包括例如关于创建被 RNC 3请求的载体的可能性的信息在内的一个群呼寻呼响应进行响应。因此，如果 MS 1没有容量或者能力创建被请求的载体的话，则 MS 1可以拒绝该寻呼请求。

RNC 3在收到来自 MS 1的该群呼寻呼响应 103后，把一个相应的寻呼响应 104发射到请求的 CN2 (例如 MSC 5)。

因此，虽然对核心网实体来说 MS 1的状态是不可见的，但是来自非一致核心网的一个寻呼请求可以被发射到 MS 1。

图 3表示如果被寻呼移动台已经具有与一个核心网 CN 2的至少一个信号连接，则其表明根据本发明的优选实施例的一个寻呼信息流的原理图CN2其中核心网 CN1例如可以是 GPRS核心网或者基于GPRS的分组交换 UMTS核心网或者任意其他分组交换 UMTS核心网或者 GSM核心网或者基于 GSM的电路交换 UMTS核心网或者任意其他电路交换 UMTS核心网。

按照图 3, 通过 UTRAN建立介于 MS 1和 CN2实体 (例如 MSC 5)之间的一个信号连接。在 UTRAN中的 RNC 3接收来自 CN1实体 (例如 SGSN 6)的寻呼请求 105. RNC 3在收到来自 CN1的寻呼请求后检测被寻呼的 MS 1已经具有一 RRC连接 (在这种情况下应归于与 CN2的信号连接)。因此，RNC 3通过使用该存在的 RRC连接把一个群呼寻呼消息 106发射到 MS 1。

MS 1在收到该群呼寻呼消息后，利用包括例如关于创建被 RNC 3请求的载体的可能性的信息在内的一个群呼寻呼响应 107进行响应。因此，如果 MS 1没有容量或者能力创建被请求的载体的话，则 MS 1

可以拒绝该寻呼请求。

RNC 3在在收到来自 MS 1的该群呼寻呼响应 107后，把一个相应的寻呼响应 108发射到请求的 CN1 (例如 SGSN 6)。

在下面，参考图 4更详细地描述由 RNC 3执行的寻呼控制。

按照图 4，在步骤 S101，RNC 3接收来自 MSC 5或者 SGSN 6的一个寻呼请求。随后，如果被寻呼的 MS 1已经具有一 RRC连接，则在步骤 S102，RNC 3进行检查。如果 MS 1不具有一 RRC连接，则在步骤 S103通过寻呼信道 PCH对一个通常的寻呼消息的正常寻呼处理将被执行。

如果对于被寻呼的 MS 1存在一 RRC连接，则在步骤 S104 RNC 3确定该被寻呼的 MS 1的服务状态，以便确定将发射群呼寻呼消息的信道以及包含在该群呼寻呼消息中的信息。

如果已确定的服务状态表示一 DCH工作状态，则 RNC3利用该存在的信号链路在专用信道上发射一个群呼寻呼消息 (步骤 SlO5)。在这种情况下，群呼寻呼消息包括定义被请求的载体、请求的核心网的标识以及寻呼模式的参数。

应该注意，该信号链路是介于 MS 1和 RNC 3之间的层 2连接并提供一公认的模式服务来传送更高层的信息，例如群呼寻呼消息或者群呼寻呼响应消息。信号链路可用于 DCH状态和 RACH/FACH状态中但是不可用于 RACH/PCH状态中。

如果已确定的服务状态表示一随机访问信道 (RACH)和正向链路访问信道 (FACH)状态，则 RNC 3利用该存在的信号无线载体在快速相关的信道 FACH上发射一群呼寻呼消息 (步骤 S106)。在这种情况下，群呼寻呼消息包括表示被请求的载体、请求的核心网的标识以及寻呼模式的参数。另外，该群呼寻呼消息可以包括定义MS 1必须启动来用于发信号的一专用信道。在这种情况下，MS 1切换到表示出的DCH状态并离开 RACH/FACH状态。

如果该服务状态表示一随机访问信道 (RACH)和寻呼信道 (PCH)状态，则 RNC 3利用 RNC 3已知的该 MS 1的位置信息在寻

呼信道 PCH上一群呼寻呼消息 (步骤 S107)。特别是，这意味着可以通过属于 MS1当前所在的一 UTRAN登记区域的一个网孔或者多个网孔发送该群呼寻呼消息。在这种情况下，群呼寻呼消息包括表示被请求的载体、请求的核心网的标识、寻呼模式以及无线网络临时身份 (RNTI)的参数，其由 RNC分配并且其存在于一 RRC连接持续期间并且例如由于服务一 RNC再布置可以在该连接期间改变。RNTI更换使用于 "正常 "寻呼消息中的 MS标识符。

在上面提到的所有情况 (DCH有效的， RACH/FACH， RACH/PCH)中，由于存在的 RRC连接已经对 UTRAN提供了所需要的位置信息，所以在寻呼请求消息中由核心网提供给 UTRAN的位置信息 (例如网孔列表)根本不需要 UTRAN使用。在大多数情况下，在 RRC连接期间 UTRAN知道的 MS位置比在核心网等级中知道的位置更准确。

当 MS 1接收群呼寻呼消息时，它检测它是否可以可以在群呼寻呼消息中表示的被请求的载体。如果 MS 1没有容量来创建该被请求的载体，则它拒绝该寻呼请求。否则，它接纳该寻呼请求。随后，MS 1利用一包括有关是否可以创建被请求的载体的信息和适当的 MM (移动性管理)协议信息在内的一群呼寻呼响应消息来响应从 RNC 3收到的群呼寻呼消息。另外，该群呼寻呼响应消息可以包括仅仅与 UTRAN相关的信息，例如，UTRAN特定的 MS分类标记信息。

在步骤 S108 RNC 3接收群呼寻呼响应消息并且把一个相应的寻呼响应消息发射到请求的核心网 (步骤 S109)。

总的来说，披露了一种用于连接了至少两个非一致核心网的移动通信网中的寻呼控制方法和装置，其中，当从非一致核心网之一已经收到对移动台的寻呼消息的请求时，则在无线接入网中检查移动台的服务状态。然后，当该移动台已经连接到另外一个非一致核心网上时，使用该无线接入网中的一存在的信号链路和/或已知的移动台位置信息来发射该群呼寻呼消息的装置。最好由连接到非一致核心网上的无线网络控制器来执行该检查。因此，从一个非一致核心网收到的寻呼请

求可以提供到一个移动台，即使该被寻呼的移动台已经连接到另外一个非一致核心网上。

应该理解，上面优选实施例和附图的描述仅仅是为了举例说明本发明。因此，按照本发明的寻呼控制方法还可以使用于另外一个移动通信系统中。而且，在附加的权利要求的范围内，本发明的优选实施例可以改变。

说 明 书 附 图

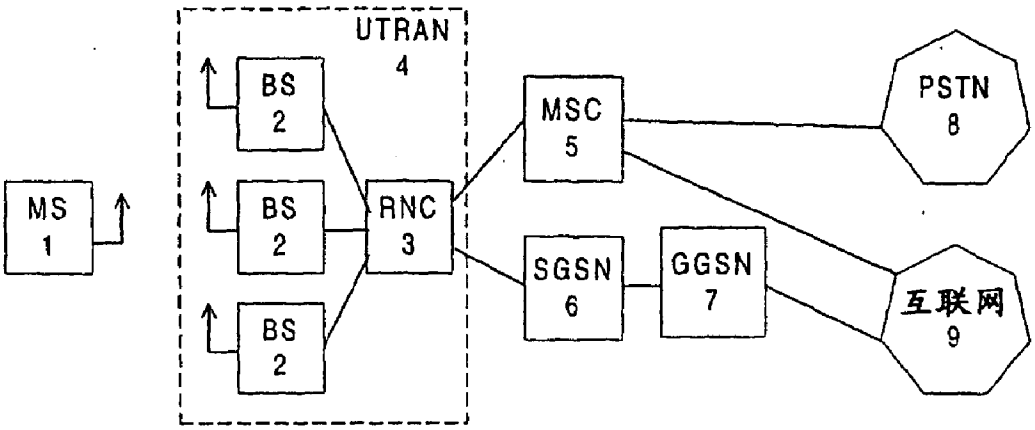

图1

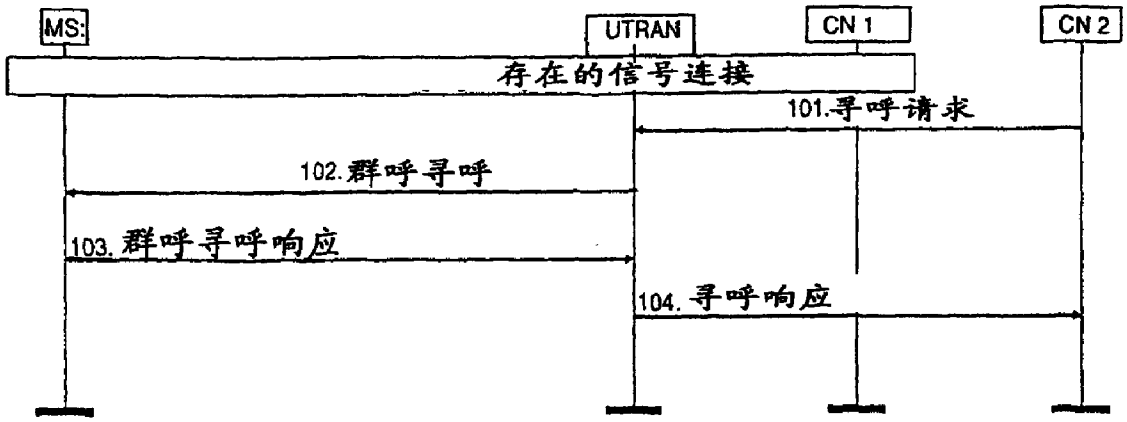
MS:
UTRAN
CN 1
CN 2
存在的信号连接
101.寻呼请求
102.群呼寻呼
103.群呼寻呼响应
104.寻呼响应

图 2

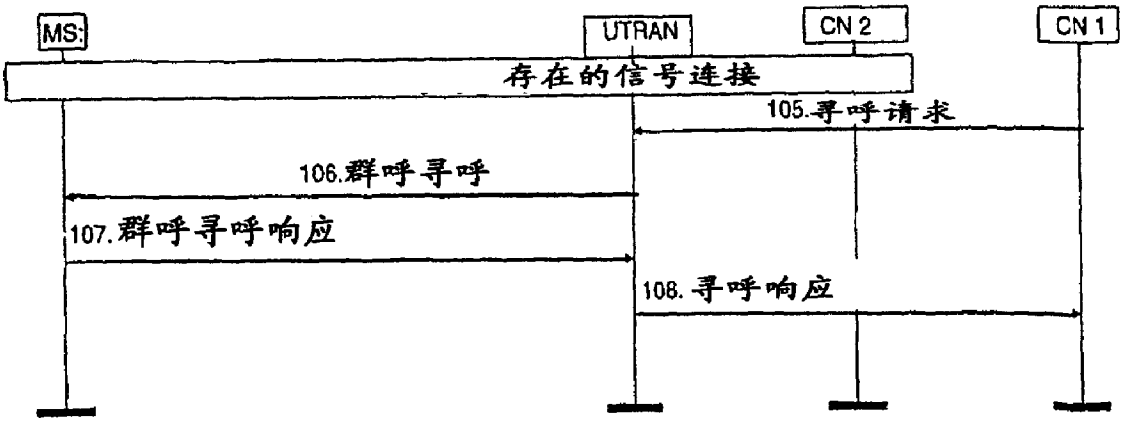
MS:
UTRAN
CN 2
CN 1
存在的信号连接
105.寻呼请求
106.群呼寻呼
107.群呼寻呼响应
108.寻呼响应

图 3

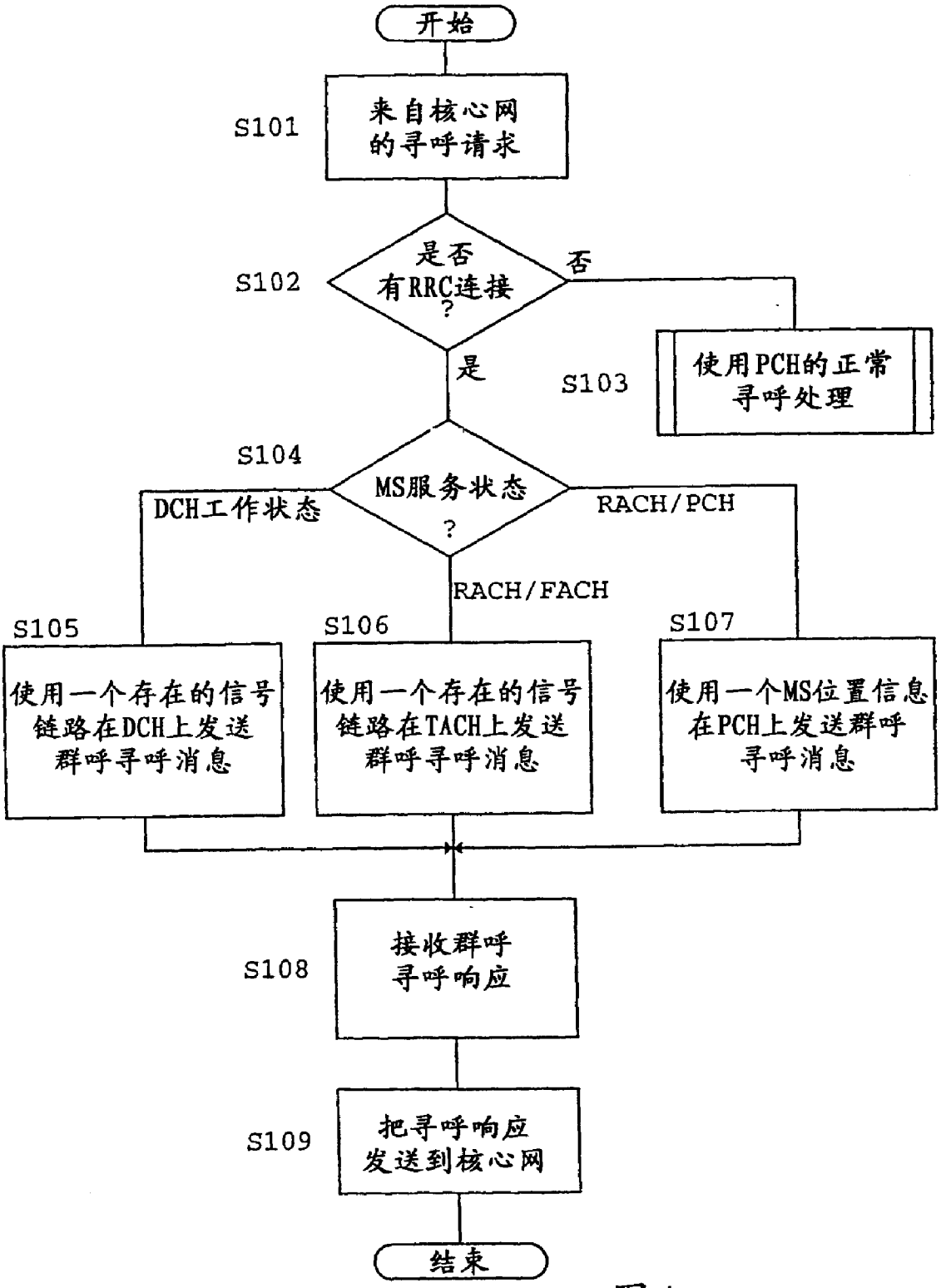
开始
S101
来自核心网
的寻呼请求
S102
是否
有RRC连接
?
否
是
S103
使用PCH的正常
寻呼处理
S104
MS服务状态
?
DCH工作状态
RACH/PCH
RACH/FACH
S105
使用一个存在的信号
链路在DCH上发送
群呼寻呼消息
S106
使用一个存在的信号
链路在TACH上发送
群呼寻呼消息
S107
使用一个MS位置信息
在PCH上发送群呼
寻呼消息
S108
接收群呼
寻呼响应
S109
把寻呼响应
发送到核心网
结束

图4

Espacenet

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Method of realizing calling time selection under idle mode by mobile telephone user's terminal

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Applicant(s):	HUAWEI TECH CO LTD [CN] +
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Priority number (s):	CN20011045112 20011230
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Abstract of CN 1430359 (A)

A calling time selection method under idle mode of the User's mobile terminal should obey a formula of Po=(IMSI div K) mod (DRX cycle length)+n*(DRX cyclo length) to reduce calcualtion and to simplify operation steps as starting from parametric inputting and to be followed with IMSI, not to continue receiving cycle length, having beared on number K of auxiliary public control physical channel of calling channel and maximum value of MAXSFN of frame number in subarea system, two cycle operation as digit as 2,3,..., m and n=0,1,2...via IMSI, recording PO value less than MAXSFN untill PO value bigger than or equal to MAXSFN to stop. The method can also be used in the time-division multiplexing mode.

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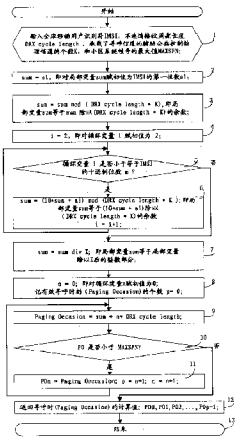
权利要求书 2 页 说明书 11 页 附图 1 页

[54] 发明名称 移动用户终端在空闲模式下选择寻呼时刻的实现方法

[57] 摘要

本发明涉及一种选择寻呼时刻的实现方法，为移动用户终端在空闲模式下寻呼时刻的选择公式：PO = (IMSI div K) mod (DRX cycle length) + n * (DRX cycle length)，设计了一种计算量小、算法实现简单和通用性好的操作步骤，可适应任意位数(m)全球移动用户识别符(IMSI)的情况，应用于频分复用宽带码分多址移动通信系统中，其基本方法也适于时分复用模式。 其处理步骤从输入参量开始，包括IMSI、不连续接收周期长度(DRX cyclelength)、承载了寻呼信道的辅助公共控制物理信道的个数 K，和小区系统帧号的最大值 MAXSFN，经 IMSI 的位数由 2，3，…，m 和 n = 0，1，2，…的两个循环操作，记录小于 MAXSFN 的 PO 值，直至 PO 值大于等于 MAXSFN 时结束。



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1. 一种移动用户终端在空闲模式下选择寻呼时刻的实现方法，应用于频分复用宽带码分多址移动通信系统中，其特征在于包括以下处理步骤：

A. 输入参量，包括m位的全球移动用户识别符（IMSI）、不连续接收周期长度、承载了寻呼信道（PCH）的辅助公共控制物理信道（SCCPCH）的个数K，和小区系统帧号（SFN）的最大值（MAXSFN）；

B. 设置一个局部变量sum，并将局部变量sum 的初值赋为全球移动用户识别符（IMSI）的第1位数值；

C. 让新局部变量sum 等于：原局部变量sum （整数）除以K倍的不连续接收周期长度（整数）的余数；

D. 将第1循环变量 i 的初值赋为2；

E. 判断第1循环变量i的值是否小于或等于全球移动用户识别符（IMSI）的位数m，若是则执行步骤F，若不是则执行步骤G；

F. 让新局部变量sum 等于：10倍的原局部变量sum与全球移动用户识别符中第i位的数值的和（整数）再除以K倍的不连续接收周期长度（整数）的余数，并让第1循环变量i自动加1，并返回步骤E继续执行；

G. 让新局部变量sum 等于：原局部变量sum（整数）除以K（整数）后的整数部分；

H. 设置第2循环变量n，并将n的初值赋为0，用p表示已经选择好的寻呼时刻（PO）的个数，并置p为0；

I. 让寻呼时刻（PO）等于局部变量sum的现值与n倍的不连续接收周期长度的和；

J. 判断寻呼时刻（PO）是否小于小区系统帧号的最大值（MAXSFN），如果寻呼时刻（PO）小于该最大值（MAXSFN），则执行步骤K，如果寻呼时刻（PO）大于或等于该最大值（MAXSFN），则执行步骤L；

K. 将当前n值下的寻呼时刻（PO）记为PO_n，让p等于 n+1 和让 n 自动加1后跳回步骤I执行；

L. 提交经上述步骤处理获得的全部与各 n 值对应的寻呼时刻（PO）值，$PO_0, PO_1, PO_2, \cdots, PO_{p-1}$。

2. 根据权利要求 1 所述的一种移动用户终端在空闲模式下选择寻呼时刻的实现方法，其特征在于：所述步骤 A 中的不连续接收周期长度是 8、16、32、64、128、256、512 中的一个数，小区系统帧号（SFN）的最大值是 4095。

3. 根据权利要求 1 所述的一种移动用户终端在空闲模式下选择寻呼时刻的实现方法，共特征在于：所述步骤 A 中的 m 位全球移动用户识别符（IMSI）是十进制数，表示为：$IMSI = a_1 a_2 \ldots a_{m-1} a_m$ ，a_1是第 1 位数，a_i是其中的第 i 位数，$0 \le a_i \le 9$。

4. 根据权利要求 1 所述的一种移动用户终端在空闲模式下选择寻呼时刻的实现方法，共特征在于：所述步骤 A 中，在移动用户终端没有全球移动用户识别符（IMSI）时，使用缺省值：IMSI = 0，和让不连续接收周期长度为 2.56 秒。

5. 根据权利要求 1 所述的一种移动用户终端在空闲模式下选择寻呼时刻的实现方法，共特征在于：所述步骤 F 中，是利用计数器进行第 1 循环变量 i 的自动加 1。

6. 根据权利要求1所述的一种移动用户终端在空闲模式下选择寻呼时刻的实现方法，共特征在于：所述步骤K中，是利用两计数器分别进行有效寻呼时刻的个数p与第2循环变量n的自动加1。

7. 根据权利要求1所述的一种移动用户终端在空闲模式下选择寻呼时刻的实现方法，共特征在于：还包括实现计算寻呼指示（PI）的方法，寻呼指示（PI）等于：用m位全球移动用户识别符（IMSI）除8192后的整数部分再除以整数Np的余数，Np是每一帧中的寻呼指示器个数，频分复用模式下的Np 取为 18、36、72、144中的一个数。

移动用户终端在空闲模式下选择寻呼时刻的实现方法

技术领域

本发明涉及第三代宽带码分多址（WCDMA）移动通信系统技术领域，更确切地说是涉及移动用户终端（UE: User Equipment）在空闲模式下实现不连续接收时，选择寻呼时刻（PO: Paging Occassion）的实现方法。

背景技术

为了实现用户终端（UE）在空闲模式下的不连续接收（DRX），第三代移动通信系统 WCDMA 25304 v3.7.0 版协议规定：移动用户终端（UE）在每一个不连续接收（DRX）周期里，只需要监视一个寻呼时刻(PO: Paging Ocassion)的一个寻呼指示器(PI: Page Indicator)。

具体地说，在空闲模式下，用户终端可以使用不连续接收（DRX）方式以减小功率消耗，当使用不连续接收（DRX）方式时，在每个不连续接收周期的寻呼时刻，移动用户终端仅需监控一个寻呼指示器（PI）。

不连续接收周期长度（DRX cycle length）应为 $MAX(2^k, PBP)$ 帧，即在2^k、PBP二者之中取最大，其中k 为{3, 4, 5, 6, 7, 8, 9}中的某一个整数，PBP为寻呼块周期（Paging Block Periodicity）。寻呼块周期（PBP）只在时分复用（TDD）模式下应用，并等于系统信息广播中的寻呼指示信道（PICH）重复周期。而在频分复用（FDD）模式下，寻呼块周期PBP = 1。

用户终端（UE）可附着于具有特定的不连续接收周期长度（DRX cycle length）的不同核心网（CN），用户终端（UE）将保存其所属的各个核心网（CN）特定的不连续接收周期长度（DRX cycle length），并使用这些不连续接收周期长度（DRX cycle length）中最短的一个。核心网电路交换域（CS CN）特定的不连续接收（DRX）周期长度系数应在系统信息给定的用户终端（UE）中的

用户信息中更新。另一方面，经用户终端（UE）与核心网分组交换域（PS CN ）协商后，由非接入层（NAS）过程更新核心网分组交换（PS CN）特定的不连续接收（DRX）周期长度系数。如果在非接入层（NAS）过程中没有指定协商值 “k”，用户终端（UE）和核心网分组交换域（PS CN）将使用由系统信息给定的核心网分组交换域（PS CN）的不连续接收（DRX）周期长度。

用于通用地面无线接入网（UTRAN）连接模式的不连续接收（DRX）周期长度，是以下几个值中最小的:

1.通用地面无线接入网不连续接收周期长度（UTRAN DRX cycle length）;

2.任何已保存的核心网特定的不连续接收周期长度（DRX cycle length），这些核心网是用户终端（UE）所连接的核心网中还未建立起信令连接的核心网（CN）。

对于频分复用（FDD）模式，用户终端必须监视由寻呼时刻给定的小区系统帧号（SFN）里的寻呼指示信道（PICH）帧号的寻呼指示器（Paging Indicator）。

对于时分复用（TDD）模式，用户终端（UE）必须监视由寻呼时刻给定的寻呼块里的寻呼指示。寻呼时刻给出了寻呼块里第一帧的小区系统帧号（SFN）。

寻呼时刻（PO）的值由下面的公式确定:

$$PO = \{(IMSI \text{ div } K) \bmod (DRX \text{ cycle length div } PBP)\} * PBP + n * DRX \text{ cycle length} + Frame\ Offset,$$

式中，IMSI表示全球移动用户识别符，div 是除法符号，K 等于 承载了寻呼信道（PCH）的辅助公共控制物理信道的（SCCPCH）个数，a mod b表示整数a除以整数b的余数，DRX cycle length表示不连续接收周期长度，n = 0, 1, 2, . . . , Frame Offset 表示帧偏移。

对于频分复用模式，帧偏移 Frame Offset = 0; 对于时分复用模式，寻呼指示信道的帧偏移值在系统消息里给定; PBP表示寻呼块周期，寻呼块周期只应用于时分复用（TDD）模式，并等于系统信息广播中的寻呼指示信道（PICH）的

重复周期，对于频分复用（FDD）模式，寻呼块周期（PBP）等于1。要求计算得到的寻呼时刻（PO）值小于小区系统帧号（SFN）的最大值。

对于频分复用（FDD）模式，因帧偏移 Frame Offset = 0和PBP = 1，可将以上公式简化为：

PO = (IMSI div K) mod (DRX cycle length) + n * (DRX cycle length)。

如果用户终端（UE）没有全球移动用户识别符（IMSI），则用户终端（UE）使用缺省值：IMSI = 0，DRX cycle length = 256，即不连续接收周期长度为2.56秒。

由于全球移动用户识别符（IMSI）一般是15位的十进制整数，而一个无符号的32位长整型最大只能表示10位的十进制数，即4294967296，因此在WCDMA 25304 v3.7.0版协议中规定，对于频分复用模式（FDD）中寻呼时刻的选择公式，如上述简化公式所示，式中的全球移动用户识别符（IMSI），有时就不能用一个无符号的长整型变量直接存储。

传统的实现技术是采用两个无符号的长整型变量ulLow与ulHigh进行存储，假设全球移动用户识别符（IMSI）是一个小于等于16位的十进制数，则用长整型变量ulLow保存十进制的全球移动用户识别符（IMSI）的低8位、用长整型变量ulHigh保存十进制的全球移动用户识别符（IMSI）剩余的高位数－高8位，选择寻呼时刻PO的具体实现方案为：

$$Paging\ \text{Occasion} = ((((ulHigh - ulHigh \bmod K)\ div\ K) \times 10^8) \bmod (DRX\ \text{cycle length}) + (((\text{ulHigh} \bmod K) \times 10^8 + ulLow)\ div\ K) \bmod (\text{DRX cycle length})) \bmod (\text{DRX cycle length}) + n \times (DRX\ \text{cycle length})。$$

显然上述实现方案不仅复杂而且不够灵活与通用，例如在全球移动用户识别符（IMSI）是一个 24 位的十进制数时，则要用三个无符号的长整型变量拼起来才能满足存储要求，还需要重新设计实现算法，并且随着全球移动用户识别符（IMSI）的位数增加，用于保存该 IMSI 所需的长整型变量也越来越多，实现算法也会越复杂。

发明内容

本发明的目的是设计一种移动用户终端在空闲模式下选择寻呼时刻的实现方法，是一种实现空闲模式下选择寻呼时刻（PO）公式的方法，该方法通用于任意位数的全球移动用户识别符（IMSI）的情况，而且实现过程简单。

实现本发明目的的技术方案是这样的：一种移动用户终端在空闲模式下选择寻呼时刻的实现方法，应用于频分复用宽带码分多址移动通信系统中，其特征在于包括以下处理步骤：

A. 输入参量，包括m位的全球移动用户识别符（IMSI）、不连续接收周期长度、承载了寻呼信道（PCH）的辅助公共控制物理信道（SCCPCH）的个数K，和小区系统帧号（SFN）的最大值（MAXSFN）；

B. 设置一个局部变量sum，并将局部变量sum 的初值赋为全球移动用户识别符（IMSI）的第1位数值；

C. 让新局部变量sum 等于：原局部变量sum （整数）除以K倍的不连续接收周期长度（整数）的余数；

D. 将第1循环变量 i 的初值赋为2；

E. 判断第1循环变量i的值是否小于或等于全球移动用户识别符（IMSI）的位数m，若是则执行步骤F，若不是则执行步骤G；

F. 让新局部变量sum 等于：10倍的原局部变量sum与全球移动用户识别符中第i位的数值的和（整数）再除以K倍的不连续接收周期长度（整数）的余数，并让第1循环变量i自动加1，并返回步骤E继续执行；

G. 让新局部变量sum 等于：原局部变量sum（整数）除以K（整数）后的整数部分；

H. 设置第2循环变量n，并将n的初值赋为0，用p表示已经选择好的寻呼时刻（PO）的个数，并置p为0；

I. 让寻呼时刻（PO）等于局部变量sum的现值与n倍的不连续接收周期长度的和；

J. 判断寻呼时刻（PO）是否小于小区系统帧号的最大值（MAXSFN），如果寻呼时刻（PO）小于该最大值（MAXSFN），则执行步骤K，如果寻呼时刻（PO）大于或等于该最大值（MAXSFN），则执行步骤L;

K. 将当前n值下的寻呼时刻（PO）记为PO_n，让p等于 n+1 和让 n 自动加1后跳回步骤I执行;

L. 提交经上述步骤处理获得的全部与各 n 值对应的寻呼时刻（PO）值，$PO_0, PO_1, PO_2, \cdots, PO_{p-1}$。

所述步骤 A 中的不连续接收周期长度是 8、16、32、64、128、256、512 中的一个数，小区系统帧号（SFN）的最大值是 4095。

所述步骤 A 中的 m 位全球移动用户识别符（IMSI）是十进制数，表示为：$IMSI = a_1 a_2 \ldots a_{m-1} a_m$ ，a_1是第 1 位数，a_i是其中的第 i 位数，$0 \le a_i \le 9$。

所述步骤 A 中，在移动用户终端没有全球移动用户识别符（IMSI）时，使用缺省值：IMSI = 0，和让不连续接收周期长度为 2.56 秒。

所述步骤 F 中，是利用计数器进行第 1 循环变量 i 的自动加 1。

所述步骤K中，是利用两计数器分别进行有效寻呼时刻的个数p与第2循环变量n的自动加1。

还包括实现计算寻呼指示（PI）的方法，寻呼指示（PI）等于：用m位全球移动用户识别符（IMSI）除8192后的整数部分再除以整数Np的余数，Np是每一帧中的寻呼指示器个数，频分复用模式下的Np 取为 18、36、72、144中的一个数。

本发明将全球移动用户识别符（IMSI）表示为：

$$\begin{aligned} IMSI &= a_1 a_2 \ldots a_{m-1} a_m \\ &= a_1 \times 10^{m-1} + a_2 \times 10^{m-2} + \ldots + a_{m-1} \times 10^1 + a_m \\ &= (((10 \times a_1 + a_2) \times 10 + a_3) \times 10 + \ldots + a_{m-1}) \times 10 + a_m, \end{aligned}$$

$0 \le a_i \le 9$，全球移动用户识别符（IMSI）的位数是m。

本发明反复利用所推导的三个数学公式：(a*b) mod c = ((a mod c)* (b mod c)) mod c ；(a div b) mod c = (a mod (b*c)) div b ；和(a + b) mod c = (a mod c + b mod c) mod c，并应用到实现空闲模式下寻呼时刻（PO）选择公式中，在时分复用模式下，PO = {(IMSI div K) mod (DRX cycle length div PBP)}*PBP + n*DRX cycle length + Frame Offset,而在频分模式下，则因PBP = 1，Frame Offset = 0，而简化为：PO = (IMSI div K) mod (DRX cycle length) + n * (DRX cycle length)。

本发明的方法与传统的采用拼字长的方式来保存全球移动用户识别符（IMSI）的实现方法相比，本发明的实现寻呼时刻（PO）计算公式的技术方案，具有计算量小、算法实现简单和通用性好的特点。

附图说明

图 1 是本发明实现频分复用模式下寻呼时刻计算公式的流程框图。

具体实施方式

本发明对实现空闲模式下寻呼时刻的计算选择公式，给出了一种通用、简单和高效的方法。

我们假设全球移动用户识别符 $IMSI = a_1 \ldots a_{m-1} a_m$ 是一个m位十进制数，m为正整数，将其中任意一位（第i位）十进制数表示为 a_i，$0 \le a_i \le 9$，$i = 1, 2, \cdots, m$，a_1 表示IMSI的最高位，a_m 表示IMSI的最低位。已知频分复用（FDD）空闲模式下寻呼时刻（PO: Paging Occasion ）的计算公式为：

PO = (IMSI div K) mod (DRX cycle length) + n * (DRX cycle length)，其中IMSI表示全球移动用户识别符，K等于承载了寻呼信道（PCH）的辅助公共控制物理信道（SCCPCH）的个数，DRX cycle length 表示不连续接收周期长度，正整数n = 0, 1, 2, ..., 4095，要求得到的寻呼时刻（PO）值小于小区系统帧号（SFN）的最大值。式中，如果用户终端（UE）没有全球移动用户识别符（IMSI），

则用户终端（UE）使用缺省值：IMSI = 0；不连续接收周期长度为2.56秒（DRX cycle length = 256）。

由于时分复用（TDD）空闲模式下寻呼时刻选择公式的技术实现方案与频分复用（FDD）空闲模式下寻呼时刻选择公式的技术实现方案类似，因而本实施例只给出频分复用（FDD）空闲模式下寻呼时刻计算公式的技术实现方案。

结合参见图1，是实现频分复用（FDD）空闲模式下寻呼时刻计算公式的技术步骤，包括：

步骤1，录入全球移动用户识别符（IMSI）、不连续接收周期长度（DRX cycle length = 8，16，32，64，128，256 或512中的一个）、承载了寻呼信道（PCH）的辅助公共控制物理信道（SCCPCH）的个数K，和小区系统帧号（SFN）的最大值（MAXSFN）；

步骤2：设置一个局部变量sum，对局部变量sum 赋初值为 IMSI的第1位数值a_1，即 $sum = a_1$；

步骤3：计算$sum = \text{sum mod (DRX cycle length} \times \text{K)}$，即让新局部变量sum 等于原局部变量sum 除以K倍的不连续接收周期长度（DRX cycle length * K）的余数；

步骤4：对第1循环变量 i 赋初值为2，即i = 2；

步骤5：判断第1循环变量的值i是否小于等于十进制IMSI的位数m，即$i \le m$，若是则执行步骤6，若不是则执行步骤7；

步骤6：在$i \le m$时，让新局部变量sum 等于10倍的原局部变量sum与第i位全球移动用户识别符的十进制数值的和，$\text{sum} = (10 \times \text{sum} + a_i)$，再除以K倍的不连续接收周期长度$(DRX \text{ cycle length} \times \text{K})$的余数，即$sum = (10 \times sum + a_i) \bmod (\text{DRX cycle length} \times \text{K})$，执行完毕后让第1循环变量i自动加1，$i = i + 1$，并返回步骤5继续执行，第1循环变量i的自动加1可利用计数器完成，步骤5、6构成流程中的第1个循环；

步骤7：在i>m时，让新局部变量sum 等于原局部变量sum除以K后的整数部分，即$sum = \text{sum div K}$，例如 81 div 4 = 20，即保留20.25的整数部分20，舍弃20.25的小数部分0.25；

步骤8：设置第2循环变量n，对n赋初值为0，n = 0，将已经选择好的（即有效的）寻呼时刻（PO）的个数用p表示，置p为0，p= 0;

步骤9：让寻呼时刻（PO）等于局部变量sum的现值与n倍的不连续接收周期长度的和，$Paging\ Occasion = \text{sum} + n \times DRX\ cycle\ length$，

步骤10：判断寻呼时刻（PO）是否小于小区系统帧号的最大值（MAXSFN），即Pagin Occasion < MAXSFN,如果寻呼时刻（PO）小于该最大值（MAXSFN），则执行步骤11，如果寻呼时刻（PO）大于或等于该最大值（MAXSFN），则执行步骤12;

步骤11：将当前n值下的寻呼时刻（PO）记为PO_n，PO_n = Paging Occasion，并让p = n+1 ；n =n +1，跳转步骤9继续执行，p与n的自动加1可利用计数器实现，步骤9、10、11构成流程中的第2个循环;

步骤12：将计算获得的全部与各n值对应的寻呼时刻（PO）值，$PO_0, PO_1, PO_2, \cdots, PO_{p-1}$提交给物理层，供其选择，并结束程序。

可以用同样的方法实现时分复用（TDD）空闲模式下寻呼时刻的选择公式：PO = {(IMSI div K) mod (DRX cycle length div PBP)} *PBP + n*DRX cycle length + Frame Offset,较频分复用空闲模式下寻呼时刻的选择公式多出的Frame Offset 项，表示寻呼指示信道的帧偏移，它的值在系统消息里给定；多出的PBP项，表示寻呼块周期，等于系统信息广播中的寻呼指示信道（PICH）的重复周期。

为了更好地理解本发明频分复用（FDD）空闲模式下寻呼时刻的选择公式的技术实现步骤，以7位十进制全球移动用户识别符IMSI为例进一步说明。

例1.假设全球移动用户识别符$IMSI = a_1 a_2 a_3 \cdots a_{m-1} a_m = 1234567$，是一个7位的十进制数，即 m = 7,承载了寻呼信道（PCH）的辅助公共控制物理信道（SCCPCH）的个数 K = 4，不连续接收周期长度 DRX cycle length = 256，小区系统帧号的最大值MAXSFN = 4095。那么频分复用（FDD）空闲模式下需要选择的寻呼时刻（Paging Occasion），采用本发明提出的技术方案按如下步骤实现：

第1步：输入全球移动用户识别符 IMSI = 1234567，K = 4为承载了寻呼信道(PCH)的辅助公共控制物理信道(SCCPCH)的个数，不连续接收周期长度 DRX cycle length = 256，小区系统帧号的最大值 MAXSFN = 4095；

第2步：即对局部变量sum赋初值，为IMSI的第1位数1，sum = 1；

第3步：$sum = \text{sum mod (DRX cycle length} \times \text{K)} = 1 \bmod (256 \times 4) = 1$，即局部变量sum等于sum= 1除以 (*DRX* cycle length)×K的余数，DRX cycle length = 256，K = 4；

第4步：i = 2，即对循环变量i 赋初值为2；

第5步：由于循环变量i = 2小于IMSI的位数7，因此执行第6步；

第6步：$sum = (10 \times sum + a_2) \bmod (\text{DRX cycle length} \times \text{K}) = 12$，即sum等于$(10 \times \text{sum} + a_2)$除以 (*DRX* cycle length × K) 的余数，第1循环变量 $i = i + 1 = 3$，由于循环变量i小于IMSI的位数7，因此执行第7步，继续执行第1个循环操作；

第7步：$sum = (10 \times sum + a_3) \bmod (\text{DRX cycle length} \times \text{K}) = 123 \bmod 1024 = 123$，即sum等于$(10 \times \text{sum} + a_3)$除以 (*DRX* cycle length × K) 的余数，第1循环变量 $i = i + 1 = 4$，由于循环变量 i 仍小于IMSI的位数7，因此执行第8步，继续执行第1个循环操作；

第8步：$sum = (10 \times sum + a_4) \bmod (\text{DRX cycle length} \times \text{K}) = 1234 \bmod 1024 = 210$，即sum等于$(10 \times \text{sum} + a_4)$除以 (*DRX* cycle length × K) 的余数，第1循环变量 $i = i + 1 = 5$，仍小于IMSI的位数7，因此执行第9步，继续执行第1个循环操作；

第9步：$sum = (10 \times sum + a_5) \bmod (\text{DRX cycle length} \times \text{K}) = 2105 \bmod 1024 = 57$，即sum等于$(10 \times \text{sum} + a_5)$除以 (*DRX* cycle length × K) 的余数，第1循环变量$i = i + 1 = 6$，由于仍小于IMSI的位数7，因此执行第10步，继续执行第1个循环操作；

第10步：$sum = (10 \times sum + a_6) \bmod (\text{DRX cycle length} \times \text{K}) = 576 \bmod 1024 = 576$，即sum等于$(10 \times \text{sum} + a_6)$除以 (*DRX* cycle length × K) 的余数，第1循环变量 $i = i + 1 = 7$，由于第1循环变量i等于全球移动用户识别符IMSI的位数7，因此执行第11步，继续执行第1个循环操作；

第11步：$sum = (10 \times sum + a_7) \bmod (\text{DRX cycle length} \times K) = 5767 \bmod 1024 = 647$，即sum 等于$(10 \times \text{sum} + a_7)$除以 $(DRX \text{ cycle length} \times K)$ 的余数，循环变量 $i = i+1 = 8$，由于第1循环变量i大于全球移动用户识别符IMSI的位数7，因此执行第12步，跳出第1个循环；

第12步：$sum = \text{sum } div\ K = 647 \text{ div } 4 = 161$，即局部变量sum等于sum除以K后的整数部分；

第13步：对第2循环变量n赋初值为0，即 n = 0；记已经选择的寻呼时刻的个数 p = 0；

第14步：$Paging \text{ Occasion} = sum + n \times DRX \text{ cycle length} = 161$；

第15步：由于Paging Occasion = 161 小于小区系统帧号的最大值MAXSFN = 4095；因此执行第16步；

第16步：$PO_0 = 161$，p = n + 1 = 1；n = n+1 = 1；执行第17步(实际是跳转第14步执行)；

第17步：重复执行第14步、第15步、第16步的过程直到计算出的Paging Occasion值大于等于小区系统帧号的最大值MAXSFN = 4095时为止，跳出第2个循环。

我们可以计算得到：

$PO_1 = 417$，p = n+1 = 2，n = n+1 = 2；

$PO_2 = 673$，p = n+1 = 3，n = n+1 = 3；

$PO_3 = 929$，p = n+1 = 4，n = n+1 = 4；

$PO_4 = 1185$，p = n+1 = 5，n = n+1 = 5；

$PO_5 = 1441$，p = n+1 = 6，n = n+1 = 6；

$PO_6 = 1697$，p = n+1 = 7，n = n+1 = 7；

$PO_7 = 1953$，p = n+1 = 8，n = n+1 = 8；

$PO_8 = 2209$，p = n+1 = 9，n = n+1 = 9；

$PO_9 = 2465$，p = n+1 = 10，n = n+1 = 10；

$PO_{10} = 2721$，p = n+1 = 11，n = n+1 = 11；

$PO_{11}=2977$, p = n+1 = 12, n = n+1 = 12;

$PO_{12}=3233$, p = n+1 = 13, n = n+1 = 13;

$PO_{13}=3489$, p = n+1 = 14, n = n+1 = 14;

$PO_{14}=3745$, p = n+1 = 15, n = n+1 = 15;

$PO_{15}=4001$, p = n+1 = 16, n = n+1 = 16;

由于此时，PO_{16} = 4257 ，大于小区系统帧号MAXSFN = 4095 因此跳出第2个循环，执行第18步;

第18步：返回寻呼时刻(Paging Occasion)的计算值，共有16个：$PO_0=161$, $PO_1=417$, $PO_2=673$, $PO_3=929$, $PO_4=1185$, $PO_5=1441$, $PO_6=1697$, $PO_7=1953$, $PO_8=2209$, $PO_9=2465$, $PO_{10}=2721$, $PO_{11}=2977$, $PO_{12}=3233$, $PO_{13}=3489$, $PO_{14}=3745$, $PO_{15}=4001$,结束。

同样还可实现寻呼指示（PI: Paging Indicator）计算公式: PI = (IMSI div 8192) mod Np，其中IMSI为全球移动用户识别符，在频分复用（FDD）模式下Np = (18, 36, 72, 144) ，表示每一帧中的寻呼指示器个数，在时分复用（TDD）模式下， Np为每个寻呼块寻呼指示数，并由系统信息中给定的寻呼指示长度L_{PI}, 突发类型(长的或短的中缀) 和寻呼指示信道（PICH ）重复长度进行计算（式中的8192及Np值是由协议决定的）。

本发明的实现方法，经在华为WCDMA移动用户终端产品中试用，获得很好的效果。

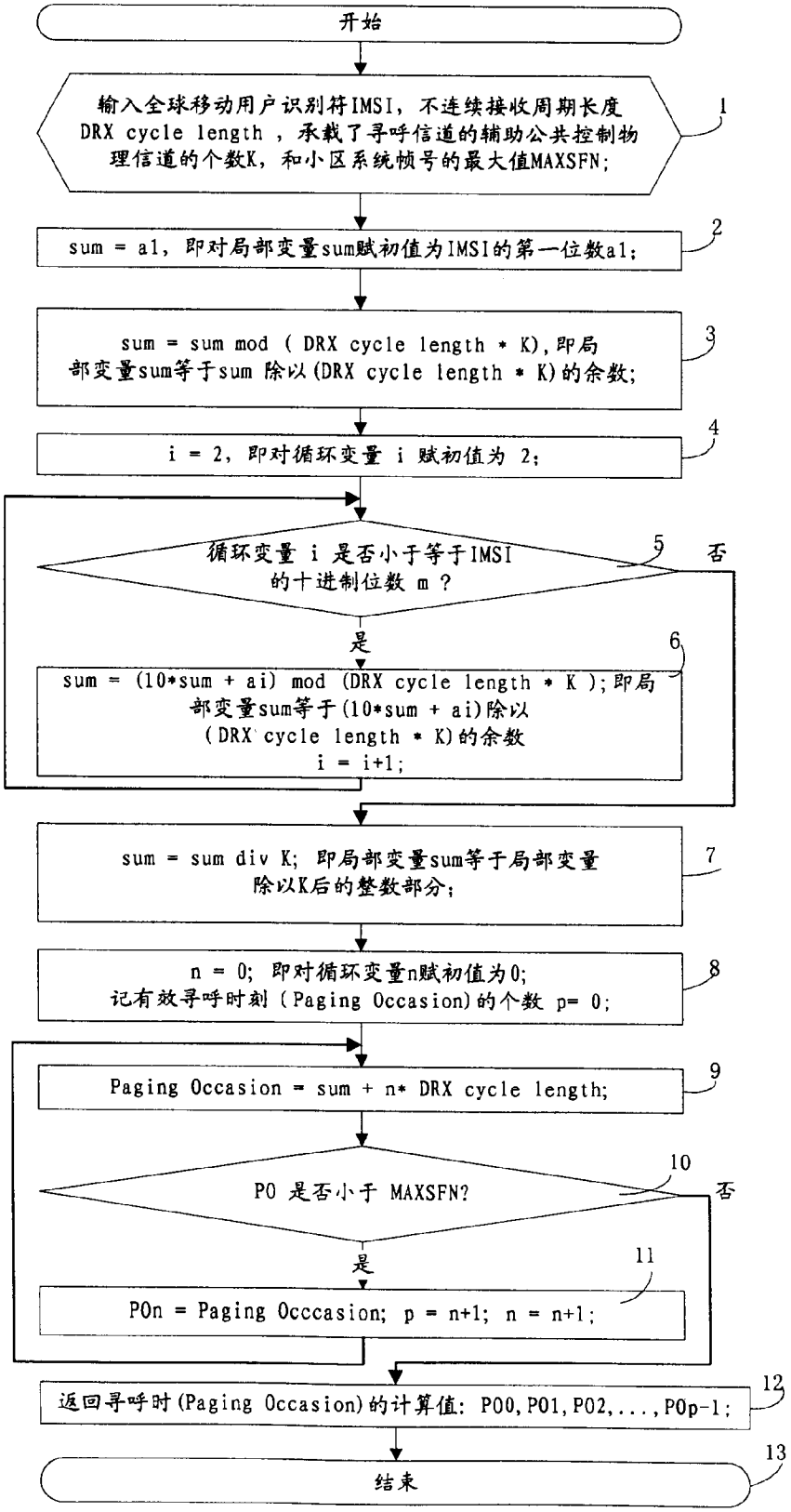
开始
输入全球移动用户识别符IMSI，不连续接收周期长度DRX cycle length，承载了寻呼信道的辅助公共控制物理信道的个数K，和小区系统帧号的最大值MAXSFN；
1
sum = a1，即对局部变量sum赋初值为IMSI的第一位数a1；
2
sum = sum mod (DRX cycle length * K)，即局部变量sum等于sum 除以(DRX cycle length * K)的余数；
3
i = 2，即对循环变量 i 赋初值为 2；
4
循环变量 i 是否小于等于IMSI的十进制位数 m ？
5
否
是
sum = (10*sum + ai) mod (DRX cycle length * K)；即局部变量sum等于(10*sum + ai)除以(DRX cycle length * K)的余数
i = i+1；
6
sum = sum div K；即局部变量sum等于局部变量除以K后的整数部分；
7
n = 0；即对循环变量n赋初值为0；
记有效寻呼时刻（Paging Occasion)的个数 p= 0；
8
Paging Occasion = sum + n* DRX cycle length；
9
PO 是否小于 MAXSFN?
10
否
是
POn = Paging Occcasion； p = n+1； n = n+1；
11
返回寻呼时(Paging Occasion)的计算值：PO0,PO1,PO2,...,POp-1；
12
结束
13

图 1

Espacenet

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Method, subscriber device and radio communication system for transmitting group messages

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Applicant(s):	SIEMENS AG [DE] +
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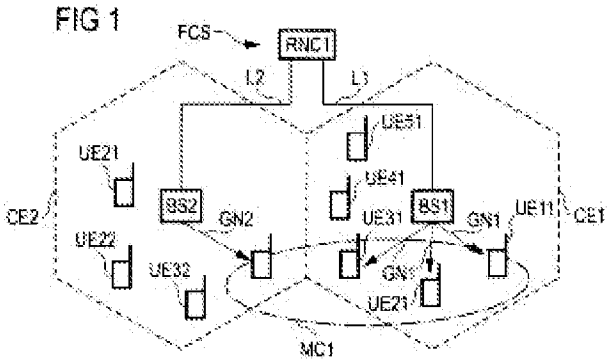
Abstract of CN 100584123 (C)

The invention is characterized in that for the purpose of sending an information to at least one group (MC1) of one or more subscriber devices of a radio communication system (FCS) regarding the presence of at least one group message (GN1) at least one common group paging indicator signal (GPI1) is additionally transmitted by one network element (BS1) to the subscriber devices of the respective group (MC1) and displayed.

FIG 1



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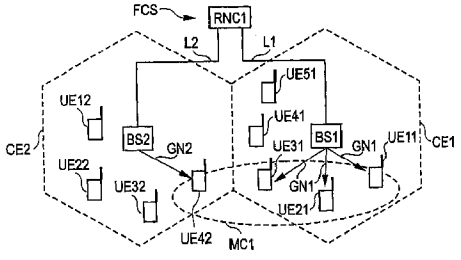
权利要求书 3 页 说明书 16 页 附图 13 页

[54] 发明名称 传输群消息的方法用户装置以及无线电通信系统

[57] 摘要

用于通过提交至少一个群消息(GN1)通知无线电通信系统(FCS)的至少一组(MC1)一个或多个用户装置，从无线电通信系统(FCS)的至少一个网络元件(BS1)向相应组(MC1)的用户装置发送和显示附加的至少一个共同的群寻呼指示器信号(GPI1)。



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1. 方法，用于通过提交至少一个群消息（GN1）通知无线电通信系统（FCS）的至少一组（MC1）一个或多个用户装置（UE11、UE21、UE31、UE42），所述的群消息应当由无线电通信系统（FCS）的至少一个网络元件（BS1、BS2）经至少一个无线电信道(PCS)发送，其中，所述群消息（GN1）向相应组（MC1）的用户装置（UE11、UE21、UE31、UE42）的提交借助于一个公共的、附加的群寻呼指示器信号（GPI1）显示并且提供用于分析。

2.如权利要求1所述方法，

其特征在于，

从至少一个网络元件（BS1）通过一个第一分开的，物理无线电信道（PICH）向相应组（MC1）的用户装置（UE11、UE21、UE31、UE42）传输公共的群寻呼指示器信号（PI）。

3.如以上权利要求之一所述方法，

其特征在于，

通过至少一个第二，分开的无线电信道（PCH）附加地传输至少一个信息信号(GI)，所述的信息信号(GI)关于要传输的群消息(GN1)的种类、提交该群消息（GN1 ）寻呼理由和/或向哪些用户装置的特定接收机组（MC1）寻址相应的群消息（GN1）。

4.如权利要求2和3之一所述方法，

其特征在于，

把用于群寻呼指示器信号(GPI1)第一分开的无线电信道(PICH)通过以单义的方式划归给带有关于相应的群消息（GN1）的信息的第二分开的无线电信道（PCH）。

5.如权利要求3或4所述方法，

其特征在于，

第二分开的无线电信道（PCH）作为其它无线电信道，尤其是第二公共控制物理信道（S-CCPCH）的组成部分传输。

6.如以上权利要求之一所述方法，

其特征在于，

在由其至少一个网络元件（BS1）发射的无线电通信系统（FSC）

的系统信息信号中，附加地夹带至少一个指示器信号(GSI)，所述的指示器信号关于在哪个无线电信道，尤其是第二公共控制物理信道上，传输至少一个带有关于相应地要传输的群消息(GN1)的传输信道（PCH）。

7.如以上权利要求之一所述方法，

其特征在于，

用基地台（BS1）作为网络元件发送群寻呼指示器信号（GPI1）和/ 或群消息（GN1）。

8.如以上权利要求之一所述方法，

其特征在于，

根据 UMTS（通用移动电信系统）标准运行无线电通信系统（FSC）。

9.如以上权利要求之一所述方法，

其特征在于，

事先通过相应的网络元件（BS1）通过至少一个信息信号通知各组（MC1）的用户装置，在哪个无线电信道（PICH）上发送群寻呼指示器信号（GPI1）和/或在哪个无线电信道（PCH）上发送关于要传输的群消息（GN1）的其它信息。

10.如以上权利要求之一所述方法，

其特征在于，

为传输群寻呼指示器信号（GPI1）和/或关于要传输的群消息（GN1）的其它的信息（GI，寻呼原因）各专用地预先占用一个无线电信道（PICH、S-CCPCH/PCH）。

11.如以上权利要求之一所述方法，

其特征在于，

为传输群寻呼指示器信号（GPI1）和/或关于要传输的群消息的其它的信息（GI，寻呼原因）各在相应的用户装置（UE1）本身和/或由至少一个网络元件（BS1）以单义的方式计算一个专用的无线电信道（PICH、S-CCPCH/PCH）。

12.如以上权利要求之一所述方法，

其特征在于，

用移动无线电装置，尤其是移动无线电话作为用户装置。

13.无线电通信系统（FCS）的用户装置（UE11），所述的用户装置以可以按照以上所述方法之一运行的方式构成。

14. 无线电通信系统（FCS）用于实施以上所述的方法之一。

传输群消息的方法用户装置以及无线电通信系统

本发明的任务是指出一种如何可以尽可能有效地通过提交群消息的通知无线电通信系统的至少一组一个或多个用户装置的途径。该任务通过以下的根据本发明所述的方法完成:

用于通过提交群消息的通知无线电通信系统的至少一组一个或多个用户装置的方法，所述的群消息应当由无线电通信系统的至少一个网络元件经至少一个无线电信道发送，其中所述群消息向相应组的用户装置的提交借助于一个公共的、附加的群寻呼指示器信号显示并且提供用于分析。

由此以有效的方式使之能够共同地借助附加的群寻呼指示器信号通知预定的一组一个或多个用户装置，对该组至少有一群消息等待从无线电通信系统的至少一个网络元件经至少一个信道传输。基于该群寻呼指示信号相应的用户装置可以如下地作出预先的选择，它是否附加地监听带有关于提交的，要传输的群消息的其它信息的至少一个其它无线电信道。如果相应的用户装置与等待传输的群消息无关，从而该用户装置不需要为之实际上通过至少一个无线电信道向无线电通信系统的至少一个网络元件建立实际上的信令连接。由此可以达到节省资源和节省能量的相应用户装置的运行。然后只有在相应的用户装置属于相应地请求的组时，它才在至少另一个无线电信道上收听，以通过该等待的、要传输的群消息监听其它的信息。

本发明此外还涉及无线电通信系统的用户装置，所述的用户装置以可以按照本发明所述的方法运行的方式构成。

此外本发明还涉及用于实施本发明所述方法的无线电通信系统。

本发明的其它扩展是从属权利要求的技术内容。

下面借助附图详细地说明本发明及其扩展。在附图中:

图 1 示意地示出用于根据本发明通知至少一组一个或多个用户装置的无线电通信系统的部件，

图 2 示意地示出在图 1 所示的无线电通信系统中在用户装置和该用户装置的无线电小区内的有关基地台之间的空气接口上的协议层模型，尤其是根据 UMTS 标准，

图 3 示出在如图 1 所示的无线电通信系统中用于如本发明所述的通知方法用的传输群寻呼指示器信号的分开的物理无线电信道的结构和帧结构或者说构造，

图 4 示意地示出从至少一个网络部件，尤其是基地台出发，通过网络方提交的至少一个要传输的群消息，通知如图 1 所示的无线电通信系统的一组用户装置的有利的信令过程，

图 5A、5B 示意地示出在图 1 的无线电通信系统的至少一个基地台与其无线电小区中的至少一个用户装置之间传输的系统信息的信息元件，其中该系统信息扩展了一个附加的信息元件，用所述的信息元件标出，是否在 UMTS 中的所谓的第二公共控制物理信道上通过所述的群消息复用了带有信息的寻呼信道（因为图 5A 和 5B 示出一个补充的表格，所述的表格为了表达清楚划分成两个分开的图，所以在下面对它们只称图 5），

图 6A-6C 示意示出信息元件“PICH-info”，作为图 5 的系统信息的另一部分，其中，把可能出现的群寻呼指示器信号在图 3 所示的其无线电信道的帧结构中的位置，为由等待的群消息有关的无线电通信系统的无线电小区中的每个用户装置附加地通过附加的信息元件传输（因为图 6A、6B 和 6C 示出一个补充的表格，所述 的表格为了表达清楚划分成三个分开的图，所以在下面对它们只称图 6），

图 7、8、9 根据本发明的方法的第一变例的关于提交的，要传输的群消息的类型和根据的附加信息元件，所述群消息在分开的无线电信道上，尤其是在寻呼信道上，传输（因为图 9A 和 9B 示出一个补充的表格，所述的表格为了表达清楚划分成两个分开的图，所以在下面对它们只称图 9）。

图 10、11 UMTS 中所谓的寻呼信道的修改的信息元件 ，所述信息元件包含关于种类、根据和/或为之确定等待的群消息的特定群的说明。

在图 1 至 11 中具有相同的作用和工作方式的元件相应地用同样的标号标示。

图 1 作为示范示意地示出无线电通信系统 FCS 的两个无线电小区 CE1、CE2，所述的无线电通信系统尤其是按照 UMTS（通用移动电信系统）标准运行的。在此无线电小区 CE1 由基地台 BS1 通过无线电技

术张开，而第二无线电小区 CE2 由基地台 BS2 管理。在此，两个基地台 BS1、BS2 代表许多，在图 1 中没有示出的无线电通信系统 FCS 的其它基地台，这些基地台具有和覆盖相应的无线电小区。各个基地台优选地通过至少一个无线电发射台和至少一个接收机构成。所述基地台优选地具有至少一个发射天线。附加地或者与其功能无关地，为提供对无线电通信系统 FCS 的用户装置的无线电连接，各个基地台可以各自管理向可能有的消息固定网络/数据固定网络的数据传输/消息传输。

在无线电通信系统FCS中消息信号/数据信号经至少一个预先确定的，在至少一个用户装置，尤其是移动无线电装置，譬如手机与至少一个基地台之间的空气接口，优选地按照时分复用多路接入的传输方法传输。优选地移动无线电系统按照 UMTS 标准（＝通用移动电信系统）构成。尤其是按所谓的 FDD 模式（频分双工）运行。在 FDD 模式中，沿上行链路和下行链路方向（上行链路＝从移动无线电装置向相应的基地台的信号传输；下行链路＝从相应所属的基地台向移动无线电装置的信号传输），通过相应分开的频率或者频率范围的分配达到分开的信号传输。同一个无线电小区中的多个用户优选地通过正交代码，尤其是通过所谓的 CDMA 的方法（＝码分多址）分开。

用户装置优选地假设为移动无线电话，尤其是手机。与之并列地用户装置还可以是其它的消息传输装置和/或数据传输装置，譬如可互连网连接的终端装置、计算机、电视装置、笔记本、电传装置，等等，带有所属的无线电单元用于“空中（on air）”通信联系，就是说通过至少一个空气接口、无线电通信网络的部件等等通信联系。在此，用户装置尤其涉及移动或袖珍的，就是说在无线电网络的不同地点的，但是在一定的条件下也可以是位置固定地安排的。

在图 1 中，两个基地台 BS1、BS2 通过所属的数据线路 L1、L2 由上级的无线电网络控制单元 RNC1 进行控制。所述无线电网络控制单元 RNC1 监控基地台 BS1、BS2 的无线电小区 CE1、CE2 中的无线电资源的分配。在该实施例中在基地台 BS1 的无线电小区 CE1 中驻留许多用户装置 UE11 至 UE15。同样地当前在基地台 BS2 的第二无线电小区中有多个用户终端装置 UE12 至 UE42。在第一无线电小区 CE1 中的用户装置 UE11、UE21、UE31 以及在第二无线电小区 CE2 中的用户装

置 UE42 事先分配给一个可以预先定义的组 MC1，对于所述的组 MC1 应当提供以尽可能有效的方式的一或多个群消息的接收。

“用户装置的组”的概念在本发明的范围内优选地是按照技术服务理解的分类，就是说，例如使之能够按照多点传播传输的或者广播传输的用户装置的划分。此外在无线电通信网络的无线电小区中的用户装置还可以根据许多其它的标准，例如尤其是譬如体育新闻、天气预报等等，或者其它的形成的根据等等，分类或者划分。

在许多现代移动无线电系统中提供的业务和应用中，特别值得追求把消息不是对一个，而是对两个或者更多的移动无线电用户传输。这样的业务和应用的例子是、新闻群、电视会议、点播电视、物流配送应用等等。

把同一消息向不同的用户传输的一个可能性是，向每个用户终端装置分开地发送一个数据或者消息的拷贝。该技术尽管简单，但是对大群用户装置却很费事。因为同一个消息通过 N （N = 消息的接收机 - 用户装置的数量）个单独的连接（ = 单点传播）进行传输，这样的处理方式需要高的带宽。

与之相反，所谓的多点传播构成一种较好的选择方案。在此把相应向之传输同一个消息的不同的用户装置结合成一个组（多点传播组），并且对该组指派一个共同的地址（多点传播地址）。接着只一次地向该多点传播地址发送所要传输的数据。通过公共的连接途径从发射机向接收机，把各个要传输的多点传播消息在理想的情况下仅一次地发送，这里所述的接收机尤其是移动无线电装置。在此不要求发射机知道在特定的多点传播地址后隐含在何处和多少接收机 - 用户装置。这样的用户装置，尤其是属于一定的、特定的多点传播组的用户装置，能够以有利的方式在网络方定义和管理。各个用户装置还可以按相应的权限自主地向一定的多点传播组登记和/或再退出登记。

在所提到的广播中作为另一种选择方案向一个地理区域内的所有的用户发送消息。例如这样的区域也可以通过整个无线电网络的一部分确定。如同在多点传播的情况那样，在此把广播消息通过共同的连接路径从发射机向各个接收机在理想的情况下仅一次地发送。把每个用户装置优选地编入一个相应的广播组，只要所述的用户愿意接收该组的广播包。从而，用户可以自行确定想要接收还是想要拒收相应的

组的所有的广播消息，或者只想接收一定的消息。

为了降低移动无线电装置的耗电，例如如果没有或者不再存在连接要建立，或者没有到来的呼叫或者数据时，这些移动无线电装置进入“静态”。在 UMTS 中把这种状态称作所谓的空闲模式。在此，相应的移动无线电装置只收听（hoeren）一定的信道。其位置还只是“相对不明确地”在网络方知道。这就是说，对于网络不知道相应的移动无线电装置刚好处在哪个无线电小区中。这时如果在这样的处于空闲模式的移动无线电装置上例如到来呼叫，或者要传输数据，则通过它在空闲模式中能收听的一定的无线电信道上，通过一定的程序向该移动无线电装置通知此事。该移动无线电装置于是建立一个对无线电网络的信令连接，通过该信令连接然后在当前所属的基地台与该移动无线电装置之间的空气接口上分配和配置无线电资源。

在 UMTS 中的空气接口上协议的分层模型为图 2 中的基地台 BS1 的无线电小区 CE1 中的用户装置 UE11 示出。移动无线电台 UE11 具有一个物理层（Physical Layer）PL1，所述的物理层在发射方负责处理要通过空气接口传输的数据，并且在接收方把接收的数据这样地向在上级的媒介接入控制层 MAC1（MAC = Medium Access Control）转交，使得能把接收的数据由该层进一步处理。网络方物理层 PL2 处在基地台 BS1 中，所述的基地台 BS1 通过固定网连接与无线电网络-控制单元 RNC1（无线电网络控制器）连接。在物理层与 MAC 层之间的连接称为传输信道，并且说明，如何传输数据（例如在基地台的无线电小区中的移动无线电装置收听的共同的信道上传输，或者只专门地为一定的移动无线电台提供的信道上传输）。MAC 层的任务是，譬如如果在共同的信道上传输数据包，就鉴定为之传输数据包的使用者，以及逻辑的无线电信道（LCS）映像在传输信道（TCS）上。为此 MAC 层向要传输的数据包添加发射方控制信息，例如相应的移动无线电台的标识，所述的标识由另一个较高的层 RLC（=无线电链路控制）层得到。在移动无线电台 UE11 中该 RLC 层用 RLC1 表示。在基地台 BS1 中该 RLC 层的表示符号是 RLC2。在此把相应的 MAC 单元例如用户装置 UE11 中的 MAC1 以及无线电网络控制单元 RNC1 中的 MAC2 与相应所属的无线电连接控制层 RLC1 或 RLC2（无线电链路控制）之间的连接称为逻辑信道。为了在传输信道上映像逻辑的无线电信道，相应的

MAC 层在发射机侧向从相应较高的 RLC 层得到的要传输的数据包添加控制信息，例如相应的移动无线电台的标识。在接收侧分析这些控制信息并且在把数据包通过逻辑连接向 RLC 层转交以前重新把该控制信息与所述数据包分开。

相应的 RLC 层 RLC1 及 RLC2 分别负责监控数据传输，这就是说用于确定出错的数据包，并且在一定的情况下重新请求数据包。在 RLC 层中可以定义多个单元。在此，每个 RLC 单元具有至少一个较高的层与 RLC 层之间的连接（例如无线电承载信道 RB）。RLC 层也可以向从较高的层得到的数据包添加控制信息。在接收侧利用这种控制信息，用于例如判断，是否包出错。在再向较高层转交以前把该控制信息从所述数据包中去掉。在 RLC 层以上有无线电资源控制层 RRC（Radio Ressource Control）。具体地，该无线电资源控制层在用户装置 UE11 处用 RRC1 标示出，在所属的无线电网络控制单元 RNC1 处用 RRC2 标示出。各个 RRC 层负责配置在它以下的层并且首先是负责建立连接。在各个 RCL 层和 RRC 层之间的连接称为 SRB（信令无线电承载信道）并且对于用户装置 UE11 用 RRC1 标示，以及对无线电网络控制单元 RNC1 用 SRB2 标示。

此外在相应 RLC 层以上有所谓的 RB（无线电承载信道），所述的 RB 用于真正的数据传输，并且表示 RLC 层与位于其上的应用之间的连接。如果传输数据包，则在相应 RLC 层的上方还有所述的包数据聚集层（PDCP=包数据聚集协议），譬如在此，PDCP1 针对用户装置 UE11 以及 PDCP2 针对无线电网络控制单元 RNC1，所述的无线电网络控制单元 RNC1 主管压缩 IP （互连网协议）包。此外在用户装置 UE11 以及基地台 BS1 的无线电网络控制单元 RNC1 的 RLC 层上方各还有所谓的广播-多点传播控制层 BMC1 及 BMC2（BMC= Broadcast Multicast Controller），它们用于接收可能的小区广播消息（CBS 消息）。在相应 BMC 层中可以与 RLC 类似地定义多个 BMC 单元。

用户装置（UE= user equipment）可能处在不同的状态。这些状态主要地说明是否相应的用户装置建立了到网络的信令连接，或者它是否在“安静”模式，它在哪些信道上收听，和知道它在网络中的何处：

-在 RRC 状态 CELL-DCH 状态中为相应移动无线电台指定专用的资源并且在小区层面上知道移动无线电台，就是说对于网络，已知移

动无线电台处在哪个小区中。

-在 RRC 状态 CELL-FACH 状态中，给相应的移动无线电台指派与其它移动无线电台共有的一般资源。在此状态下也在小区层面上知道移动无线电台。

-在 RRC 状态 CELL-PCH 状态中移动无线电台从网络接收广播消息并且收听通知信道 PICH（寻呼指示器信道）和 PCH（寻呼信道），通过它们网络可以通知移动无线电台，例如对移动无线电台有消息要提交。在此状态在小区的层面上移动无线电台是已知的。

-RRC 状态 URA-PCH 状态与 CELL-PCH 状态类似，区别是网络不准确地知道移动无线电台所处在的无线电小区，而是网络只知道移动无线电台可能驻留在哪一组小区中。

-在空闲模式中移动无线电台同样地从网络接收广播消息并且收听通知信道。与 URA-PCH 和 CELL-PCH 状态相反，无线电资源控制单元 RNC 却根本不知道移动无线电台本身，也不知道移动无线电台是否处在由它监管的小区中。

可以通过一定的机制向在空闲和连接的模式（CELL-DCH 和 CELL-FACH 状态）中的用户装置通知不同的事件。例如这可以是到来的呼叫或者是数据传输的开始。寻呼的通知机制，也就是用于发送等待的消息的呼叫，优选地分两个阶段进行。在第一步骤中，无线电网络通过所谓的寻呼指示器信道 PICH 上，也就是说概括地讲在一个特意设置的第一分开的无线电信道上的一个指示器通知，消息在寻呼信道 PCH 上，也就是说在另一个第二分开的无线电信道上准备为该移动无线电台收取并且接着发送。在第二步骤中，相应的移动无线电台至少部分地挑选出在其中含有真正的通知的，尤其是寻呼的原因（寻呼类型、寻呼记录、寻呼理由）的 PCH 信道。相应的用户装置从这些信息中了解到，是否涉及专门针对它的消息，并且了解消息涉及的是什么。只有在用户装置肯定地确定，要传输的消息真正是对该用户编址的，它才建立对无线电网络的信令连接，于是通过所述的信令连接分配，就是说，指派或提供以及配置用于传输消息的无线电资源 。

用于寻呼的机制优选地区分为两种类型，其区别是相应地要通知的用户装置处于什么样的状态:

-寻呼类型 1: 该程序用于向空闲模式、CELL-PCH 或者 URA-PCH

状态中的一定的 UE 发送寻呼信息。为此用所谓的寻呼控制信道（PCCH）作逻辑信道。在网络中的较高的层可以促进寻呼，例如为了促进建立信令连接。

-寻呼类型 2：该程序用于向在连接的模式中在 CELL-DOCH 或者 CELL-FACH 状态的一定的用户装置，缩写为 UE，传输专用的，也就是专门的寻呼信息。

在以下的实施例的范围内特别地关注寻呼类型 1，因为在此考察的情况是，应当没有对网络的专用连接地通过寻呼指示器通知一组多点传播用户装置或者移动无线电装置到来了多点传播消息。在一定的情况下可以以类似的方式用相同的方法也通知在连接的模式中的在 CELL-DCH 或者 CELL-FACH 状态的相应用户装置到来了新的多点传播消息。在 UMTS 中的物理无线电信道 S-CCPCH （第二公共控制物理信道）传输传输信道 PCH （寻呼信道）和/或 FACH（正向接入信道）的信息。如果用户装置应当接收寻呼信息，就通过 S-CCPCH 传输寻呼信道 PCH 。在系统信息（SIB 5 和/或 6=系统信息段 5 和/或 6）中，定义对当前处在一个无线电小区中的所有的移动无线电装置提供的公共的无线电信道比如 S-CCPCH。在系统信息中向一个用户装置指派的每个 S-CCPCH 可以优选地包含直到一个寻呼信道 PCH 。在一个无线电小区中既可以提供一个也可以提供多个 PCH 。对每个 PCH 以一定的方式优选地刚好指派一个寻呼指示器无线电信道 PICH 。在系统信息中定义一个以上的寻呼信道 PCH （和所属的，固定地指派的寻呼指示器无线电信道 PICH）的情况下相应用户装置如下地进行选择，它接着在哪些寻呼无线电信道收听，就是说切换成准备接收。为此相应的用户装置选择出表列的无线电信道 S-CCPCH 之一 ，优选地基于相应用户装置专用的国际移动用户标识符 IMSI：

“选取的 S-CCPCH” 指数=IMSI 模式 K ，

其中 K 等于在系统信息中说明的传输寻呼信道 PCH 的 S-CCPCH 的数量。换言之，仅传输 FACH 无线电信道（正向接入信道）的无线电信道 S-CCPCH 不计入其内。优选地按其在系统信息中出现的顺序标出 S-CCPCH 的指数（0 至 K-1）。传输寻呼信道 PCH 的无线电信道 S-CCPCH 在系统信息中说明为第一个。“选取的 S-CCPCH 的指数” 标记选取的应当由相应用户装置譬如 UE11 使用的 PCH 和指派给它的

PICH 。

寻呼指示器信道或者说信道 PICH 是用于传输寻呼指示器的物理信道。优选地总是以确定的方式向传输 PCH 传输信道的 S-CCPCH 指派 PICH 。图 3 示出 UMTS-FDD（频分双工）模式的 PICH 帧结构 RF 的构造。一个 PICH 帧优选地持续 10ms 并且尤其是 300 比特（（b0、b1、…、b299）长。从这些比特中用头 288 比特（（b0、b1、…、b287）传输寻呼指示器。其余的 12 比特因此在形式上看不是 PICH 的一部分并且不应当被传输。PICH 帧的这个部分为将来的使用保留。也就是尽管预先把传输信道 PCCH 的帧结构 RF 的第一分段 BP 保留用于存储寻呼指示器，然而在第二个，在此是结束侧的分段 T 0 还是空着的。

在每个 PICH 帧中传输 Np（Np=18、36、72 或者 144）个寻呼指示器。把哪些寻呼指示器（Pq）指派给哪些 UE，在此适宜地通过相应的用户装置和/或相应指派的基地台以及其所指示的无线电网络控制单元的发射单元/接收单元中的较高的协议层计算。在此指数“q”指出在相应的 PICH 帧的内部的位置并且有利地计算为：

$$q=\left(PI+\left\lfloor\left((18\times(SFN+\lfloor SFN/8\rfloor+\lfloor SFN/64\rfloor+\lfloor SFN/512\rfloor))\bmod 144\right)\times\frac{Np}{144}\right\rfloor\right)\bmod Np$$

式中“PI”由较高的层为每个 UE 计算尤其计算为：

```
PI = (IMSI div 8192) mod Np   [3GPP TR 25.304]
```

式中 SNF 是在对于 P-CCPCH 出现 PICH 时，P-CCPCH（主要的 CCPCH）的“系统帧”号码（SFN= System Frame Number）。由于 q 是 SFN 的函数，指派给 UE 的寻呼指示器的位置不断地变换。IMS（国际移动用户台标识符）指派给每个移动无线电装置并且单义地标识它们。

如果把一定的 PICH 帧中的寻呼指示器设定为逻辑“1”，于是指派给该寻呼指示器的用户装置（=UE）读取相应 S-CCPCH 的 PCH。

在借助于 PICH 上的寻呼指示器通知一个用户装置新的事件以后，于是该用户装置适宜地设法知道为此的具体理由。这尤其是有利的，因为可以在计算把一个 PICH 帧内的哪个寻呼指示器指派给哪个

UE 时可以出现两个或者多个 UE 收听同一个寻呼指示器的情况。相应的用户装置了解，现在该寻呼是否对该相应的用户装置专门确定的，和什么是该寻呼的确切理由，其中该用户装置读取在寻呼信道（PCH ）上传输的各种信息元件，所述的寻呼信道（PCH ）又是映像在以前确定的 S-CCPCH 上：

首先相应有关的用户装置对照图 7 在相应指定的 PCH 上读取信息元件“寻呼类型 1”。由此主要地告知该用户装置，对该寻呼有多少“动机”。此外该用户装置得到对照图 8 的信息元件“寻呼记录”的参阅材料。通过该信息元件该用户装置主要得到通过寻呼知道的事件是为它自己确定的还是为其它的用户装置确定的。此外该用户装置还得到对照图 9 的信息元件“寻呼原因”的参阅材料，在其中又说明寻呼的确切理由 。这主要可以是到来的呼叫或者是数据传输的开始。在图 7、8 和 9 中示出的带有没有下划线的，也就是没有特别标出的成员元件的信息元件特别是已经相应于 3GPP 规范[3GPP TS 25.331]详细地说明了。

如以上已经说明，相应的用户装置现在知道了通知的理由并向网络建立信令连接，然后通过所述的信令连接提供传输所述消息或数据的相应资源。

根据现有技术通过到来消息或者到来的呼叫要告知移动无线电装置至此奉献的传输数据的开始或者类似事件，就是说特别地，经过所谓的寻呼通知了移动无线电装置。

在各种业务和应用中常常要把消息不仅向一个而是向两个或者更多的移动无线电用户传输。例如这一般地在多点传播，并且特别在 UMTS 中尤其是在多媒体广播/多点传播业务（MBSB）尤其是这种情况。下面在本文中述及“群业务”，其中“群业务”可以包含多个群（例如彩票、股行情、天气、...）或者类别。

根据现有技术必须把这样的“群业务” 奉献给用户，就是说经过单个的指定给该移动无线电装置的寻呼指示器告知到来的消息（=每个移动无线电装置 1 个寻呼指示器）。假如在一个无线电小区中有 50 个移动无线电装置，它们都录入一个“群业务”的群中，就要借助于 50 个专门的寻呼指示器告知它们到来相应的消息。

与之相反本发明的原理的核心是为“群业务”引入一个群寻呼指

示器，应当通过所述的群寻呼指示器向一组用户发送一个消息，尤其是多点传播业务。

有利地采用这样的群寻呼指示器告知想要接收一定的业务或者服务的一个或优选地多个移动无线电装置(应当通过它们向一组用户发送消息（尤其是多点传播业务）)到来这样的群消息，或者其它的动机。

与现有技术相反这样的“群寻呼指示器”不是给相应用户装置专门地指派的，而给一组一个或多个用户装置指派的。在此这些用户装置或者说 UE 在此适宜地具有共同性，它们都使用同样的“群业务”，尤其是多点传播业务。这就是说，它们至少属于一个接收一定的“群业务”，尤其是多点传播业务的组（=每个业务，尤其是多点传播业务仅 1 个寻呼指示器）。

下面的方法步骤适用于保证群方式的寻呼:

-在第一步骤中，相应的移动无线电装置（UE）确定，登记进一个“群业务”尤其是多点传播业务，它适宜地收听传输 PCH 的无线电小区的 S-CCPCH 。

-在第二步骤中，在 PICH 帧内确定一个指派给相应的移动无线电装置（UE）的组的群寻呼指示器，所述的移动无线电装置（UE）的组属于一个“群业务”，尤其是多点传播业务。

-在第三步骤中，优选地扩展已有的信息元件，从所述信息元件中了解寻呼的理由，从而移动无线电装置从中知道，为哪些多点传播群发出的消息。所述的信息元件此外在一定的情况还包含其它的信息。

各个用户装置从系统信息中得到在一个无线电小区中提供的关于 S-CCPCH 的信息，以及是否该无线电小区传输 PCH 的信息。优选地对每个 S-CCPCH 固定地指派一个 PICH。用户装置确定或者计算，它适宜地收听哪个 S-CCPCH/PCH 和 PICH，以及 PICH 帧的哪个群寻呼指示器指派给“群业务”，尤其是多点传播业务。

在得到在 PICH 上传输的“群寻呼指示器”，尤其是多点寻呼指示器以后，接着该移动无线电装置收听该指派的 PCH 。然后在该 PCH 上传输信息元件，所述的信息元件以有利的方式含有关于有关的消息是针对哪个群，尤其是多点传播群（图 7、8、9 中的信息元件寻呼类型 1、寻呼记录、寻呼原因）的信息。如果一个移动无线电装置属于相应的组，就接着建立对移动无线电网络的信令连接，通过所述的信令连接

分配用于传输该消息的资源。

在此有利地，向所有的移动无线电装置通过共同的“群寻呼指示器”告知到来一群消息，尤其是多点传播消息。根据现有技术，为此必须采用 N （N=在该无线电小区中的 MC 用户的数量）个寻呼指示器，这费用很高，并且效率过低。

根据本发明方法的用于通过共同的“群寻呼指示器”通告一组接收机的适当流程示于图 4 中:

相应用户装置（=UE，在此是 UE11）从无线电网络 UT 的至少一个部件，尤其是基地台（在 UMTS 中该 UTRAN=通用地面无线电接入网络）接收系统信息 SI，并且从中读出，哪些 S-CCPCH 在该无线电小区中传输，以及这些 S-CCPCH 的哪些传输 PCH。对每个传输 PCH 的 S-CCPCH 固定地指派一个 PICH 。此前在一个步骤 SUT 中网络确定应当在哪个 S-CCPCH 上传输群信息。在相应的步骤 SUE 中 UE 确定它适宜地收听哪些 S-CCPCH 和所属的 PICH。这些确定的可能的变例在下面一段中说明。

如果现在面临一群“群业务”的群消息 GN1 的传输，网络（尤其是 UTRAN）UT 就在步骤 PIC 中在此前选取的 PICH 上发送相应的群寻呼指示器信号 GPI。所有的登记到一群“群业务”的 UE，在下个步骤 RGPI 中读出该群寻呼指示器信号 GPI 并且识别出现有应当传输群消息 GN1。在此前在网络中以及在 UE 中确定，把一个 PICH 帧中的哪个群寻呼指示器专门地指派给每个“群业务”。对此可能的变例在下面一段中说明。

为了了解，是否到来的群消息特定地涉及相应的用户装置，因为该用户装置是相应组的成员，所以它在另一个步骤 APIN 中读取在 PCH 上传输的寻呼信息 PIN（尤其是相应图 7 与 9 的信息元件寻呼类型 1、寻呼记录和寻呼原因）。 在字段或者说信息元件寻呼记录中主要有尤其群标识 GI（比较图 9），所述的群标识 GI 标识出一定的“群业务”。其它可能的变例在下面的一段落中说明。

如果基于传输的寻呼信息 PIN 相应的用户装置识别出，它对等待或者说到来的群消息 GN1 不感兴趣时，它就又转回它以前所处的状态。如果 UE 识别出，它对到来的群消息 GN1 感兴趣时，它就建立信令连接 SV，通过所述的信令连接 SV 分配和配置资源以接着传输群消息。

对于确定在哪个 S-CCPCH 或 PCH 以及所属的 PICH 上用户装置登记到一个“群业务”、接收信令数据，有不同的可能性：

-在相当适宜的变例中，登记进一个“群业务”的所有的 UE 收听相同的 S-CCPCH。在此 UE 收听哪个 S-CCPCH 的信息含在系统信息（SIB5/6）中，为此对系统信息补充附加的信息元件。

图 5 示出在 SIB5 和 6 中传输的信息元件“第二 CCPCH 系统信息”的[3GPP TS 25.331，第 10.3.6.72 节]示例。在此与现有技术相反补充所谓的“群业务指示器”，所述的群业务指示器说明，是否和哪个传输 PCH（和所属的 PICH）的 S-CCPCH 用于传输“群业务”信息。标记出对现有技术的改变。

-另一个可能性是，总是使用相同的、预定的 S-CCPCH 传输一个与接收机组有关的信息。例如这可以总是在系统信息定义的 S-CCPCH 中的头一个或者最后一个。

所属的 PICH 传输群寻呼指示器。S-CCPCH 传输 PCH，优选地通过所述的 PCH 传输关于寻呼理由的信息。

-登记进一个“群业务”的 UE 全都收听相同的 S-CCPCH。在 UE 的较高的协议层中计算该 UE 收听哪个 S-CCPCH。为了进行这种计算，以有利的方式使用一种“群业务”标识，所述的“群业务”标识适宜地是对相应的 UE 知道的或者使之知道的。

在采用群特定的（不是“群业务”特定的）标识例如 IMGI（国际移动群标识）在计算相应所属的 S-CCPCH 时有利地保证，尽管是不同的群却对相同的 S-CCPCH（和所述的 PICH）计算同一个“群业务”标识。对于 UE 为传输“群寻呼”信息计算不同的 S-CCPCH 情况，适宜地在每个这样的 S-CCPCH 上传输相应的信息。所属的 PICH 传输群寻呼指示器例如 GPI1。所述的 S-PPCH 传输通过它传输关于寻呼理由的信息的 PCH。

-在所有的在一个无线电小区中传输的传输 PCH 的 S-CCPCH 上将传输“群业务”信息。这就是说在所有所属的 PICH 上将传输“群寻呼指示器。从而在所有的 PCH 上有利地传输关于寻呼理由的信息，然而这决定了相对高的冗余。

以下在一个 PICH 帧中选择群寻呼指示器的可能性，适用于为了能够向请求的、有关的组的用户装置有关“群业务”或者其它等待的群

消息的事件发出信令（例如到来的消息等等）：

对“群业务”的所有的群使用一个群寻呼指示器，从而通过到来消息告知UE，现在有群业务。附加地在此还应当考虑两个其它的次要的可能性：

-每个“群业务”的组使用一个群寻呼指示器，从而在该“群业务”登记的 UE 可以已经在该群寻呼指示器识别出是否涉及所关心的消息（缺点：在许多多点传播（MC ）群的情况下需要许多群寻呼指示器）。

-对于一定的MC 群（一个“群业务”的所有MC群的子集）使用一个群寻呼指示器，从而对该“群业务登记”的UE，已经可以在该群寻呼指示器预先选择，到来的消息是否为它特定的，也就是是否它关心的。然后用户装置才从寻呼原因了解，该消息实际上是用于什么群的。

在计算或者说确定在一个 PICH 帧中的哪些寻呼指示器是用于哪些“群业务”时，可能适宜地，对于在收听同一个PICH的其它UE还尽可能少地指定同一个群寻呼指示器。这既适用于属于其它“群业务”的UE，也适用于没有登记“群业务”的UE。这有提高所述方法的效率的优点。

这由此例如可以如下达到：

-在不同的 PICH 和 PCH 上发送不同的 MC 业务和群的寻呼信息。

-对于 PICH、“群寻呼指示器”和不传输“群寻呼指示器”的PICH，应用不同的DRX 周期。PICH 不由 UE 在每个帧中接收，而是以规则的间隔，即所谓的DRX 周期（例如为了节省能量）接收。通过对带有或不带有“群寻呼指示器”的PICH使用不同的DRX 周期，可以防止寻呼指示器的“双重占据”。

然而如果还有这样的情况，对两个或者多个UE指派同一个寻呼指示器的情况，那么这些UE从相应的信息元件中读出寻呼的理由、和该事件实际上是对谁感兴趣，是适宜的。

计算或者说确定在一个 PICH 群中哪个群寻呼指示器是指派给哪个“群业务”的，优选地通过较高的层进行。

对于计算相应的群寻呼指示器例如 GPI1 的位置“q”可以例如利用一个群标识（例如 IMGI，国际移动群标识符）。计算“GPI1”的

公式可以如以下的形式:

$$GPI1 = (IMGI \text{ div } 8192) \bmod Np$$

另一个可能性是，对于“群业务”目标总是使用相同的预先定义的群寻呼指示器。例如这可以总是在一个 PICH 帧中的第一个或者最后一个群寻呼指示器或者任意的另一个。在一个 PICH 帧内部的哪个群寻呼指示器为“群业务”保留，例如可以通过扩展相应的信息元件得知。

在图 6 中信息元件“PICH Info“[3GPP TS 25.331，第 10.3.6.49 章]通过具有名称“Group PI”的附加信息 GPI 扩展。该信息元件说明群寻指示器在指派给一个“群业务”的 PICH 帧中的位置。该改变对于此实施例只用于 FDD（频分双工）。该对于现有技术的改变通过对附加的信息信号的下划线标出。

此外有可能将尚未使用的 PICH 帧（见图 3）的比特 TO 用于“群业务”目的。

通过扩展负责寻呼的信息元件，应以较寻呼所的“群业务”的群为有利的方式指示出寻呼的理由。这要在下面以多点传播业务的例子示出。

一个可能性是，把图 9 的信息元件“寻呼记录” [3GPP TS 25.331，第 10.3.3.23 章]扩展一个附加的元件 GI（“多点传播群标识”），在其中然后标记“多点传播业务”的多点传播群。附加地“寻呼记录”指点信息元件“寻呼原因”[3GPP TS 25.331，第 10.3.3.22 章]，适宜地扩展了附加的元件 TMS（“终止多点传播会话”），该元件 TMS 说明寻呼的理由，即开始的多点传播传输的（见图 9）。对于现有技术的改变相应地通过对相应的附加信息信号的下划线标出。

另一个可能性是，一个 UE 在读取如以上说明的根据本发明含有附加的元件（“终止多点传播会话”）的信息元件“寻呼原因”时，得到相应于图 10 的对另一个新的信息元件（“终止多点传播会话”）的指点 PTMS。在该信息元件中现在有到来的消息为之确定的多点传播群，通过一个多点传播群指示器 GI 表示。把对现有技术的改变标记出。对于第一个说明的可能性，在此不需要改变信息元件“寻呼记录”。

适当地在一定的情况下还可以，已在由其发射至少一个网络元件的无线电通信系统的系统信息信号（见图5）中，附加地夹带至少一个指示器信号，譬如 GSI，所述的指示器信号关于在哪个无线电信道，尤其是第二公共控制物理信道上，传输至少一个带有关于相应地要传输的群消息的传输信道（PCH）。

在说明书中采用了下面列出的缩写:

BMC 广播/多点传播控制
DCH 专用信道
DRX 间歇接收
FACH 正向接入信道
FDD 频分双工
IMSI 国际移动用户标识符
IP 互连网协议
MAC 媒体接入控制
MC 多点传播
MS 移动站
P-CCPCH 主公共控制物理信道
PCH 寻呼信道
PDCP 包数据聚集协议
PI 寻呼指示器
PICH 寻呼指示器信道
RB 无线电承载信道
RLC 无线电链路控制
RRC 无线电资源控制
S-CCPCH 第二公共控制物理信道
SFN 系统帧号
SRB 信令无线电承载信道
UE 用户装置
UMTS 通用移动电信系统
URA UMTS 寻路区域

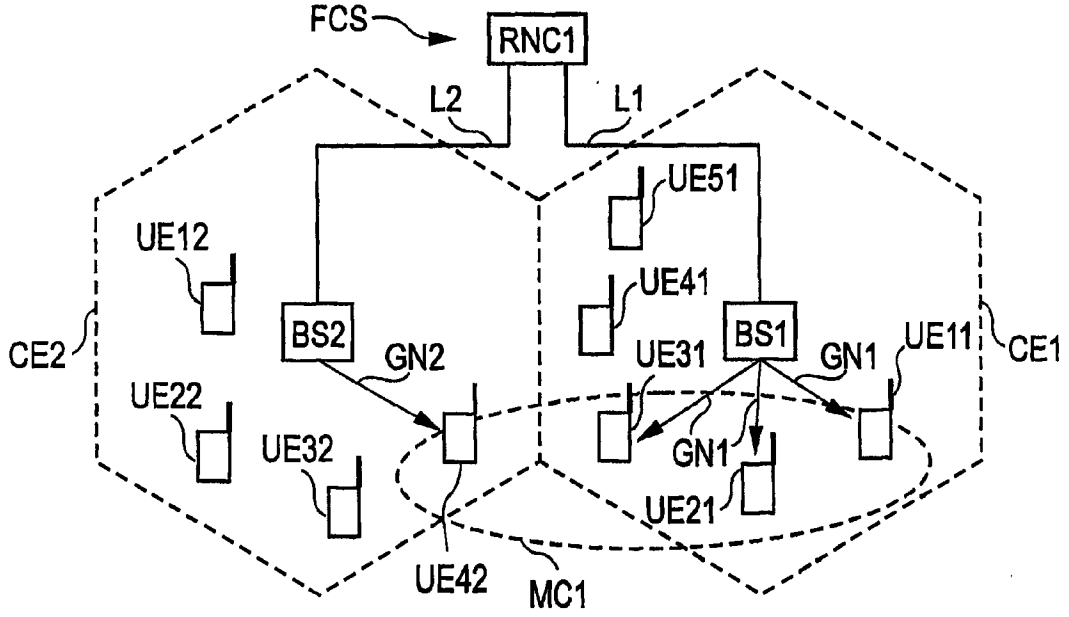
FCS
RNC1
L2
L1
UE51
UE12
UE41
BS2
BS1
GN2
UE31
GN1
UE11
CE2
CE1
UE22
UE32
GN1
UE21
UE42
MC1

图 1

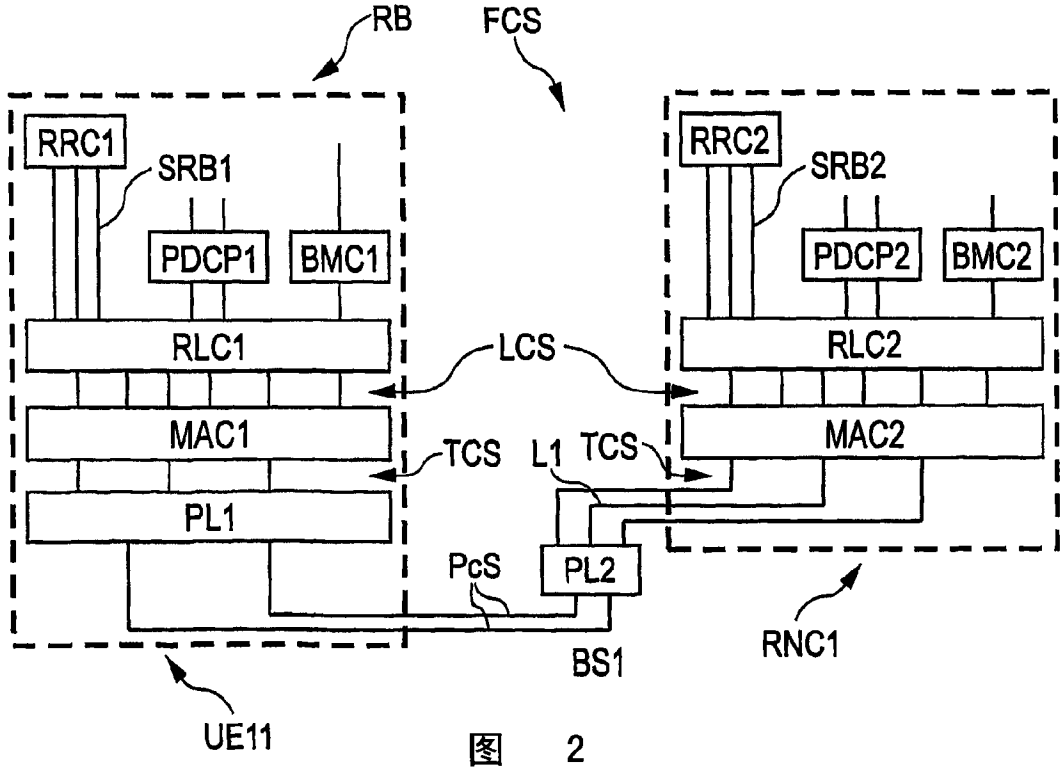
RB
FCS
RRC1
SRB1
PDCP1
BMC1
RLC1
LCS
MAC1
TCS
L1
TCS
PL1
PcS
PL2
BS1
UE11
RRC2
SRB2
PDCP2
BMC2
RLC2
MAC2
RNC1

图 2

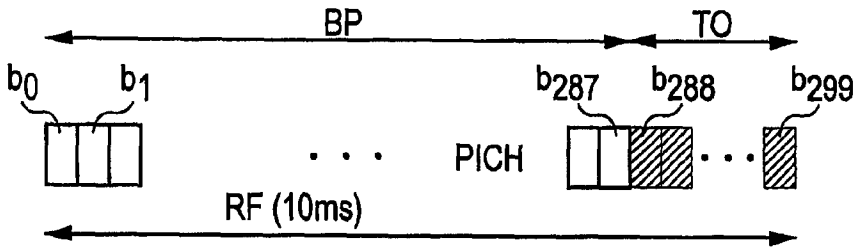
BP
TO
b0
b1
b287
b288
b299
PICH
RF (10ms)

图 3

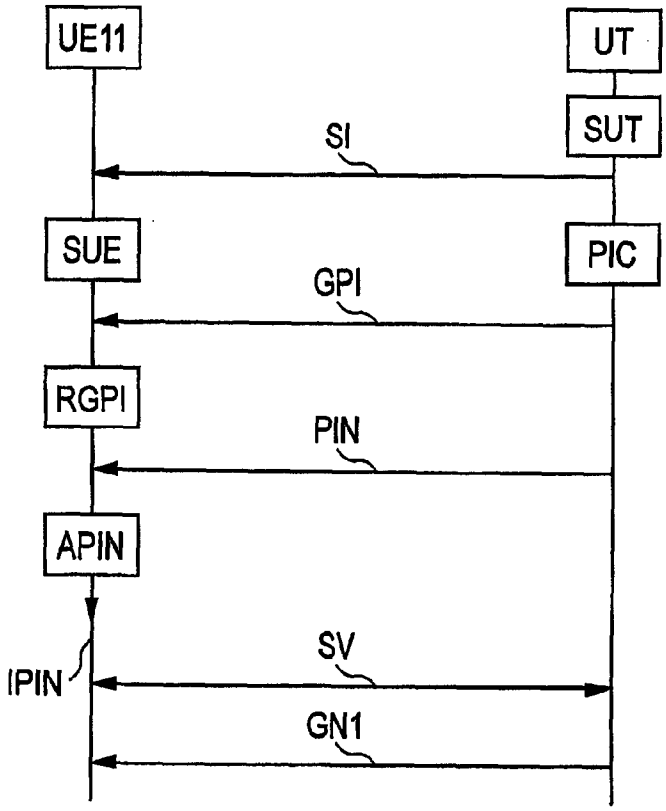
UE11
UT
SUT
SI
SUE
PIC
GPI
RGPI
PIN
APIN
IPIN
SV
GN1

图 4

第二CCPCH系统信息(Secondary CCPCH system information)

信息元件	需求	多个	类型和参考	语义说明
第二CCPCH系统信息 (Secondary CCPCH system information)	MP	(1至<最大SCCPCH>) (1 to <max SCCPCH>)		
第二CCPCH信息 (>Secondary CCPCH info)	MP		第二CCPCH信息 10.3.6.71 (Secondary CCPCH info 10.3.6.71	
>TFCS	MD		传输格式结合组 10.3.5.20 (Transport format-combination set 10.3.5.20	对于FACH和PCH预定值是以前在此表中的SCCPCH的"TFCS"的值 (注: 于是第一表现是MP)。
>FACH/PCH-信息 (>FACH/PCH information)	MD	(1至<最大FACHPCH>) 1 to <max FACHPCH>		预定值是以前在此表中的SCCPCH的"FACH/PCH"值 (注: 于是第一表现是MP)。
>>传输信道识别 (>>Transport channel identity)	MP		传输信道识别 10.3.5.18 Transport channel identity 10.3.5.18	

图 5A

第二CCPCH系统信息 (Secondary CCPCH system information)

信息元件	需求	多个	类型和参考	语义说明
>>TFS	MP		传输格式组 10.3.5.23 (Transport format set 10.3.5.23)	对于每个FACH和PCH注2.
>>CTCH-指示器 (>>CTCH indicator)	MP		布尔式的 (Boolean)	值"WAHR"指示，将CTCH映像在FACH上，而"FALSCH"指示不将CTCH映像。
>PICH-信息 (>PICH info)	OP		PICH-信息10.3.6.49 (PICH info 10.3.6.49)	仅在PCH在第二CCPCH上复用时才有PICH信息
> 群业务指示器 (>Group Service Indicator GSI)	OP		布尔式的 (Boolean)	仅在PCH在S-CCPCH上复用时才有的群业务指示器。指示用哪个SCCPCH和哪个所属PICH用于传输群业务信息

图 5B

PICH信息（系统信息） (PICH Info (system information))

信息元件组名称	需求	多个	类型和参考	语义说明
WAHL: 模式 (CHOICE mode)	MP			
>FDD				
>> 信道化代码 (>>Channelisation code)	MP		整数 (0..255)	SF是固定的并且等于256
>> 每帧的PI数量 (>>Number of PI per frame)	MP		整数 (18, 36, 72, 144)	
>> STTD指示器 (>>STTD indicator)	MP		STTD指示器 10.3.6.78 (STTD Indicator 10.3.6.78)	
>> 群PI (>>Group PI) GPI	OP		整数（0....每帧的PI数量） (Integer (0..Number of PI per frame))	为群业务在PICH帧中确定的PI的位置
>TDD				
>> 信道化代码 (>>Channelisation code)	MD		列举 ((16/1).. (16/16)) (Enumerated ((16/1)...(16/16))	预定值是传输所属的PCH的由SCCPCH采用的信道化代码

图 6A

PICH信息（系统信息）(PICH Info (system information))

信息元件组名称	需求	多个	类型和参考	语义说明
>> 时隙号 (>>Timeslot number)	MD		时隙号 10.3.6.84 (Timeslot number 10.3.6.84)	预定值是传输所属的PCH的由SCCPCH采用的时隙
>> 选择：脉冲组类型 (>>CHOICE Burst Type)	MP			
>>> 类型1 (>>>Type 1)				
>>>> 中间脉冲组移动 (>>>>Midamble Shift)	MP		整数 (0..15)	
>>> 类型2 (>>>Type 2)				
>>>> 中间脉冲组移动 (>>>>Midamble Shift)	MP		整数 (0..5)	
>> 重复周期/时长 (>>Repetition period/length)	MD		列举 ((4/2), (8/2), (8/4), (16/2), (16/4), (32/2), (32/4), (64/2), (64/4)) (Enumerated ((4/2), (8/2), (8/4), (16/2), (16/4), (32/2), (32/4), (64/2), (64/4)))	预定值是 "(64/2)".

图 6B

PICH信息（系统信息） (PICH Info (system information))

信息元件组名称	需求	多个	类型和参考	语义说明
>> 偏移 (>>Offset)	MP		整数（0...重复周期1） (Integer(0...Repetition period-1))	SFN模式重复周期=偏移 (SFN mod Repetitionperiod=Offset)
>> 寻呼指示器长度 (>>Paging indicator length)	MD		整数 (4, 8, 16)	示出寻呼指示器以比特表示的长度，预定值是4。
>>N_{GAP}	MD		整数 (2, 4, 8)	在为该寻呼情况传输的PICH的最后一个帧与为该寻呼情况传输寻呼报文的PICH的第一个帧之间的帧数。预定值是4。
>>N_{PCH}	MD		整数 (1..8)	寻呼群的数量。预定值是2。

图 6C

寻呼类型1 (PCH) ((Paging Type 1(PCH))

信息元件组名称	需求	多个	类型和参考	语义说明
消息类型 (Message Type)	MP		消息类型 (Message Type)	
UE信息元件 (UE Information elements)				
寻呼数据组表 (Paging record list)	OP	1至 <最大寻呼1> (1 to <max-Page 1>)		
> 寻呼数据组 (>Paging record)	MP		寻呼数据组 10.3.3.23 (Paging record 10.3.3.23)	
其它信息元件 (Other information elements)				
BCCH- 修改信息 (BCCH modification info)	OP		BCCH-修改信息 10.3.8.1 (BCCH modification info 10.3.8.1)	

图 7

寻呼理由（PCH）((Paging cause (PCH))

信息元件组名称	需求	多个	类型和参考	语义说明
寻呼理由 (Paging cause)	MP		列举（会话连接结束、流连接结束、互动连接结束、背景连接结束、带有较高优先权的信号指示结束，带有低优先权的信号指示结束，多点传播会议结束，结束，原因不明） (Enumerated (Terminating Conversational Call, Terminating Streaming Call, Terminating Interactive Call, Terminating Background Call, Terminating High Priority Signalling, Terminating Low Priority Signalling, Terminating Multicast Session, Terminating - cause unknown)) TMS	

图 8

寻呼数据组（PCH）((Paging record (PCH))

信息元件组名称	需求	多个	类型和参考	语义说明
WAHL: 使用的寻呼识别 (CHOICE Used paging identity)	MP			
>CN- 识别 (>CN identity)	MP			
>>寻呼理由 (>>Paging cause)	MP		寻呼理由 10.3.3.22 (Paging cause 10.3.3.22)	
>>CN- 域识别 (>>CN domain identity)	MP		CN域识别 10.3.1.1 (CN domain identity 10.3.1.1)	
>>WAHL UE-识别 (>>CHOICE UE Identity)	MP			
>>>IMSI (GSM-MAP)			IMSI (GSM-MAP) 10.3.1.5	
>>>TMSI (GSM-MAP)			TMSI (GSM-MAP) 10.3.1.17	
>>>P-TMSI (GMS-MAP)			P-TMSI (GSM-MAP) 10.3.1.13	
>>>IMSI (DS-41)			TIA/EIA/IS-2000-4	
>>>TMSI (DS-41)			TIA/EIA/IS-2000-4	
>>UTRAN 识别 (>>UTRAN identity)				

图 9A

寻呼数据组（PCH）((Paging record (PCH))

信息元件组名称	需求	多个	类型和参考	语义说明
>>U-RNTI	MP		U-RNTI 10.3.3.47	
CN起源的对连接模式的UE的寻呼 (>>CN originated page to connected mode UE)	OP			
>>> 寻呼理由 (>>>Paging cause)	MP		寻呼理由 10.3.3.22 (Paging cause 10.3.3.22)	
>>>CN-域识别 (>>>CN domain identity)	MP		CN域识别 10.3.1.1 (CN domain identity 10.3.1.1)	
>>> 寻呼数据组类型标识 (>>>Paging record type identifier)	MP		寻呼数据组类型标识 10.3.1.10 (Paging record type identifier 10.3.1.10)	
>> 群识别 (>>Group identity) GI	OP		多点传播群指示器（例如IMGI） (Multicast Group Indicator (e.g. IMGI))	专用于到来的消息的多点传播群指示器

图 9B

寻呼理由（PCH）((Paging cause (PCH))

信息元件组名称	需求	多个	类型和参考	语义说明
寻呼理由 (Paging cause)	MP		列举（会话连接结束、流连接结束、互动连接结束、背景连接结合、带有高优先权的信号指示结束，带有低优先权的信号指示结束，多点传播会议结束，结束，原因未知） (Enumerated (Terminating Conversational Call, Terminating Streaming Call, Terminating Interactive Call, Terminating Background Call, Terminating High Priority Signalling, Terminating Low Priority Signalling, Terminating Multicast Session, Terminating - cause unknown))	PTMS

图 10

多点传播会议结束 (Terminating Multicast Session)

信息元件组名称	需求	多个	类型和参考	语义说明
多点传播群指示器 (Multicast Group Indicator) GI	OP		多点传播群指示器（例如IMGI） (Multicast Group Indicator (e.g. IMGI))	多点传播群指示器，专用于到来的消息确定

图 11

Electronic Patent Application Fee Transmittal

Application Number:	12159841
Filing Date:	22-Oct-2008
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Filer:	Sevan Savsa/Neeti Rajput
Attorney Docket Number:	2101-3515

Filed as Large Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt

EFS ID:	11057584
Application Number:	12159841
International Application Number:	
Confirmation Number:	3203
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Customer Number:	35884
Filer:	Sevan Savsa/Neeti Rajput
Filer Authorized By:	Sevan Savsa
Attorney Docket Number:	2101-3515
Receipt Date:	27-SEP-2011
Filing Date:	22-OCT-2008
Time Stamp:	13:31:34
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	26848
Deposit Account	502290
Authorized User	
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1	Information Disclosure Statement (IDS) Form (SB08)	2101-3515_092011_IDSform_FR.pdf	612436 5e916efd30035565f577723434e1d735d21a2114	no	4
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	2101-3515_092011_IDSform_US.pdf	612287 1e17fd176919ee743bbafe13c05f310756831377	no	4
Warnings:					
Information:					
3	Foreign Reference	CN1315121.pdf	1772855 986e9256cb1ddf124ee1b841aecc6154740617be	no	17
Warnings:					
Information:					
4	Foreign Reference	CN1430359.pdf	2145299 638e618d5bc1e14405a96fc675f76a3d649f96ce	no	16
Warnings:					
Information:					
5	Foreign Reference	CN1565140.pdf	5112277 584af412a4008f9839b1583458dee8581d2f6538	no	34
Warnings:					
Information:					
6	Non Patent Literature	1_3GPP.pdf	18250093 7fcd5d54ccf1d78464b2bc1bdb4c17c88806fc3f	no	50
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Information:					
7	Non Patent Literature	2_3GPP.pdf	16086888 58e4f3fa6e8fe3f2236772f8743c1472e219a4db	no	50
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Information:					
8	Non Patent Literature	3_3GPP.pdf	15831212 c66e515c185380d184f7b5ba12246042b9ea4f6f	no	50
Warnings:					
Information:					

9	Non Patent Literature	4_3GPP.pdf	14468100 b1cbbf56809bafe5e4e1810ed6d0ce7463429dd4	no	50
Warnings:					
Information:					
10	Non Patent Literature	5_3GPP.pdf	16399562 7f448aa53833ed9af415c00b318d1d44b0d72681	no	50
Warnings:					
Information:					
11	Non Patent Literature	6_3GPP.pdf	16910971 d7c533fdcb3725f573e240266b58480a5916a6bf	no	50
Warnings:					
Information:					
12	Non Patent Literature	7_3GPP.pdf	15751034 e9d5d528aea02fe0d2c83d272c77233f30ade014	no	50
Warnings:					
Information:					
13	Non Patent Literature	8_3GPP.pdf	15389134 a11f1b68dc6387c64fac280849cc4db561e1b633	no	50
Warnings:					
Information:					
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Warnings:					
Information:					
15	Non Patent Literature	10_3GPP.pdf	12713854 cb917f99ee5cc03f814f57ccfa3521b1d5993e6b	no	50
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Information:					
16	Non Patent Literature	11_3GPP.pdf	12852921 b5918d292b1f78e04c0fedaa49763a78281b1a79	no	50
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Information:					
17	Non Patent Literature	12_3GPP.pdf	12641087 482a23a4c8c9325bce4317af32fc6a1be3a108b9	no	50
Warnings:					
Information:					

18	Non Patent Literature	13_3GPP.pdf	12591963 37b9315ea1607e5f8e4f42c485cde63f1b6c89ed	no	50
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Information:					
19	Non Patent Literature	14_3GPP.pdf	13149218 efb0db6094462e73f5ab2f4f1430bb6230a502c4	no	50
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Information:					
20	Non Patent Literature	15_3GPP.pdf	12919131 f1a2682e74b5cbc11c87b5c5331bba5ada7ad5ca	no	50
Warnings:					
Information:					
21	Non Patent Literature	16_3GPP.pdf	14067338 4933e8913ab799b42d8382d112d157ee116c3cf3	no	50
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Information:					
22	Non Patent Literature	17_3GPP.pdf	11571326 c870911d0b0ca762dc6ccd6ab1aa3558768b2d0f	no	50
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23	Non Patent Literature	18_3GPP.pdf	11417894 d1bec90d352f65472d15c75eb304f9386df66d62	no	50
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Information:					
24	Non Patent Literature	19_3GPP.pdf	12471099 4f2d8c7cfe4e03f61ced59933e4c10e904aeed96	no	50
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Information:					
26	Non Patent Literature	21_3GPP.pdf	15922674 f21233c076a8abdac19e4a82cac00a953da92a96	no	50
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Information:					

27	Non Patent Literature	22_3GPP.pdf	14192413 70d07b08749f5c9f59649e50b86b9c8c3ca28951	no	50
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Information:					
28	Non Patent Literature	23_3GPP.pdf	14998389 7189e552983c02ff50e2c64b2fba748611206070	no	50
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Information:					
29	Non Patent Literature	24_3GPP.pdf	13789561 c71b20fca86c07c9fc49bf580f5687e188ca5da3	no	26
Warnings:					
Information:					
30	Fee Worksheet (SB06)	fee-info.pdf	30686 80870d204ef2dd079b017a964892eee121322d30	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	350177137		

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/159,841	10/22/2008	Young Dae Lee	2101-3515	3203

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EXAMINER	
CHO, UN C	

ART UNIT	PAPER NUMBER
2617	

NOTIFICATION DATE	DELIVERY MODE
09/22/2011	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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UNITED STATES DEPARTMENT OF COMMERCE
U.S. Patent and Trademark Office
Address : COMMISSIONER FOR PATENTS
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APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
12/159,841	22 October, 2008	LEE, YOUNG DAE	2101-3515

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

EXAMINER	
UN C. CHO	
ART UNIT	PAPER
2617	20110913

DATE MAILED:

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner for Patents

The IDSs submitted on 9/7/2011 and 9/12/2011 have been placed in record and considered by the examiner.

/UN C. CHO/
Primary Examiner, Art Unit 2617

PTO-90C (Rev.04-03)

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	7848308		2010-12-07	Lee et al.	

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20060256818		2006-11-16	Shvodian et al.	
	2	20050107036		2005-05-19	Song et al.	

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Receipt date: 09/12/2011		
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
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Examiner Signature	/Un Cho/	Date Considered	09/13/2011

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[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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PTO/SB/08a (01-10)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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(Not for submission under 37 CFR 1.99)

Application Number	12159841
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First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	7099309		2006-08-29	Davidson	
	2	7376424		2008-05-20	Kim et al.	
	3	7398108		2008-07-08	Hondo	
	4	7016343		2006-03-21	Mermel et al.	

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20050105482		2005-05-19	Kobayashi et al.	
	2	20040171395		2004-09-02	Shin	

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Receipt date: 09/12/2011	Application Number	12159841
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2008-10-22
(Not for submission under 37 CFR 1.99)	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

	3	20040057387		2004-03-25	Yi et al.	
	4	20050265301		2005-12-01	Heo et al.	
	5	20040008659		2004-01-15	Kim	
	6	20030137931		2003-07-24	Hans et al.	
	7	20040196861		2004-10-07	Rinchiuso et al.	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

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Examiner Signature	/Un Cho/	Date Considered	09/13/2011

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[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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Receipt date: 09/07/2011
Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	Cho, Un C
Attorney Docket Number	2101-3515

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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	1	20040103435		2004-05-27	Yi, et al.	
	2	20080232291		2008-09-25	Hus, et al.	
	3	20060146745		2006-07-06	Cai, et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
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Receipt date: 09/07/2011		
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Application Number	12159841
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	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	Cho, Un C
	Attorney Docket Number	2101-3515

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1		☐
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EXAMINER SIGNATURE			
Examiner Signature	/Un Cho/	Date Considered	09/13/2011

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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NOTICE OF ALLOWANCE AND FEE(S) DUE

35884 7590 09/12/2011

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

EXAMINER
CHO, UN C

ART UNIT	PAPER NUMBER
2617	

DATE MAILED: 09/12/2011

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/159,841	10/22/2008	Young Dae Lee	2101-3515	3203

TITLE OF INVENTION: METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1510	$300	$0	$1810	12/12/2011

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

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Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
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INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

35884 7590 09/12/2011

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

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I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/159,841	10/22/2008	Young Dae Lee	2101-3515	3203

TITLE OF INVENTION: METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1510	$300	$0	$1810	12/12/2011

EXAMINER	ART UNIT	CLASS-SUBCLASS
CHO, UN C	2617	455-458000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

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1 _____

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:

❑ Issue Fee

❑ Publication Fee (No small entity discount permitted)

❑ Advance Order - # of Copies _____

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❑ A check is enclosed.

❑ Payment by credit card. Form PTO-2038 is attached.

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

❑ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

❑ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/159,841	10/22/2008	Young Dae Lee	2101-3515	3203

35884 7590 09/12/2011

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EXAMINER	
CHO, UN C	

ART UNIT	PAPER NUMBER
2617	

DATE MAILED: 09/12/2011

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 577 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 577 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No.	Applicant(s)	
	12/159,841	LEE, YOUNG DAE	
	Examiner	Art Unit	
	UN C. CHO	2617	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *8/24/2011*.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are *1-11 and 13-15*.

4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☒ All b) ☐ Some* c) ☐ None of the:
      1. ☒ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date See Continuation Sheet
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

/UN C. CHO/
Primary Examiner, Art Unit 2617

Continuation of Attachment(s) 3. Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date: 7/25/2011,7/26/2011,8/30/2011.

Information Disclosure Statement

1. The information disclosure statement (IDS) submitted on 7/25/2011, 7/26/2011 and 8/30/2011 have been placed in record and considered by the examiner.

Terminal Disclaimer

2. The terminal disclaimer filed on 8/24/2011 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of U.S. Patent No. 7,826,859 B2 has been reviewed and is accepted. The terminal disclaimer has been recorded.

Allowable Subject Matter

3. Claims 1 – 11 and 13 – 15 are allowed.

The following is an examiner's statement of reasons for allowance:

Applicant's claims are allowed for the reasons recited by applicant in the amendment filed on 8/24/2011.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to UN C. CHO whose telephone number is (571)272-7919. The examiner can normally be reached on 9:00AM - 6:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, George Eng can be reached on 571-272-7495. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/UN C. CHO/
Primary Examiner, Art Unit 2617

PTO/SB/08a (01-10)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2009106289	RU		2010-08-27	Qualcomm Inc.		☐

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

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	Attorney Docket Number	2101-3515

	1		☐

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Examiner Signature	/Un Cho/	Date Considered	09/06/2011

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[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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	1	2003174470	JP		2003-06-20	Mitsubishi Electric Corp.		☐

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	Attorney Docket Number	2101-3515

	1	QUALCOMM, "Need for MAC-hs segmentation mechanism," 3GPP TSG-RAN WG2 meeting #28, R2-020769, April 2002.	☐

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	1	20020126629		2002-09-12	Jiang et al.	

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20030078046		2003-04-24	Seo	

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	1		☐

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	1	2006352705	JP		2006-12-28	NTT DOCOMO INC		☐

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	Art Unit	2617
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	Attorney Docket Number	2101-3515

	1	Ericsson, "Solution for sending NAS together with RRC connection request," R2-071817, 3GPP TSG-RAN WG2#58, May 2007.	☐
	2	LG Electronics Inc., "Default SRB for initial access," R2-061958, 3GPP TSG-RAN WG2 LTE Ad-hoc, June 2006.	☐

If you wish to add additional non-patent literature document citation information please click the Add button **Add**

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Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12159841	LEE, YOUNG DAE
	Examiner	Art Unit
	UN C CHO	2617

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☒ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	07/18/2011	09/06/2011							
1	1	✓	=							
2	2	✓	=							
3	3	✓	=							
4	4	✓	=							
5	5	✓	=							
6	6	✓	=							
7	7	✓	=							
8	8	✓	=							
9	9	✓	=							
10	10	✓	=							
11	11	✓	=							
	12	O	-							
12	13	✓	=							
13	14	✓	=							
14	15		=							

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ORIGINAL		INTERNATIONAL CLASSIFICATION									
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED				
455	458	H	0	4	W	68 / 00 (2009.01.01)	H	0	4	B	7 / 00 (2006.01.01)
CROSS REFERENCE(S)		H	0	4	W	72 / 00 (2009.01.01)					

CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
455	450	515			

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☒ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1														
2	2														
3	3														
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14	15														

(Assistant Examiner)	(Date)	Total Claims Allowed: 14	
/UN C CHO/ Primary Examiner.Art Unit 2617	09/06/2011	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	5

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
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	Examiner	**Art Unit**
	UN C CHO	2617

SEARCHED

Class	Subclass	Date	Examiner
455	458,447,450,515	7/18/2011	UC

SEARCH NOTES

Search Notes	Date	Examiner
East Search including keywords, class/subclass, inventor, assignee	7/18/2011	UC
Updated East Search including inventor, assignee, claim language	9/6/2011	UC

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner
See Search Report		9/6/2011	UC

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	1	7848308		2010-12-07	Lee et al.	

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	1	20060256818		2006-11-16	Shvodian et al.	
	2	20050107036		2005-05-19	Song et al.	

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CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Sevan Savsa/	Date (YYYY-MM-DD)	2011-09-12
Name/Print	Sevan Savsa	Registration Number	61,718

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	12159841
Filing Date:	22-Oct-2008
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Filer:	Sevan Savsa/Neeti Rajput
Attorney Docket Number:	2101-3515

Filed as Large Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt

EFS ID:	10930011
Application Number:	12159841
International Application Number:	
Confirmation Number:	3203
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Customer Number:	35884
Filer:	Sevan Savsa/Neeti Rajput
Filer Authorized By:	Sevan Savsa
Attorney Docket Number:	2101-3515
Receipt Date:	12-SEP-2011
Filing Date:	22-OCT-2008
Time Stamp:	18:22:09
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	6182
Deposit Account	502290
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	2101-3515_090811_IDSform.pdf	612327 e63fd19c531589a24141e4d116535021815e4d30	no	4
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30685 ddfadb5ad228eecf7e666bf71a29230998d5a9c3	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	643012		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	7099309		2006-08-29	Davidson	
	2	7376424		2008-05-20	Kim et al.	
	3	7398108		2008-07-08	Hondo	
	4	7016343		2006-03-21	Mermel et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20050105482		2005-05-19	Kobayashi et al.	
	2	20040171395		2004-09-02	Shin	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

	3	20040057387		2004-03-25	Yi et al.	
	4	20050265301		2005-12-01	Heo et al.	
	5	20040008659		2004-01-15	Kim	
	6	20030137931		2003-07-24	Hans et al.	
	7	20040196861		2004-10-07	Rinchiuso et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1		☐

If you wish to add additional non-patent literature document citation information please click the Add button Add

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

EXAMINER SIGNATURE			
Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

CERTIFICATION STATEMENT

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OR

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☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Harry Lee/	Date (YYYY-MM-DD)	2011-09-12
Name/Print	Harry Lee	Registration Number	56,814

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

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Electronic Patent Application Fee Transmittal

Application Number:	12159841
Filing Date:	22-Oct-2008
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Filer:	Harry Sung Lee/Neeti Rajput
Attorney Docket Number:	2101-3515

Filed as Large Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt

EFS ID:	10930472
Application Number:	12159841
International Application Number:	
Confirmation Number:	3203
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Customer Number:	35884
Filer:	Harry Sung Lee/Neeti Rajput
Filer Authorized By:	Harry Sung Lee
Attorney Docket Number:	2101-3515
Receipt Date:	12-SEP-2011
Filing Date:	22-OCT-2008
Time Stamp:	18:56:59
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	6631
Deposit Account	502290
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	2101-3515_081111_IDSform.pdf	612477 5093ed9ca697255f987fb6070773d6c9b7b2314f	no	5
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30631 e9c7bf5f52dbcdab27427d3b194195854e086688	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	643108		

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	Cho, Un C
Attorney Docket Number	2101-3515

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20040103435		2004-05-27	Yi, et al.	
	2	20080232291		2008-09-25	Hus, et al.	
	3	20060146745		2006-07-06	Cai, et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] ¡	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	Cho, Un C
	Attorney Docket Number	2101-3515

If you wish to add additional Foreign Patent Document citation information please click the Add button			Add
NON-PATENT LITERATURE DOCUMENTS			Remove
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1		☐
If you wish to add additional non-patent literature document citation information please click the Add button			Add

EXAMINER SIGNATURE			
Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	Cho, Un C
	Attorney Docket Number	2101-3515

CERTIFICATION STATEMENT

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☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Sevan Savsa/	Date (YYYY-MM-DD)	2011-09-07
Name/Print	Sevan Savsa	Registration Number	61,718

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Electronic Acknowledgement Receipt

EFS ID:	10896345
Application Number:	12159841
International Application Number:	
Confirmation Number:	3203
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Customer Number:	35884
Filer:	Sevan Savsa/Diana Kim
Filer Authorized By:	Sevan Savsa
Attorney Docket Number:	2101-3515
Receipt Date:	07-SEP-2011
Filing Date:	22-OCT-2008
Time Stamp:	16:44:58
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	2101-3515_082911_IDSForm.pdf	612345 0ce8c2b93bf6e17645c37cee0fc809be2a23aeb8	no	4

Warnings:	
Information:	

Total Files Size (in bytes):	612345

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Application Number	Application/Control No.	Applicant(s)/Patent under Reexamination	
	12/159,841	LEE, YOUNG DAE	

Document Code - DISQ	Internal Document – DO NOT MAIL

TERMINAL DISCLAIMER	☒ APPROVED	☐ DISAPPROVED
Date Filed : 8/24/11	This patent is subject to a Terminal Disclaimer	

Approved/Disapproved by:

Felicia D. Roberts

7,826,859

U.S. Patent and Trademark Office

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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	1	2006352705	JP		2006-12-28	NTT DOCOMO INC		☐

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	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

	1	Ericsson, "Solution for sending NAS together with RRC connection request," R2-071817, 3GPP TSG-RAN WG2#58, May 2007.	☐
	2	LG Electronics Inc., "Default SRB for initial access," R2-061958, 3GPP TSG-RAN WG2 LTE Ad-hoc, June 2006.	☐

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A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Sevan Savsa/	Date (YYYY-MM-DD)	2011-08-30
Name/Print	Sevan Savsa	Registration Number	61,718

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	1	20020126629		2002-09-12	Jiang et al.	

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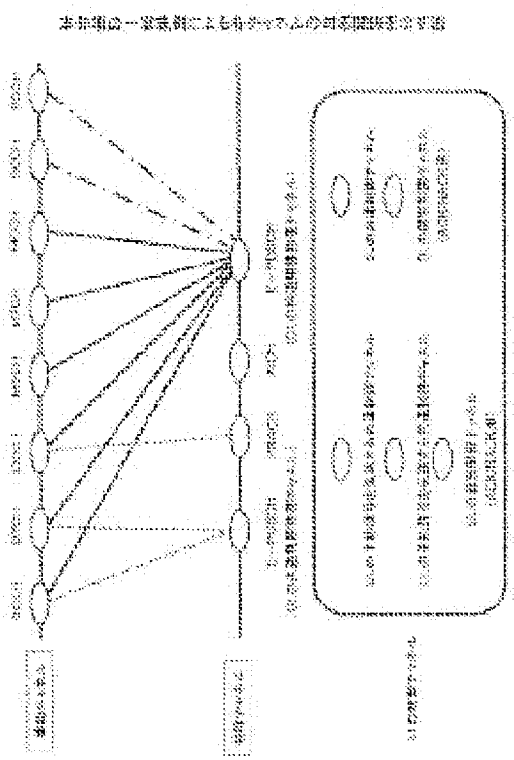
Bibliographic data: JP 2006352705 (A)

CHANNEL TRANSMISSION APPARATUS AND CHANNEL TRANSMISSION METHOD

Publication date:	2006-12-28
Inventor(s):	MOGI MASAYUKI; KATO YASUHIRO; UMESH ANIL; NAKAMURA TAKEHIRO +
Applicant(s):	NTT DOCOMO INC +
Classification:	**- international:** ***H04J13/00; H04W72/04***
	- European: H04J13/00
Application number:	JP20050178531 20050617
Priority number(s):	JP20050178531 20050617
Also published as:	• JP 4651462 (B2) • EP 1892990 (A1) • US 2009219906 (A1) • KR 20080042797 (A) • WO 2006135064 (A1) • more

Abstract of JP 2006352705 (A)

PROBLEM TO BE SOLVED: To provide a channel transmission apparatus for efficiently transmitting a CCCH used in a process of RRC connection establishment on a shared wireless logic channel in a channel transmission system wherein a transmission method is sequentially changed depending on characteristics of logic channels when the logic channels are transmitted on the shared wireless physical channel. ; SOLUTION: The wireless physical channel can be shared in use with the logic channels, a plurality of wireless physical control channels are prepared collaterally with the wireless physical channel and each wireless physical control channel includes a common control channel shared in use. The channel transmission apparatus includes a logic channel type discrimination means for discriminating a type of the logic channel and a channel transmission means for transmitting an identifier of UE through the wireless physical control channel in response to the type of the logic channel. The identification method of the UE in the wireless physical control channel is revised in response to the type of the logic channel. ; COPYRIGHT: (C)2007,JPO&INPIT



(19)日本国特許庁(JP)　(12)公開特許公報(A)　(11)特許出願公開番号
特開2006-352705
(P2006-352705A)
(43)公開日　平成18年12月28日(2006.12.28)

(51)Int.Cl.			F I			テーマコード（参考）
H04Q	***7/38***	***(2006.01)***	H04B	7/26	109M	5K022
H04J	***13/00***	***(2006.01)***	H04B	7/26	109N	5K067
			H04J	13/00	A	

審査請求 未請求　請求項の数 8　OL　（全 18 頁）

(21)出願番号　特願2005-178531 (P2005-178531)
(22)出願日　平成17年6月17日 (2005.6.17)

(71)出願人　392026693
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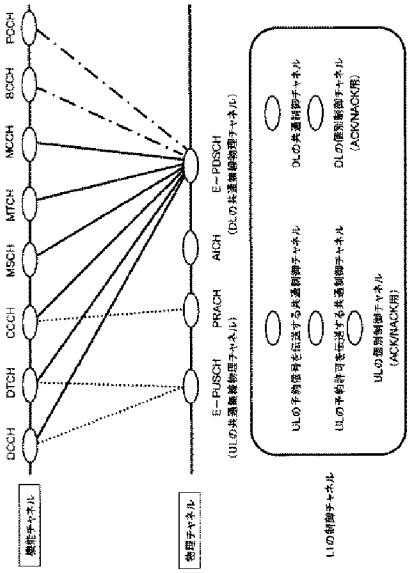
最終頁に続く

(54)【発明の名称】チャネル伝送装置及びチャネル伝送方法

(57)【要約】
【課題】　複数の論理チャネルを共通の無線物理チャネル上で伝送する場合に論理チャネルの特性に応じて逐次伝送方法を変更するチャネル伝送システムにおいて、ＲＲＣコネクション確立過程で使用されるＣＣＣＨをシェアードチャネル上で効率よく伝送するチャネル伝送装置を提供すること。
【解決手段】　無線物理チャネルは複数の論理チャネルに共通に使用可能であり、無線物理チャネルに付随して複数の無線物理制御チャネルが用意され、無線物理制御チャネルには共通に使用可能な共通制御チャネルが含まれる。チャネル伝送装置は、論理チャネルの種別を判定する論理チャネル種別判定手段と、論理チャネルの種別に応じて、ＵＥの識別子を無線物理制御チャネルで伝送するチャネル伝送手段とを備える。無線物理制御チャネルにおけるＵＥの識別方法は論理チャネルの種別に応じて変更される。
【選択図】　図４

本発明の一実施例による各チャネルの対応関係を示す図



【特許請求の範囲】
【請求項1】
無線アクセスネットワーク（ＲＡＮ）内の端末（ＵＥ）と通信するチャネル伝送装置であって、
前記無線物理チャネルは複数の論理チャネルに共通に使用可能であり、
前記無線物理チャネルに付随して複数の無線物理制御チャネルが用意され、
前記無線物理制御チャネルには共通に使用可能な共通制御チャネルが含まれ、
論理チャネルの種別を判定する論理チャネル種別判定手段と、
論理チャネルの種別に応じて、ＵＥの識別子を無線物理制御チャネルで伝送するチャネル伝送手段と、
を備え、
前記無線物理制御チャネル上における前記ＵＥの識別方法が論理チャネルの種別に応じて変更される
ことを特徴とするチャネル伝送装置。
【請求項2】
請求項１記載のチャネル伝送装置であって、
前記無線制御物理チャネルの情報を報知情報で報知する手段
を備え、前記無線物理制御チャネルの情報は、報知情報で報知されることを特徴とするチャネル伝送装置。
【請求項3】
請求項２記載のチャネル伝送装置であって、前記ＵＥが前記無線物理チャネル上で識別子を識別する識別子手段を有し、前記共通制御チャネル上で、無線コネクション確立以前の前記ＵＥの識別は、共通の識別子を用いて行なわれることを特徴とするチャネル伝送装置。
【請求項4】
請求項３記載のチャネル伝送装置であって、
前記共通制御チャネル上で前記共通の識別子が認識された場合に、前記ＵＥでデータが受信されることを特徴とするチャネル伝送装置。
【請求項5】
請求項４記載のチャネル伝送装置であって、
前記無線物理制御チャネルは、予約信号を伝送する為の予約信号伝送チャネル、及び前記予約信号に対する予約許可信号を伝送する為の予約許可チャネルを含んで構成され、
前記予約許可信号を予約許可チャネル上で伝送するチャネル伝送手段と、
を備え、
前記予約信号はシグネチャを含んで構成され、前記予約信号に対する予約許可信号は、無線コネクション確立以前の前記ＵＥの場合には、前記予約許可チャネル上で伝送されることを特徴とするチャネル伝送装置。
【請求項6】
請求項５記載のチャネル伝送装置であって、
前記予約許可チャネル上で伝送される予約許可信号を解析する予約許可信号解析手段と、
を備え、
前記予約許可チャネル上での前記ＵＥの識別は、前記シグネチャを用いて行なわれることを特徴とするチャネル伝送装置。
【請求項7】
請求項６記載のチャネル伝送装置であって、
前記予約許可チャネル上で前記シグネチャが認識された場合に、当該予約許可を解析する手段が設けられることを特徴とするチャネル伝送装置。
【請求項8】

無線アクセスネットワーク（ＲＡＮ）内の端末（ＵＥ）と通信するチャネル伝送方法であって、
前記無線物理チャネルは複数の論理チャネルに共通に使用可能であり、
前記無線物理チャネルに付随して複数の無線物理制御チャネルが用意され、
前記無線物理制御チャネルには共通に使用可能な共通制御チャネルが含まれ、
論理チャネルの種別を判定し、
論理チャネルの種別に応じてＵＥの識別子を無線物理制御チャネルで伝送し、
前記無線物理制御チャネル上における前記ＵＥの識別方法が論理チャネルの種別に応じて変更される
【発明の詳細な説明】チャネル伝送方法。
【技術分野】
【0001】
本発明は、１つの無線物理チャネル上での論理チャネルの伝送方法に関し、特にコネクションの確立前に論理チャネルを伝送する技術に関する。
【背景技術】
【0002】
Ｗ－ＣＤＭＡ（Ｗｉｄｅｂａｎｄ－Ｃｏｄｅ　Ｄｉｖｉｓｉｏｎ　Ｍｕｌｔｉｐｌｅ　Ａｃｃｅｓｓ）方式の移動通信システムでは非特許文献１に示されるように、チャネル、接続シーケンス及び無線物理チャネルの様々な対応関係が規定されている。チャネル間の対応関係としては、ＲＬＣとＭＡＣとの間で定義される機能チャネルである論理チャネル（Ｌｏｇｉｃａｌ　Ｃｈａｎｎｅｌ）と、ＭＡＣレイヤと物理レイヤの間で定義される機能チャネルであるトランスポートチャネル（Ｔｒａｎｓｐｏｒｔ　Ｃｈａｎｎｅｌ）と、物理レイヤ（Ｐｈｙｓｉｃａｌ　ｌａｙｅｒ）で定義される機能チャネルである物理チャネル（Ｐｈｙｓｉｃａｌ　Ｃｈａｎｎｅｌ）との３種類のチャネル階梯が定義されている。論理チャネルはトランスポートチャネルとの対応関係を有し、トランスポートチャネルは物理チャネルとの対応関係を有する。
【0003】
Ｗ－ＣＤＭＡ方式の移動通信システムでは、複数の論理チャネルは複数のトランスポートチャネルを介して複数の無線物理チャネル上へ配置（マッピング）される。図１は従来のチャネルの対応関係を示す。
【0004】
一方、図２に示されるように、接続シーケンスはＲＲＣ接続又はコネクション（Ｃｏｎｎｅｃｔｉｏｎ）が確立されるまでの移動局（ＵＥ）の識別はＬ３（ＲＲＣ）での識別子（ＴＭＳＩ）によりなされる。故に、ＲＲＣコネクションが確立されるまでの間Ｌ２では個別の対応関係が無いため、論理チャネルはＣＣＣＨで伝送される。また、ＲＲＣコネクション確立後のＵＥはＬ２での識別子（Ｃ－又はＨ－ＲＮＴＩ）で識別される為、Ｌ２レベルで個別の対応関係があり、論理チャネルはＤＣＣＨに変更される。
【0005】
具体的には、ＲＲＣコネクション確立時の制御信号である“ＲＲＣコネクション要求”はＣＣＣＨで伝送され、無線物理チャネルはＰＲＡＣＨ（ＲＡＣＨ）である。さらに、“ＲＲＣコネクションセットアップ”もＣＣＣＨで伝送され、無線物理チャネルはＳＣＣＰＣＨ（ＦＡＣＨ）である。これ以降の通信（シグナリング）はＲＲＣコネクションが確立される為、論理チャネルはＤＣＣＨで伝送され、無線物理チャネルはＤＰＣＨ（ＤＣＣＨ）で伝送される。ＲＲＣコネクション設定時に用意される伝送路はＳＤＣＣＨであり、Ｕ－プレーン（ｐｌａｎｅ）伝送用のチャネルは用意されていない。
【0006】
この様に、ＲＲＣコネクションセットアップ時に（ＲＲＣ接続の設定時に）ＲＲＣのシグナリングで無線チャネルが変更される。無線ベアラセットアップ（Ｒａｄｉｏ　Ｂｅａｒｅｒ　Ｓｅｔｕｐ）でＵ－プレーン伝送用の無線物理チャネルが設定される。即ち、ＲＲＣのシグナリングによりチャネルが追加される。

【0007】
また、個別チャネル確立前の上り方向のアクセス方式はプリアンブルを用いて行なわれ、プリアンブルは１６チップのシグネチャを２５６回繰り返した４０９６チップ長で構成され、プリアンブルをランピングしながら行われる。基地局（ＢＴＳ）は当該プリアンブルを受信した時点でＡＩＣＨを用いて肯定応答（Ａｃｋ）／非肯定応答（Ｎａｃｋ）を返す。Ａｃｋの場合にはシステムで予め規定されたスロット（通常は３乃至４スロット）後にデータを（ＰＲＡＣＨ上で）伝送する。プリアンブルにはトラフィック情報は含まれない。
【0008】
ところで、高速ダウンリンクパケットアクセス（ＨＳＤＰＡ）方式では、ＵＥ間で共通に使用可能なシェアードチャネル（ｓｈａｒｅｄ　ｃｈａｎｎｅｌ）（ＨＳ－ＰＤＳＣＨ）が用意されている。このチャネル上でＤＣＣＨやＤＴＣＨのＲＲＣコネクション確立後の論理チャネルが伝送される。ＨＳ－ＰＤＳＣＨに付随して、ＨＳ－ＰＤＳＣＨ上でのデータが到着した事を通知するための共通の制御ＣＨであるＨＳ－ＳＣＣＨも用意されている。ＨＳ－ＳＣＣＨ上ではＵＥはＬ２の識別子でマスキングされたデータから自分宛のデータが到着したことを認識する。またＨＳ－ＳＣＣＨは各ＵＥで最大４コード（Ｃｏｄｅ）まで受信可能であるが、当該セルで使用するＨＳ－ＳＣＣＨのコードはＲＲＣのシグナリングによりＵＥに通知される。コードは無線ベアラセットアップ／リコンフィギュレーション（Ｒｅｃｏｎｆｉｇｕｒａｔｉｏｎ）に含まれる。ＨＳ－ＰＤＳＣＨ上ではＨＡＲＱ及びＡＭＣの技術が使用される。
【0009】
また、エンハンストアップリンク（Ｅｎｈａｎｃｅｄ　Ｕｐｌｉｎｋ）では基地局（Ｎｏｄｅ　Ｂ）でスケジューリングが行なわれる為、基地局（Ｎｏｄｅ　Ｂ）へデータを伝送する為の予約信号を伝送するチャネル（Ｅ－ＤＰＣＣＨ）、および予約許可を伝送するチャネル（Ｅ－ＲＧＣＨ，Ｅ－ＡＧＣＨ）が定義され、さらに上りデータを伝送するチャネル（Ｅ－ＤＰＤＣＨ）も定義される。Ｅ－ＤＰＤＣＨ上ではＨＳ－ＰＤＳＣＨと同様にＨＡＲＱが実現される。
【非特許文献1】立川敬二監修、「Ｗ－ＣＤＭＡ移動通信方式」、ｐｐ．１０３－１５７
【発明の開示】
【発明が解決しようとする課題】
【0010】
従来技術では、論理チャネル、トランスポートチャネル及び物理チャネルの３段階のチャネル階層があり、論理チャネルはトランスポートチャネルに対応付けられ、トランスポートチャネルは物理チャネルに対応付けられる。複数の論理チャネルはトランスポートチャネルを介して複数の無線物理チャネルに割り当てられている。基本的には論理チャネルの特性に応じて無線物理チャネルが定められている。例えばＣＣＣＨはＰＲＡＣＨやＳＣＣＰＣＨで伝送され、ＤＣＣＨやＤＴＣＨはＤＰＣＨやＨＳ－ＰＤＳＣＨで伝送される。接続シーケンスを考えてみると、ＲＲＣコネクション確立過程におけるＣＣＣＨ（論理チャネル）のシグナリングについては、上りはＰＲＡＣＨで伝送され、折り返しの下りはＳＣＣＰＣＨで伝送される。また、ＲＲＣコネクション確立後のシグナリングでは、ＤＣＣＨはＤＰＣＨ上で伝送される。この様にＷ－ＣＤＭＡでは論理チャネルの特性に応じて無線物理チャネルが規定され、ＲＲＣのシグナリングで無線物理チャネルの変更が行なわれる。この為、無線物理チャネルを変更する為のプロシージャやメッセージが必要になる。また、チャネル遷移をするためのプロトコル状態が増える問題や、制御遅延、データロス等の問題もある。更にＷ－ＣＡＭＡでは、シグナリング後にＵ－プレーン伝送用の論理チャネル（ベアラ）が追加される為、そこでもＬ３のシグナリングが用いられる必要がある。
【0011】
ＲＲＣコネクション確立前におけるＵＥの識別はＬ３の識別子で行なわれる一方、現状のシェアードチャネルに付随する無線物理制御チャネル上ではＵＥはＬ２のシグナリング

で識別されており、識別法が異なる。

【0012】

さらにＨＳ－ＰＤＳＣＨ（物理チャネル）にはＨＳ－ＤＳＣＨ（トランスポートチャネル）のみがマッピング可能であり、他のトランスポートチャネル（例えば、ＰＣＨ，ＢＣＨ等）をマッピングすることはできない。ＨＳ－ＤＳＣＨには、ＤＣＣＨおよびＤＴＣＨのみが配置可能（マッピング可能）であり、他の論理チャネルはＬ２レベルでのＵＥの識別が困難である理由からマッピングすることができない。

【0013】

本発明の課題は、複数の機能チャネル（論理チャネル）を共通の無線物理チャネル上で伝送する場合に論理チャネルの特性に応じて逐次伝送方法を変更するチャネル伝送システムにおいて、ＲＲＣコネクション確立過程で使用されるＣＣＣＨを無線物理チャネル（シェアードチャネル）上で効率よく伝送するチャネル伝送装置及びチャネル伝送方法を提供することである。

【課題を解決するための手段】

【0014】

本発明では、無線アクセスネットワーク（ＲＡＮ）内の端末（ＵＥ）と通信するチャネル伝送装置が使用される。本装置では、前記無線物理チャネルは複数の論理チャネルに共通に使用可能であり、前記無線物理チャネルに付随して複数の無線物理制御チャネルが用意され、前記無線物理制御チャネルには共通に使用可能な共通制御チャネルが含まれる。本装置は、論理チャネルの種別を判定する論理チャネル種別判定手段と、論理チャネルの種別に応じて、ＵＥの識別子を無線物理制御チャネルで伝送するチャネル伝送手段とを備える。前記無線物理制御チャネル上における前記ＵＥの識別方法は論理チャネルの種別に応じて変更される。

【発明の効果】

【0015】

本発明によれば、複数の機能チャネル（論理チャネル）を共通の無線物理チャネル上で伝送する場合に論理チャネルの特性に応じて逐次伝送方法を変更するチャネル伝送システムにおいて、ＲＲＣコネクション確立過程で使用されるＣＣＣＨを無線物理チャネル上で効率よく伝送できる。

【発明を実施するための最良の形態】

【0016】

本発明の一形態にあっては、無線アクセスネットワーク（ＲＡＮ）と端末（ＵＥ）との間で無線コネクションが確立され、データ伝送に用いる複数の論理チャネルが無線物理チャネル上で伝送される。前記論理チャネルでは、制御用の論理チャネルとデータ通信用の論理チャネルが用意される。前記論理チャネルに対して共通に使用可能な無線物理チャネルが用意され、論理チャネルは１種類の無線物理チャネルとしか対応関係を持たず、さらに前記無線物理チャネルに付随して前記論理チャネルを伝送する為の共通の無線物理制御チャネルが複数用意される。前記論理チャネルに応じて逐次前記無線物理制御チャネル上での伝送方法が変更される。即ち、無線物理制御チャネルにおけるＵＥの識別方法が論理チャネルの種別に応じて変更される。従来ではＬ２レイヤで個別チャネルが設定された後でしか無線物理制御チャネルにおけるＵＥの判別がされておらず、無線物理制御チャネル上におけるＵＥの識別方法は１通りしかなかった点で、本発明は大きく異なる。

【0017】

無線物理チャネルは、少なくとも、共通チャネルの論理チャネル及び個別チャネルの論理チャネルに共通に使用される。共通チャネルは不特定のユーザに共通するチャネルであり、個別チャネルは特定のユーザに対するチャネルである。無線物理チャネルは、共通チャネル及び個別チャネルの論理チャネルに加えて、ブロードキャストキャストチャネルの論理チャネルに共通に使用されてもよい。無線物理チャネルは、共通チャネル及び個別チャネルの論理チャネルに加えて、ページングチャネルの論理チャネルに共通に使用されてもよい。更には、１種類の無線物理チャネル（シェアードチャネル）上で全論理チャネル

が伝送されてもよい。

【0018】

本発明の一形態では、シェアードチャネルに付随する共通に使用される物理制御チャネル上で論理チャネルの種別（ＣＣＣＨ）に応じて伝送方法（ＵＥの識別方法）を変更することにより、シグナリングからＵ－プレーンデータの伝送までの接続シーケンスの過程が、同じ無線物理チャネル上で実現できる。複数ある論理チャネルを１つの無線物理チャネル上に配置する為、チャネルの構成を簡易にすることができる。更に、プロトコル状態を複数定義する必要性が無くなり、試験稼動の低減や、Ｌ３シグナリングによるチャネル遷移プロシージャを省略でき、Ｌ３シグナリングのメッセージ長を削減できる。また、チャネル遷移に伴う遅延を低減することもでき、接続遅延を短くできる効果もある。更に、データロスを回避する事もできる。

【実施例】

【0019】

以下、本発明の第1実施例による装置及び方法が説明される。

【0020】

＜通信システム＞

図３は本実施例で想定される通信システムを示す。本実施例の想定する通信システム（具体的には無線アクセスネットワーク）は、複数の送信装置又は基地局（ＢＴＳ）（１－１，１－２，１－３）、送信装置が接続される無線ネットワークコントローラ（ＲＮＣ）（１－４）、および複数の受信装置又は移動局（ＵＥ）（１－５，１－６，１－７，１－８，１－９，１－１０）から構成される。通信システムでは、ＢＴＳとＵＥとの間で情報のやり取りを可能とするために無線を用いてサービスエリアが形成される。

【0021】

ＢＴＳは物理レイヤのプロトコルスタックを有し、更に再送制御（ＨＡＲＱ）の機能を有するＭＡＣレイヤも含んで構成される。また、Ｌ３（ＲＲＣ）レイヤのシグナリングはＲＮＣとＵＥとの間で終端される。ＲＡＮの構成によってはＲＮＣが用意されない構成であっても良く（即ちＲＮＣの有する機能がＢＴＳに分散されてもよい）、その場合にはＬ３のシグナリングはＢＴＳとＵＥとの間で終端される。ＢＴＳとＵＥとの間ではＢＴＳからＵＥへ（下り方向：ＤＬ）、ＵＥからＢＴＳへ（上り方向：ＵＬ）伝送する無線物理チャネルとして、複数のＵＥで共通に使用できる無線物理チャネルが定義される。この無線物理チャネル上であらゆる論理チャネルを伝送することが可能である。

【0022】

本実施例では送信装置及び受信装置を無線リンクを介して情報を伝送するＢＴＳ及びＵＥとして定義したが、送信装置と受信装置との間の伝送路は無線に限定されるものではなく有線の伝送路であっても良い。

【0023】

＜機能チャネル及び物理チャネルの対応関係＞

次に、本実施例で想定される論理チャネル及び物理チャネルの対応関係が、Ｗ－ＣＤＭＡで提供されている論理チャネルおよび無線物理チャネルを用いて、図４を参照しながら説明される。論理チャネルは、ＢＣＣＨ，ＰＣＣＨ，ＭＣＣＨ，ＤＣＣＨ，ＣＣＣＨ，ＤＴＣＨ，ＭＳＣＨ，およびＭＴＣＨから構成され、本実施例では特にＣＣＣＨおよびＤＣＣＨに着目する。一方、無線物理チャネルは、共通に使用可能な無線物理チャネルが上り方向および下り方向に対して１本ずつ存在し（Ｅ－ＰＤＳＣＨ，およびＥ－ＰＵＳＣＨ）、さらにＵＬでＰＲＡＣＨが用意される。ＤＬの無線物理チャネル（Ｅ－ＰＤＳＣＨ）上では，ＢＣＣＨ，ＰＣＣＨ，ＭＣＣＨ，ＤＣＣＨ，ＣＣＣＨ，ＭＳＣＨ，ＭＴＣＨ，およびＤＴＣＨを伝送することが可能である。ＵＬの無線物理チャネル（Ｅ－ＰＵＳＣＨ）上では，ＤＣＣＨ，ＤＴＣＨを伝送することが可能である。ＰＲＡＣＨ上ではＣＣＣＨを伝送可能である。

【0024】

ところで、無線物理チャネルには上記のＤＬとＵＬのデータ伝送に用いる共の通無線物

理チャネルに加えて、共通無線物理チャネルを制御する為の無線物理制御チャネルが付随して存在する。図示の例では、共通無線物理チャネルに付随するものしか描かれていないが、これ以外の無線物理制御チャネル（例えば、共通パイロットチャネル、シンクロナイゼーションチャネル等）が複数存在してもよい。ＵＬの共通無線物理チャネル（Ｅ－ＰＵＳＣＨ）に付随して予約信号送信チャネル、予約許可信号送信チャネル及びインディケータチャネルが用意される。予約信号送信チャネルはＵＬでデータが発生した際に予約信号を伝送する為の共通のチャネルである。通常は、ＲＲＣコネクション確立後に設定されるが、本実施例ではＬ３識別の段階でも設定できる。予約許可信号送信チャネルは予約信号送信チャネルの折り返しとしてＵＥに対して予約許可を送信する為の共通のチャネルである。通常はＲＲＣコネクション確立後に設定されるが、本実施例ではＬ３識別の段階でも設定できる。インディケータチャネルはＵＬのデータ伝送でＨＡＲＱに伴う再送制御を行なう場合、ＡＣＫ／ＮＡＣＫを送信側へ通知する為のチャネルである。それはＲＲＣコネクション確立後に設定される。

【0025】

同様に、ＤＬの共通無線物理チャネル（Ｅ－ＰＤＳＣＨ）に付随して共通無線物理制御チャネル及びインディケータチャネルが用意される。共通無線物理制御チャネルは共通無線物理チャネル上でデータを伝送することを受信側に事前に通知するためのチャネルである。通常はＲＲＣコネクション確立後に設定されるが、本実施例ではＬ３識別の段階でも設定できる。インディケータチャネルはＤＬのデータ伝送でＨＡＲＱに伴う再送制御を行なう場合、ＡＣＫ／ＮＡＣＫ（又はＣＱＩ（Ｃｈａｎｎｅｌ　Ｑｕａｌｉｔｙ　Ｉｎｄｉｃａｔｏｒ））を送信側へ通知する為のチャネルである。それはＲＲＣコネクション確立後に設定される。

【0026】

説明の簡明化のため、本実施例では論理チャネルと無線物理チャネルとの対応関係に注目し、Ｗ－ＣＤＭＡで定義されているトランスポートチャネルに関する説明は省略される。論理チャネルと物理チャネルとの間に何らかのトランスポートチャネルが定義されてもよい。

【0027】

＜接続シーケンス＞

図５は本実施例による接続シーケンスを示す。本実施例ではＲＲＣコネクションを確立するまでの過程のシーケンスに焦点をあてて説明がなされる。ＵＥは“ＲＲＣコネクション要求（Ｃｏｎｎｅｃｔｉｏｎ　Ｒｅｑｕｅｓｔ）”をＲＮＣに伝送する為に、ＢＴＳとの間の無線物理チャネルを予約するプリアンブル（Ｐｒｅａｍｂｌｅ）をＢＴＳに対して送信する。プリアンブルはＵＥがランダムに選択するシグネチャを含んで構成される。プリアンブルを受信したＢＴＳは、その許可又はグラント（Ｇｒａｎｔ）をＡＩＣＨ上で送信する。ＡＩＣＨで許可を得たＵＥは予めシステムで指定されたタイミング（時間及び/又は周波数等）及び上りの無線物理チャネル（ＰＲＡＣＨ）上で、“ＲＲＣコネクション要求”を送信する。ＢＴＳに到着した“ＲＲＣコネクション要求”はＲＮＣへ伝送される。“ＲＲＣコネクション要求”を受信したＲＮＣは，“ＲＲＣコネクションセットアップ（Ｃｏｎｎｅｃｔｉｏｎ　Ｓｅｔｕｐ）”を送信する。ＢＴＳは到着した“ＲＲＣコネクションセットアップ”をＲＮＣに伝送する為に、ＨＳ－ＳＣＣＨ相当の共通の無線制御チャネル（ＲＲＣ　Ｃｏｎｎｅｃｔｉｏｎ確立後も同一チャネルで下り方向の無線物理チャネル（Ｅ－ＰＤＳＣＨ）でのデータ到着を通知する）上でデータ到着通知を送信する。前記データ到着通知はグローバルな識別子（ＲＮＴＩの中から事前にＣＣＣＨ用に割り当てておく）を含んで構成される。グローバルな識別子はＣＣＣＨの論理チャネルを通信する複数のＵＥ間で共用可能な識別子であり、「共通の識別子」と呼んでもよい。ＢＴＳは、あわせて、データ到着通知で指示したタイミングで“ＲＲＣコネクションセットアップ”を下りの共通無線物理チャネル上で送信する。データ到着通知を受信したＵＥは到着通知で指示されるタイミングで“ＲＲＣコネクションセットアップ”を受信する。“ＲＲＣコネクションセットアップ”がＵＥで受信された後、ＲＲＣコネクションが確立され、ＵＥ

はＲＲＣコネクションセットアップで指示された無線物理チャネルを追加する（上り方向の予約信号送信用の個別制御チャネル、ＨＡＲＱ用のＡＣＫ／ＮＡＣＫチャネル、同様に下り方向の無線チャネルも追加する）。この後は、個別の制御チャネルを用いて予約信号がＢＴＳに送信される。予約許可はＲＲＣコネクション確立前のチャネルと同様に予約許可チャネルで伝送される。

【0028】

＜ＲＮＣの構成＞

図６は本実施例で想定されるＲＮＣに備わる機能についてのブロック図である。ＲＮＣは図６に示されるように制御部、有線信号送受信部及びＬ３制御部から構成される。制御部は各機能エンティティに対して制御行い、ＲＮＣ全体の動作を司る。有線信号送受信部はＢＴＳとＲＮＣとの間で信号の送受信を行う為の機能を提供する。Ｌ３制御部は、ＵＥとＲＮＣとの間でＬ３のシグナリングを行なう機能を有する。

【0029】

＜ＢＴＳの構成＞

図７は本実施例で想定されるＢＴＳに備わる機能についてのブロック図である。ＢＴＳは、制御部、無線信号送受信部、有線信号送受信部、予約信号解析部、予約許可信号作成部、データ到着通知作成部及びデータ蓄積部から構成される。

【0030】

制御部は各機能エンティティに対して制御行い、ＢＴＳ全体の動作を司る。無線信号送受信部は、ＵＥとＢＴＳとの間で確立される無線リンクを通じて信号のやり取りをする為に必要な処理（無線変調、チャネル符号化等）を行なう機能を有する。有線信号送受信部はＲＮＣ（上位Ｎｏｄｅ）とＢＴＳとの間で有線回線を用いて信号を伝送する為に必要な処理を行なう機能を有する。予約信号解析部は２つの機能を有し、プリアンブルを解析する機能に加えて、ＲＲＣコネクション確立後の予約チャネルで伝送される予約信号を解析する機能を有する。予約許可信号作成部も２つの機能を有し、プリアンブルに対する応答する機能および予約チャネルで伝送されてきた予約信号に対する応答の予約許可を作成する機能を有する。データ到着通知作成部は、有線信号送受信部でＲＮＣ（上位Ｎｏｄｅ）から伝送されてきた信号がある場合に、下り方向の無線物理チャネル上で該当信号を伝送する為に、データが到着した事を通知する信号を作成する機能を有し、上記データの種別（論理チャネルの種別）に応じて識別子を適宜設定する機能をあわせて有する。データ蓄積部はＲＮＣ（上位Ｎｏｄｅ）から伝送されてきた信号を有線信号送受信部で下り方向の無線物理チャネル上で伝送できるタイミングまで該当信号を保持する機能を有する。

【0031】

＜ＵＥの構成＞

図８は本実施例で想定されるＵＥが備える機能についてのブロック図を示す。ＵＥは制御部、信号送受信部、予約信号作成部、再送回数監視部、タイマ制御部、予約許可チャネル解析部、Ｌ３制御部及び共通制御チャネル解析部から構成される。制御部は、各機能エンティティに対して制御行い、移動局装置全体の動作を司る。信号送受信部は、制御信号及びユーザデータをＵＥとＲＡＮ（ＢＴＳ，ＲＮＣ）との間で伝送する為のチャネル符号化、無線変調、同期確立等の無線レイヤの処理を行なう機能を有し、予約許可チャネルや共通制御チャネルで指示されたタイミングで信号の送信および受信を行なう機能もあわせて有する。予約信号作成部は、上り方向の予約型アクセスでＢＴＳに対して送信予約を行う為の予約信号を作成する機能を有し、データ発生時や呼出時の接続シーケンス開始時ではプリアンブルを作成する機能も有する。再送回数監視部は、プリアンブルの再送回数を監視する機能を有する。タイマ制御部はプリアンブルの送信後にＡＩＣＨで許可（Ｇｒａｎｔ）を待機している間の監視を行う。予約許可チャネル解析部は接続シーケンス初期段階（ＲＲＣコネクション確立前）のプリアンブルに対する許可がＡＩＣＨで伝送されていることを認識する機能、およびＲＲＣコネクション確立後に予約許可チャネルで伝送された予約許可信号内に含まれる送信許可タイミング（時間，周波数等）を解析する機能をあわせて有する。Ｌ３制御部は接続シーケンスにおいてＬ３（ＲＲＣ）制御信号の送受信機

能およびＬ３制御信号の解析を行なう機能を有する。共通制御チャネル解析部は下りの無線物理チャネル上でデータが送信されるタイミングを解析する機能を有し、ＲＲＣコネクション確立前の段階では、共通制御チャネル上の信号はグローバルな識別子でマスキングされており、該当識別子を認識する機能をあわせて有する。

【0032】

＜ＲＮＣの動作フロー（ＲＲＣコネクションの確立）＞

図９は本実施例で想定されるＲＮＣの動作フローを示す。本実施例では特にＲＲＣコネクションが確立されるまでの接続シーケンスが説明される。ＲＮＣはＢＴＳから“ＲＲＣコネクション要求”を受信したか否かを判断する（ステップ１）。ステップ１の判断の結果、“ＲＲＣコネクション要求”を受信していた場合には“ＲＲＣコネクションセットアップ”をＢＴＳに対して伝送する（ステップ２）。“ＲＲＣコネクションセットアップ”の送信後、ＲＮＣは“ＲＲＣコネクションセットアップ確認”を受信したか否かを判断する（ステップ３）。ステップ３の判断の結果、“ＲＲＣコネクションセットアップ確認”を受信していた場合には、ＲＮＣは次に送信されてくる予定のＲＲＣシグナリングメッセージの受信体勢に入る。一方ステップ１の判断の結果、“ＲＲＣコネクション要求”を受信していない場合には、ＲＮＣは当該処理を終了する。ステップ３の判断の結果、“ＲＲＣコネクションセットアップ確認”を受信していない場合にはＲＮＣは当該処理を終了する。

【0033】

＜ＢＴＳの動作フロー＞

図１０は本実施例で想定されるＢＴＳの動作フローを示す。ＢＴＳはＵＥからプリアンブルを受信したか否かを判断する（ステップ１）。ステップ１の判断の結果、プリアンブルを受信していた場合には、プリアンブル中のシグネチャを用いて許可（Ｇｒａｎｔ）信号を作成し、それをＡＩＣＨで伝送する（ステップ２）。ＢＴＳはＵＥから“ＲＲＣコネクション要求”を受信したか否かを判断する（ステップ３）。ステップ３の判断の結果、“ＲＲＣコネクション要求”を受信していた場合には、ＢＴＳは受信した“ＲＲＣコネクション要求”をＲＮＣに送信する。ＢＴＳは、“ＲＲＣコネクション要求”の応答としてＲＮＣから“ＲＲＣコネクションセットアップ”を受信した場合には、“ＲＲＣコネクションセットアップ”を送信する。これは共通制御チャネル上でグローバルな識別子を用いて行われる。ＢＴＳは通知したタイミングで“ＲＲＣコネクションセットアップ”メッセージを下りの共通無線物理チャネル上で伝送する（ステップ５）。ＢＴＳはＵＥとの間で設定された予約チャネルで予約信号が送信されているかを判断する（ステップ６）。ステップ６の判断の結果、予約信号が送信されている場合にはＢＴＳは予約許可チャネルで予約許可信号を送信する（ステップ７）。以後、ステップ６，７の手順が反復される。一方、ステップ１の判断の結果、プリアンブルが送信されていない場合にはＢＴＳは当該処理を終了する。ステップ３の判断の結果、ＢＴＳが“ＲＲＣコネクション要求”を受信していない場合には、“ＲＲＣコネクション要求”を受信するまでＢＴＳはステップ３で待機する。ステップ６の判断の結果、予約信号が送信されていない場合には、予約信号が送信されてくるまでＢＴＳはステップ６で待機する。

【0034】

＜ＵＥの動作フロー＞

図１１は本実施例で想定される移動局装置（ＵＥ）の動作フローを示す。ＵＥはＲＡＮからのページング（Ｐａｇｉｎｇ）の有無を判断する、或いはＵＥで送信すべきデータが発生したか否かを判断する（ステップ１）。ステップ１の判断の結果、ページング又は送信すべきデータがある場合には、ＲＲＣコネクション確立の処理に入る。ＵＥはＢＴＳに上り信号を送信する為のプリアンブルを作成する。そのプリアンブルはシグネチャを含めて構成する（ステップ２）。ＵＥはステップ２で作成されたプリアンブルを送信する（ステップ３）。ＵＥはＢＴＳから送信されるＡＩＣＨ上でシグネチャで構成された許可（Ｇｒａｎｔ）信号が送信されているか否かを判断する（ステップ４）。ステップ４の判断の結果、ＡＩＣＨ上で自ＵＥのシグネチャを含む許可信号が伝送されている場合には、予め

形成されたシステムで指定されたタイミング（及び周波数，変調方式等）で、ＲＲＣ接続を確立する為のＬ３制御信号、“ＲＲＣコネクション要求”をＢＴＳへ送信する（ステップ５）。ステップ５において、“ＲＲＣコネクション要求”の送信後、共通制御チャネル上でグローバルな識別子でマスキングされたデータ到着通知が伝送されているか否かが判断される（ステップ６）。ステップ６の判断の結果、共通制御チャネル上でデータ到着通知が伝送されている場合には、ＵＥはデータ到着通知を解析し、データ到着通知に含まれる指示（変調方式，チャネル符号化，周波数，送信タイミング等）に基づいてＤＬの無線物理チャネルで伝送されるデータ（ＲＲＣコネクションセットアップ）を受信する（ステップ７）。ＵＥは、ＤＬの無線物理チャネルで受信した“ＲＲＣコネクションセットアップ”に自ＵＥのＴＭＳＩが含まれているか否かを判断する（ステップ１０）。ステップ１０の判断の結果、自ＵＥのＴＭＳＩが含まれている場合には、ＵＥは“ＲＲＣコネクションセットアップ”に含まれる無線物理チャネル情報に基づいて個別の無線物理チャネル（制御用）を設定する（ステップ１１）。以後のＬ３制御信号およびユーザデータの送受信の為の予約信号の送信は、共通に設定する予約信号送信用のチャネルで伝送される（ステップ１２）。

【0035】

一方、ステップ１の判断の結果、ＲＡＮからのページングも送信すべきデータも無い場合にはＵＥは当該処理を終了する。また、ステップ４の判断の結果、ＡＩＣＨ上で許可信号を受信できていない場合には、予め定められた時間経過後にプリアンブルの再送を行なう（ステップ８）。プリアンブルの再送信後、ＵＥは再送信回数が予め規定されている回数に到達しているかを判断する（ステップ９）。ステップ９の判断の結果、予め定められた回数に到着していない場合には、フローはステップ４の処理に戻る。一方、予め定められた再送信回数に到達している場合にはＵＥは当該処理を終了する。ステップ６の判断の結果、共通制御チャネル上でグローバルな識別子でマスキングされたデータ到着通知を受信していない場合には、ＵＥはデータ到着通知を受信するまでステップ６で待機する。また、ステップ１０で受信したデータに自ＵＥのＴＭＳＩが含まれていない場合には、自ＵＥのＴＭＳＩが含まれたデータを受信するまでステップ６で待機する。

【実施例】

【0036】

以下、本発明の第２実施例による装置及び方法が説明される。

【0037】

本実施例で想定される通信システムは第１実施例で説明された通信システムと同様であるため、重複的な説明は省略される。本実施例で想定される機能チャネル及び物理チャネルの対応関係は、概して第１実施例で説明された機能チャネル及び物理チャネルの対応関係と同様であるが、図１２に示されるように、アップリンク（ＵＬ）の無線チャネルにおいて、ＣＣＣＨもＥ－ＰＵＳＣＨで伝送される点が特に異なる。即ち、第1実施例では下り回線で唯１つの共用チャネルが使用され、第２実施例では上り回線で唯１つの共用チャネルが使用され且つ下回線でも唯１つの共用チャネルが使用される。

【0038】

＜接続シーケンス＞

図１３を参照しながら本実施例で想定される接続シーケンスが説明される。本実施例でもＲＲＣコネクションを確立するまでの過程のシーケンスが重点的に説明される。ＵＥは、“ＲＲＣコネクション要求”をＲＮＣに伝送する為に、ＢＴＳとの間の無線物理チャネルを予約する予約信号をＢＴＳに対して送信する。予約信号はＵＥがランダムに（或いはそれ以外の方法で）選択するシグネチャを含んで構成される。シグネチャの構成はＷ－ＣＤＭＡ方式の場合と同様の構成をとっても良いし、Ｌ２識別子（ＲＮＴＩ）の一部がシグネチャに割り当てられてもよい。予約信号を受信したＢＴＳは、予約許可（予約許可はシグネチャを含んで構成される）を予約許可チャネル上で送信する。予約許可チャネルはＲＲＣコネクション確立後においても引き続き予約許可を伝送するチャネルとして使用できる。予約許可チャネルで予約許可を受信したＵＥは予約許可で指定されたタイミング（時

間，周波数等）及び上りの共通無線物理チャネル（Ｅ－ＰＵＳＣＨ）上で、“ＲＲＣコネクション要求”を送信する。ＢＴＳに到着した“ＲＲＣコネクション要求”はＲＮＣへ更に伝送される。“ＲＲＣコネクション要求”を受信したＲＮＣは“ＲＲＣコネクションセットアップ”を送信する。ＢＴＳは、そこに到着した“ＲＲＣコネクションセットアップ”を伝送する為に、ＨＳ－ＳＣＣＨ相当の共通の無線制御チャネル上で，データ到着通知を送信する。ＲＲＣコネクション確立後も同一チャネルで下り方向の無線物理チャネル（Ｅ－ＰＤＳＣＨ）でのデータ到着が通知される。データ到着通知はグローバルな識別子（ＲＮＴＩの中から事前にＣＣＣＨ用に割り当てておく）を含んで構成される。ＢＴＳは、あわせて、データ到着通知で指示したタイミングで“ＲＲＣコネクションセットアップ”を下りの共通無線物理チャネル上で送信する。データ到着通知を受信したＵＥは、到着通知で指示されるタイミングで“ＲＲＣコネクションセットアップ”を受信する。“ＲＲＣコネクションセットアップ”がＵＥで受信されると、ＲＲＣコネクションが確立され、ＵＥはＲＲＣコネクションセットアップで指示された無線物理チャネルを追加する（上り方向の予約信号送信用の個別制御チャネル、ＨＡＲＱ用のＡＣＫ／ＮＡＣＫチャネル、同様に下り方向の無線チャネル等も追加する）。その後は個別の制御チャネルを用いて予約信号がＢＴＳに送信される。予約許可はＲＲＣコネクション確立前のチャネルと同様に予約許可チャネルで伝送される。

【0039】

＜ＲＮＣ構成＞

本実施例で想定されるＲＮＣの構成は第１実施例で説明済みのＲＮＣ（図６）の構成と同様であるため重複的な説明は省略される。

【0040】

＜ＢＴＳ構成＞

本実施例で想定されるＢＴＳの構成は概して第１実施例で説明済みのＢＴＳ（図７）の構成と同様である。しかし、本実施例のＢＴＳでは、予約信号解析部はＵＥから伝送される予約信号の解析を行なう機能を有する。予約許可信号作成部はＵＥから伝送された予約信号に対して予約許可通知を送信する為の予約許可を伝送する機能を有する。

【0041】

＜ＵＥ構成＞

本実施例で想定されるＵＥの構成は第１実施例で説明済みのＵＥ（図８）の構成と同様である。しかし、本実施例のＵＥの予約信号作成部は予約信号を作成する機能を有する。この予約信号は“ＲＲＣコネクション要求”を伝送する為の上り方向の無線チャネル（Ｅ－ＰＵＳＣＨ）上での割り当て許可を得るためのものであり、ＲＲＣコネクション確立後においても上り方向の無線チャネルの割り当て許可を得るためのものでもある。予約許可チャネル解析部はＢＴＳから送信される予約許可が予約許可チャネル上で伝送されている事を監視する機能および予約許可で指示される送信タイミング（時間，周波数等）を解析する機能を有する。

【0042】

＜ＲＮＣの動作フロー（ＲＲＣコネクションの確立）＞

本実施例で想定されるＲＮＣの動作フローは図９で説明済みのフローと同様であるため説明は省略される。

【0043】

＜ＢＴＳの動作フロー（ＲＲＣコネクションの確立）＞

図１４を参照しながら本実施例で想定されるＢＴＳの動作フローが説明される。本実施例では特にＲＲＣコネクションが確立されるまでの接続シーケンスが説明される。ＢＴＳはＵＥからの予約信号を受信したか否かを判断する（ステップ１）。ステップ１の判断の結果、ＢＴＳが予約信号を受信していた場合には、予約信号に含まれるシグネチャを用いて予約許可信号を作成する（ステップ２）。作成した予約許可信号は予約許可チャネルで伝送される（ステップ３）。ＢＴＳはＵＥから“ＲＲＣ接続要求”を受信したか否かを判断する（ステップ４）。ステップ４の判断の結果、“ＲＲＣコネクション要求”が受信さ

れていた場合には、受信した“ＲＲＣコネクション要求”はＲＮＣに送信され、“ＲＲＣコネクション要求”の応答としてＲＮＣから“ＲＲＣコネクションセットアップ”を受信すると、ＢＴＳは“ＲＲＣコネクションセットアップ”を送信することを共通制御チャネル上でグローバルな識別子を用いて通知する（ステップ５）。通知されたタイミングで“ＲＲＣコネクションセットアップ”メッセージが下りの共通無線物理チャネル上で伝送される（ステップ６）。ＢＴＳはＵＥとの間で設定した予約チャネルで予約信号が送信されているか判断する（ステップ７）。ステップ７の判断の結果、予約信号が送信されている場合には予約許可チャネルで予約許可信号が送信される（ステップ８）。以後はステップ７，８の手順が繰り返えされる。

【0044】

一方、ステップ１の判断の結果、予約信号が送信されていない場合にはＢＴＳは当該処理を終了する。ステップ４の判断の結果、“ＲＲＣコネクション要求”が受信されていない場合には、“ＲＲＣコネクション要求”が受信されるまでＢＴＳはステップ４で待機する。ステップ７の判断の結果、予約信号が送信されていない場合には、ＢＴＳは予約信号が送信されてくるまでステップ７で待機する。

【0045】

＜ＵＥの動作フロー（ＲＲＣコネクションの確立）＞

図１５を参照しながら本実施例で想定される移動局装置（ＵＥ）の動作フローが説明される。本実施例でも特にＲＲＣコネクションが確立されるまでの接続シーケンスが説明される。ＲＲＣコネクション確立後は、ＵＥとＲＡＮとの間でＬ２の識別子で認識する個別論理チャネルが確立され、個別の制御チャネルが用意され、予約，信号の送受信等の処理が行なわれる。

【0046】

ＵＥはＲＡＮからページングが有るか否か、或いはＵＥで送信すべきデータが発生したか否か判断する（ステップ１）。ステップ１の判断の結果、ページング或いは送信すべきデータがある場合には、ＵＥはＲＲＣコネクション確立の処理に入る。ＵＥはＢＴＳに対して上り信号を送信する為の予約信号を作成する。該当予約信号はＵＥがランダムに選択するシグネチャを含んで構成する（ステップ２）。予約信号はシグネチャを用いて拡散系列を作る構成であっても良いし、シグネチャを信号内部に含む構成でも良い。ステップ２で作成された予約信号はＵＥから送信される（ステップ３）。ＢＴＳから送信される予約許可チャネル上で、自ＵＥが選択したシグネチャで構成された予約許可信号が送信されているか否かが判断される（ステップ４）。予約許可チャネルで伝送される予約許可信号はシグネチャでマスキングされていても良いし、シグネチャを信号内部に含む構成でも良い。ステップ４の判断の結果、予約許可チャネル上で自ＵＥが選択したシグネチャを含む予約許可信号が伝送されている場合には、予約許可信号が解析される。ＵＥは、予約許可信号で指示される送信タイミング（周波数，変調方式等）で、ＲＲＣコネクションを確立する為のＬ３制御信号、“ＲＲＣコネクション要求”をＢＴＳへ送信する（ステップ５）。ステップ５において、“ＲＲＣコネクション要求”の送信後、共通制御チャネル上でグローバルな識別子でマスキングされたデータ到着通知が伝送されているか否かが判断される（ステップ６）。ステップ６の判断の結果、共通制御チャネル上でデータ到着通知が伝送されている場合には、データ到着通知が解析され、データ到着通知に含まれる指示（変調方式，チャネル符号化，周波数，送信タイミング等）に基づいて、ＵＥはＤＬの無線物理チャネルで伝送されるデータ（ＲＲＣコネクションセットアップ）を受信する（ステップ７）。ＵＥは、ＤＬの無線物理チャネルで受信された“ＲＲＣコネクションセットアップ”に自ＵＥのＴＭＳＩが含まれているか否かを判断する（ステップ１０）。ステップ１０の判断の結果、自ＵＥのＴＭＳＩが含まれていた場合には“ＲＲＣコネクションセットアップ”に含まれている無線物理チャネル情報に基づいて個別の無線物理チャネル（制御用）が設定される（ステップ１１）。以後のＬ３制御信号およびユーザデータの送受信の為の予約信号の送信は、共通に設定される予約信号送信用のチャネルで伝送される（ステップ１２）。

【0047】
一方、ステップ１の判断の結果、ＲＡＮからのページングも送信すべきデータも無い場合には、当該処理は終了する。また、ステップ４の判断の結果、予約許可チャネル上で自ＵＥのシグネチャを含む予約許可信号が受信されていない場合には、予め定められた時間後に予約信号の再送が行なわれる（ステップ８）。予約信号の再送信後に、再送信回数が予め規定されている回数に到達しているか否かが判断される（ステップ９）。ステップ９の判断の結果、予め定められた回数に達していない場合には、フローはステップ４の処理に戻る。一方、予め定められた再送信回数に到達している場合には当該処理は終了する。ステップ６の判断の結果、共通制御チャネル上でグローバルな識別子でマスキングされたデータ到着通知を受信していない場合には、ＵＥはデータ到着通知を受信するまでステップ６で待機する。また、ステップ１０で、受信したデータに自ＵＥのＴＭＳＩが含まれていない場合には自ＵＥのＴＭＳＩを含むデータが受信されるまでＵＥはステップ１０で待機する。

【図面の簡単な説明】

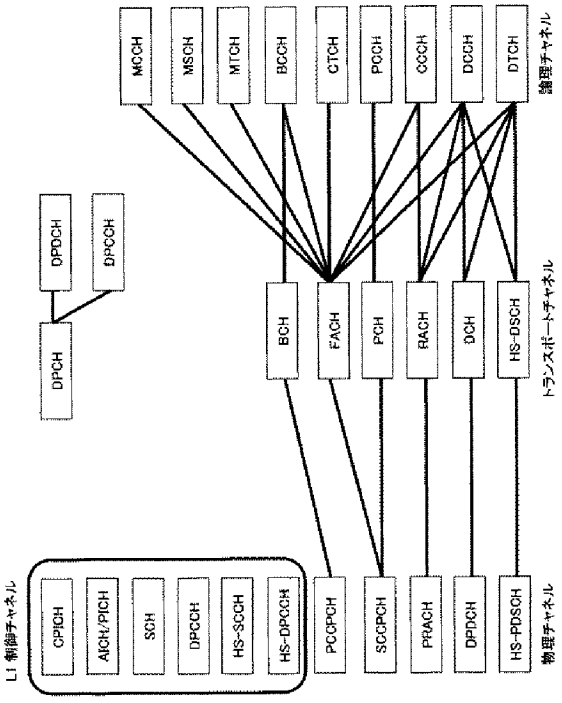
【0048】
【図1】チャネルの対応関係を示す図である。
【図2】従来の接続シーケンスを示す図である。
【図3】通信システムを示す図である。
【図4】本発明の一実施例による各チャネルの対応関係を示す図である。
【図5】本発明の一実施例による接続シーケンスを示す図である。
【図6】本発明の一実施例によるＲＮＣの機能ブロック図を示す。
【図7】本発明の一実施例によるＢＴＳの機能ブロック図を示す。
【図8】本発明の一実施例によるＵＥの機能ブロック図を示す。
【図9】本発明の一実施例によるＲＮＣの動作例を示すフローチャートである。
【図10】本発明の一実施例によるＢＴＳの動作例を示すフローチャートである。
【図11】本発明の一実施例によるＵＥの動作例を示すフローチャートである。
【図12】本発明の一実施例による各チャネルの対応関係を示す図である。
【図13】本発明の一実施例による接続シーケンスを示す図である。
【図14】本発明の一実施例によるＢＴＳの動作例を示すフローチャートである。
【図15】本発明の一実施例によるＵＥの動作例を示すフローチャートである。

【符号の説明】

【0049】
ＵＥ　移動局
ＢＴＳ　基地局
ＲＮＣ　無線ネットワークコントローラ

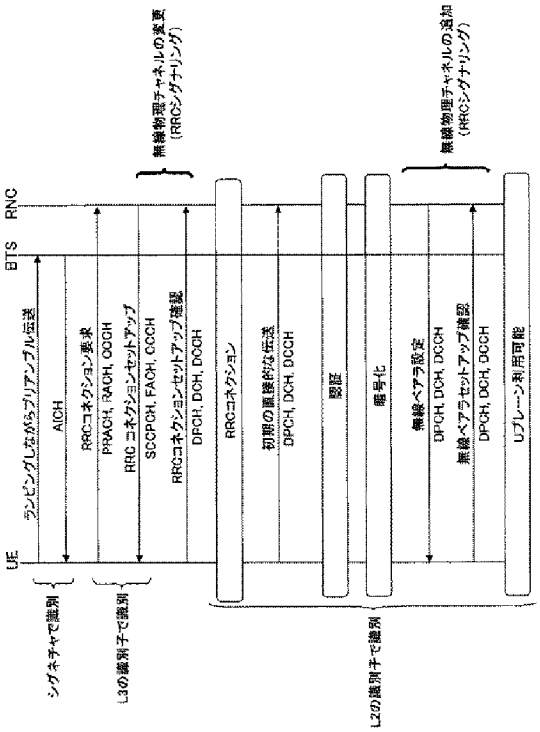
【図1】

チャネルの対応関係を示す図



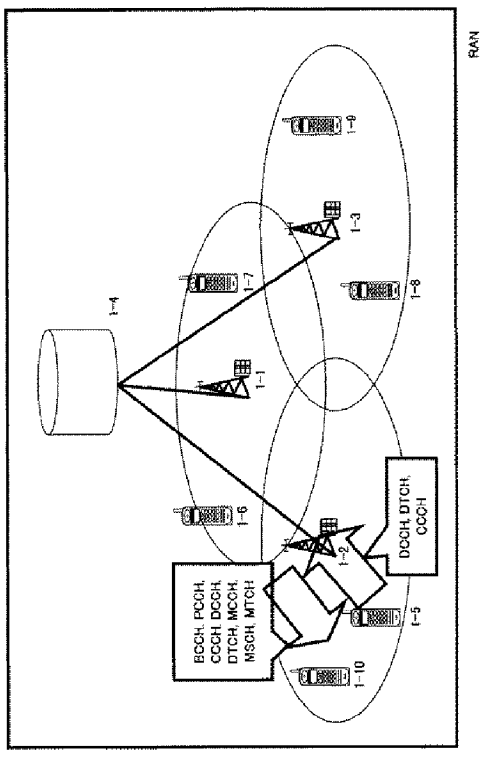
【図2】

従来の接続シーケンスを示す図



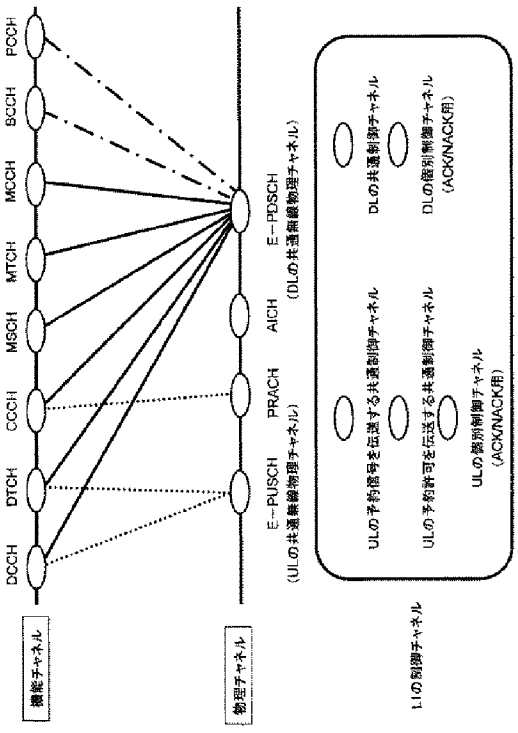
【図3】

通信システムを示す図



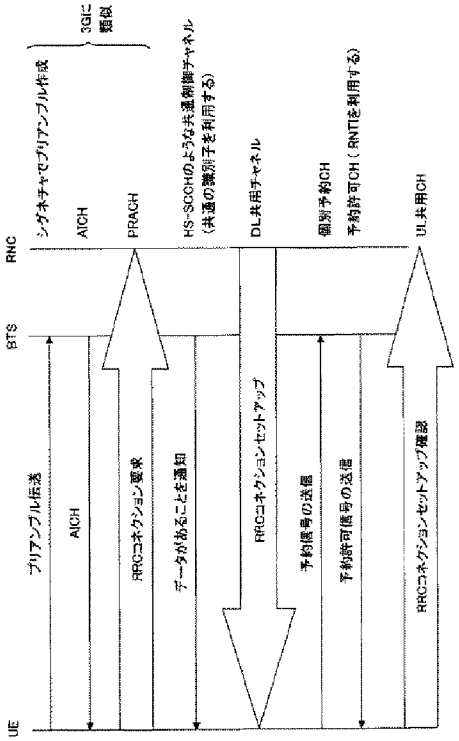
【図4】

本発明の一実施例による各チャネルの対応関係を示す図



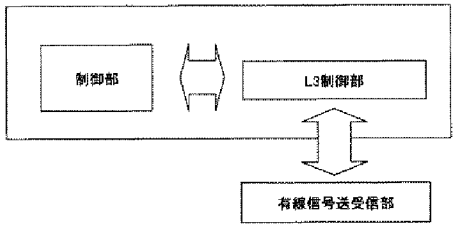
【図5】

本発明の一実施例による接続シーケンスを示す図



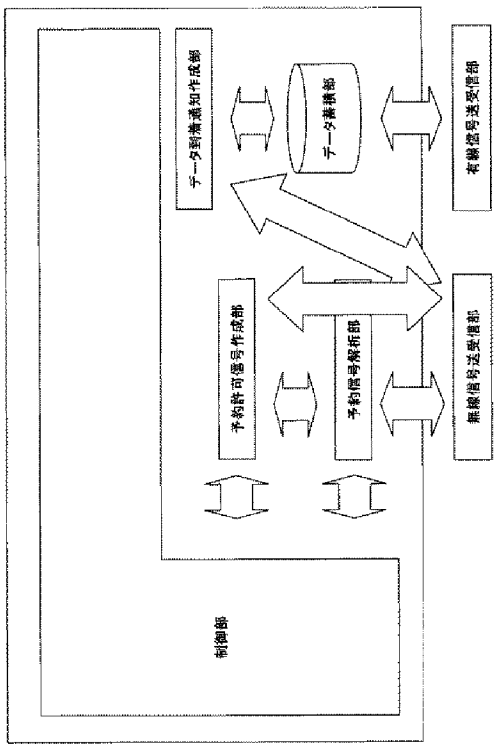
【図6】

本発明の一実施例によるRNCの機能ブロック図



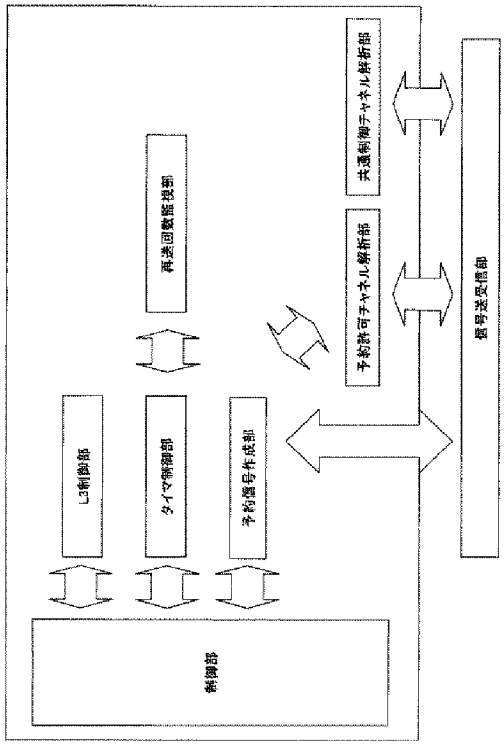
【図7】

本発明の一実施例によるBTSの機能ブロック図



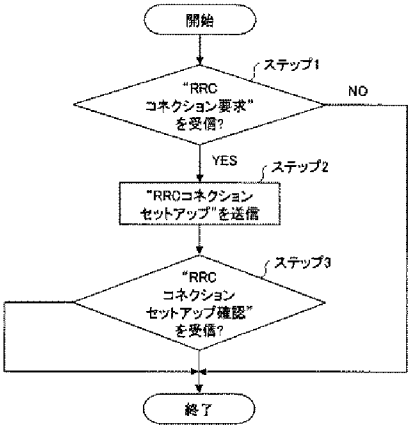
【図8】

本発明の一実施例によるUEの機能ブロック図



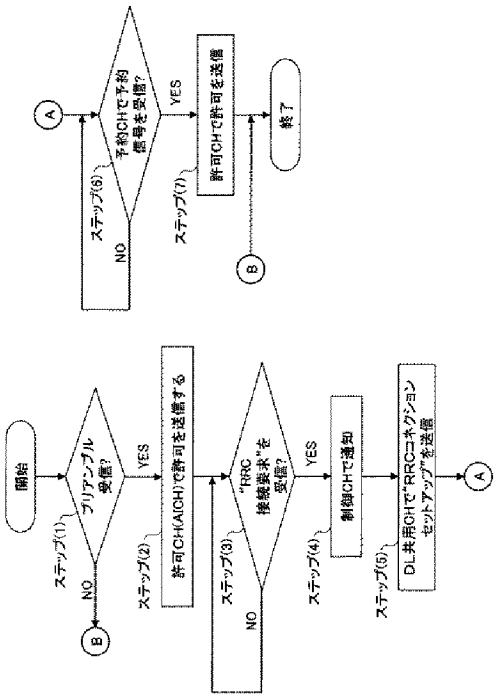
【図9】

本発明の一実施例によるRNCの動作例を示すフローチャート



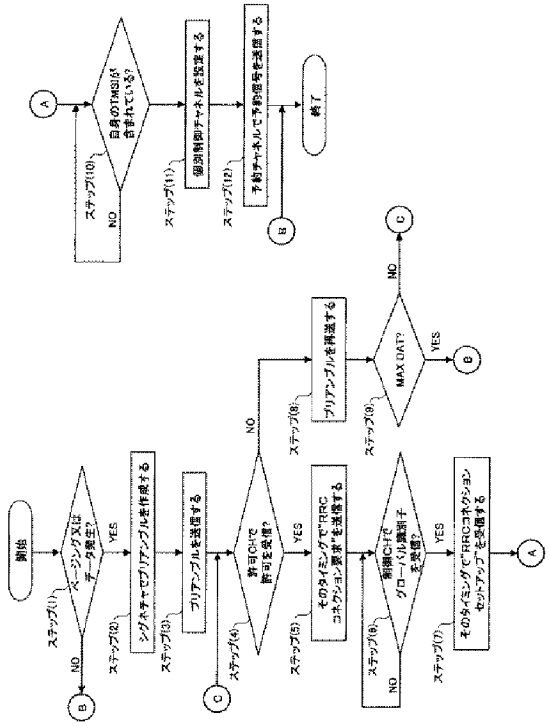
【図10】

本発明の一実施例によるBTSの動作例を示すフローチャート



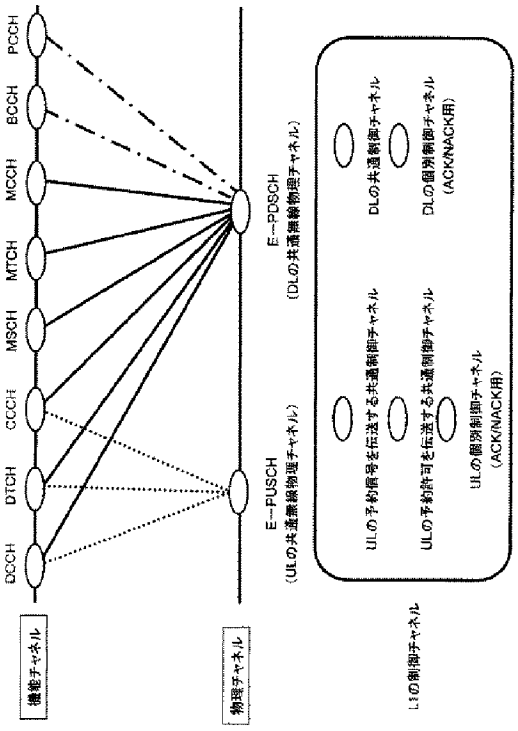
【図11】

本発明の一実施例によるUEの動作例を示すフローチャート



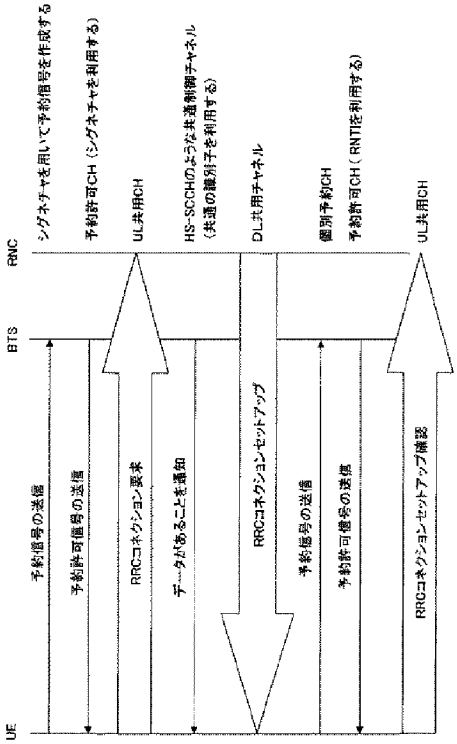
【図12】

本発明の一実施例による各チャネルの対応関係を示す図



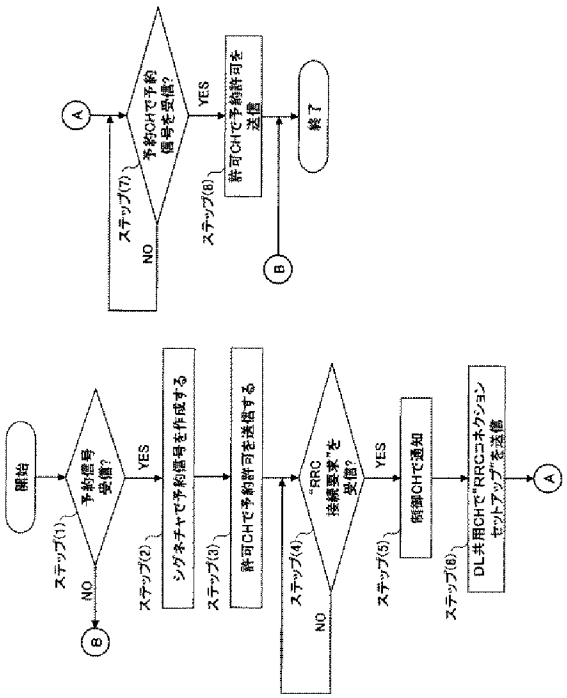
【図13】

本発明の一実施例による接続シーケンスを示す図



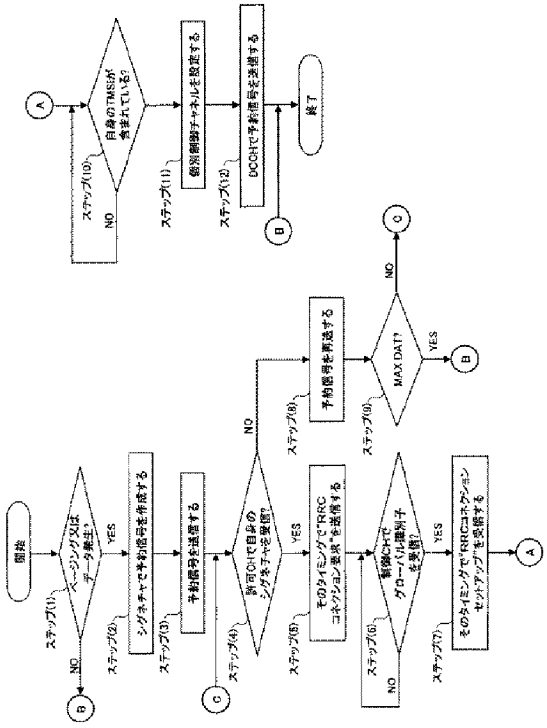
【図14】

本発明の一実施例によるBTSの動作例を示すフローチャート



【図15】

本発明の一実施例によるUEの動作例を示すフローチャート



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Ｆターム(参考) 5K022 EE02　EE14　EE21　EE31
5K067 AA13　BB21　CC10　DD17　EE02　EE10　HH22　HH23

Electronic Acknowledgement Receipt

EFS ID:	10846975
Application Number:	12159841
International Application Number:	
Confirmation Number:	3203
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Customer Number:	35884
Filer:	Sevan Savsa/Neeti Rajput
Filer Authorized By:	Sevan Savsa
Attorney Docket Number:	2101-3515
Receipt Date:	30-AUG-2011
Filing Date:	22-OCT-2008
Time Stamp:	17:54:15
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	2101-3515_080311_IDSform_FR.pdf	612423 7b920e69f25176da536319f2a3c29cfb77d7a251	no	4

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Information:	

A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.

2	Information Disclosure Statement (IDS) Form (SB08)	2101-3515_080311_IDSform_US.pdf	612193 37f5cee4c2943bbf38b90e73aa3f3fccc2cfe981	no	4
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Information:					
3	Foreign Reference	JP2006-352705.pdf	1755641 b18cdcc5be7b278cf2469c1666c07e65fd45a5ec	no	19
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Information:					
4	Non Patent Literature	R2-061958.pdf	34460 93df167242752bb3cbdf2e9479ae92149de29a17	no	2
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Information:					
5	Non Patent Literature	R2-071817.pdf	614551 0c28fc954a68b87c3f88b5f89eb7adb14c9ae11b	no	8
Warnings:					
Information:					
		Total Files Size (in bytes):	3629268		

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<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Young Dae LEE, et al.		Art Unit:	2617
Serial No:	12/159,841	Examiner:	CHO, Un C.
Filed:	October 22, 2008	Conf. No.:	3203
For:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM		

AMENDMENT

Mail Stop AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This paper is in response to the Office Action mailed on July 22, 2011, in connection with the above-identified application. This response is due on October 24, 2011, October 22, 2011 being a Saturday. It is believed that no fee is due in connection with this paper. Please charge any fees, if required, and credit any overpayment to our **Deposit Account No. 502290**. Reconsideration of the application in view of the following amendments and remarks is respectfully requested.

Amendments to the Claims

Please amend claims 1-3, 5, 6, 8-11, 13 and 14, cancel claim 12 without prejudice, and add new claim 15 as follows:

1. (Currently amended) A method of receiving a paging message at a ~~user equipment~~ User Equipment (UE) in a wireless communication system, the method comprising:

receiving, from a network, paging indication information ~~including a~~ including UE identification information and scheduling information for a paging channel (PCH) on which a paging message is transmitted, the scheduling information including allocation information ~~of a~~ indicating a time-frequency region through which the paging message is transmitted;

obtaining the paging indication information when the UE identification information is identical to an identity of the UE; and

receiving, from the network, the paging message through the time-frequency region indicated by the paging indication information.

2. (Currently amended) The method of claim 1, wherein the UE is in ~~an RRC~~ a radio resource control (RRC) idle mode and the UE identification information is a long UE identity.

3. (Currently amended) The method of claim 1, wherein the UE is in ~~an RRC~~ a radio resource control (RRC) connected mode and the UE identification information is a short UE identity.

4. (Original) The method of claim 1, wherein the paging indication information is received on a paging indication channel (PICH).

5. (Currently amended) The method of claim 1, ~~wherein~~ further comprising including the paging indication information ~~is included~~ in L1/2 control information to be transmitted.

6. (Currently amended) The method of claim 1, wherein the paging indication information is received on different sub-carriers and in different time ~~interval~~ intervals.

7. (Original) The method of claim 1, wherein the paging indication information is received during a paging occasion.

8. (Currently amended) A method of transmitting a paging message at a network in a wireless communication system, the method comprising:

transmitting, ~~to a UE,~~ to a User Equipment (UE), paging indication information ~~including a~~ including UE identification information and scheduling information for a paging channel (PCH) on which a paging message is transmitted, the scheduling information including allocation information ~~of a~~ indicating a time-frequency region through which the paging message is transmitted; and

transmitting the paging message through the time-frequency region indicated by the paging indication information.

9. (Currently amended) The method of claim 8, wherein the UE is in ~~an RRC~~ a radio resource control (RRC) idle mode and the UE identification information is a long UE identity.

10. (Currently amended) The method of claim 8, wherein the UE is in ~~an RRC~~ a radio resource control (RRC) connected mode and the UE identification information is a short UE identity.

11. (Currently amended) A method of receiving a paging message at a ~~user equipment~~ User Equipment (UE) in a wireless communication system, the method comprising:

receiving, from a network, paging indication information ~~including a~~ including UE identification information and scheduling information for a paging channel (PCH) on which a paging message is transmitted;

obtaining the received paging indication information when the UE identification information is identical to an identity of the UE; and

receiving a paging message using the paging indication information by combining a plurality of paging channels from a plurality of cells,

wherein the scheduling information includes allocation information of a time-frequency region through which the paging message is transmitted.

12. (Canceled)

13. (Currently amended) The method of claim 11, wherein the paging indication information is received ~~from a~~ from the plurality of cells, ~~and further comprises~~ the method further comprising:

combining the paging indication information from the plurality of cells.

14. (Currently amended) The method of claim 11 ~~or 13~~, wherein the plurality of cells are included in one tracking area (TA).

15. (New) The method of claim 13, wherein the plurality of cells are included in one tracking area (TA).

REMARKS

Applicant has studied the Office Action mailed on July 22, 2011. Claims 1-11 and 13-15 are pending. Claims 1-3, 5, 6, 8-11, 13 and 14 have been amended, claim 12 has been canceled without prejudice, and claim 15 has been added. Claims 1, 8 and 11 are the independent claims. No new matter has been added as the amendments have support in the specification as originally filed. It is submitted that the application, as amended, is in condition for allowance. Reconsideration is respectfully requested.

Priority under 35 U.S.C. § 119

Applicant notes with appreciation that the originally filed drawings have been accepted and that the foreign priority claim and receipt of the certified copies of the priority documents have been acknowledged.

Amendments to the Claims

It is respectfully submitted that the claim amendments presented herein do not add any new matter or features. In particular, the features newly recited in amended independent claim 11 have been incorporated from its dependent claim 12 and claim 12 has been canceled without prejudice. Claims 1-3, 5, 6, 8-11, 13 and 14 have been amended to define abbreviated elements in the claims or to more clearly define the invention and it is respectfully submitted that the amendments are not related to patentability. Consequently, the claim amendments should not require any further search by the Examiner. Accordingly, entry of the amendments to the application, as an earnest attempt to advance prosecution, is respectfully requested.

Double Patenting Rejection

The Examiner rejected claims 1-10 based on non-statutory type double patenting in view of claims 1-8 of U.S. Patent Number 7,826,859 (hereinafter, "the `859 patent"). This rejection is respectfully traversed.

It is respectfully submitted that the `859 patent and the present application are commonly owned. A terminal disclaimer in compliance with 37 C.F.R. 1.321(c) is

submitted with this paper to overcome this rejection. Accordingly, reconsideration and withdrawal of this rejection is respectfully requested. Moreover, as no other rejections of claims 1-10 were included in the present Office Action, an indication of allowability of claims 1-10 in the next Office Communication is respectfully requested.

Rejection under 35 U.S.C. § 102

Claims 11 and 13 were rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent Application Publication Number 2004/0147271 to Billon et al. (hereinafter, "Billon"). This rejection is respectfully traversed.

Independent claim 11 has been amended by incorporating the limitations of claim 12, and claim 12 was canceled without prejudice. As indicated at page 6 of the Office Action, claim 12 was "objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims."

Applicant submits that claim 12 depended directly from independent claim 11. Applicant respectfully submits that by incorporating the features of claim 12 into independent claim 11, amended independent claim 11 is allowable over Billon and in condition for allowance. Accordingly, reconsideration and withdrawal of the rejection of independent claim 11 is respectfully requested.

Applicant submits that claim 13 depends from independent claim 11. As indicated previously, amended independent claim 11 is allowable over Billon. Moreover, claim 13 is allowable over Billon at least by virtue of dependency upon an allowable base claim and reconsideration and withdrawal of the rejection of claim 13 is respectfully requested.

Rejection under 35 U.S.C. § 103

Claim 14 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Billon in view of U.S. Patent Application Publication Number 2004/0180675 to Choi et al. (hereinafter, "Choi"). This rejection is respectfully traversed.

Claim 14 depends from amended independent claim 11. As indicated previously, independent claim 11 is in condition for allowance by virtue of incorporation of allowable subject matter. Moreover, claim 14 is also allowable at least by virtue of dependency upon an allowable base claim and reconsideration and withdrawal of the rejection of claim 14 is respectfully requested.

Allowable Subject Matter

Applicant graciously acknowledges the Examiner's indication at page 6 of the Office Action that claim 12 is "objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims." As indicated previously, the features of claim 12 were incorporated into independent claim 11, from which claim 12 claimed dependency, and claim 12 was canceled without prejudice. Accordingly, an indication of allowability of amended independent claim 11 in the next Office communication is respectfully requested.

New Claim

Applicant submits that claim 14, prior to the current amendment, was a multiple-dependent claim depending from claims 11 and 13. By this amendment, claim 14 was amended to depend only from claim 11 and claim 15 was added. Claim 15 differs from amended claim 14 in that it depends from claim 13, which depends from amended independent claim 11. As indicated previously, independent claim 11 is in condition for allowance by virtue of incorporation of allowable subject matter. Accordingly, Applicant submits that claim 15 is also allowable at least by virtue of dependency upon an allowable base claim and an indication of allowability of new claim 15 in the next Office communication is respectfully requested.

CONCLUSION

In light of the above remarks, Applicant submits that the present Amendment places all claims of the present application in condition for allowance. Reconsideration of the application, as amended, is requested.

No amendment made was related to the statutory requirements of patentability unless expressly stated herein; and no amendment made was for the purpose of narrowing the scope of any claim, unless Applicant has argued herein that such amendment was made to distinguish over a particular reference or combination of references.

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at the Los Angeles, California, telephone number (213) 623-2221 to discuss the steps necessary for placing the application in condition for allowance.

Respectfully submitted,

Lee, Hong, Degerman, Kang & Waimey

Date: August 24, 2011

By: /David G. Majdali/
David G. Majdali
Registration No. 53,257

Customer No. 035884

Electronic Patent Application Fee Transmittal

Application Number:	12159841
Filing Date:	22-Oct-2008
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Filer:	Richard C. Salfelder/Anna Tounian
Attorney Docket Number:	2101-3515

Filed as Large Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Statutory or terminal disclaimer	1814	1	140	140
		Total in USD ($)		**140**

Electronic Acknowledgement Receipt

EFS ID:	10808625
Application Number:	12159841
International Application Number:	
Confirmation Number:	3203
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Customer Number:	35884
Filer:	Richard C. Salfelder/Anna Tounian
Filer Authorized By:	Richard C. Salfelder
Attorney Docket Number:	2101-3515
Receipt Date:	24-AUG-2011
Filing Date:	22-OCT-2008
Time Stamp:	21:08:06
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$140
RAM confirmation Number	8102
Deposit Account	502290
Authorized User	SALFELDER,RICHARD C.

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	2101-3515-Transmittal-ROA-TD.pdf	59651 080fbeda738836d88a3328f9f9c6103e8022ede0	no	1
Warnings:					
Information:					
2	Terminal Disclaimer Filed	2101-3515-TD.pdf	35388 f3afdbe021664eaa2cb4021d293a84ad45343e9c	no	1
Warnings:					
Information:					
3	Request for Corrected Filing Receipt	2101-3515-ReqCorrFR.pdf	64999 261ec0ee0a79181ae0ad382e5d9f8f94330e3a30	no	1
Warnings:					
Information:					
4	Miscellaneous Incoming Letter	2101-3515-Marked-upFR.pdf	215088 31e956cf9c13300f4f35df82ca13d7126b17a88d	no	1
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Information:					
5		2101-3515-ROA.pdf	72797 498cdc23559489079489 1849b9a4f0592794b103	yes	8

Multipart Description/PDF files in .zip description

Document Description	Start	End
Amendment/Req. Reconsideration-After Non-Final Reject	1	1
Claims	2	4
Applicant Arguments/Remarks Made in an Amendment	5	8

Warnings:					
Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	30262 474356b965f9564c66857710a974ebb4b09c4286	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	478185	

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Customer No. 035884 **Docket No. 2101-3515**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Young Dae LEE, et al.	Art Unit:	2617
Serial No:	12/159,841	Examiner:	CHO, Un C.
Filed:	October 22, 2008	Conf. No.:	3203
For:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM		

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:
Transmitted herewith is an AMENDMENT in the above-identified application.

☐ A petition for extension of time for _ month(s) is enclosed.
☒ A Terminal Disclaimer is enclosed.
☐ No additional fee is required.

The fee has been calculated as shown below:

	(Col. 1) CLAIMS REMAINING AFTER AMENDMENT		(Col. 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Col. 3) PRESENT EXTRA*	LG/SM $ ENTITY FEE		ADD'L FEE DUE
TOTAL CLAIMS FEE	14	-	20 **	0	LG=$52 SM=$26	$52	$ 0
INDEPENDENT CLAIMS FEE	3	-	3 ***	0	LG=$220 SM=$110	$220	$ 0
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIMS					LARGE ENTITY FEE = $390 SMALL ENTITY FEE = $195		$ 0
						TOTAL	$ 0

* If the entry in Col. 1 is less than the entry in Col. 2, write "0" in Col. 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, write "20" in this space.
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, write "3" in this space. The "Highest Number Previously Paid For" (Total or Independent) is the highest number found from the equivalent box on Col. 1 of a prior amendment or the number of claims originally filed.

☒ The Commissioner is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to **Deposit Account No. 502290**:
- ☐ Excess claim(s) fee in the amount of $___.
- ☐ RCE fee in the amount of $___.
- ☐ Extension fees in the amount of $____.
- ☐ Petition fee in the amount of $____.
- ☒ **Terminal Disclaimer fee in the amount of $140.**
- ☒ Any filing fees under 37 CFR 1.16 for the presentation of extra claims.
- ☒ Any patent application processing fees under 37 CFR 1.17.

Respectfully submitted,
Lee, Hong, Degerman, Kang & Waimey

Date: August 24, 2011

By: /Richard C. Salfelder/
Richard C. Salfelder
Registration No. 51,127
Attorney for Applicant(s)

PTO/SB/26 (07-09)
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TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT	Docket Number (Optional) 2101-3515

In re Application of: Young Dae LEE

Application No.: 12/159,841

Filed: October 22, 2008

For: METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM

The owner*, LG Electronics Inc., of 100 percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term **prior patent** No. 7,826,859 as the term of said prior patent is defined in 35 U.S.C. 154 and 173, and as the term of said **prior patent** is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the **prior patent** are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term as defined in 35 U.S.C. 154 and 173 of the **prior patent**, "as the term of said **prior patent** is presently shortened by any terminal disclaimer," in the event that said **prior patent** later:

expires for failure to pay a maintenance fee;
is held unenforceable;
is found invalid by a court of competent jurisdiction;
is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
has all claims canceled by a reexamination certificate;
is reissued; or
is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

Check either box 1 or 2 below, if appropriate.

1. ☐ For submissions on behalf of a business/organization (e.g., corporation, partnership, university, government agency, etc.), the undersigned is empowered to act on behalf of the business/organization.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

2. ☑ The undersigned is an attorney or agent of record. Reg. No. 51,127

/Richard C. Salfelder/ — Signature
August 24, 2011 — Date

Richard C. Salfelder, Esq. — Typed or printed name

213.623.2221 — Telephone Number

☑ Terminal disclaimer fee under 37 CFR 1.20(d) included.

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*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Customer No: 035884 Docket No. 2101-3515

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Young Dae LEE, et al.		Art Unit:	2617
Serial No:	12/159,841	Examiner:	CHO, Un C.
Filed:	October 22, 2008	Conf. No.:	3203
For:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM		

REQUEST FOR CORRECTED FILING RECEIPT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir or Madam:

We respectfully request the correction to two sections of the Filing Receipt. Specifically, in the *Applicant(s)* section, only the first of the four (4) inventors were included on the Filing receipt. Accordingly, please add the other three inventors Sung Duck CHUN, Myung Cheul JUNG, and Sung Jun PARK. Additionally, in the *Foreign Applicants* section, the Korean priority application was erroneously listed as KR 10-207-000936 instead of 10-**2007**-000936.

Enclosed please find the marked-up first page of the filing receipt reflecting the correction to the *Applicant(s)* and the *Foreign Applications* sections. It is respectfully noted that all four (4) inventors and the Korean priority application were listed correctly on the Declaration/Power of Attorney and cover page of PCT Publication No. 2007/078172 as filed.

Please process the correction and forward us a corrected filing receipt at your convenience.

Respectfully submitted,
Lee, Hong, Degerman, Kang & Waimey

Date: August 24, 2011

By: /Richard C. Salfelder/
Richard C. Salfelder
Registration No. 59,657
Attorney for Applicant(s)

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY DOCKET NO	TOT CLAIMS	IND CLAIMS
12/159,841	10/22/2008	2617	1430	2101-3515	14	3

CONFIRMATION NO. 3203

35884
LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

FILING RECEIPT

Date Mailed: 12/04/2009

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Sung Duck CHUN, Gyeonggi-do (KR)
Myung Cheul JUNG, Gyeonggi-do (KR)
Young Dae Lee, GYEONGGI-DO, KOREA, REPUBLIC OF; Sung Jun PARK, Gyeonggi-do (KR)

Power of Attorney: The patent practitioners associated with Customer Number 35884

Domestic Priority data as claimed by applicant

This application is a 371 of PCT/KR2007/000078 01/05/2007
which claims benefit of 60/757,063 01/05/2006
and claims benefit of 60/783,250 03/16/2006
and claims benefit of 60/784,680 03/21/2006
and claims benefit of 60/797,402 05/02/2006

Foreign Applications

REPUBLIC OF KOREA 10-~~207~~-0000936 01/04/2007

2007

If Required, Foreign Filing License Granted: 05/20/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/159,841**

Projected Publication Date: 03/11/2010

Non-Publication Request: No

Early Publication Request: No

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 12/159,841	Filing Date 10/22/2008	☐ To be Mailed

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☐		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	08/24/2011	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 14	Minus	** 20	= 0	X $ =		OR	X $52=	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $ =		OR	X $220=	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/PAMELA YOUNG/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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PTO/SB/08a (01-10)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	Cho, Un C
Attorney Docket Number	2101-3515

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2003174470	JP		2003-06-20	Mitsubishi Electric Corp.		☐

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	Cho, Un C
	Attorney Docket Number	2101-3515

	1	QUALCOMM, "Need for MAC-hs segmentation mechanism," 3GPP TSG-RAN WG2 meeting #28, R2-020769, April 2002.	☐

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	Cho, Un C
	Attorney Docket Number	2101-3515

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Sevan Savsa/	Date (YYYY-MM-DD)	2011-07-26
Name/Print	Sevan Savsa	Registration Number	61,718

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

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3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Espacenet

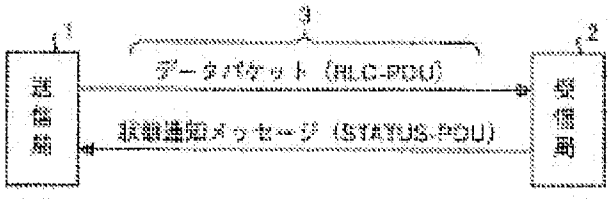
Bibliographic data: JP 2003174470 (A)

DATA PACKET TRANSMITTER, DATA PACKET RECEIVER, DATA PACKET TRANSMISSION SYSTEM AND DATA PACKET RETRANSMISSION CONTROL METHOD

Publication date:	2003-06-20
Inventor(s):	KIKUCHI NOBUO; KUZE TOSHIYUKI +
Applicant(s):	MITSUBISHI ELECTRIC CORP +
Classification:	**- international:** ***H04L1/18; H04L12/56;*** (IPC1-7): H04L1/18; H04L12/56 **- European:**
Application number:	JP20020127222 20020426
Priority number(s):	JP20020127222 20020426; JP20010303273 20010928
Also published as:	• JP 3645230 (B2)

Abstract of JP 2003174470 (A)

PROBLEM TO BE SOLVED: To reduce a useless retransmission even when the retransmission of data and a retransmission request pass each other between a transmitting station and a receiving station. ; SOLUTION: When a status notice message (STATUS-PDU) is received from a receiving station 2, a transmitting station 1 judges the presence/absence of a retransmission control table and when there is the retransmission control table, the transmitting station refers to the relevant retransmission control table. When the upper limit value of sequence numbers contained in the status notice message is less than the upper limit value of sequence numbers contained in the retransmission control table, the difference of information on a data packet contained in the retransmission control table and the status notice message is extracted and necessity of retransmission is decided. ;



(19)日本国特許庁（ＪＰ）　(12) **公開特許公報（Ａ）**　(11)特許出願公開番号
特開2003－174470
（P2003－174470A）
(43)公開日　平成15年６月20日(2003.6.20)

(51)Int.Cl.[7]	識別記号	ＦＩ	テーマコード(参考)
Ｈ０４Ｌ　12/56		Ｈ０４Ｌ　12/56	Ｚ　５Ｋ０１４
1/18		1/18	５Ｋ０３０

審査請求　有　　請求項の数33　ＯＬ　（全 45 頁）

(21)出願番号　特願2002－127222(P2002－127222)
(22)出願日　平成14年４月26日(2002.4.26)
(31)優先権主張番号　特願2001－303273(P2001－303273)
(32)優先日　平成13年９月28日(2001.9.28)
(33)優先権主張国　日本（ＪＰ）

(71)出願人　000006013
三菱電機株式会社
東京都千代田区丸の内二丁目２番３号
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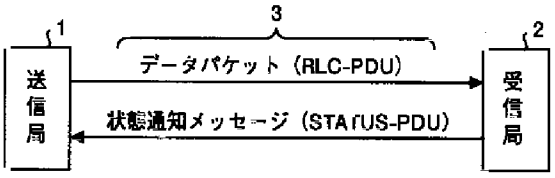
(74)代理人　100089118
弁理士　酒井　宏明

Ｆターム(参考)　5K014 AA01 DA02 FA03 FA11
5K030 HA08 JL01 KA04 LA01 MB13

(54)【発明の名称】　データパケット送信装置、データパケット受信装置、データパケット伝送システムおよびデータパケット再送制御方法

(57)【要約】
【課題】　送信局と受信局との間でデータの再送と再送要求のすれ違いが発生した場合でも、無駄な再送を抑制すること。
【解決課題】　送信局１は、受信局２から状態通知メッセージ（STATUS-PDU）を受信した場合に、再送制御テーブルの存在有無を判断し、再送制御テーブルが存在する場合は、当該再送制御テーブルを参照し、前記状態通知メッセージに含まれるシーケンス番号上限値が前記再送制御テーブルに含まれるシーケンス番号上限値未満であるとき、前記再送制御テーブルと前記状態通知メッセージとに含まれるデータパケットに関する情報の差分を抽出し、再送の要否を判定する。



【特許請求の範囲】
【請求項１】　受信側にシーケンス番号付きのデータパケットを送信している過程で受信側から、受信したデータパケットのシーケンス番号の上限値と誤りが検出されたデータパケットに関する情報とを含む状態通知メッセージを受けたとき、その誤りが検出されたデータパケットの再送を実施するデータパケット送信装置において、
受信側から前記状態通知メッセージを受信した場合に、再送制御テーブルの存在有無を判断する判断手段と、
前記判断手段によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージに含まれるシーケンス番号上限値が前記再送制御テーブルに含まれるシーケンス番号上限値未満であるとき、前記再送制御テーブルと前記状態通知メッセージとに含まれるデータパケットに関する情報の差分を抽出し、再送の要否を判定する判定手段と、
を備えたことを特徴とするデータパケット送信装置。
【請求項２】　前記判断手段によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージに含まれるシーケンス番号上限値が前記再送制御テーブルに含まれるシーケンス番号上限値を超えるとき、当該再送制御テーブルを削除する削除手段を備えたことを特徴とする請求項１に記載のデータパケット送信装置。
【請求項３】　受信側にシーケンス番号付きのデータパケットを送信している過程で受信側から、受信したデータパケットのシーケンス番号の上限値と誤りが検出されたデータパケットに関する情報とを含む状態通知メッセージを受けたとき、その誤りが検出されたデータパケットの再送を実施するデータパケット送信装置において、
受信側に前記状態通知メッセージの送信を要求する状態通知要求メッセージのシーケンス番号をカウントするカウンタと、
前記状態通知要求メッセージを送信する際に前記カウンタのカウント値を要求番号として付加する要求番号付加手段と、
前記状態通知メッセージを受信した場合に、再送制御テーブルの存在有無を判断する判断手段と、
前記判断手段によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージと前記再送制御テーブルとに含まれるシーケンス番号上限値が一致する場合において、前記状態通知メッセージの送信理由が送信局からの前記状態通知要求メッセージの受信であり当該状態通知メッセージに含まれる前記要求番号が前記再送制御テーブルに含まれる要求番号以下のとき、または、前記状態通知メッセージの送信理由が周期タイマのタイムアウトであり当該送信理由が前記再送制御テーブルに含まれる送信理由と一致しないとき、あるいは、前記状態通知メッセージの送信理由が送信局からの前記状態通知要求メッセージの受信でなく、かつ前記周期タイマのタイムアウトでもないとき、前記再送制御テーブルと前記状態通知メッセージとに含まれるデータパケットに関する情報の差分を抽出し、再送の要否を判定する判定手段と、
を備えたことを特徴とするデータパケット送信装置。
【請求項４】　前記判断手段によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージと前記再送制御テーブルとに含まれるシーケンス番号上限値が一致する場合において、前記状態通知メッセージに含まれる前記要求番号が前記再送制御テーブルに含まれる前記要求番号よりも大きいとき、ないしは、前記状態通知メッセージの送信理由が周期タイマのタイムアウトであり当該送信理由が前記再送制御テーブルに含まれる送信理由と一致するとき、当該再送制御テーブルを削除する削除手段を備えたことを特徴とする請求項３に記載のデータパケット送信装置。
【請求項５】　前記判断手段によって再送制御テーブルが存在しないと判断された場合において、再送を実施すると決定した場合に、再送処理実行決定時までに受信側に送信したデータパケットのシーケンス番号上限値および該当する場合は前記要求番号と前記状態通知メッセージから読み出した送信理由および再送するデータパケットに関する情報とを設定した前記再送制御テーブルを作成するテーブル設定手段と、
前記再送制御テーブルの作成後に、当該再送制御テーブルに設定されている再送するデータパケットに関する情報に基づき当該データパケットについての再送を実施する再送手段と、
を備えたことを特徴とする請求項１～４のいずれか一つに記載のデータパケット送信装置。
【請求項６】　送信側からシーケンス番号付きのデータパケットを受信している過程で誤りを検出したとき、送信側に受信したデータパケットのシーケンス番号の上限値と誤りが検出されたデータパケットに関する情報とを含む状態通知メッセージを送信するデータパケット受信装置において、
前記状態通知メッセージの送信原因が、状態通知要求メッセージの受信であるか、誤りの検出であるか、周期タイマのタイムアウトであるかの送信理由を作成する送信理由作成手段と、
前記状態通知メッセージを送信する際に、前記送信理由作成手段が作成した送信理由と当該送信理由が状態通知要求メッセージの受信であるときは受信した状態通知要求メッセージから読み出した要求番号とを付加する送信理由付加手段と、
を備えたことを特徴とするデータパケット受信装置。
【請求項７】　受信したデータパケットのシーケンス番号の上限値と誤りが検出されたデータパケットに関する情報とを含む状態通知メッセージを送信するデータパケ

ット受信装置と、前記データパケット受信装置にシーケンス番号付きのデータパケットを送信している過程で受信した前記状態通知メッセージに基づきその誤りが検出されたデータパケットの再送を実施するデータパケット送信装置とを備えるデータパケット伝送システムにおいて、
前記データパケット送信装置は、
前記状態通知メッセージを受信した場合に、再送制御テーブルの存在有無を判断する判断手段と、
前記判断手段によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージに含まれるシーケンス番号上限値が前記再送制御テーブルに含まれるシーケンス番号上限値未満のとき、前記再送制御テーブルと前記状態通知メッセージとに含まれるデータパケットに関する情報の差分を抽出し、再送の要否を判定する判定手段と、
を備えたことを特徴とするデータパケット伝送システム。

【請求項８】　前記データパケット送信装置は、
前記判断手段によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージに含まれるシーケンス番号上限値が前記再送制御テーブルに含まれるシーケンス番号上限値を超えるとき、当該再送制御テーブルを削除する削除手段を備えたことを特徴とする請求項７に記載のデータパケット伝送システム。

【請求項９】　受信したデータパケットのシーケンス番号の上限値と誤りが検出されたデータパケットに関する情報とを含む状態通知メッセージを送信するデータパケット受信装置と、前記データパケット受信装置にシーケンス番号付きのデータパケットを送信している過程で受信した前記状態通知メッセージに基づきその誤りが検出されたデータパケットの再送を実施するデータパケット送信装置とを備えるデータパケット伝送システムにおいて、
前記データパケット送信装置は、
前記データパケット受信装置に状態通知メッセージの送信を要求する状態通知要求メッセージのシーケンス番号をカウントするカウンタと、
前記状態通知要求メッセージを送信する際に前記カウンタのカウント値を要求番号として付加する要求番号付加手段と、
前記状態通知メッセージを受信した場合に、再送制御テーブルの存在有無を判断する判断手段と、
前記判断手段によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージと前記再送制御テーブルとに含まれるシーケンス番号上限値が一致する場合において、前記状態通知メッセージの送信理由が送信局からの前記状態通知要求メッセージの受信であり当該状態通知メッセージに含まれる前記要求番号が前記再送制御テーブルに含まれる要求番号以下のとき、または、前記状態通知メッセージの送信理由が周期タイマのタイムアウトでありその送信理由が前記再送制御テーブルに含まれる送信理由と一致しないとき、あるいは、前記状態通知メッセージの送信理由が送信局からの前記状態通知要求メッセージの受信でなく、かつ前記周期タイマのタイムアウトでもないとき、前記再送制御テーブルと前記状態通知メッセージとに含まれるデータパケットに関する情報の差分を抽出し、再送の要否を判定する判定手段と、
を備えたことを特徴とするデータパケット伝送システム。

【請求項１０】　前記データパケット送信装置は、
前記判断手段によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージと前記再送制御テーブルとに含まれるシーケンス番号上限値が一致する場合において、前記状態通知メッセージに含まれる前記要求番号が前記再送制御テーブルに含まれる前記要求番号よりも大きいとき、ないしは、前記状態通知メッセージの送信理由が周期タイマのタイムアウトでありその送信理由が前記再送制御テーブルに含まれる送信理由と一致するとき、当該再送制御テーブルを削除する削除手段を備えたことを特徴とする請求項９に記載のデータパケット伝送システム。

【請求項１１】　前記判断手段によって再送制御テーブルが存在しないと判断された場合において、再送を実施すると決定した場合に、再送処理実行決定時までに前記データパケット受信装置に送信したデータパケットのシーケンス番号上限値および該当する場合は前記要求番号と前記状態通知メッセージから読み出した送信理由および再送するデータパケットに関する情報とを設定した前記再送制御テーブルを作成するテーブル設定手段と、
前記再送制御テーブルの作成後に、当該再送制御テーブルに設定されている再送するデータパケットに関する情報に基づき当該データパケットについての再送を実施する再送手段と、
を備えたことを特徴とする請求項７～１０のいずれか一つに記載のデータパケット伝送システム。

【請求項１２】　前記データパケット受信装置は、
前記状態通知メッセージの送信原因が、状態通知要求メッセージの受信であるか、誤りの検出であるか、周期タイマのタイムアウトであるかの送信理由を作成する送信理由作成手段と、
前記状態通知メッセージを送信する際に、前記送信理由作成手段が作成した送信理由とその送信理由が状態通知要求メッセージの受信であるときは受信した状態通知要求メッセージから読み出した要求番号とを付加する送信理由付加手段と、
を備えたことを特徴とする請求項８～１１のいずれか一つに記載のデータパケット伝送システム。

【請求項１３】　データパケット送信装置が、データパケット受信装置にシーケンス番号付きのデータパケットを送信している過程で前記データパケット受信装置から、受信したデータパケットのシーケンス番号の上限値と誤りが検出されたデータパケットに関する情報とを含む状態通知メッセージを受けたとき、その誤りが検出されたデータパケットの再送を実施するデータパケット再送制御方法において、
前記データパケット送信装置は、
前記状態通知メッセージを受信した場合に、再送制御テーブルの存在有無を判断する判断工程と、
前記判断工程によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージに含まれるシーケンス番号上限値が前記再送制御テーブルに含まれるシーケンス番号上限値未満のとき、前記再送制御テーブルと前記状態通知メッセージとに含まれるデータパケットに関する情報の差分を抽出し、再送の要否を判定する判定工程と、
を含むことを特徴とするデータパケット再送制御方法。
【請求項１４】　前記判断工程によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージに含まれるシーケンス番号上限値が前記再送制御テーブルに含まれるシーケンス番号上限値を超えるとき、当該再送制御テーブルを削除する削除工程を含むことを特徴とする請求項１３に記載のデータパケット再送制御方法。
【請求項１５】　データパケット送信装置が、データパケット受信装置にシーケンス番号付きのデータパケットを送信している過程で前記データパケット受信装置から、受信したデータパケットのシーケンス番号の上限値と誤りが検出されたデータパケットに関する情報とを含む状態通知メッセージを受けたとき、その誤りが検出されたデータパケットの再送を実施するデータパケット再送制御方法において、
前記データパケット送信装置は、
前記データパケット受信装置に状態通知メッセージの送信を要求する状態通知要求メッセージのシーケンス番号をカウントするカウンタのカウント値を要求番号として前記状態通知要求メッセージに付加して送信する要求番号付加工程と、
前記データパケット受信装置から前記状態通知メッセージを受信した場合に、再送制御テーブルの存在有無を判断する判断工程と、
前記判断工程によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージと前記再送制御テーブルとに含まれるシーケンス番号上限値が一致する場合において、前記状態通知メッセージの送信理由が送信局からの前記状態通知要求メッセージの受信であり当該状態通知メッセージに含まれる前記要求番号が前記再送制御テーブルに含まれる要求番号以下のとき、または、前記状態通知メッセージの送信理由が周期タイマのタイムアウトであり当該送信理由が前記再送制御テーブルに含まれる送信理由と一致しないとき、あるいは、前記状態通知メッセージの送信理由が送信局からの前記状態通知要求メッセージの受信でなく、かつ前記周期タイマのタイムアウトでもないとき、前記再送制御テーブルと前記状態通知メッセージとに含まれるデータパケットに関する情報の差分を抽出し、再送の要否を判定する判定工程と、
を含むことを特徴とするデータパケット再送制御方法。
【請求項１６】　前記判断工程によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージと前記再送制御テーブルとに含まれるシーケンス番号上限値が一致する場合において、前記状態通知メッセージに含まれる前記要求番号が前記再送制御テーブルに含まれる前記要求番号よりも大きいとき、または、前記状態通知メッセージの送信理由が周期タイマのタイムアウトであり当該送信理由が前記再送制御テーブルに含まれる送信理由と一致するとき、当該再送制御テーブルを削除する削除工程を含むことを特徴とする請求項１５に記載のデータパケット再送制御方法。
【請求項１７】　前記判断工程によって再送制御テーブルが存在しないと判断された場合において、再送を実施すると決定した場合に、再送処理実行決定時までに受信側に送信したデータパケットのシーケンス番号上限値および該当する場合は前記要求番号と前記状態通知メッセージから読み出した送信理由および再送するデータパケットに関する情報とを設定した前記再送制御テーブルを作成するテーブル設定工程と、
前記再送制御テーブルの作成後に、当該再送制御テーブルに設定されている再送するデータパケットに関する情報に基づきそのデータパケットについての再送を実施する再送工程と、
を含むことを特徴とする請求項１３～１６のいずれか一つに記載のデータパケット再送制御方法。
【請求項１８】　前記データパケット受信装置は、
前記状態通知メッセージの送信原因が、前記状態通知要求メッセージの受信であるか、誤りの検出であるか、周期タイマのタイムアウトであるかの送信理由を作成する送信理由作成工程と、
前記状態通知メッセージを送信する際に、前記送信理由作成工程が作成した送信理由とその送信理由が状態通知要求メッセージの受信であるときは受信した状態通知要求メッセージから読み出した要求番号とを付加する送信理由付加工程と、
を含むことを特徴とする請求項１５～１７のいずれか一つに記載のデータパケット再送制御方法。
【請求項１９】　複数の受信装置に対してシーケンス番号つきの同一データパケットをマルチキャストし、各受

信装置から正常に受信したマルチキャストデータパケットのシーケンス番号の上限値と誤りが検出されたマルチキャストデータパケットに関する情報とを含む状態通知メッセージを受けたとき、前記誤りが検出されたマルチキャストデータパケットの再送を実施するデータパケット送信装置において、
前記状態通知メッセージに含まれるシーケンス番号に基づき再送制御テーブルの対応するシーケンス番号に関する内容を参照し、再送未実施であるとき、当該シーケンス番号のマルチキャストデータパケットについて再送を実施する再送実施手段と、
前記再送が実施されたマルチキャストデータパケットのシーケンス番号と対応付けて前記再送を実施した時点で送信済みのシーケンス番号の上限値を前記再送制御テーブルに設定するテーブル設定手段と、
を備えたことを特徴とするデータパケット送信装置。
【請求項２０】　前記状態通知メッセージに含まれるシーケンス番号に基づき参照した前記再送制御テーブルの対応するシーケンス番号に関する内容が再送実施済みであるとき、前記状態通知メッセージに含まれる当該受信装置が正常に受信したマルチキャストデータパケットのシーケンス番号の上限値が、前記再送制御テーブルに設定されている再送を実施した時点で送信済みのシーケンス番号の上限値よりも大きい場合にのみ、当該シーケンス番号のマルチキャストデータパケットについて再送を実施する再送実施手段、
を備えたことを特徴とする請求項１９に記載のデータパケット送信装置。
【請求項２１】　前記状態通知メッセージに含まれる送信理由が無条件再送要求である場合に、前記再送制御テーブルの内容によらず、当該状態通知メッセージに含まれるシーケンス番号のマルチキャストデータパケットについて再送を実施する再送実施手段、
を備えたことを特徴とする請求項１９または２０に記載のデータパケット送信装置。
【請求項２２】　前記再送制御テーブルにおいて再送実施済みのシーケンス番号と同番の新規データパケットが送信されたとき、当該シーケンス番号に関する内容を再送未実施に戻す処理を行うテーブルリセット手段、
を備えたことを特徴とする請求項１９～２１のいずれか一つに記載のデータパケット送信装置。
【請求項２３】　送信装置からシーケンス番号つきのマルチキャストデータパケットを受信している過程でシーケンス番号の抜けやデータの誤りを検出したとき、送信装置に対して、受信したマルチキャストデータパケットのシーケンス番号の上限値と前記誤りが検出されたマルチキャストデータパケットに関する情報とを含む状態通知メッセージを送信するデータパケット受信装置において、
前記送信する状態通知メッセージに無条件に再送を要求する送信理由と無条件ではない再送を要求する送信理由とを含ませる送信理由作成手段、
を備えたことを特徴とするデータパケット受信装置。
【請求項２４】　受信したマルチキャストデータパケットのシーケンス番号の上限値と誤りが検出されたマルチキャストデータパケットに関する情報とを含む状態通知メッセージを送信する複数のデータパケット受信装置と、前記複数のデータパケット受信装置に対しシーケンス番号つきの同一データパケットをマルチキャストし、前記複数のデータパケット受信装置から前記状態通知メッセージを受信したとき、前記誤りが検出されたマルチキャストデータパケットの再送を実施するデータパケット送信装置とを備えるデータパケット伝送システムにおいて、
前記データパケット送信装置は、
前記状態通知メッセージに含まれるシーケンス番号に基づき再送制御テーブルの対応するシーケンス番号に関する内容を参照し、再送未実施であるとき、当該シーケンス番号のマルチキャストデータパケットについて再送を実施する再送実施手段と、
前記再送が実施されたマルチキャストデータパケットのシーケンス番号と対応付けて前記再送を実施した時点で送信済みのシーケンス番号の上限値を前記再送制御テーブルに設定するテーブル設定手段と、
を備えたことを特徴とするデータパケット伝送システム。
【請求項２５】　前記データパケット送信装置は、
前記状態通知メッセージに含まれるシーケンス番号に基づき参照した前記再送制御テーブルの対応するシーケンス番号に関する内容が再送実施済みであるとき、前記状態通知メッセージに含まれる当該受信装置が正常に受信したマルチキャストデータパケットのシーケンス番号の上限値が、前記再送制御テーブルに設定されている再送を実施した時点で送信済みのシーケンス番号の上限値よりも大きい場合にのみ、当該シーケンス番号のマルチキャストデータパケットについて再送を実施する再送実施手段、
を備えたことを特徴とする請求項２４に記載のデータパケット伝送システム。
【請求項２６】　前記データパケット送信装置は、
前記状態通知メッセージに含まれる送信理由が無条件再送要求である場合に、前記再送制御テーブルの内容によらず、当該状態通知メッセージに含まれるシーケンス番号のマルチキャストデータパケットについて再送を実施する再送実施手段、
を備えたことを特徴とする請求項２４または２５に記載のデータパケット伝送システム。
【請求項２７】　前記データパケット送信装置は、
前記再送制御テーブルにおいて再送実施済みのシーケンス番号と同番の新規データパケットが送信されたとき、

当該シーケンス番号に関する内容を再送未実施に戻す処理を行うテーブルリセット手段、
を備えたことを特徴とする請求項２４～２６のいずれか一つに記載のデータパケット伝送システム。
【請求項２８】　前記データパケット受信装置は、
前記送信する状態通知メッセージに無条件に再送を要求する送信理由と無条件ではない再送を要求する送信理由とを含ませる送信理由作成手段、
を備えたことを特徴とする請求項２４～２７のいずれか一つに記載のデータパケット伝送システム。
【請求項２９】　データパケット送信装置が、複数のデータパケット受信装置に対しシーケンス番号つきの同一データパケットをマルチキャストし、前記データパケット受信装置から正常に受信したマルチキャストデータパケットのシーケンス番号の上限値と誤りが検出されたマルチキャストデータパケットに関する情報とを含む状態通知メッセージを受けたとき、前記誤りが検出されたマルチキャストデータパケットの再送を実施するデータパケット再送制御方法において、
前記データパケット送信装置は、
前記状態通知メッセージに含まれるシーケンス番号に基づき再送制御テーブルの対応するシーケンス番号に関する内容を参照し、再送未実施であるとき、当該シーケンス番号のマルチキャストデータパケットについて再送を実施する再送実施工程と、
前記再送が実施されたマルチキャストデータパケットのシーケンス番号と対応付けて前記再送を実施した時点で送信済みのシーケンス番号の上限値を前記再送制御テーブルに設定するテーブル設定工程と、
を含むことを特徴とするデータパケット再送制御方法。
【請求項３０】　前記データパケット送信装置は、
前記状態通知メッセージに含まれるシーケンス番号に基づき参照した前記再送制御テーブルの対応するシーケンス番号に関する内容が再送実施済みであるとき、前記状態通知メッセージに含まれる当該受信装置が正常に受信したマルチキャストデータパケットのシーケンス番号の上限値が、前記再送制御テーブルに設定されている再送を実施した時点で送信済みのシーケンス番号の上限値よりも大きい場合にのみ、当該シーケンス番号のマルチキャストデータパケットについて再送を実施する再送実施工程、
を含むことを特徴とする請求項２９に記載のデータパケット再送制御方法。
【請求項３１】　前記データパケット送信装置は、
前記状態通知メッセージに含まれる送信理由が無条件再送要求である場合に、前記再送制御テーブルの内容によらず、当該状態通知メッセージに含まれるシーケンス番号のマルチキャストデータパケットについて再送を実施する再送実施工程、
を含むことを特徴とする請求項２９または３０に記載のデータパケット再送制御方法。
【請求項３２】　前記データパケット送信装置は、
前記再送制御テーブルにおいて再送実施済みのシーケンス番号と同番の新規データパケットが送信されたとき、当該シーケンス番号に関する内容を再送未実施に戻す処理を行うテーブルリセット工程、
を含むことを特徴とする請求項２９～３１のいずれか一つに記載のデータパケット再送制御方法。
【請求項３３】　前記データパケット受信装置は、
前記送信する状態通知メッセージに無条件に再送を要求する送信理由と無条件ではない再送を要求する送信理由とを含ませる工程、
を含むことを特徴とする請求項２９～３２のいずれか一つに記載のデータパケット再送制御方法。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】この発明は、データパケットの送信に際して再送制御を行うデータパケット送信装置、受信したデータパケットについての再送要求を行うデータパケット受信装置、有線、無線に関わらず、任意の通信回線で接続されたデータパケット送信装置とデータパケット受信装置との間で再送制御を行いつつデータパケットの送受信を実行するデータパケット伝送システムおよびデータパケット再送制御方法に関し、特に、複数のデータパケットをまとめて送受信するようなデータパケット伝送システムおよびデータパケット再送制御方法に関するものである。
【０００２】
【従来の技術】複数のデータをまとめて送受信するような通信システムにおけるデータパケット再送制御方法として、例えば、ＩＭＴ－２０００の一つの方式として３ＧＰＰ（3rd Generation Partnership Project）で策定している無線リンク制御（ＲＬＣ：Radio Link Control）のプロトコル仕様ＴＳ　２５．３２２　Ｖ３．５．０（２０００－１２）に記載されている方法が従来から知られている。
【０００３】以下、この３ＧＰＰで策定している無線リンク制御のプロトコル仕様に記載されているデータパケット再送制御方法について、図２２～図２６を参照して説明する。なお、図２２は、従来のデータパケット再送制御方法を説明するシーケンス図である。図２３は、従来の送信局が送信するデータパケットのフォーマット例を示す図である。図２４は、従来の受信局が送信する状態通知メッセージのフォーマット例を示す図である。図２５は、状態通知メッセージに含まれる送達確認情報要素のフォーマット例を示す図である。図２６は、状態通知メッセージに含まれる再送要求情報要素のフォーマット例を示す図である。
【０００４】まず、フォーマットの内容を説明する。図２３において、データパケット（以降「RLC-PDU」と記

述する。ＰＤＵ：Protocol Data Unit）３００ａは、第１行と第2行のデータ単位に「Ｄ／Ｃ」３０１と「Sequence Number」３０２と「Ｐ」３０３と「ＨＥ」３０４とが設けられ、第3行以降のＮ行に「Length Indicator」３０７－１～３０７－Ｎと「Ｅ」３０５－１～３０５－Ｎとが設けられ、その後の複数行にデータ部「Data」３０８が設けられている。

【０００５】「Ｄ／Ｃ」３０１は、当該RLC-PDU３００ａがユーザデータであるか制御データであるかを示すフラグである。「Sequence Number」３０２は、当該RLC-PDU３００ａのシーケンス番号である。「Ｐ」３０３は、状態通知メッセージを要求するフラグ（Ｐｏｌビットと呼ばれる）である。「ＨＥ」３０４並びに「Ｅ」３０５－１～３０５－Ｎは、後続のヘッダ情報の有無を示すフラグである。「LengthIndicator」３０７－１～３０７－Ｎは、データ部「Data」３０８の有効データ長を示し、上位レイヤのＰＤＵの最後尾を含む場合にのみ設定される。

【０００６】図２４において、状態通知メッセージ（以下「STATUS-PDU」と記述する）３１０ａは、「Ｄ／Ｃ」３０１と「PDU type」３１１と「$SUFI_1$」３１３－１～「$SUFI_K$」３１３－Ｋ（以下「ＳＵＦＩ」３１３と記述する）と「ＰＡＤ」３１４とで構成されている。

【０００７】「Ｄ／Ｃ」３０１は、当該 STATUS-PDU３１０ａがユーザデータであるか制御データであるかを示すフラグである。「PDU type」３１１は、当該制御データの種別を示し、STATUS-PDU３１０ａであることが示されている。「PDU type」３１１と「ＰＡＤ」３１４との間に設けられているデータ部分には、後述するように「ＳＵＦＩ」３１３で示される複数の情報要素を含むことができる。

【０００８】図２５において、送達確認情報要素４１０は、図２４の「ＳＵＦＩ」３１３で示される複数の情報要素の一つであり、「Type＝ACK」４１１と「ＬＳＮ」４１２とで構成されている。「ＬＳＮ」４１２は、連続して受信したシーケンス番号の次の値を示す。但し、同一のSTATUS-PDU３１０ａに図２６に示す再送要求情報要素４２０を含む場合には、「ＬＳＮ」４１２は受信したシーケンス番号の上限値の次の値を示す。

【０００９】図２６において、再送要求情報要素４２０は、図２４の「ＳＵＦＩ」３１３で示される複数の情報要素の一つであり、「Type＝LIST」４２１と、「LENGTH」４２２と、再送を要求するRLC-PDU３００ａの先頭のシーケンス番号「SN_1」４２４－１～「SN_{LENGTH}」４２４－Ｌ(以下、シーケンス番号「ＳＮ」４２４と記述する）と、それらにそれぞれ続くRLC-PDU３００ａの数「L_1」４２５－１～「L_{LENGTH}」４２５－Ｌ（以下、後続数「Ｌ」４２５と記述する）とで構成されている。「LENGTH」４２２は、シーケンス番号「ＳＮ」４２４とRLC-PDU３００ａの後続数「Ｌ」４２５の組の数である。例えば、シーケンス番号＝５，６，７のRLC-PDU３００ａの再送を要求する場合は、ＳＮ＝５、Ｌ＝２が設定される。

【００１０】次に、図２２を用いて従来のデータパケット再送制御方法について説明する。３ＧＰＰで策定中の通信方式では、周期的な送信間隔TTI（ＴＴＩ：Transmission Time Interval）毎に複数のRLC-PDU３００ａをまとめて送信することが可能である。図２２では、送信間隔TTI毎に４個のRLC-PDU３００ａを送信する場合の例が示されている。なお、図２２では、送信局と受信局の送信間隔TTIは、同じで、送信と受信のタイミングにずれはないものとしている。

【００１１】図２３に示すように、送信局が受信局へ送信するRLC-PDU３００ａは、データ部３０８にシーケンス番号３０２が付加されている。送信局は、ヘッダ中の「Ｐ」３０３を設定して受信局に対して状態通知メッセージの送信を要求することが可能である。例えば、送信局は、上位レイヤから受け取ったデータの最後尾を含むRLC-PDU３００ａや、送達確認がとれていないRLC-PDU３００ａの割合がある一定数以上になった場合にそれ以降に送信するRLC-PDU３００ａなどに対して「Ｐ」３０３を設定することがある。

【００１２】受信局は、受信したRLC-PDU３００ａのシーケンス番号３０２をチェックし、順番通りに受信していないシーケンス番号３０２を検出した場合、つまりシーケンス番号３０２に抜けを検出した場合や、ヘッダ中の「Ｐ」３０３が設定されたRLC-PDU３００ａを受信した場合、あるいは周期的なタイマがタイムアウトする毎などに、図２６に示す再送要求情報要素４２０や図２５に示す送達確認情報要素４１０を設定したSTATUS-PDU３１０ａを作成し、送達確認と再送要求を送信局に対して通知する。

【００１３】具体的には、図２２において、送信局が送信間隔TTI-0の期間で送信した４個のRLC-PDU（Seq.No=0,1,2,3）のうち２個のRLC-PDU（Seq.No=1,2）に抜けがあった場合、受信局は、次の送信間隔TTI-1の期間で実施するプロトコル処理１１０ａにおいてSeq.No=1,2の抜けを検出し、次のようなSTATUS-PDU３１０ａを作成する。すなわち、このSTATUS-PDU３１０ａでは、図２４～図２６において、「ＬＳＮ」４１２に正常に受信できたとした場合のシーケンス番号上限値「３」の次の値「４」が設定され、「ＳＮ」４２４に再送を要求するRLC-PDU３００の先頭シーケンス番号「１」が設定され、「Ｌ」４２５に後続数「１」が設定されている。受信局は、次の送信間隔TTI-2の期間において、上記のような内容２００ａを有するSTATUS-PDU３１０ａを送信し、送信局に対して再送を要求する。

【００１４】送信局は、次の送信間隔TTI-3の期間で実施するプロトコル処理１００ａにおいて、STATUS-PDU３１０ａの再送要求情報要素４２０からSeq.No=1,2の抜け

を認識し、つまりSeq.No=1,2のRLC-PDU３００ａについて再送要求を認識し、次の送信間隔TTI-4の期間においてSeq.No=1,2のRLC-PDU３００ａについて再送を実施する。一方、送信局が、送信間隔TTI-2の期間において送信するSeq.No=11のRLC-PDU３００ａにＰｏ１１ビットＰ（「Ｐ」３０３）を設定した場合、受信局は、次の送信間隔TTI-3の期間で実施するプロトコル処理１１１ａにおいてＰｏＩＩビットＰ（「Ｐ」３０３）を検出する。

【００１５】この時点では、受信局は、再送を要求したSeq.No=1,2のRLC-PDU３００ａを未だ受信していないので、送信間隔TTI-3の期間で実施するプロトコル処理１１１ａにおいて、次の内容を有するSTATUS-PDU３１０ａを作成する。すなわち、STATUS-PDU３１０ａでは、「ＬＳＮ」４１２に状態通知メッセージの送信要求を認識した送信間隔TTI-3の期間までに受信できた場合のシーケンス番号上限値「１１」の次の値「１２」が設定され、「ＳＮ」４２４に再送を要求するRLC-PDU３００ａの先頭シーケンス番号「１」が設定され、「Ｌ」４２５に後続数「１」が設定されている。受信局は、次の送信間隔TTI-4の期間において、上記のような内容２０１ａを有するSTATUS-PDU３１０ａを送信し、Seq.No=1,2のRLC-PDU３００ａについての再送要求を送信局に対して通知する。

【００１６】送信局は、次の送信間隔TTI-5の期間で実施するプロトコル処理１０１ａにおいて、Seq.No=1,2のRLC-PDU３００ａについての再送要求を認識し、次の送信間隔TTI-6の期間でSeq.No=1,2のRLC-PDU３００ａについての再送を再度実施する。なお、送信局が、送信間隔TTI-5の期間において送信するSeq.No=19のRLC-PDU３００ａにＰｏ１１ビットＰ（「Ｐ」３０３）を設定した場合、受信局は、次の送信間隔TTI-6の期間で実施するプロトコル処理１１２ａにおいてそのＰｏ１１ビットＰ（「Ｐ」３０３）を検出し、STATUS-PDU３１０ａの送信要求を認識する。

【００１７】

【発明が解決しようとする課題】しかしながら、上記のような従来のデータパケット再送制御方法では、送信局と受信局との間でデータの再送と再送要求のすれ違いが発生する場合に、無駄なデータ再送を行うことがあるという問題がある。例えば、図２２における送信間隔TTI-3、TTI-4の期間では、送信局は、再送要求を認識してデータ再送を実施するが、受信局は、先に要求したデータを受信していないので再度、再送を要求するSTATUS-PDU３１０ａを送信する。このように、送信局と受信局との間でデータの再送と再送要求のすれ違いが発生する場合がある。この場合に、従来では、図２２に示すように、送信間隔TTI-4の期間で再送したSeq.No=1,2のRLC-PDU３００ａが正しく受信されているにもかかわらず、送信間隔TTI-6の期間で再度Seq.No=1,2のRLC-PDU３００ａを送信するという無駄なデータ再送を行うことがある。

【００１８】この発明は、上記に鑑みてなされたもので、送信局と受信局との間でデータパケットの再送と再送要求のすれ違いが発生した場合でも、無駄な再送を抑制することができ、無線回線あるいは有線回線のリソースを無駄に消費することの防止可能な再送制御が行えるデータパケット送信装置、データパケット受信装置、それらにより構成されるデータパケット伝送システムおよびデータパケット再送制御方法を得ることを目的とする。

【００１９】

【課題を解決するための手段】上記目的を達成するために、この発明にかかるデータパケット送信装置は、受信側にシーケンス番号付きのデータパケットを送信している過程で受信側から、受信したデータパケットのシーケンス番号の上限値と誤りが検出されたデータパケットに関する情報とを含む状態通知メッセージを受けたとき、その誤りが検出されたデータパケットの再送を実施するデータパケット送信装置において、受信側から前記状態通知メッセージを受信した場合に、再送制御テーブルの存在有無を判断する判断手段と、前記判断手段によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージに含まれるシーケンス番号上限値が前記再送制御テーブルに含まれるシーケンス番号上限値未満であるとき、前記再送制御テーブルと前記状態通知メッセージとに含まれるデータパケットに関する情報の差分を抽出し、再送の要否を判定する判定手段とを備えたことを特徴とする。

【００２０】この発明によれば、データパケット送信装置では、受信側から状態通知メッセージが受信された場合に、まず判断手段にて再送制御テーブルの存在有無が判断される。その結果、再送制御テーブルが存在する場合は、判定手段にて当該再送制御テーブルが参照され、状態通知メッセージに含まれるシーケンス番号上限値が再送制御テーブルに含まれるシーケンス番号上限値未満であるとき、再送制御テーブルと状態通知メッセージとに含まれるデータパケットに関する情報の差分が抽出され、再送の要否が判定される。具体的には、差分がないときは、既に再送を実施したデータパケットの送達確認待ちであることから再送は実施せず、差分がある場合に、当該差分に関わるデータパケットについて再送を実施すると判定される。

【００２１】つぎの発明にかかるデータパケット送信装置は、上記の発明において、前記判断手段によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージに含まれるシーケンス番号上限値が前記再送制御テーブルに含まれるシーケンス番号上限値を超えるとき、当該再送制御テーブルを削除する削除手段を備えたことを特徴とする。

【００２２】この発明によれば、データパケット送信装

置では、上記の発明において、再送制御テーブルが存在する場合に、削除手段にて、再送制御テーブルが参照され、状態通知メッセージに含まれるシーケンス番号上限値が再送制御テーブルに含まれるシーケンス番号上限値を超えるとき、当該再送制御テーブルが削除される。

【００２３】つぎの発明にかかるデータパケット送信装置は、受信側にシーケンス番号付きのデータパケットを送信している過程で受信側から、受信したデータパケットのシーケンス番号の上限値と誤りが検出されたデータパケットに関する情報とを含む状態通知メッセージを受けたとき、その誤りが検出されたデータパケットの再送を実施するデータパケット送信装置において、受信側に前記状態通知メッセージの送信を要求する状態通知要求メッセージのシーケンス番号をカウントするカウンタと、前記状態通知要求メッセージを送信する際に前記カウンタのカウント値を要求番号として付加する要求番号付加手段と、前記状態通知メッセージを受信した場合に、再送制御テーブルの存在有無を判断する判断手段と、前記判断手段によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージと前記再送制御テーブルとに含まれるシーケンス番号上限値が一致する場合において、前記状態通知メッセージの送信理由が送信局からの前記状態通知要求メッセージの受信であり当該状態通知メッセージに含まれる前記要求番号が前記再送制御テーブルに含まれる要求番号以下のとき、または、前記状態通知メッセージの送信理由が周期タイマのタイムアウトであり当該送信理由が前記再送制御テーブルに含まれる送信理由と一致しないとき、あるいは、前記状態通知メッセージの送信理由が送信局からの前記状態通知要求メッセージの受信でなく、かつ前記周期タイマのタイムアウトでもないとき、前記再送制御テーブルと前記状態通知メッセージとに含まれるデータパケットに関する情報の差分を抽出し、再送の要否を判定する判定手段とを備えたことを特徴とする。

【００２４】この発明によれば、データパケット送信装置では、受信側に状態通知メッセージの送信を要求する状態通知要求メッセージが送信されるたびにカウンタがインクリメントされ、要求番号付加手段によって、そのカウンタのカウント値が要求番号として上記送信される状態通知要求メッセージに付加される。状態通知メッセージが受信されると、まず判断手段にて再送制御テーブルの存在有無が判断される。その結果、再送制御テーブルが存在する場合には、判定手段にて当該再送制御テーブルが参照され、状態通知メッセージと再送制御テーブルとに含まれるシーケンス番号上限値が一致する場合には、状態通知メッセージの送信理由が送信局からの状態通知要求メッセージの受信であり当該状態通知メッセージに含まれる要求番号が再送制御テーブルに含まれる要求番号以下のとき、または、状態通知メッセージの送信理由が周期タイマのタイムアウトであり当該送信理由が再送制御テーブルに含まれる送信理由と一致しないとき、あるいは、状態通知メッセージの送信理由が送信局からの状態通知要求メッセージの受信でなく、かつ周期タイマのタイムアウトでもないとき、再送制御テーブルと状態通知メッセージとに含まれるデータパケットに関する情報の差分が抽出され、再送の要否が判定される。具体的には、差分がないときは、既に再送を実施したデータパケットの送達確認待ちであることから再送は実施せず、差分がある場合に、当該差分に関わるデータパケットについて再送を実施すると判定される。

【００２５】つぎの発明にかかるデータパケット送信装置は、上記の発明において、前記判断手段によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージと前記再送制御テーブルとに含まれるシーケンス番号上限値が一致する場合において、前記状態通知メッセージに含まれる前記要求番号が前記再送制御テーブルに含まれる前記要求番号よりも大きいとき、ないしは、前記状態通知メッセージの送信理由が周期タイマのタイムアウトであり当該送信理由が前記再送制御テーブルに含まれる送信理由と一致するとき、当該再送制御テーブルを削除する削除手段を備えたことを特徴とする。

【００２６】この発明によれば、データパケット送信装置では、上記の発明において、再送制御テーブルが存在する場合に、削除手段にて、再送制御テーブルが参照され、状態通知メッセージと再送制御テーブルとに含まれるシーケンス番号上限値が一致する場合には、前記状態通知メッセージに含まれる要求番号が再送制御テーブルに含まれる要求番号よりも大きいとき、ないしは、状態通知メッセージの送信理由が周期タイマのタイムアウトであり当該送信理由が再送制御テーブルに含まれる送信理由と一致するとき、当該再送制御テーブルが削除される。

【００２７】つぎの発明にかかるデータパケット送信装置は、上記の発明において、前記判断手段によって再送制御テーブルが存在しないと判断された場合において、再送を実施すると決定した場合に、再送処理実行決定時までに受信側に送信したデータパケットのシーケンス番号上限値および該当する場合は前記要求番号と前記状態通知メッセージから読み出した送信理由および再送するデータパケットに関する情報とを設定した前記再送制御テーブルを作成するテーブル設定手段と、前記再送制御テーブルの作成後に、当該再送制御テーブルに設定されている再送するデータパケットに関する情報に基づき当該データパケットについての再送を実施する再送手段とを備えたことを特徴とする。

【００２８】この発明によれば、データパケット送信装置では、上記の発明において、再送制御テーブルが存在しない場合には、再送を実施すると決定された場合に、

テーブル設定手段にて、再送処理実行決定時までに受信側に送信したデータパケットシーケンス番号の上限値および該当する場合は要求番号と状態通知メッセージから読み出した送信理由および再送するデータパケットに関する情報とが設定される。その後、再送手段にて、当該再送制御テーブルに設定されている再送するデータパケットに関する情報に基づき当該データパケットについての再送が実施される。

【0029】つぎの発明にかかるデータパケット受信装置は、送信側からシーケンス番号付きのデータパケットを受信している過程で誤りを検出したとき、送信側に受信したデータパケットのシーケンス番号の上限値と誤りが検出されたデータパケットに関する情報とを含む状態通知メッセージを送信するデータパケット受信装置において、前記状態通知メッセージの送信原因が、状態通知要求メッセージの受信であるか、誤りの検出であるか、周期タイマのタイムアウトであるかの送信理由を作成する送信理由作成手段と、前記状態通知メッセージを送信する際に、前記送信理由作成手段が作成した送信理由と当該送信理由が状態通知要求メッセージの受信であるときは受信した状態通知要求メッセージから読み出した要求番号とを付加する送信理由付加手段とを備えたことを特徴とする。

【0030】この発明によれば、データパケット受信装置では、状態通知メッセージの送信原因が発生すると、送信理由作成手段にて、状態通知要求メッセージの受信であるか、誤りの検出であるか、周期タイマのタイムアウトであるかの送信理由が作成され、送信理由付加手段にて、その作成された送信理由と当該送信理由が状態通知要求メッセージの受信であるときは受信した状態通知要求メッセージから読み出した要求番号とが状態通知メッセージに付加され、データパケット送信装置に向けて送信される。

【0031】つぎの発明にかかるデータパケット伝送システムは、受信したデータパケットのシーケンス番号の上限値と誤りが検出されたデータパケットに関する情報とを含む状態通知メッセージを送信するデータパケット受信装置と、前記データパケット受信装置にシーケンス番号付きのデータパケットを送信している過程で受信した前記状態通知メッセージに基づきその誤りが検出されたデータパケットの再送を実施するデータパケット送信装置とを備えるデータパケット伝送システムにおいて、前記データパケット送信装置は、前記状態通知メッセージを受信した場合に、再送制御テーブルの存在有無を判断する判断手段と、前記判断手段によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージに含まれるシーケンス番号上限値が前記再送制御テーブルに含まれるシーケンス番号上限値未満のとき、前記再送制御テーブルと前記状態通知メッセージとに含まれるデータパケットに関する情報の差分を抽出し、再送の要否を判定する判定手段とを備えたことを特徴とする。

【0032】この発明によれば、データパケット伝送システムにおけるデータパケット送信装置において、状態通知メッセージが受信された場合には、まず判断手段にて再送制御テーブルの存在有無が判断される。その結果、再送制御テーブルが存在する場合には、判定手段にて当該再送制御テーブルが参照され、状態通知メッセージに含まれるシーケンス番号上限値が再送制御テーブルに含まれるシーケンス番号上限値未満のとき、再送制御テーブルと状態通知メッセージとに含まれるデータパケットに関する情報の差分が抽出され、再送の要否が判定される。具体的には、差分がないときは、既に再送を実施したデータパケットの送達確認待ちであることから再送は実施せず、差分がある場合に、当該差分に関わるデータパケットについて再送を実施すると判定される。

【0033】つぎの発明にかかるデータパケット伝送システムは、上記の発明において、前記データパケット送信装置は、前記判断手段によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージに含まれるシーケンス番号上限値が前記再送制御テーブルに含まれるシーケンス番号上限値を超えるとき、当該再送制御テーブルを削除する削除手段を備えたことを特徴とする。

【0034】この発明によれば、データパケット伝送システムにおけるデータパケット送信装置において、再送制御テーブルが存在する場合に、削除手段にて、再送制御テーブルが参照され、状態通知メッセージに含まれるシーケンス番号上限値が再送制御テーブルに含まれるシーケンス番号上限値を超えるとき、当該再送制御テーブルが削除される。

【0035】つぎの発明にかかるデータパケット伝送システムは、受信したデータパケットのシーケンス番号の上限値と誤りが検出されたデータパケットに関する情報とを含む状態通知メッセージを送信するデータパケット受信装置と、前記データパケット受信装置にシーケンス番号付きのデータパケットを送信している過程で受信した前記状態通知メッセージに基づきその誤りが検出されたデータパケットの再送を実施するデータパケット送信装置とを備えるデータパケット伝送システムにおいて、前記データパケット送信装置は、前記データパケット受信装置に状態通知メッセージの送信を要求する状態通知要求メッセージのシーケンス番号をカウントするカウンタと、前記状態通知要求メッセージを送信する際に前記カウンタのカウント値を要求番号として付加する要求番号付加手段と、前記状態通知メッセージを受信した場合に、再送制御テーブルの存在有無を判断する判断手段と、前記判断手段によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージと前記再送制御テーブルとに含ま

れるシーケンス番号上限値が一致する場合において、前記状態通知メッセージの送信理由が送信局からの前記状態通知要求メッセージの受信であり当該状態通知メッセージに含まれる前記要求番号が前記再送制御テーブルに含まれる要求番号以下のとき、または、前記状態通知メッセージの送信理由が周期タイマのタイムアウトでありその送信理由が前記再送制御テーブルに含まれる送信理由と一致しないとき、あるいは、前記状態通知メッセージの送信理由が送信局からの前記状態通知要求メッセージの受信でなく、かつ前記周期タイマのタイムアウトでもないとき、前記再送制御テーブルと前記状態通知メッセージとに含まれるデータパケットに関する情報の差分を抽出し、再送の要否を判定する判定手段とを備えたことを特徴とする。

【００３６】この発明によれば、データパケット伝送システムにおけるデータパケット送信装置において、受信側に状態通知メッセージの送信を要求する状態通知要求メッセージが送信されるたびにカウンタがインクリメントされ、要求番号付加手段によってそのカウンタのカウント値が要求番号として上記送信する状態通知要求メッセージに付加される。状態通知メッセージが受信されると、まず判断手段にて再送制御テーブルの存在有無が判断される。その結果、再送制御テーブルが存在する場合には、判定手段にて当該再送制御テーブルが参照され、状態通知メッセージと再送制御テーブルとに含まれるシーケンス番号上限値が一致する場合には、状態通知メッセージに含まれる要求番号が再送制御テーブルに含まれる要求番号以下のとき、または、状態通知メッセージの送信理由が周期タイマのタイムアウトであり当該送信理由が再送制御テーブルに含まれる送信理由と一致しないとき、あるいは、状態通知メッセージの送信理由が送信局からの状態通知要求メッセージの受信でなく、かつ周期タイマのタイムアウトでもないとき、再送制御テーブルと状態通知メッセージとに含まれるデータパケットに関する情報の差分が抽出され、再送の要否が判定される。具体的には、差分がないときは、既に再送を実施したデータパケットの送達確認待ちであることから再送は実施せず、差分がある場合に、当該差分に関わるデータパケットについて再送を実施すると判定される。

【００３７】つぎの発明にかかるデータパケット伝送システムは、上記の発明において、前記データパケット送信装置は、前記判断手段によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージと前記再送制御テーブルとに含まれるシーケンス番号上限値が一致する場合において、前記状態通知メッセージに含まれる前記要求番号が前記再送制御テーブルに含まれる前記要求番号よりも大きいとき、ないしは、前記状態通知メッセージの送信理由が周期タイマのタイムアウトであり当該送信理由が前記再送制御テーブルに含まれる送信理由と一致するとき、当該再送制御テーブルを削除する削除手段を備えたことを特徴とする。

【００３８】この発明によれば、データパケット伝送システムにおけるデータパケット送信装置では、再送制御テーブルが存在する場合に、削除手段にて、再送制御テーブルが参照され、状態通知メッセージと再送制御テーブルとに含まれるシーケンス番号上限値が一致する場合には、状態通知メッセージに含まれる要求番号が再送制御テーブルに含まれる要求番号よりも大きいとき、ないしは、状態通知メッセージの送信理由が周期タイマのタイムアウトであり当該送信理由が再送制御テーブルに含まれる送信理由と一致するとき、当該再送制御テーブルが削除される。

【００３９】つぎの発明にかかるデータパケット伝送システムは、上記の発明において、前記判断手段によって再送制御テーブルが存在しないと判断された場合において、再送を実施すると決定した場合に、再送処理実行決定時までに前記データパケット受信装置に送信したデータパケットのシーケンス番号上限値および該当する場合は前記要求番号と前記状態通知メッセージから読み出した送信理由および送信するデータパケットに関する情報とを設定した前記再送制御テーブルを作成するテーブル設定手段と、前記再送制御テーブルの作成後に、当該再送制御テーブルに設定されている送信するデータパケットに関する情報に基づき当該データパケットについての再送を実施する再送手段とを備えたことを特徴とする。

【００４０】この発明によれば、データパケット伝送システムにおけるデータパケット送信装置において、再送制御テーブルが存在しない場合には、再送を実施すると決定された場合に、テーブル設定手段にて、再送処理実行決定時までに受信側に送信したデータパケットのシーケンス番号上限値および該当する場合は要求番号と状態通知メッセージから読み出した送信理由および送信するデータパケットに関する情報とが設定される。その後、再送手段にて、当該再送制御テーブルに設定されている送信するデータパケットに関する情報に基づき当該データパケットについての再送が実施される。

【００４１】つぎの発明にかかるデータパケット伝送システムは、上記の発明において、前記データパケット受信装置は、前記状態通知メッセージの送信原因が、状態通知要求メッセージの受信であるか、誤りの検出であるか、周期タイマのタイムアウトであるかの送信理由を作成する送信理由作成手段と、前記状態通知メッセージを送信する際に前記送信理由作成手段が作成した送信理由と当該送信理由が状態通知要求メッセージの受信であるときは受信した状態通知要求メッセージから読み出した要求番号とを付加する送信理由付加手段とを備えたことを特徴とする。

【００４２】この発明によれば、データパケット伝送システムにおけるデータパケット受信装置において、状態

通知メッセージの送信原因が発生すると、送信理由作成手段にて、状態通知要求メッセージの受信であるか、誤りの検出であるか、周期タイマのタイムアウトであるかの送信理由が作成され、送信理由付加手段にて、その作成された送信理由と当該送信理由が状態通知要求メッセージの受信であるときは受信した状態通知要求メッセージから読み出した要求番号とが状態通知メッセージに付加され、データパケット送信装置に向けて送信される。

【0043】つぎの発明にかかるデータパケット再送制御方法は、データパケット送信装置がデータパケット受信装置にシーケンス番号付きのデータパケットを送信している過程で前記データパケット受信装置から、受信したデータパケットのシーケンス番号の上限値と誤りが検出されたデータパケットに関する情報とを含む状態通知メッセージを受けたとき、その誤りが検出されたデータパケットの再送を実施するデータパケット再送制御方法において、前記データパケット送信装置は、前記状態通知メッセージを受信した場合に、再送制御テーブルの存在有無を判断する判断工程と、前記判断工程によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージに含まれるシーケンス番号上限値が前記再送制御テーブルに含まれるシーケンス番号上限値未満のとき、前記再送制御テーブルと前記状態通知メッセージとに含まれるデータパケットに関する情報の差分を抽出し、再送の要否を判定する判定工程とを含むことを特徴とする。

【0044】この発明によれば、データパケット送信装置では、受信側から状態通知メッセージが受信された場合に、まず判断工程にて再送制御テーブルの存在有無が判断される。その結果、再送制御テーブルが存在する場合には、判定工程にて当該再送制御テーブルが参照され、状態通知メッセージに含まれるシーケンス番号上限値が再送制御テーブルに含まれるシーケンス番号上限値未満であるとき、再送制御テーブルと状態通知メッセージとに含まれるデータパケットに関する情報の差分が抽出され、再送の要否が判定される。具体的には、差分がないときは、既に再送を実施したデータパケットの送達確認待ちであることから再送は実施せず、差分がある場合に、当該差分に関わるデータパケットについて再送を実施すると判定される。

【0045】つぎの発明にかかるデータパケット再送制御方法は、上記の発明において、前記判断工程によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージに含まれるシーケンス番号上限値が前記再送制御テーブルに含まれるシーケンス番号上限値を超えるとき、当該再送制御テーブルを削除する削除工程を含むことを特徴とする。

【0046】この発明によれば、データパケット送信装置において、再送制御テーブルが存在する場合に、削除工程にて、再送制御テーブルが参照され、状態通知メッセージに含まれるシーケンス番号上限値が再送制御テーブルに含まれる前記シーケンス番号上限値を超えるとき、当該再送制御テーブルが削除される。

【0047】つぎの発明にかかるデータパケット再送制御方法は、データパケット送信装置が、データパケット受信装置にシーケンス番号付きのデータパケットを送信している過程で前記データパケット受信装置から、受信したデータパケットのシーケンス番号の上限値と誤りが検出されたデータパケットに関する情報とを含む状態通知メッセージを受けたとき、その誤りが検出されたデータパケットの再送を実施するデータパケット再送制御方法において、前記データパケット送信装置は、前記データパケット受信装置に状態通知メッセージの送信を要求する状態通知要求メッセージのシーケンス番号をカウントするカウンタのカウント値を要求番号として前記状態通知要求メッセージに付加して送信する要求番号付加工程と、前記データパケット受信装置から前記状態通知メッセージを受信した場合に、再送制御テーブルの存在有無を判断する判断工程と、前記判断工程によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージと前記再送制御テーブルとに含まれるシーケンス番号上限値が一致する場合において、前記状態通知メッセージの送信理由が送信局からの前記状態通知要求メッセージの受信であり当該状態通知メッセージに含まれる前記要求番号が前記再送制御テーブルに含まれる要求番号以下のとき、または、前記状態通知メッセージの送信理由が周期タイマのタイムアウトであり当該送信理由が前記再送制御テーブルに含まれる送信理由と一致しないとき、あるいは、前記状態通知メッセージの送信理由が送信局からの前記状態通知要求メッセージの受信でなく、かつ前記周期タイマのタイムアウトでもないとき、前記再送制御テーブルと前記状態通知メッセージとに含まれるデータパケットに関する情報の差分を抽出し、再送の要否を判定する判定工程とを含むことを特徴とする。

【0048】この発明によれば、データパケット送信装置では、データパケット受信装置に状態通知メッセージの送信を要求する状態通知要求メッセージが送信されるたびにカウンタがインクリメントされ、要求番号付加工程にてそのカウンタのカウント値が要求番号として上記送信する状態通知要求メッセージに付加される。状態通知メッセージが受信されると、まず判断工程にて再送制御テーブルの存在有無が判断される。その結果、再送制御テーブルが存在する場合には、判定工程にて当該再送制御テーブルが参照され、状態通知メッセージと再送制御テーブルとに含まれるシーケンス番号上限値が一致する場合には、状態通知メッセージに含まれる要求番号が再送制御テーブルに含まれる要求番号以下のとき、または、状態通知メッセージの送信理由が周期タイマのタイ

ムアウトであり当該送信理由が再送制御テーブルに含まれる送信理由と一致しないとき、あるいは、状態通知メッセージの送信理由が送信局からの状態通知要求メッセージの受信でなく、かつ周期タイマのタイムアウトでもないとき、再送制御テーブルと状態通知メッセージとに含まれるデータパケットに関する情報の差分が抽出され、再送の要否が判定される。具体的には、差分がないときは、既に再送を実施したデータパケットの送達確認待ちであることから再送は実施せず、差分がある場合に、当該差分に関わるデータパケットについて再送を実施すると判定される。

【００４９】つぎの発明にかかるデータパケット再送制御方法は、上記の発明において、前記判断工程によって再送制御テーブルが存在すると判断された場合に当該再送制御テーブルを参照し、前記状態通知メッセージと前記再送制御テーブルとに含まれるシーケンス番号上限値が一致する場合において、前記状態通知メッセージに含まれる前記要求番号が前記再送制御テーブルに含まれる前記要求番号よりも大きいとき、または、前記状態通知メッセージの送信理由が周期タイマのタイムアウトであり当該送信理由が前記再送制御テーブルに含まれる送信理由と一致するとき、当該再送制御テーブルを削除する削除工程を含むことを特徴とする。

【００５０】この発明によれば、データパケット送信装置において、再送制御テーブルが存在する場合に、削除工程にて、再送制御テーブルが参照され、状態通知メッセージと再送制御テーブルとに含まれる前記シーケンス番号上限値が一致する場合において、状態通知メッセージに含まれる要求番号が再送制御テーブルに含まれる要求番号よりも大きいとき、または、状態通知メッセージの送信理由が周期タイマのタイムアウトであり当該送信理由が再送制御テーブルに含まれる送信理由と一致するとき、当該再送制御テーブルが削除される。

【００５１】つぎの発明にかかるデータパケット再送制御方法は、上記の発明において、前記判断工程によって再送制御テーブルが存在しないと判断された場合において、再送を実施すると決定した場合に、再送処理実行決定時までに前記データパケット受信装置に送信したデータパケットのシーケンス番号の上限値および該当する場合は前記要求番号と前記状態通知メッセージから読み出した送信理由および送信するデータパケットに関する情報とを設定した前記再送制御テーブルを作成するテーブル設定工程と、前記再送制御テーブルの作成後に、当該再送制御テーブルに設定されている送信するデータパケットに関する情報に基づき当該データパケットについての再送を実施する再送工程とを含むことを特徴とする。

【００５２】この発明によれば、データパケット送信装置において、再送制御テーブルが存在しない場合には、再送を実施すると決定された場合に、テーブル設定工程にて、再送処理実行決定時までに受信側に送信したデータパケットのシーケンス番号の上限値および該当する場合は要求番号と状態通知メッセージから読み出した送信理由および送信するデータパケットに関する情報とが設定される。その後、再送工程にて、当該再送制御テーブルに設定されている送信するデータパケットに関する情報に基づき当該データパケットについての再送が実施される。

【００５３】つぎの発明にかかるデータパケット再送制御方法は、上記の発明において、前記データパケット受信装置は、前記状態通知メッセージの送信原因が、前記状態通知要求メッセージの受信であるか、誤りの検出であるか、周期タイマのタイムアウトであるかの送信理由を作成する送信理由作成工程と、前記状態通知メッセージを送信する際に、前記送信理由作成工程が作成した送信理由と当該送信理由が状態通知要求メッセージの受信であるときは受信した状態通知要求メッセージから読み出した要求番号とを付加する送信理由付加工程とを含むことを特徴とする。

【００５４】この発明によれば、データパケット受信装置において、状態通知メッセージの送信原因が発生すると、送信理由作成工程にて、状態通知要求メッセージの受信であるか、誤りの検出であるか、周期タイマのタイムアウトであるかの送信理由が作成され、送信理由付加工程にて、その作成された送信理由と当該送信理由が状態通知要求メッセージの受信であるときは受信した状態通知要求メッセージから読み出した要求番号とが状態通知メッセージに付加され、データパケット送信装置に向けて送信される。

【００５５】つぎの発明にかかるデータパケット送信装置は、複数の受信装置に対してシーケンス番号つきの同一データパケットをマルチキャストし、各受信装置から正常に受信したマルチキャストデータパケットのシーケンス番号の上限値と誤りが検出されたマルチキャストデータパケットに関する情報とを含む状態通知メッセージを受けたとき、前記誤りが検出されたマルチキャストデータパケットの再送を実施するデータパケット送信装置において、前記状態通知メッセージに含まれるシーケンス番号に基づき再送制御テーブルの対応するシーケンス番号に関する内容を参照し、再送未実施であるとき、当該シーケンス番号のマルチキャストデータパケットについて再送を実施する再送実施手段と、前記再送が実施されたマルチキャストデータパケットのシーケンス番号と対応付けて前記再送を実施した時点で送信済みのシーケンス番号の上限値を前記再送制御テーブルに設定するテーブル設定手段とを備えたことを特徴とする。

【００５６】この発明によれば、マルチキャストでデータパケットを送信するデータパケット送信装置では、状態通知メッセージが受信されると、その状態通知メッセージに含まれるシーケンス番号に基づき再送制御テーブルの対応するシーケンス番号に関する内容が参照され、

再送未実施であるとき、再送実施手段にて、当該シーケンス番号のマルチキャストデータパケットについて再送が実施される。そしてテーブル設定手段にて、再送が実施されたマルチキャストデータパケットのシーケンス番号と対応付けてその再送を実施した時点で送信済みのシーケンス番号の上限値が前記再送制御テーブルに設定される。つまり、再送制御テーブルには、当初は、当該シーケンス番号のマルチキャストデータパケットが再送未実施であると表示されているが、再送が実施されると、その再送の実施状況が設定され、再送実施済みであることが表示される。

【００５７】つぎの発明にかかるデータパケット送信装置は、上記の発明において、前記状態通知メッセージに含まれるシーケンス番号に基づき参照した前記再送制御テーブルの対応するシーケンス番号に関する内容が再送実施済みであるとき、前記状態通知メッセージに含まれる当該受信装置が正常に受信したマルチキャストデータパケットのシーケンス番号の上限値が、前記再送制御テーブルに設定されている再送を実施した時点で送信済みのシーケンス番号の上限値よりも大きい場合にのみ、当該シーケンス番号のマルチキャストデータパケットについて再送を実施する再送実施手段を備えたことを特徴とする。

【００５８】この発明によれば、マルチキャストでデータパケットを送信するデータパケット送信装置では、上記の発明において、前記状態通知メッセージに含まれるシーケンス番号に基づき参照した前記再送制御テーブルの対応するシーケンス番号に関する内容が再送実施済みであるとき、前記状態通知メッセージに含まれる当該受信装置が正常に受信したマルチキャストデータパケットのシーケンス番号の上限値が、前記再送制御テーブルに設定されている再送を実施した時点で送信済みのシーケンス番号の上限値よりも大きい場合にのみ、再送実施手段にて、当該シーケンス番号のマルチキャストデータパケットについて再送が実施される。

【００５９】つぎの発明にかかるデータパケット送信装置は、上記の発明において、前記状態通知メッセージに含まれる送信理由が無条件再送要求である場合に、前記再送制御テーブルの内容によらず、当該状態通知メッセージに含まれるシーケンス番号のマルチキャストデータパケットについて再送を実施する再送実施手段を備えたことを特徴とする。

【００６０】この発明によれば、マルチキャストでデータパケットを送信するデータパケット送信装置では、上記の発明において、前記状態通知メッセージに含まれる送信理由が無条件再送要求である場合には、再送実施手段にて、前記再送制御テーブルの内容によらず、当該状態通知メッセージに含まれるシーケンス番号のマルチキャストデータパケットについて再送が実施される。

【００６１】つぎの発明にかかるデータパケット送信装置は、上記の発明において、前記再送制御テーブルにおいて再送実施済みのシーケンス番号と同番の新規データパケットが送信されたとき、当該シーケンス番号に関する内容を再送未実施に戻す処理を行うテーブルリセット手段を備えたことを特徴とする。

【００６２】この発明によれば、マルチキャストでデータパケットを送信するデータパケット送信装置では、上記の発明において、テーブルリセット手段にて、前記再送制御テーブルにおいて再送実施済みのシーケンス番号と同番の新規データパケットが送信されたとき、当該シーケンス番号に関する内容を再送未実施に戻す処理が行われる。

【００６３】つぎの発明にかかるデータパケット受信装置は、送信装置からシーケンス番号つきのマルチキャストデータパケットを受信している過程でシーケンス番号の抜けやデータの誤りを検出したとき、送信装置に対して、受信したマルチキャストデータパケットのシーケンス番号の上限値と前記誤りが検出されたマルチキャストデータパケットに関する情報とを含む状態通知メッセージを送信するデータパケット受信装置において、前記送信する状態通知メッセージに無条件に再送を要求する送信理由と無条件ではない再送を要求する送信理由とを含ませる送信理由作成手段を備えたことを特徴とする。

【００６４】この発明によれば、マルチキャストでデータパケットを受信する各データパケット受信装置では、状態通知メッセージを送信する際に、送信理由作成手段にて、その送信する状態通知メッセージに無条件に再送を要求する送信理由と無条件ではない再送を要求する送信理由とを含ませることが行われる。

【００６５】つぎの発明にかかるデータパケット伝送システムは、受信したマルチキャストデータパケットのシーケンス番号の上限値と誤りが検出されたマルチキャストデータパケットに関する情報とを含む状態通知メッセージを送信する複数のデータパケット受信装置と、前記複数のデータパケット受信装置に対しシーケンス番号つきの同一データパケットをマルチキャストし、前記複数のデータパケット受信装置から前記状態通知メッセージを受信したとき、前記誤りが検出されたマルチキャストデータパケットの再送を実施するデータパケット送信装置とを備えるデータパケット伝送システムにおいて、前記データパケット送信装置は、前記状態通知メッセージに含まれるシーケンス番号に基づき再送制御テーブルの対応するシーケンス番号に関する内容を参照し、再送未実施であるとき、当該シーケンス番号のマルチキャストデータパケットについて再送を実施する再送実施手段と、前記再送が実施されたマルチキャストデータパケットのシーケンス番号と対応付けて前記再送を実施した時点で送信済みのシーケンス番号の上限値を前記再送制御テーブルに設定するテーブル設定手段とを備えたことを特徴とする。

【0066】この発明によれば、マルチキャストでデータパケットの授受を行うデータパケット伝送システムにおけるデータパケット送信装置では、状態通知メッセージが受信されると、その状態通知メッセージに含まれるシーケンス番号に基づき再送制御テーブルの対応するシーケンス番号に関する内容が参照され、再送未実施であるとき、再送実施手段にて、当該シーケンス番号のマルチキャストデータパケットについて再送が実施される。そして、テーブル設定手段にて、再送が実施されたマルチキャストデータパケットのシーケンス番号と対応付けてその再送を実施した時点で送信済みのシーケンス番号の上限値が前記再送制御テーブルに設定される。つまり、再送制御テーブルには、当初は、当該シーケンス番号のマルチキャストデータパケットが再送未実施であると表示されているが、再送が実施されると、その再送の実施状況が設定され、再送実施済みであることが表示される。

【0067】つぎの発明にかかるデータパケット伝送システムは、上記の発明において、前記データパケット送信装置は、前記状態通知メッセージに含まれるシーケンス番号に基づき参照した前記再送制御テーブルの対応するシーケンス番号に関する内容が再送実施済みであるとき、前記状態通知メッセージに含まれる当該受信装置が正常に受信したマルチキャストデータパケットのシーケンス番号の上限値が、前記再送制御テーブルに設定されている再送を実施した時点で送信済みのシーケンス番号の上限値よりも大きい場合にのみ、当該シーケンス番号のマルチキャストデータパケットについて再送を実施する再送実施手段を備えたことを特徴とする。

【0068】この発明によれば、マルチキャストでデータパケットの授受を行うデータパケット伝送システムにおけるデータパケット送信装置では、上記の発明において、前記状態通知メッセージに含まれるシーケンス番号に基づき参照した前記再送制御テーブルの対応するシーケンス番号に関する内容が再送実施済みであるとき、前記状態通知メッセージに含まれる当該受信装置が正常に受信したマルチキャストデータパケットのシーケンス番号の上限値が、前記再送制御テーブルに設定されている再送を実施した時点で送信済みのシーケンス番号の上限値よりも大きい場合にのみ、再送実施手段にて、当該シーケンス番号のマルチキャストデータパケットについて再送が実施される。

【0069】つぎの発明にかかるデータパケット伝送システムは、上記の発明において、前記データパケット送信装置は、前記状態通知メッセージに含まれる送信理由が無条件再送要求である場合に、前記再送制御テーブルの内容によらず、当該状態通知メッセージに含まれるシーケンス番号のマルチキャストデータパケットについて再送を実施する再送実施手段を備えたことを特徴とする。

【0070】この発明によれば、マルチキャストでデータパケットの授受を行うデータパケット伝送システムにおけるデータパケット送信装置では、上記の発明において、前記状態通知メッセージに含まれる送信理由が無条件再送要求である場合には、再送実施手段にて、前記再送制御テーブルの内容によらず、当該状態通知メッセージに含まれるシーケンス番号のマルチキャストデータパケットについて再送が実施される。

【0071】つぎの発明にかかるデータパケット伝送システムは、上記の発明において、前記データパケット送信装置は、前記再送制御テーブルにおいて再送実施済みのシーケンス番号と同番の新規データパケットが送信されたとき、当該シーケンス番号に関する内容を再送未実施に戻す処理を行うテーブルリセット手段を備えたことを特徴とする。

【0072】この発明によれば、マルチキャストでデータパケットの授受を行うデータパケット伝送システムにおけるデータパケット送信装置では、上記の発明において、テーブルリセット手段にて、前記再送制御テーブルにおいて再送実施済みのシーケンス番号と同番の新規データパケットが送信されたとき、当該シーケンス番号に関する内容を再送未実施に戻す処理が行われる。

【0073】つぎの発明にかかるデータパケット伝送システムは、上記の発明において、前記データパケット受信装置は、前記送信する状態通知メッセージに無条件に再送を要求する送信理由と無条件ではない再送を要求する送信理由とを含ませる送信理由作成手段を備えたことを特徴とする。

【0074】この発明によれば、マルチキャストでデータパケットの授受を行うデータパケット伝送システムにおけるデータパケット受信装置では、上記の発明において、状態通知メッセージを送信する際に、送信理由作成手段にて、その送信する状態通知メッセージに無条件に再送を要求する送信理由と無条件ではない再送を要求する送信理由とを含ませることが行われる。

【0075】つぎの発明にかかるデータパケット再送制御方法は、データパケット送信装置が、複数のデータパケット受信装置に対しシーケンス番号つきの同一データパケットをマルチキャストし、前記データパケット受信装置から正常に受信したマルチキャストデータパケットのシーケンス番号の上限値と誤りが検出されたマルチキャストデータパケットに関する情報とを含む状態通知メッセージを受けたとき、前記誤りが検出されたマルチキャストデータパケットの再送を実施するデータパケット再送制御方法において、前記データパケット送信装置は、前記状態通知メッセージに含まれるシーケンス番号に基づき再送制御テーブルの対応するシーケンス番号に関する内容を参照し、再送未実施であるとき、当該シーケンス番号のマルチキャストデータパケットについて再送を実施する再送実施工程と、前記再送が実施されたマ

ルチキャストデータパケットのシーケンス番号と対応付けて前記再送を実施した時点で送信済みのシーケンス番号の上限値を前記再送制御テーブルに設定するテーブル設定工程とを含むことを特徴とする。

【0076】この発明によれば、マルチキャストでデータパケットの授受を行う際に、データパケット送信装置では、再送を要求する状態通知メッセージが受信されると、その状態通知メッセージに含まれるシーケンス番号に基づき再送制御テーブルの対応するシーケンス番号に関する内容が参照され、再送未実施であるとき、再送工程にて、当該シーケンス番号のマルチキャストデータパケットについて再送が実施される。そして、テーブル設定工程にて、再送が実施されたマルチキャストデータパケットのシーケンス番号と対応付けてその再送を実施した時点で送信済みのシーケンス番号の上限値が前記再送制御テーブルに設定される。つまり、再送制御テーブルには、当初は、当該シーケンス番号のマルチキャストデータパケットが再送未実施であると表示されているが、再送が実施されると、その再送の実施状況が設定され、再送実施済みであることが表示される。

【0077】つぎの発明にかかるデータパケット再送制御方法は、上記の発明において、前記データパケット送信装置は、前記状態通知メッセージに含まれるシーケンス番号に基づき参照した前記再送制御テーブルの対応するシーケンス番号に関する内容が再送実施済みであるとき、前記状態通知メッセージに含まれる当該受信装置が正常に受信したマルチキャストデータパケットのシーケンス番号の上限値が、前記再送制御テーブルに設定されている再送を実施した時点で送信済みのシーケンス番号の上限値よりも大きい場合にのみ、当該シーケンス番号のマルチキャストデータパケットについて再送を実施する再送実施工程を含むことを特徴とする。

【0078】この発明によれば、上記の発明において、データパケット送信装置では、再送を要求する状態通知メッセージが受信されると、前記状態通知メッセージに含まれるシーケンス番号に基づき参照した前記再送制御テーブルの対応するシーケンス番号に関する内容が再送実施済みであるとき、前記状態通知メッセージに含まれる当該受信装置が正常に受信したマルチキャストデータパケットのシーケンス番号の上限値が、前記再送制御テーブルに設定されている再送を実施した時点で送信済みのシーケンス番号の上限値よりも大きい場合にのみ、再送実施工程にて、当該シーケンス番号のマルチキャストデータパケットについて再送が実施される。

【0079】つぎの発明にかかるデータパケット再送制御方法は、上記の発明において、前記データパケット送信装置は、前記状態通知メッセージに含まれる送信理由が無条件再送要求である場合に、前記再送制御テーブルの内容によらず、当該状態通知メッセージに含まれるシーケンス番号のマルチキャストデータパケットについて再送を実施する再送実施工程を含むことを特徴とする。

【0080】この発明によれば、上記の発明において、データパケット送信装置では、再送を要求する状態通知メッセージが受信されると、前記状態通知メッセージに含まれる送信理由を調べ、その送信理由が無条件再送要求である場合には、再送実施工程にて、前記再送制御テーブルの内容によらず、当該状態通知メッセージに含まれるシーケンス番号のマルチキャストデータパケットについて再送が実施される。

【0081】つぎの発明にかかるデータパケット再送制御方法は、上記の発明において、前記データパケット送信装置は、前記再送制御テーブルにおいて再送実施済みのシーケンス番号と同番の新規データパケットが送信されたとき、当該シーケンス番号に関する内容を再送未実施に戻す処理を行うテーブルリセット工程を含むことを特徴とする。

【0082】この発明によれば、上記の発明において、データパケット送信装置では、テーブルリセット工程にて、前記再送制御テーブルにおいて再送実施済みのシーケンス番号と同番の新規データパケットが送信されたとき、当該シーケンス番号に関する内容を再送未実施に戻す処理が行われる。

【0083】つぎの発明にかかるデータパケット再送制御方法は、上記の発明において、前記データパケット受信装置は、前記送信する状態通知メッセージに無条件に再送を要求する送信理由と無条件ではない再送を要求する送信理由とを含ませる工程を含むことを特徴とする。

【0084】この発明によれば、マルチキャストでデータパケットを受信する各データパケット受信装置では、状態通知メッセージを送信する際に、送信理由作成工程にて、その送信する状態通知メッセージに無条件に再送を要求する送信理由と無条件ではない再送を要求する送信理由とを含ませることが行われる。

【0085】

【発明の実施の形態】以下に添付図面を参照して、この発明にかかるデータパケット送信装置、データパケット受信装置、データパケット伝送システムおよびデータパケット再送制御方法の好適な実施の形態を詳細に説明する。

【0086】実施の形態1．図1は、この発明の実施の形態1であるデータパケット伝送システムの構成を示すブロック図である。図2は、図1に示す送信局の構成を示すブロック図である。図3は、図1に示す送信局が送信するデータパケットのフォーマット例を示す図である。図4は、図1に示す送信局が再送制御のために備える再送制御テーブルの構成例を示す図である。図5は、図1に示す受信局の構成を示すブロック図である。図6は、図1に示す受信局が状態通知要求メッセージ受信に対して送信する状態通知メッセージのフォーマット例を示す図である。図7は、図1に示す受信局が誤り検出や

周期タイマのタイムアウトによって送信する状態通知メッセージのフォーマット例を示す図である。なお、図３，図６，図７では、従来例（図２３，図２４）と同等な部分には同じ番号、もしくは相当する番号が付与されている。

【００８７】図１において、データパケット送信装置である送信局１とデータパケット受信装置である受信局２とは、伝送路（無線伝送路または有線伝送路）３を介して接続されている。送信局１は、上位レイヤから送られてくる新規ＰＤＵ（シーケンス番号付きのデータパケット）を所定個数ずつインターリーブして生成したデータパケット（RLC-PDU）を伝送路３に順々に送信する。このとき、送信局１は、送信するシーケンス番号付きのデータパケットにＰｏｌｌビットを付与することができる。このＰｏｌｌビットが付与されたシーケンス番号付きのデータパケットは、受信局２に状態通知メッセージ（STATUS-PDU）の送信を要求する状態通知要求メッセージと称される。

【００８８】このＰｏｌｌビットは、送達確認がとれていないデータパケットの割合が一定数を超えた場合にそれ以降に送信するデータパケットに設定されることがある。また上位のレイヤから受け取ったデータパケットの最後尾を示す必要がある場合にその最後尾を含むデータパケットに設定されることがある。受信局２は、伝送路３から取り込んだデータパケット（RLC-PDU）をデインターリーブしてシーケンス番号付きのデータパケットを復元し、シーケンス番号の連続性やＣＲＣを確認しつつ、受信データについての処理を実行する。このとき、受信局２は、送られてきたデータパケット（RLC-PDU）の受信状態等を状態通知メッセージ（STATUS-PDU）を用いて送信局１に通知することを行う。

【００８９】状態通知メッセージ（STATUS-PDU）は、送信局１から状態通知要求メッセージが送られてきたときに作成され送信される他、受信局２で自発的に作成され送信される場合がある。自発的に送信する場合としては、シーケンス番号の抜けやＣＲＣエラーなどの誤りが検出されたときと、周期タイマがタイムアウトしたときとである。誤り検出時に作成され送信される状態通知メッセージ（STATUS-PDU）には、誤りのあったデータパケットのシーケンス番号と正常に受信できたシーケンス番号の上限値とが含まれる。状態通知要求メッセージの受信時やタイムアウト時に作成され送信される状態通知メッセージ（STATUS-PDU）には、誤り検出が行われていた場合には、上記と同内容であるが、シーケンス番号の連続性やＣＲＣの確認が正しく行えた場合には、その旨（ＡＣＫ）と正常に受信できたデータパケットのシーケンス番号の上限値とが含まれる。

【００９０】送信局１は、受信局２から誤りのあったデータパケットのシーケンス番号を含む状態通知メッセージ（STATUS-PDU）を受信すると、再送要求と認識し、再送を実施するが、この実施の形態１では、送信局１は図２に示す構成を備え、受信局２は図５に示す構成を備え、その再送の実施を一定の条件下に行うようにしている。なお、以下の説明では、誤り検出の例としてシーケンス番号の抜け検出を取り上げている。

【００９１】図２は、送信局の再送制御に関わる部分の構成を中心に示すブロック図である。図２において、送信局１は、送信ＰＤＵ生成部１１と送信部１２とPoll Counter１３と再送判断部１４と再送制御テーブル１５とメッセージ受付処理部１６と受信部１７とを備えている。

【００９２】Poll Counter１３は、Ｐｏｌｌビットの設定があるたびにインクリメントされるカウンタである。Poll Counter１３のカウント値は、要求番号として送信ＰＤＵ生成部１１と再送判断部１４とに出力される。送信ＰＤＵ生成部１１は、上位レイヤからの新規ＰＤＵ（シーケンス番号付きの送信データパケット）を所定個数ずつインターリーブして生成したデータパケット（RLC-PDU）を送信部１２を介して伝送路３に順々に送信する。このとき、送信ＰＤＵ生成部１１は、Ｐｏｌｌビットの設定入力があると、そのＰｏｌｌビットを該当するデータパケットに付与するとともに、そのデータパケットにPoll Counter１３のカウント値を要求番号として付与する。また、送信ＰＤＵ生成部１１は、再送判断部１４から再送ＰＤＵ（シーケンス番号付きの再送データパケット）が入力すると、その再送ＰＤＵと新規ＰＤＵを含んだデータパケット（RLC-PDU）を生成する。

【００９３】受信局２から送られてくる上記状態通知メッセージ（STATUS-PDU）は、受信部１７を介してメッセージ受付処理部１６に入力される。メッセージ受付処理部１６は、受け取った状態通知メッセージ（STATUS-PDU）を再送判断部１４に伝達するとともに、その状態通知メッセージ（STATUS-PDU）に図２６に示す再送要求情報要素４２０が含まれている場合には、それに設定されている情報（先頭のシーケンス番号、後続数、組数）を取り出し、保存する。この保存した情報は、再送判断部１４が利用するようになっている。

【００９４】再送判断部１４は、メッセージ受付処理部１６から状態通知メッセージ（STATUS-PDU）を受け取ると、まず、再送制御テーブル１５の存在有無を調べる。その結果、再送制御テーブル１５が存在しない場合には、再送判断部１４は、再送処理が必要と判断し、その判断時までに送信したデータパケットのシーケンス番号の上限値などを後述するように再送制御テーブル１５に設定し、再送ＰＤＵを送信ＰＤＵ生成部１１に出力する。

【００９５】一方、再送制御テーブル１５が存在する場合には、再送判断部１４は、再送制御テーブル１５を参照し、基本的には、受け取った状態通知メッセージ（STATUS-PDU）に含まれるシーケンス番号の上限値と再送制

御テーブル１５に設定されているシーケンス番号の上限値との大小比較を行う。そして、受け取った状態通知メッセージ（STATUS-PDU）に含まれるシーケンス番号の上限値が再送制御テーブル１５に設定されているシーケンス番号の上限値を超えない場合には、受け取った状態通知メッセージ（STATUS-PDU）と再送制御テーブル１５とに設定されているデータパケットに関する情報の差分を抽出し、再送の実施要否を判断するようになっている。具体的な判断条件には、各種のものがあるが、それらについては後述する。

【００９６】このとき、再送制御テーブル１５は、１以上設定されるので、再送判断部１４は、各再送制御テーブル１５について上記の判断動作を行う。その過程で不要となった再送制御テーブル１５については、削除操作を行い、再送制御テーブル１５が必要とされた場合にはその追加設定の操作を行うようになっている。

【００９７】再送制御テーブル１５について説明する前に、送信局１が送信するデータパケットのフォーマットについて説明する。図３において、データパケット（以下単に「RLC-PDU」と記述することがある）３００には、この実施の形態１では、「Poll Counter」３０６が追加されている。「Poll Counter」３０６には、「Ｐ」３０３へのＰｏ１１ビットの設定によってインクリメントされるPoll Counter１３のカウント値が設定される。つまり、Poll Counter１３は、状態通知要求メッセージのシーケンス番号をカウントしていることになる。その他は、従来例（図２３）と同様である。なお、「Ｐ」３０３にＰｏ１１ビットが設定されているRLC-PDU３００は、状態通知要求メッセージである。以後の説明では、「Ｐ」３０３の表記は、Ｐｏ１１ビットが設定されていることを意味しているとする。

【００９８】さて、再送制御テーブル１５には、図４に示すように、「Poll Counter」４０１，「Cause」４０２，「ＶＴ（Ｍ）」４０３，「LENGTH」４０４，「SN_1」４０５－１～「SN_{LENGTH}」４０５－Ｌ（以下単に「ＳＮ」４０５、「ＳＮ」などと記述する），「L_1」４０６－１～「L_{LENGTH}」４０６－Ｌ（以下単に「Ｌ」４０６，「Ｌ」などと記述する）などが設定されるようになっている。「Poll Counter」４０１には、Poll Counter１３のカウント値、つまり受信局２に送信した要求番号が設定される。この設定が行われるときには、その後再送が実施される。したがって、「Poll Counter」４０１には、再送決定時点でのPoll Counter１３のカウント値が設定されることになる。

【００９９】「Cause」４０２には、受信された状態通知メッセージから取り出した送信理由「Cause」が設定される。「ＶＴ（Ｍ）」４０３には、再送決定時点までに送信したデータパケットのシーケンス番号上限値が設定される。「ＳＮ」４０５には、再送したデータパケットの先頭シーケンス番号が設定される。「Ｌ」４０６には、「ＳＮ」４０５のデータパケットに連続して後続するデータパケットの数（以下「後続数」という）が設定される。「LENGTH」４０４には、先頭シーケンス番号「ＳＮ」４０５と後続数「Ｌ」４０６との組の数が設定される。

【０１００】次に、受信局２について説明する。図５は、受信局２の再送制御に関わる部分の構成を中心に示すブロック図である。受信局２は、図５に示すように、受信部２１とシーケンス監視部２２と周期タイマ２３と送信理由作成部２４と状態通知メッセージ作成部２５と送信部２６とを備えている。

【０１０１】受信部２１は、送信局１から送られてくるデータパケット（RLC-PDU）をデインターリーブし、個々のデータパケットを受信処理系にあるシーケンス監視部２２に伝達するとともに、そのデインターリーブした個々のデータパケットの中に「Ｐ」３０３付きのデータパケット、つまり状態通知要求メッセージが含まれているか否かを調べる。そして、状態通知要求メッセージを検出すると、それに含まれるメッセージ要求（「Ｐ」３０３）と要求番号（Poll Counter３０６）を取り出し、それらを状態通知メッセージ作成部２５に出力する一方、メッセージ要求（「Ｐ」３０３）を送信理由作成部２４に出力する。

【０１０２】シーケンス監視部２２は、連続して受け取ったデータパケットにおけるシーケンス番号の連続性を調べ、シーケンス番号の抜けを検出すると、欠落したシーケンス番号を状態通知メッセージ作成部２５に出力するとともに、欠落を検出した旨を送信理由作成部２４に通知する。周期タイマ２３は、例えば５秒などの間隔を計時し、計時するたびにタイムアウトした旨を送信理由作成部２４と状態通知メッセージ作成部２５とに通知する。

【０１０３】送信理由作成部２４は、状態通知メッセージ作成部２５が状態通知メッセージ（STATUS-PDU）を作成し送信する原因となった事由、つまり送信理由を作成し、状態通知メッセージ作成部２５に出力する。すなわち、送信理由作成部２４は、受信部２１からメッセージ要求（「Ｐ」３０３）を受け取ると、送信理由“「Ｐ」３０３の受信”を作成し、状態通知メッセージ作成部２５に出力する。送信理由作成部２４は、周期タイマ２３からタイムアウトを受け取ると、送信理由“周期タイマのタイムアウト”を作成し、状態通知メッセージ作成部２５に出力する。また、送信理由作成部２４は、シーケンス監視部２２から抜け検出を受け取ると、送信理由“シーケンス番号３０２の抜け検出”を作成し、状態通知メッセージ作成部２５に出力する。

【０１０４】状態通知メッセージ作成部２５は、図６および図７に示す状態通知メッセージ（以下単に「STATUS-PDU」と記述することがある）を作成し、送信部２６を介して伝送路３へ送信局１に向けて送信する。図６およ

び図7に示すように、この実施の形態1では、送信理由「Cause」315が追加されている。送信理由「Cause」315には、送信理由作成部24から受け取った送信理由が設定される。図6に示すSTATUS-PDU310−1は、受信局2がPo11ビットの受信によって送信するメッセージであるので、送信理由「Cause」315に“「P」303の受信”が設定される。図7に示すSTATUS-PDU310−2は、シーケンス監視部22での抜け検出や周期タイマ23のタイムアウトによって送信するメッセージであるので、送信理由「Cause」315には、“シーケンス番号302の抜け検出”または“周期タイマのタイムアウト”が設定される。

【0105】そして、図6に示すように、受信局2がPo11ビットの受信によって送信するSTATUS-PDU310−1では、「Poll Counter」316と「R」312とが追加されている。「Poll Counter」316には、受信部21から受け取った要求番号(Poll Counter306)がそのまま設定される。「R」312は、リザーブビットである。

【0106】なお、図6および図7において、その他は、従来のSTATUS-PDU310a(図24)と同等である。すなわち、図25に示した送達確認情報要素410と図26に示した再送要求情報要素420は、この実施の形態でも同様に適用される。つまり、状態通知メッセージ作成部25は、送達確認情報要素410に「LSN」412を設定する。再送を要求するデータパケットがある場合には、再送要求情報要素420に「SN」424と「L」425と「LENGTH」422を設定する。

【0107】次に、図8を参照して、上述したように構成されるデータパケット伝送システムにおいて実施されるデータパケット再送制御動作を説明する(動作例1)。なお、図8は、データパケット再送制御動作を説明するシーケンス図である。3GPPで策定中の通信方式では、周期的な送信間隔TTI(TTI:Transmission TimeInterval)毎に複数のRLC-PDU300をまとめて送信することが可能である。図8では、送信間隔TTI毎に4個のRLC-PDU300を送信する場合の例が示されている。また、図8では、送信局と受信局の送信間隔TTIは、同じで、送信と受信のタイミングにずれはないものとしている。

【0108】図8において、送信局が送信間隔TTI-0の期間において送信した4個のRLC-PDU(Seq.No=0,1,2,3)のうち2個のRLC-PDU(Seq.No=1,2)に抜けがあった場合、受信局は、次の送信間隔TTI-1の期間で実施するプロトコル処理110−1でのRLC-PDU受信処理においてSeq.No=1,2の抜けを検出し、次のようなSTATUS-PDU(200−1)310−2を作成する。すなわち、このSTATUS-PDU(200−1)310−2では、図7、図25、図26において、送信理由「Cause」315に“送信シーケンス番号302の抜け検出”を示す「Miss」が設定され、「LSN」412に正常に受信できたとした場合のシーケンス番号上限値「3」のつぎの値「4」が設定され、「SN」424に再送を要求するRLC-PDU300の先頭シーケンス番号「1」が設定され、「L」425に後続数「1」が設定されている。

【0109】受信局は、次の送信間隔TTI-2の期間において、上記のような内容を有するSTATUS-PDU(200−1)310−2を送信し、送信局に対して再送を要求する。送信局は、次の送信間隔TTI-3の期間で実施するプロトコル処理100−1でのSTATUS-PDU受信処理において、受信したSTATUS-PDU(200−1)310−2の再送要求情報要素420からSeq.No=1,2の抜けを認識し、つまりSeq.No=1,2のRLC-PDU300についての再送要求を認識する。そして、この例では、再送制御テーブル15が存在しないので、再送制御テーブル15について次のように設定する。

【0110】すなわち、図4において、「Cause」402には、受信したSTATUS-PDU310−2の送信理由「Cause」315から読み取った送信理由「Miss」が設定される。「VT(M)」403には、再送を実施すると決定した送信間隔TTI-3の期間までに受信局に送信したRLC-PDU300のシーケンス番号の上限値「15」が設定される。「SN」405には、STATUS-PDU310−2から取り込んだ先頭のシーケンス番号「1」が設定される。「L」406には、STATUS-PDU310−2から取り込んだ後続数「1」が設定される。「LENGTH」404には組数「1」が設定される。なお、後述するように、Seq.No=11のRLC-PDU300では、Po11ビットP1が設定され、「Poll Counter」306のカウント値は「1」になっているので、「Poll Counter」401には、再送を実施すると判断した時点(つまり、送信間隔TTI-3の期間)での「Poll Counter」306のカウント値「1」が設定される。

【0111】送信局は、次の送信間隔TTI-4の期間においてSeq.No=1,2のRLC-PDU300について再送を実施する。送信間隔TTI-4の期間では、再送に関わるSeq.No=1,2の2つのRLC-PDU300と本来の送信データであるSeq.No=16,17の2つのRLC-PDU300が送信されることになる。

【0112】一方、送信局では、送信間隔TTI-2の期間で送信するSeq.No=11のRLC-PDU300においてPo11ビットP1(「P」303)の設定が行われると、Poll Counter13がインクリメントされ、そのカウント値「1」が要求番号としてRLC-PDU300の「Poll Counter」306に設定される。つまり、送信間隔TTI-2の期間においては、受信局に対し状態通知要求と要求番号付きのRLC-PDU300が送信される。

【0113】受信局は、次の送信間隔TTI-3の期間で実施するプロトコル処理111−1でのRLC-PDU受信処理において、Po11ビットP1(「P」303)を検出

して状態通知メッセージ（STATUS-PDU３１０－１）の送信要求を認識する。但し、この時点では、受信局は、再送を要求したSeq.No=1,2のRLC-PDU３００を未だ受信していない。したがって、受信局は、次のような内容の状態通知メッセージ（STATUS-PDU（２０１－１）３１０－１）を作成する。

【０１１４】すなわち、送信間隔TTI-3の期間で実施するプロトコル処理１１１－１において作成されるSTATUS-PDU（２０１－１）３１０－１には、図６、図２５、図２６において、送信理由「Cause」３１５に“Ｐｏｌｌビットｐ１（「Ｐ」３０３）の受信”を示す「Ｐ１」が設定され、要求番号（「Poll Counter」３１６）に受信した状態通知要求メッセージの「Poll Counter」３０６から読み取った値「１」が設定され、「ＬＳＮ」４１２に状態通知メッセージの送信要求を認識した送信間隔TTI-3の期間までに受信できた場合のシーケンス番号上限値「１１」のつぎの値「１２」が設定され、「ＳＮ」４２４に再送を要求するRLC-PDU３００の先頭シーケンス番号「１」が設定され、「Ｌ」４２５に後続数「１」が設定されている。

【０１１５】受信局は、次の送信間隔TTI-4の期間において、上記のような内容を有するSTATUS-PDU（２０１－１）３１０－１を送信し、Seq.No=1,2のRLC-PDU３００についての再送要求を送信局に対して再度通知する。送信局は、受信したSTATUS-PDU３１０－１に対して、次の送信間隔TTI-5の期間で実施するプロトコル処理１０１－１において、Seq.No=1,2のRLC-PDU３００についての再送要求を認識すると、再送制御テーブル１５の存在を確認して再送制御テーブル１５を参照し、次のようにして再送実施の要否を判断する。

【０１１６】まず、STATUS-PDU３１０－１に含まれる「ＬＳＮ」から「－１」した値と再送制御テーブル１５に設定されている「ＶＴ（Ｍ）」４０３との大小比較を行う。ＬＳＮ－１＝１１であり、「ＶＴ（Ｍ）」４０３の値「１５」よりも小さい。これによって、送信局は、今回受信したSTATUS-PDU３１０－１は、Seq.No=1,2のRLC-PDU３００についての再送を実施する以前に送信された状態通知メッセージであることを確認する。

【０１１７】次いで、受信したSTATUS-PDU３１０－１に設定されている「LENGTH」４２２、「ＳＮ」４２４および「Ｌ」４２５と、再送制御テーブル１５に設定されている「LENGTH」４０４、「ＳＮ」４０５および「Ｌ」４０６とを比較する。ここでは、共に、ＬＥＮＧＴＨ＝１，ＳＮ＝１，Ｌ＝１であり、同じである。

【０１１８】このことから、今回受信した再送要求に関わるSeq.No=1,2のRLC-PDU３００については、既に再送を実施しその送達確認待ちであること、また、新規の再送要求は含まれていないことが認識できる。したがって、送信局は、送信間隔TTI-5の期間で実施するプロトコル処理１０１－１でのSTATUS-PDU受信処理では、Seq.No=1,2のRLC-PDU３００についての再送は実施しないと決定する。

【０１１９】なお、送信局が、送信間隔TTI-5の期間において送信するSeq.No=19のRLC-PDU３００においてＰｏｌｌビットＰ２（「Ｐ」３０３）を設定した場合、受信局は、次の送信間隔TTI-6の期間で実施するプロトコル処理１１２－１においてＰｏｌｌビットＰ２（「Ｐ」３０３）を検出し、STATUS-PDU３１０－１の送信要求を認識する。受信局は、図示しないつぎの送信間隔TTI-7においてSTATUS-PDU３１０－１を返送するが、その返送するSTATUS-PDU３１０－１によって、送信局が再送したSeq.No=1,2のRLC-PDU３００についての受信結果を通知することになる。

【０１２０】このように、実施の形態１によれば、送信局は、再送制御テーブル１５を使用して、RLC-PDU３００の再送を実施する毎に、状態通知メッセージから読み取った送信理由「Cause」４０２と、テーブル設定時点までに送信したシーケンス番号の上限値「ＶＴ（Ｍ）」４０３と、その設定時点での「Poll Counter」４０１の値と、再送したRLC-PDU３００のシーケンス番号「ＳＮ」４０５および後続数「Ｌ」４０６、「LENGTH」４０４とを対応付けて記憶しておくので、RLC-PDU３００の再送とすれ違いで受信したＰｏｌｌビット受信に基づくSTATUS-PDU３１０－１による再送要求に起因する無駄な再送を抑制することができ、また必要な再送のみを実施することができるので、無線回線あるいは有線回線のリソースを無駄に消費することが防止できる。

【０１２１】実施の形態２．図９は、この発明の実施の形態２であるデータパケット再送制御方法を説明するシーケンス図である。この実施の形態２では、図１に示したデータパケット伝送システムにおいて実施されるデータパケット再送制御動作の動作例２が示されている。図９において、送信局が送信間隔TTI-0の期間で送信した４個のRLC-PDU（Seq.No=0,1,2,3）３００のうち２個のRLC-PDU（Seq.No=1,2）３００に抜けがあった場合、受信局は、次の送信間隔TTI-1の期間で実施するプロトコル処理１１０－２でのRLC-PDU受信処理において、Seq.No=1,2の抜けを検出すると、次のようなSTATUS-PDU（２００－２）３１０－２を作成する。

【０１２２】すなわち、このSTATUS-PDU（２００－２）３１０－２では、図７、図２５、図２６において、送信理由「Cause」３１５に“送信シーケンス番号３０２の抜け検出”を示す「Miss」が設定され、「ＬＳＮ」４１２に正常に受信できたとした場合のシーケンス番号上限値「３」のつぎの値「４」が設定され、「ＳＮ」４２４に再送を要求するRLC-PDU３００の先頭シーケンス番号「１」が設定され、「Ｌ」４２５に後続数「１」が設定されている。

【０１２３】受信局は、次の送信間隔TTI-2の期間において、上記のような内容を有するSTATUS-PDU（２００－

２）３１０－２を送信局に対して送信し再送を要求する。送信局は、次の送信間隔TTI-3の期間で実施するプロトコル処理１００－２でのSTATUS-PDU受信処理において、受信したSTATUS-PDU（２００－２）３１０－２の再送要求情報要素４２０からSeq.No=1,2の抜けを認識し、つまりSeq.No=1,2のRLC-PDU３００についての再送要求を認識する。そして、この例では、再送制御テーブル１５が存在しないので、再送制御テーブル１５について次のように設定する。

【０１２４】すなわち、図４において、「Cause」４０２には、受信したSTATUS-PDU３１０－２の送信理由「Cause」３１５から読み取った「Miss」が設定される。「ＶＴ（Ｍ）」４０３には、再送を実施すると決定した送信間隔TTI-3の期間までに受信局に送信したRLC-PDU３００のシーケンス番号の上限値「１５」が設定される。「ＳＮ」４０５には、STATUS-PDU３１０－２から取り込んだ先頭のシーケンス番号「１」が設定される。「Ｌ」４０６には、STATUS-PDU３１０－２から取り込んだ後続数「１」が設定される。「LENGTH」４０４には組数「１」が設定される。なお、実施の形態１とは異なり、Seq.No=11のRLC-PDU３００では、Ｐｏ１１ビットが設定されないので、再送を実施すると判断した時点（つまり、送信間隔TTI-3の期間）での「Poll Counter」３０６のカウント値は「０」であり、「PollCounter」４０１には値「０」が設定される。

【０１２５】送信局は、次の送信間隔TTI-4の期間においてSeq.No=1,2のRLC-PDU３００について再送を実施する。送信間隔TTI-4の期間では、再送に関わるSeq.No=1,2の２つのRLC-PDU３００と本来の送信データであるSeq.No=16,17の２つのRLC-PDU３００が送信されることになる。

【０１２６】一方、受信局では、送信間隔TTI-3の期間において周期タイマ２３がタイムアウト（ＴＯ）したので、その送信間隔TTI-3の期間で実施するプロトコル処理１１１－２において、タイムアウト（ＴＯ）に基づく状態通知メッセージ（STATUS-PDU３１０－２）の送信要求を認識する。但し、この時点では、受信局は、再送を要求したSeq.No=1,2のRLC-PDU３００を未だ受信していない。したがって、受信局は、次のような内容の状態通知メッセージ（STATUS-PDU（２０１－２）３１０－２）を作成する。

【０１２７】すなわち、このSTATUS-PDU（２０１－２）３１０－２には、図７、図２５、図２６において、送信理由「Cause」３１５に“周期タイマのタイムアウト”を示す「ＴＯ」が設定され、「ＬＳＮ」４１２にSTATUS-PDU３１０－２の送信要求を認識した送信間隔TTI-3の期間までに受信できたとした場合のシーケンス番号上限値「１１」のつぎの値「１２」が設定され、「ＳＮ」４２４に再送を要求するRLC-PDU３００の先頭シーケンス番号「１」が設定され、「Ｌ」４２５に後続数「１」が設定されている。

【０１２８】受信局は、次の送信間隔TTI-4の期間において、上記のような内容を有するSTATUS-PDU（２０１－２）３１０－２を送信し、Seq.No=1,2のRLC-PDU３００についての再送要求を送信局に対して再度通知する。送信局は、受信したSTATUS-PDU（２０１－２）３１０－２に対して、次の送信間隔TTI-5の期間で実施するプロトコル処理１０１－２でのSTATUS-PDU受信処理において、Seq.No=1,2のRLC-PDU３００についての再送要求を認識すると、再送制御テーブル１５の存在を確認して再送制御テーブル１５を参照し、次のようにして再送実施の要否を判断する。

【０１２９】まず、STATUS-PDU（２０１－２）３１０－２に含まれる「ＬＳＮ」から「－１」した値と再送制御テーブル１５に設定されている「ＶＴ（Ｍ）」４０３との大小比較を行う。ＬＳＮ－１＝１１であり、「ＶＴ（Ｍ）」４０３の値「１５」よりも小さい。これによって、今回受信したSTATUS-PDU３１０－２は、Seq.No=1,2のRLC-PDU３００についての再送を実施する以前に送信された状態通知メッセージであることを確認する。

【０１３０】次いで、受信したSTATUS-PDU（２０１－２）３１０－２に設定されている「LENGTH」４２２、「ＳＮ」４２４および「Ｌ」４２５と、再送制御テーブル１５に設定されている「LENGTH」４０４、「ＳＮ」４０５および「Ｌ」４０６とを比較する。ここでは、共に、ＬＥＮＧＴＨ＝１，ＳＮ＝１，Ｌ＝１であり、同じである。

【０１３１】このことから、今回受信した再送要求に関わるSeq.No=1,2のRLC-PDU３００については、既に再送を実施しその送達確認待ちであること、また、新規の再送要求は含まれていないことが認識できる。したがって、送信局は、送信間隔TTI-5の期間で実施するプロトコル処理１０１－２でのSTATUS-PDU受信処理では、Seq.No=1,2のRLC-PDU３００についての再送は実施しないと決定する。

【０１３２】なお、送信局が、送信間隔TTI-5の期間において送信するSeq.No=19のRLC-PDU３００においてＰｏ１１ビットＰ１（「Ｐ」３０３）を設定した場合、受信局は、次の送信間隔TTI-6の期間で実施するプロトコル処理１１２－２でのRLC-PDU受信処理においてＰｏ１１ビットＰ１（「Ｐ」３０３）を検出し、STATUS-PDU３１０－１の送信要求を認識する。受信局は、図示しない次の送信間隔TTI-7においてSTATUS-PDU３１０－１を返送する。受信局は、その返送するSTATUS-PDU３１０－１によって、送信局が再送したSeq.No=1,2のRLC-PDU３００についての受信結果を通知することになる。

【０１３３】このように、実施の形態２によれば、送信局は、再送制御テーブル１５を使用して、RLC-PDU３００の再送を実施する毎に、状態通知メッセージから読み取った送信理由「Cause」４０２と、テーブル設定時点

までに送信したシーケンス番号の上限値「ＶＴ（Ｍ）」４０３と、再送したRLC-PDU３００のシーケンス番号「ＳＮ」４０５および後続数「Ｌ」４０６、「LENGTH」４０４とを対応付けて記憶しておくので、RLC-PDU３００の再送とすれ違いで受信した周期タイマのタイムアウトに基づくSTATUS-PDU３１０－２による再送要求に起因する無駄な再送を抑制することができ、また必要な再送のみを実施することができるので、無線回線あるいは有線回線のリソースを無駄に消費することが防止できる。

【０１３４】実施の形態３．図１０は、この発明の実施の形態３であるデータパケット再送制御方法を説明するシーケンス図である。この実施の形態３では、図１に示したデータパケット伝送システムにおいて実施されるデータパケット再送制御動作の動作例３が示されている。図１０において、送信局が送信間隔TTI-0の期間で送信した４個のRLC-PDU（Seq.No=0,1,2,3）３００のうち２個のRLC-PDU（SN=1,2）３００に抜けがあった場合、受信局は、次の送信間隔TTI-1の期間で実施するプロトコル処理１１０－３でのRLC-PDU受信処理において、Seq.No=1,2の抜けを検出すると、受信局は、次のようなSTATUS-PDU（２００－３）３１０－２を作成する。

【０１３５】すなわち、このSTATUS-PDU（２００－３）３１０－２には、図７、図２５、図２６において、送信理由「Cause」３１５に“送信シーケンス番号３０２の抜け検出”を示す「Miss」が設定され、「ＬＳＮ」４１２に正常に受信できたとした場合のシーケンス番号上限値「３」のつぎの値「４」が設定され、「ＳＮ」４２４に再送を要求するRLC-PDU３００の先頭シーケンス番号「１」が設定され、「Ｌ」４２５に後続数「１」が設定されている。受信局は、次の送信間隔TTI-2の期間において、上記のような内容を有するSTATUS-PDU（２００－３）３１０－２を送信し、送信局に対して再送を要求する。

【０１３６】送信局は、次の送信間隔TTI-3の期間で実施するプロトコル処理１００－３でのSTATUS-PDU受信処理において、受信したSTATUS-PDU（２００－３）３１０－２の再送要求情報要素４２０からSeq.No=1,2の抜けを認識し、つまりSeq.No=1,2のRLC-PDU３００についての再送要求を認識する。そして、この例では、再送制御テーブル１５が存在しないので、再送制御テーブル１５について次のように設定する。

【０１３７】すなわち、図４において、「Cause」４０２には、受信したSTATUS-PDU３１０－２の送信理由「Cause」３１５から読み取った送信理由「Miss」が設定される。「ＶＴ（Ｍ）」４０３には、再送を実施すると決定した送信間隔TTI-3の期間までに受信局に送信したRLC-PDU３００のシーケンス番号の上限値「１５」が設定される。「ＳＮ」４０５には、STATUS-PDU３１０－２から取り込んだ先頭のシーケンス番号「１」が設定される。「Ｌ」４０６には、STATUS-PDU３１０－２から取り込んだ後続数「１」が設定される。「LENGTH」４０４には組数「１」が設定される。なお、実施の形態１と同様に、Seq.No=11のRLC-PDU３００では、Ｐｏｌｌビット Ｐ１（「Ｐ」３０３）が設定されるので、再送を実施すると判断した時点（つまり、送信間隔TTI-3の期間）での「Poll Counter」３０６のカウント値は「１」であり、「Poll Counter」４０１には値「１」が設定される。

【０１３８】送信局は、次の送信間隔TTI-4の期間においてSeq.No=1,2のRLC-PDU３００について再送を実施する。送信間隔TTI-4の期間では、再送に関わるSeq.No=1,2の２つのRLC-PDU３００と本来の送信データであるSeq.No=16,17の２つのRLC-PDU３００が送信されることになる。

【０１３９】一方、送信局では、送信間隔TTI-2の期間で送信するSeq.No=11のRLC-PDU３００においてＰｏｌｌビット Ｐ１（「Ｐ」３０３）の設定が行われると、Poll Counter１３がインクリメントされ、そのカウント値「１」が要求番号としてRLC-PDU３００の「Poll Counter」３０６に設定される。つまり、送信間隔TTI-2の期間において、受信局に対し状態通知要求と要求番号行きのRLC-PDU３００が送信される。このとき、送信局が送信間隔TTI-2の期間において送信するSeq.No=9のRLC-PDU３００が正しく受信局に届かなかったとする。

【０１４０】この結果、受信局は、次の送信間隔TTI-3の期間で実施するプロトコル処理１１１－３でのRLC-PDU受信処理において、Seq.No=9のRLC-PDU３００の抜けを検出するとともに、Seq.No=11のRLC-PDU３００においてＰｏｌｌビット Ｐ１（「Ｐ」３０３）が設定されていることを検出する。但し、この時点では、受信局は、再送を要求したSeq.No=1,2のRLC-PDU３００も未だ受信していない。したがって、受信局は、次のような内容の状態通知メッセージ（STATUS-PDU（２０１－３）３１０－１，３１０－２）を作成する。

【０１４１】すなわち、送信間隔TTI-3の期間で実施するプロトコル処理１１１－３でのRLC-PDU受信処理において作成されるSTATUS-PDU（２０１－３）３１０－１では、図６、図２５、図２６において、送信理由「Cause」３１５に“Ｐｏｌｌビット Ｐ１（「Ｐ」３０３）の受信”を示す「Ｐ１」が設定され、要求番号（「Poll Counter」３１６）に受信した状態通知要求メッセージの「Poll Counter」３０６から読み取った値「１」が設定され、「ＬＳＮ」４１２に状態通知メッセージの送信要求を認識した送信間隔TTI-3の期間までに受信できたとした場合のシーケンス番号上限値「１１」のつぎの値「１２」が設定されている。また、「ＳＮ」４２４と「Ｌ」４２５とには、Seq.No=1,2のRLC-PDU３００についての再送要求「ＳＮ＝１，Ｌ＝１」と、Seq.No=9のRLC-PDU３００についての再送要求「ＳＮ＝９，Ｌ＝０」とが設定され、「LENGTH」４２２には「２」が設定されている。

【０１４２】受信局は、次の送信間隔TTI-4の期間において、上記のような内容を有するSTATUS-PDU（２０１－３）３１０－１を送信し、Seq.No=1,2,9のRLC-PDU３００についての再送要求を送信局に対して通知する。送信局は、受信したSTATUS-PDU（２０１－３）３１０－１に対して、次の送信間隔TTI-5の期間で実施するプロトコル処理１０１－３でのSTATUS-PDU受信処理において、Seq.No=1,2,9のRLC-PDU３００についての再送要求を認識すると、再送制御テーブル１５の存在を確認して再送制御テーブル１５を参照し、次のようにして再送実施の要否を判断する。

【０１４３】まず、STATUS-PDU（２０１－３）３１０－１に含まれる「ＬＳＮ」から「－１」した値と再送制御テーブル１５に設定されている「ＶＴ（Ｍ）」４０３との大小比較を行う。ＬＳＮ－１＝１１であり、「ＶＴ（Ｍ）」４０３の値「１５」よりも小さい。これによって、今回受信したSTATUS-PDU３１０－１は、Seq.No=1,2のRLC-PDU３００についての再送を実施する以前に送信されたメッセージであることを確認する。

【０１４４】次いで、STATUS-PDU（２０１－３）３１０－１に設定されている「LENGTH」４２２、「ＳＮ」４２４および「Ｌ」４２５と、再送制御テーブル１５に設定されている「LENGTH」４０４、「ＳＮ」４０５および「Ｌ」４０６とを比較する。ここでは、再送制御テーブル１５の「LENGTH」４０４は「１」であるが、STATUS-PDU３１０－１の「LENGTH」４２２は「２」である。再送制御テーブル１５には、「ＳＮ＝１，Ｌ＝１」の設定はあるが、「ＳＮ＝９，Ｌ＝０」の設定がない。

【０１４５】このことから、今回受信した再送要求に関わるSeq.No=1,2,9のうち、連続するシーケンス番号Seq.No=1,2のRLC-PDU３００については、既に再送を実施しその送達確認待ちであること、また、シーケンス番号Seq.No=9については、新規の再送要求であることが認識できる。

【０１４６】したがって、送信局は、送信間隔TTI-5の期間で実施するプロトコル処理１０１－３でのSTATUS-PDU受信処理では、Seq.No=1,2のRLC-PDU３００の再送は実施せず、Seq.No=9のRLC-PDU３００のみ再送を実施すると決定する。すなわち、Seq.No=9について図４に示した再送制御テーブル１５を新たに設定する。その結果、次の送信間隔TTI-6の期間では、再送に関わるSeq.No=9のRLC-PDU３００と本来の送信データであるSN=22,23,24の３つのRLC-PDU３００が送信されることになる。再送制御テーブル１５は、再送の成功通知等で削除されるので、それまでの間、Seq.No=1,2についての再送制御テーブルと、Seq.No=9についての再送制御テーブルとが並存することになる。

【０１４７】なお、送信局が、送信間隔TTI-5の期間において送信するSeq.No=19のRLC-PDU３００においてＰｏｌｌビットＰ２（「Ｐ」３０３）を設定した場合、受信局は、送信間隔TTI-6の期間で実施するプロトコル処理１１２－３でのRLC-PDU受信処理においてＰｏｌｌビットＰ２（「Ｐ」３０３）を検出し、STATUS-PDU３１０－１の送信要求を認識する。受信局は、図示しない次の送信間隔TTI-7においてSTATUS-PDU３１０－１を返送する。受信局は、その返送するSTATUS-PDU３１０－１によって、送信局が再送したSeq.No=1,2のRLC-PDU３００についての受信結果を通知することになる。

【０１４８】このように、実施の形態３によれば、送信局は、再送制御テーブル１５を使用して、RLC-PDU３００の再送を実施する毎に、状態通知メッセージから読み取った送信理由「Cause」４０２と、テーブル設定時点までに送信したシーケンス番号の上限値「ＶＴ（Ｍ）」４０３と、その設定時点での「Poll Counter」４０１の値と、再送したRLC-PDU３００のシーケンス番号「ＳＮ」４０５および後続数「Ｌ」４０６、「LENGTH」４０４とを対応付けて記憶しておくので、RLC-PDU３００の再送とすれ違いで受信したＰｏｌｌビット受信に基づくSTATUS-PDU３１０－１による再送要求に起因する無駄な再送を抑制することができ、また必要な再送のみを実施することができるので、無線回線あるいは有線回線のリソースを無駄に消費することが防止できる。

【０１４９】実施の形態４．図１１～図１３は、この発明の実施の形態４であるデータパケット再送制御方法を説明するフローチャートである。この実施の形態４では、実施の形態１～３で説明したデータパケット再送制御動作（動作例１～３）を含み送信局が行う一般的なデータパケット再送制御動作が示されている。以下、図２～図４、図６～図１０、図２５、図２６を適宜に参照して説明する。

【０１５０】図１１～図１３において、送信局では、受信局から送られてくるパケット（ＰＤＵ）がチェックされ（ステップＳＴ１）、「PDU-type」３１１によって状態通知メッセージの受信であるか否かが判断される（ステップＳＴ２）。状態通知メッセージの受信ではない場合には、判断結果は否定（ステップＳＴ２：Ｎｏ）となり、ステップＳＴ１７に進み、データパケットの送信処理（ステップＳＴ１７～ＳＴ２１）が実行される。また、状態通知メッセージの受信である場合には、判断結果は肯定（ステップＳＴ２：Ｙｅｓ）となり、ステップＳＴ３に進み、再送制御処理（ステップＳＴ３～ＳＴ２７）が実行される。

【０１５１】まず、データパケットの送信処理（ステップＳＴ１７～ＳＴ２１）について説明する。ステップＳＴ１７では、上位のレイヤから新規ＰＤＵが送られてくるか否かが判断される。新規ＰＤＵが送られてくると、判断結果は肯定（ステップＳＴ１７：Ｙｅｓ）となり、ステップＳＴ１８に進み、今まで受け取ったデータパケット（ＰＤＵ）や再送データ生成処理（ステップＳＴ１３～ＳＴ１６）で生成された再送データパケット（ＰＤ

Ｕ）に新規ＰＤＵを含めた送信データパケット（ＰＤＵ）が作成される。つぎに、Ｐｏ１１ビットの設定要否が判断され（ステップＳＴ１９）、判断結果が肯定（ステップＳＴ１９：Ｙｅｓ）の場合には、ステップＳＴ２０に進み、該当するデータパケット（ＰＤＵ）にＰｏ１１ビットが設定され、同時にPoll Counter１３がインクリメントされる。その後、データパケット（RLC-PDU３００）の送信処理が実行される（ステップＳＴ２１）。また、ステップＳＴ１９においてＰｏ１１ビットの設定はしないと判断した場合には（ステップＳＴ１９：Ｎｏ）、直接ステップＳＴ２１に進み、そのままデータパケット（RLC-PDU３００）の送信処理が実行される。

【０１５２】一方、ステップＳＴ１７において、新規ＰＤＵが送られてこない場合には、判断結果は否定（ステップＳＴ１７：Ｎｏ）となり、Ｐｏ１１ビットの設定要否が判断される（ステップＳＴ２２）。判断結果が肯定（ステップＳＴ２２：Ｙｅｓ）の場合には、ステップＳＴ２３に進み、最後に送信したデータパケット（ＰＤＵ）にＰｏ１１ビットが設定され、同時にPoll Counter１３がインクリメントされる。その後、データパケット（RLC-PDU３００）の送信処理が実行される（ステップＳＴ２１）。この場合には、同番のシーケンス番号を持つデータパケット（RLC-PDU３００）が繰り返し送信されることになる。なお、ステップＳＴ２２においてＰｏ１１ビットの設定はしないと判断した場合には（ステップＳＴ２２：Ｎｏ）、送信処理は行わず、そのまま処理を終了する。

【０１５３】次に、再送制御処理（ステップＳＴ３～ＳＴ２７）について説明する。ステップＳＴ３では、受信された状態通知メッセージが再送要求情報要素４２０を含むか否かが調査される。含む場合には、その再送要求情報要素４２０の「LENGTH」４２２，「ＳＮ」４２４，「Ｌ」４２５を取り出して保持する。その後再送制御テーブル１５が存在するか否かが判断される（ステップＳＴ４）。ここでは、例えば、１ビットの再送制御テーブル有無フラグによって判断することとする。再送制御テーブル１５が一つでも存在すれば、再送制御テーブル有無フラグは、セットされるようになっている。

【０１５４】再送制御テーブル１５が存在しない場合には、ステップＳＴ４での判断結果が否定（ステップＳＴ４：Ｎｏ）となり、ステップＳＴ１３に進み、次のようにして再送データパケットの生成処理（ステップＳＴ１３～ＳＴ１６）が実行され、再送が実施される（ステップＳＴ１８～ＳＴ２１）。これらは、前述した例えば送信間隔TTI-3、TTI-4の期間での処理動作である。

【０１５５】ステップＳＴ１３では、再送要求情報要素４２０が保存されているか否かが判断される。保存されている場合には、判断結果は肯定（ステップＳＴ１３：Ｙｅｓ）となり、ステップＳＴ１４に進み、ステップＳＴ３にて保存した再送要求情報要素４２０の「LENGTH」４２２，「ＳＮ」４２４，「Ｌ」４２５の情報に基づき該当するデータパケットが記憶装置から読み出され、再送を実施するデータパケット（再送ＰＤＵ）の送信準備が行われる。並行して再送制御テーブル１５が図４で説明したようにして作成される（ステップＳＴ１５）。作成が完了すると再送制御テーブル有無フラグがセットされ（ステップＳＴ１６）、上述のようにして再送が実施される（ステップＳＴ１８～ＳＴ２１）。

【０１５６】なお、ステップＳＴ１３において、再送要求情報要素４２０が保存されていない場合は、判断結果は否定（ステップＳＴ１３：Ｎｏ）となり、ステップＳＴ１７に進み、上述のようにして通常のデータが送信される（ステップＳＴ１７～ＳＴ２３）。このルートには、再送に成功した場合が含まれる。

【０１５７】一方、ステップＳＴ４において、再送制御テーブル１５が存在する場合には、ステップＳＴ４での判断結果が肯定（ステップＳＴ４：Ｙｅｓ）となり、ステップＳＴ５に進み、その受信された状態通知メッセージの情報に基づく再送の要否判定や再度制御テーブル１５の削除・追加の処理が実行される（ステップＳＴ５～ＳＴ２７）。これらは、前述した例えば送信間隔TTI-5の期間、およびそれ以降での該当する送信間隔での期間（図示されてないが、送信間隔TTI-8、TTI-11等の期間）での処理動作である。

【０１５８】まず、ステップＳＴ５では、受信された状態通知メッセージから以下の情報（１）～（３）が読み出される。（１）要求番号（Poll Counter３１６）が読み出される。以下「ＰＣｓ」とする。これは、状態通知メッセージが、STATUS-PDU３１０－１の場合に読み出される。（２）送信理由「Cause」３１５が読み出される。以下「ＣＡｓ」とする。これは、状態通知メッセージが、STATUS-PDU３１０－１、３１０－２のいずれである場合でも読み出される。（３）上限値「ＬＳＮ－１」が読み出される。以下「ＶＴＭｓ」とする。これは、状態通知メッセージが、STATUS-PDU３１０－１、３１０－２のいずれである場合でも読み出される。

【０１５９】次に、再送制御テーブル１５のポインタを先頭に設定し（ステップＳＴ６）、再送制御テーブル１５から以下の情報（１）～（４）が読み出される。（１）要求番号（Poll Counter４０１）が読み出される。以下「ＰＣｔ」とする。「ＰＣｔ」は、テーブルへの設定がない場合もあるので、読み出されない場合もある。（２）送信理由「Cause」４０２が読み出される。以下「ＣＡｔ」とする。これは、必ず読み出される。（３）上限値「ＶＴ（Ｍ）」が読み出される。以下「ＶＴＭｔ」とする。これは、必ず読み出される。（４）「ＳＮ」４０５と「Ｌ」４０６と「LENGTH」４０４とが読み出される。これらは再送済みの情報である。

【０１６０】次のステップＳＴ８では、状態通知メッセージから読み出した上限値ＶＴＭｓが、再送制御テーブ

ル１５から読み出した上限値ＶＴＭｔよりも大きいか否かが判断される。つまり、今回受信された状態通知メッセージが、テーブル設定後（再送実施決定後）に作成されたものか否かが判断される。

【０１６１】ステップＳＴ８での判断において、ＶＴＭｓ＞ＶＴＭｔである場合には、判断結果は肯定（ステップＳＴ８：Ｙｅｓ）となり、ステップＳＴ９に進み、当該再送制御テーブル１５を削除する。これは、送信間隔TTI-8の期間およびそれ以降の該当する送信間隔の期間において行われる処理である。これらの期間では、再送の成否が認識される。したがって、再送が成功した場合は、不要となるから該当する再度制御テーブル１５を削除するのであり、再送が失敗した場合には、再度制御テーブル１５の設定をやり直すから該当する再度制御テーブル１５を削除するのである。

【０１６２】次いで、ステップＳＴ１０では、次の再送制御テーブル１５が存在するか否かが判断される。判断結果が肯定（ステップＳＴ１０：Ｙｅｓ）である場合には、その再送制御テーブル１５のポインタを先頭に設定し（ステップＳＴ１１）、ステップＳＴ７に戻り、上限値の大小比較を行う。一方、次の再送制御テーブル１５が存在しない場合は、判断結果が否定（ステップＳＴ１０：Ｎｏ）となり、ステップＳＴ１２に進み、再送制御テーブル有無フラグをリセットしてステップＳＴ１３に進む。

【０１６３】例えば、送信間隔TTI-8の期間での再送済み確認処理において、再送の失敗が認識された場合には、再送要求情報要素４２０の内容がステップＳＴ３において保存されているので、上記テーブル削除後のステップＳＴ１３では、判断結果が肯定（ステップＳＴ１３：Ｙｅｓ）となり、新たに再送制御テーブル１５が作成され（ステップＳＴ１４～ＳＴ１６）、再度の再送が実施される（ステップＳＴ１８～ＳＴ２１）。なお、再送に成功した場合には、再送要求情報要素４２０の内容がステップＳＴ３において保存されていないので、上記テーブル削除後のステップＳＴ１３では、判断結果が否定（ステップＳＴ１３：Ｎｏ）となり、通常のデータ送信が行われる（ステップＳＴ１７～ＳＴ２１）。

【０１６４】さて、ステップＳＴ８での判断において、ＶＴＭｓ＞ＶＴＭｔでない場合には、判断結果が否定（ステップＳＴ８：Ｎｏ）となり、ステップＳＴ２４に進み、次のようにして再送の要否判断処理（ステップＳＴ２４～ＳＴ２７）が行われる。まず、ステップＳＴ２４では、ＶＴＭｓ＝ＶＴＭｔであるか否かが判断される。ＶＴＭｓ＝ＶＴＭｔでない場合、つまりＶＴＭｓ＜ＶＴＭｔである場合には、判断結果は否定（ステップＳＴ２４：Ｎｏ）となり、ステップＳＴ２７に進み、再送済みの確認処理が行われる。すなわち、再送制御テーブル１５の情報と受信された状態通知メッセージの再送要求との差分が抽出され、差分があれば再送要求情報要素４２０の「LENGTH」４２２，「ＳＮ」４２４，「Ｌ」４２５が保持される。その後、ステップＳＴ１０、ステップＳＴ１２を経由してステップＳＴ１３に進む。

【０１６５】例えば、図８と図１１における送信間隔TTI-5の期間での再送済み確認処理では、差分が抽出できないので、ステップＳＴ１３の判断は否定（ステップＳＴ１３：Ｎｏ）となり、ステップＳＴ１７に進み、Seq.No=1,2についての不要な再送は行われず、通常のデータ送信のみが行われる（ステップＳＴ１７～ＳＴ２３）。しかし、図９における送信間隔TTI-5の期間での再送済み確認処理では、差分が抽出できるので、ステップＳＴ１３の判断結果は肯定（ステップＳＴ１３：Ｙｅｓ）となり、ステップＳＴ１４に進み、Seq.No=9についての再送制御テーブル１５が新たに作成され（ステップＳＴ１４～ＳＴ１６）、Seq.No=1,2についての不要な再送は行われず、通常のデータ送信とともに、Seq.No=9についての再送が実施される（ステップＳＴ１８～ＳＴ２１）。

【０１６６】一方、ステップＳＴ１７→ＳＴ２２→ＳＴ２３の処理で説明したように同番のシーケンス番号を持つデータパケットが送信されることがあるので、ＶＴＭｓ＝ＶＴＭｔとなることがある。これは、送信間隔TTI-5の期間だけでなく、その後の送信間隔TTI-8の期間およびそれ以降の期間においても生ずると考えられる。ＶＴＭｓ＝ＶＴＭｔの場合には、ステップＳＴ２４での判断結果が肯定（ステップＳＴ２４：Ｙｅｓ）となり、受信された状態通知メッセージの送信理由ＣＡｓが、“Ｐｏｌｌビットの受信”であるか、“周期タイマのTime Out（タイムアウト）”であるかが判断される（ステップＳＴ２５、ＳＴ２８）。

【０１６７】ＣＡｓ＝Ｐｏｌｌ（送信理由ＣＡｓが“Ｐｏｌｌビットの受信”）である場合は、ステップＳＴ２５の判断結果は肯定（ステップＳＴ２５：Ｙｅｓ）となり、ステップＳＴ２６に進み、ＰＣｓ＞ＰＣｔであるか否か、つまり要求番号の大小関係が判断される。ＰＣｓ＞ＰＣｔである場合には、ステップＳＴ２６の判断結果は肯定（ステップＳＴ２６：Ｙｅｓ）となり、ステップＳＴ９に進み、該当する再送制御テーブル１５の削除が行われる。これは、例えば送信期間TTI-8の期間での再送済み確認処理において、再送成功を確認できた場合や再送失敗を確認できた場合に、送信期間TTI-5の期間で設定されたＣＡｓ＝Missによる再送制御テーブル１５を削除する場合が該当する。再送失敗を確認できた場合には、ステップＳＴ１０→ＳＴ１２→ＳＴ１３と進み、新たな再送制御テーブル１５が作成され、再度の再送が実施される（ステップＳＴ１３～ＳＴ２１）。また、ＰＣｓ≦ＰＣｔである場合には、ステップＳＴ２６の判断結果は否定（ステップＳＴ２６：Ｎｏ）となり、ステップＳＴ２７に進み、上述したように差分の抽出が行われる。その後、ステップＳＴ１０→ＳＴ１２→ＳＴ１３と進み、不要な再送は行われず、必要な再送が実施される

（ステップＳＴ１３〜ＳＴ２１）。

【０１６８】ＣＡｓ＝Time Out（送信理由ＣＡｓが“周期タイマのTime Out（タイムアウト）”）である場合は、ステップＳＴ２８の判断は肯定（ステップＳＴ２８：Ｙｅｓ）となり、ステップＳＴ２９に進み、ＣＡｓ＝ＣＡｔであるか否かが判断される。例えば、図9において、送信期間TTI-5での再送済み確認処理では、ＣＡｓ＝ＴＯ（周期タイマのTime Out）であり、ＣＡｔ＝Missであるが、送信期間TTI-8以降の該当する期間での再送済み確認処理においてＣＡｓ＝ＣＡｔ＝Time Outとなる場合がある。この場合には、ステップＳＴ２９の判断結果は肯定（ステップＳＴ２９：Ｙｅｓ）となり、ステップＳＴ９に進み、該当する再送制御テーブル１５の削除が行われる。これは、送信期間TTI-8以降の該当する期間での再送済み確認処理において、再送成功を確認できた場合や再送失敗を確認できた場合に、送信期間TTI-5の期間で設定されたＣＡｓ＝Missによる再送制御テーブル１５を削除する場合が該当する。再送失敗を確認できた場合には、ステップＳＴ１０→ＳＴ１２→ＳＴ１３と進み、新たな再送制御テーブル１５が作成され、再度の再送が実施される（ステップＳＴ１３〜ＳＴ２１）。

【０１６９】また、ＣＡｓ＝ＣＡｔでない場合には、つまり、ＣＡｔ＝Ｐｏｌｌである場合には、ステップＳＴ２９の判断結果は否定（ステップＳＴ２９：Ｎｏ）となり、ステップＳＴ２７に進み、上述したように差分の抽出が行われる。その後、ステップＳＴ１０→ＳＴ１２→ＳＴ１３と進み、不要な再送は行われず、必要な再送が実施される（ステップＳＴ１３〜ＳＴ２１）。また、送信理由ＣＡｓがＰｏｌｌビットの受信でなく（ステップＳＴ２５：Ｎｏ）しかもTime Out（タイムアウト）でない場合（ステップＳＴ２８：Ｎｏ）、つまり、抜け検出「Miss」による場合は、直接ステップＳＴ２７に進み、上述したように差分の抽出が行われる。その後、ステップＳＴ１０→ＳＴ１２→ＳＴ１３と進み、不要な再送は行われず、必要な再送が実施される（ステップＳＴ１３〜ＳＴ２１）。

【０１７０】このように、この実施の形態4によれば、再送実施決定時にそれまで送信できたデータパケットのシーケンス番号上限値等を設定した再送制御テーブルを作成しておき、受信された状態通知メッセージに含まれるシーケンス番号上限値と再送制御テーブルのシーケンス番号上限値情報との大小比較を行い、受信された状態通知メッセージの作成時点を判断するようにした。また、同番のシーケンス番号の付与されたデータパケットが送信される場合があることに備えて、受信側が状態通知メッセージに送信理由を付加するようにしたので、それらに基づき再送の要否判断が適切に行えるようになる。

【０１７１】実施の形態５．図１４は、この発明の実施の形態５であるマルチキャストデータパケット伝送システムの構成を示すブロック図である。図１５は、図１４に示す送信局が再送制御のために備える再送制御テーブルの構成例を示す図である。

【０１７２】図１４に示すように、マルチキャストデータパケット伝送システムは、マルチキャストデータパケットの送信装置である送信局１ａと、マルチキャストパケットデータの受信装置である複数の受信局（図１４では、受信局２ａ，２ｂ，２ｃが示されている）とが、個別伝送路（個別無線伝送路または個別有線伝送路）もしくは共通伝送路（共通無線伝送路または共通有線伝送路）を介して送受信を行うように構成されている。

【０１７３】すなわち、送信局１ａは、個別伝送路（個別無線伝送路または個別有線伝送路）もしくは共通伝送路（共通無線伝送路または共通有線伝送路）３ａ，３ｂ，３ｃを使用してマルチキャストデータパケット(RLC-PDU)を複数の受信局２ａ，２ｂ、２ｃに対して伝送する。この送信局から受信局への伝送路を下り伝送路と称し、マルチキャストデータパケット(RLC-PDU)は、下り伝送路上のマルチキャストチャネルを使用して送信される。

【０１７４】また、複数の受信局２ａ，２ｂ，２ｃは、それぞれ個別伝送路（個別無線伝送路または個別有線伝送路）もしくは共通伝送路（共通無線伝送路または共通有線伝送路）４ａ，４ｂ，４ｃを使用して状態通知メッセージ(STATUS-PDU)を送信局に対して伝送する。この受信局から送信局への伝送路を上り伝送路と称し、状態通知メッセージ(STATUS-PDU)は、上り個別伝送路上の上り個別チャネル、もしくは上り共通伝送路上の上り共通チャネルを使用して送信される。

【０１７５】図１４に示す送信局１ａは、例えば、図2に示すように構成されるが、この実施の形態５では、Ｐｏｌｌビットやpoll　Counter１３を用いないで再送制御を行う。したがって、再送制御テーブルも図4に示した再送制御テーブル１５ではなく、例えば、図１５に示す構成の再送制御テーブル１５０を用いる。また、マルチキャストデータパケット(RLC-PDU)のフォーマットには、図２３に示したフォーマットを用いることにする。

【０１７６】また、受信局２ａ，２ｂ，２ｃは、それぞれ、例えば、図5に示すように構成される。図5において、送信理由作成部２４では、抜け検出やタイムアウトを受けて、無条件に再送を要求する送信理由と、無条件ではない再送を要求する送信理由とが作成される。なお、メッセージ要求を受けて送信理由を作成する場合はないとしている。状態通知メッセージ作成部２５では、状態通知メッセージ(STATUS-PDU)が図7，図２５，図２６に示したフォーマットで作成される。

【０１７７】図１５に示す再送制御テーブル１５０は、ＳＮ１５１と、ＶＴＭｔ１５２と、再送フラグ１５３との3つの項目欄で構成されている。ＳＮ１５１には、送信するマルチキャストデータパケット(RLC-PDU)の一連

のシーケンス番号が設定される。図１５では、ＳＮ１５１には、番号０から番号２０４７までの一連のシーケンス番号が設定されている。

【０１７８】ＶＴＭｔ１５２には、再送を実施するときに、ＳＮ１５１における再送を実施するマルチキャストデータパケット(RLC-PDU)のシーケンス番号が記載されている行において、その再送を実施する送信間隔TTI内に送信するマルチキャストデータパケット(RLC-PDU)のシーケンス番号上限値が設定される。

【０１７９】再送フラグ１５３には、ＳＮ１５１におけるシーケンス番号毎に、再送未実施のときは“ＯＦＦ”フラグが設定され、再送実施時に“ＯＮ”フラグが設定される。つまり、再送フラグ１５３には、ＶＴＭｔ１５２に有効な値が設定されたときに対応するシーケンス番号について再送実施済みを示す“ＯＮ”フラグが設定される。そして、同番の新規マルチキャストデータパケット(RLC-PDU)を送信する際にクリアされ、再送未実施を示す“ＯＦＦ”フラグが設定される。

【０１８０】次に、図１６を参照して、図１４に示すマルチキャストデータパケット伝送システムにおいて実施されるマルチキャストデータパケットの再送制御動作を説明する（動作例１）。なお、図１６は、受信局から送信局への状態通知メッセージの送信に上り共通チャネルを使用する場合のマルチキャストデータパケットの再送制御動作を説明するシーケンス図である。

【０１８１】先に説明した実施の形態１～４と同様に、この実施の形態５および以降に説明する実施の形態６～９においても、送信間隔TTI毎に４個のマルチキャストデータパケット(RLC-PDU)を送信する場合の例が示されている。また、送信局１ａと受信局２ａ，２ｂ，２ｃの送信間隔TTIは同じで、送信と受信のタイミングはずれていないとしている点も同様である。但し、この実施の形態５および以降に説明する実施の形態６～９において用いるマルチキャストデータパケット(RLC-PDU)は、前述したように図２３に示したフォーマットで構成される。以降、マルチキャストデータパケット(RLC-PDU)は、単に「RLC-PDU」または「RLC-PDU３００ａ」と記す。また、状態通知メッセージ(STATUS-PDU)３１０－２は、単に「STATUS-PDU」または「STATUS-PDU３１０－２」と記す。

【０１８２】図１６において、送信局１ａは、送信間隔TTI-0の期間において４個のRLC-PDU（Seq.No=0,1,2,3）３００ａを送信する。受信局２ａは、次の送信間隔TTI-1の期間にて実施するプロトコル処理１１０－４ａでのRLC-PDU受信処理において、送信局１ａが送信間隔TTI-0の期間において送信した４個のRLC-PDU（Seq.No=0,1,2,3）３００ａのうち、１個のRLC-PDU（Seq.No=1）３００ａの抜けが検出（ＳＮ＝１抜け検出）されたので、再送を要求するSTATUS-PDU（２００－４ａ）３１０－２を次のようにして作成する。

【０１８３】受信局２ｂでも、同じ送信間隔TTI-1の期間にて実施するプロトコル処理１１０－４ｂでのRLC-PDU受信処理において、送信局１ａが送信間隔TTI-0の期間において送信した４個のRLC-PDU（Seq.No=0,1,2,3）３００ａのうち、２個のRLC-PDU（Seq.No=1,2）３００ａの抜けが検出（ＳＮ＝１，２抜け検出）されたので、再送を要求するSTATUS-PDU（２００－４ｂ）３１０－２を次のようにして作成する。

【０１８４】すなわち、STATUS-PDU（２００－４ａ）３１０－２とSTATUS-PDU（２００－４ｂ）３１０－２とでは、図７，図２５，図２６において、送信理由「Cause」３１５に“送信シーケンス番号３０２の抜け検出”を示す「Miss」が設定される。「ＬＳＮ」４１２に正常に受信できたシーケンス番号の上限値（「ＶＴＭｓ」と記述する）「３」の次の値（次に受信を期待するシーケンス番号）「４」が設定される。「ＳＮ」４２４に再送を要求するRLC-PDU３００ａの先頭のシーケンス番号「１」が設定される。「Ｌ」４２５には、受信局２ａのSTATUS-PDU（２００－４ａ）３１０－２では後続数「０」が設定され、受信局２ｂのSTATUS-PDU（２００－４ｂ）３１０－２では後続数「１」が設定される。

【０１８５】受信局２ａ，２ｂは、共に、送信局に対して再送を要求するために、次の送信間隔TTI-2の期間において上記のような内容を有するSTATUS-PDU（２００－４ａ）３１０－２，STATUS-PDU（２００－４ｂ）３１０－２を上り共通チャネル上に送信を試みる。つまり、上り共通チャネルへのアクセス権の獲得制御が実施される。その結果、受信局２ａが送信権を獲得し、送信間隔TTI-2の期間において、STATUS-PDU（２００－４ａ）３１０－２を上り共通チャネル上に送信する。また、受信局２ｂは、ランダムな時間間隔の後、例えば５送信間隔の後の送信間隔TTI-7の期間において上り共通チャネル上への送信権を獲得し、STATUS-PDU（２００－４ｂ）３１０－２を上り共通チャネル上に送信する。

【０１８６】送信局１ａは、次の送信間隔TTI-3の期間にて実施するプロトコル処理１００－４でのSTATUS-PDU受信処理において、受信局２ａから受信されたSTATUS-PDU（２００－４ａ）３１０－２から１個のRLC-PDU(Seq.No=1)３００ａの再送要求を認識する。これによって、送信局１ａは、図１５に示す再送制御テーブル１５０をチェックし、再送要求されたSeq.No=1のRLC-PDU３００ａの再送状況を調べる。ＳＮ１５１におけるＳＮ＝１に対する再送フラグ１５３は、“ＯＦＦ”である。

【０１８７】そこで、送信局１ａは、再送未実施であると判断し、Seq.No=1のRLC-PDU３００ａの再送を準備する。再送制御テーブル１５０では、ＳＮ１５１におけるＳＮ＝１に対するＶＴＭｔ１５２の値を送信間隔TTI-3の期間において送信されるシーケンス番号の上限値「１５」に設定し、対応する再送フラグ１５３に“ＯＮ”フラグを設定する。そして、送信局１ａは、次の送信間隔

TTI-4の期間において、再送RLC-PDU(Seq.No=1)３００ａと共に新規RLC-PDU(Seq.No=16,17,18)３００ａを下り伝送路上のマルチキャストチャネルを使用して送信する。

【０１８８】受信局２ａでは、次の送信間隔TTI-5の期間にて実施するプロトコル処理１１１－４ａでのRLC-PDU受信処理において、送信局１ａが送信間隔TTI-4の期間において送信した４個のRLC-PDU（Seq.No=1,16,17,18）が正しく受信され、再送を要求したSeq.No=1のRLC-PDU３００ａの受信が確認される（ＳＮ＝１再送確認）。

【０１８９】受信局２ｂでも、同じ送信間隔TTI-5の期間にて実施するプロトコル処理１１１－４ｂでのRLC-PDU受信処理において、送信局１ａが送信間隔TTI-4の期間において送信した４個のRLC-PDU（Seq.No=1,16,17,18）が正しく受信され、再送を要求しようとしたSeq.No=1,2のRLC-PDU３００ａのうち、Seq.No=1のRLC-PDU３００ａの受信が確認される（ＳＮ＝１再送確認）。

【０１９０】一方、受信局２ｃでは、その同じ送信間隔TTI-5の期間にて実施するプロトコル処理１１１－４ｃでのRLC-PDU受信処理において、送信局１ａが送信間隔TTI-4の期間において送信した４個のRLC-PDU（Seq.No=1,16,17,18)のうち、１個のRLC-PDU（Seq.No=17）３００ａの抜けが検出（ＳＮ＝１７抜け検出）されたので、再送を要求するSTATUS-PDU（２００－４ｃ）３１０－２を作成する。

【０１９１】このSTATUS-PDU（２００－４ｃ）３１０－２には、図７，図２５，図２６において、送信理由「Cause」３１５に“送信シーケンス番号３０２の抜け検出”を示す「Miss」が設定される。「ＬＳＮ」４１２に正常に受信できたシーケンス番号の上限値（ＶＴＭｓ）「１８」の次の値（次に受信を期待するシーケンス番号）「１９」が設定される。「ＳＮ」４２４に再送を要求するRLC-PDU３００ａの先頭シーケンス番号「１７」が設定される。「Ｌ」４２５には、後続数「０」が設定される。

【０１９２】受信局２ｃは、送信局に対して再送を要求するために、次の送信間隔TTI-6の期間において上記のような内容を有するSTATUS-PDU（２００－４ｃ）３１０－２を上り共通チャネル上に送信を試みる。つまり、上り共通チャネルへのアクセス権の獲得制御が実施される。その結果、受信局２ｃは送信権を獲得し、STATUS-PDU（２００－４ｃ）３１０－２を上り共通チャネル上に送信する。

【０１９３】ここで、上記したように、次の送信間隔TTI-7の期間においては、受信局２ｂは、STATUS-PDU（２００－４ｂ）３１０－２を上り共通チャネル上に送信する。受信局２ｂでは、先の送信間隔TTI-5の期間においてSeq.No=1のRLC-PDU３００ａは受信済みである。しかし、この送信間隔TTI-7の期間において送信するSTATUS-PDU（２００－４ｂ）３１０－２は、抜けを検出したプロトコル処理１１０－４ｂにて作成されたものであるので、Seq.No=1,2のRLC-PDU３００ａについての再送要求が行われる。

【０１９４】送信局１ａは、次の送信間隔TTI-7の期間にて実施するプロトコル処理１０１－４でのSTATUS-PDU受信処理において、受信局２ｃから受信されたSTATUS-PDU（２００－４ｃ）３１０－２から１個のRLC-PDU(Seq.No=17)３００ａの再送要求を認識する。これによって、送信局１ａは、図１５に示す再送制御テーブル１５０をチェックし、再送要求されたSeq.No=17のRLC-PDU３００ａの再送状況を調べる。ＳＮ１５１におけるＳＮ＝１７に対する再送フラグ１５３は、“ＯＦＦ”である。

【０１９５】そこで、送信局１ａは、再送未実施であると判断し、Seq.No=17のRLC-PDU３００ａの再送を準備する。再送制御テーブル１５０では、ＳＮ１５１におけるＳＮ＝１７に対するＶＴＭｔ１５２の値を送信間隔TTI-7の期間において送信されるシーケンス番号の上限値「３０」に設定し、対応する再送フラグ１５３に“ＯＮ”フラグを設定する。

【０１９６】そして、送信局１ａは、次の送信間隔TTI-8の期間において、再送RLC-PDU(Seq.No=17)３００ａと共に新規RLC-PDU(Seq.No=31,32,33)３００ａを下り伝送路上のマルチキャストチャネルを使用して送信する。受信局２ｃでは、次の送信間隔TTI-8の期間において実施するプロトコル処理１１１－４ｃでのRLC-PDU受信処理において、再送RLC-PDU(Seq.No=17)３００ａの受信を確認する（ＳＮ＝１７再送確認）。

【０１９７】このとき、送信局１ａでは、さらに、送信間隔TTI-8の期間において実施するプロトコル処理１０２－４でのSTATUS-PDU受信処理において、受信局２ｂから受信されたSTATUS-PDU（２００－４ｂ）３１０－２から２個のRLC-PDU(Seq.No=1,2)３００ａの再送要求を認識する。これによって、送信局１ａは、図１５に示す再送制御テーブル１５０をチェックし、再送要求されたSeq.No=1,2のRLC-PDU３００ａの再送状況を調べる。ＳＮ１５１におけるＳＮ＝１に対する再送フラグ１５３は、“ＯＮ”であるので、再送済みである。一方、ＳＮ＝２に対する再送フラグ１５３は、“ＯＦＦ”であるので、再送未実施であることがわかる。

【０１９８】そこで、送信局１ａでは、ＳＮ１５１におけるＳＮ＝１についての再送の要否を次のようにして決定する。すなわち、受信局２ｂから受信されたSTATUS-PDU（２００－４ｂ）３１０－２に設定されているシーケンス番号の上限値ＶＴＭｓと再送制御テーブルに設定されているシーケンス番号の上限値ＶＴＭｔとの大小比較を行い、ＳＮ＝１についての再送の要否を決定する。ここでは、ＶＴＭｓ＝３、ＶＴＭｔ＝１５であるので、ＶＴＭｓ＜ＶＴＭｔとなり、再送不要と判断し、ＳＮ＝１，すなわち、Seq.No=1のRLC-PDU３００ａについては再送を再度準備することはしない。

【０１９９】一方、ＳＮ１５１におけるＳＮ＝２につい

ては再送を実施するので、Seq.No=2のRLC-PDU３００ａの再送を準備する。再送制御テーブル１５０では、ＳＮ＝２に対応するＶＴＭｔ１５２の値に送信間隔TTI-8の期間において送信されるシーケンス番号の上限値「３３」を設定し、再送フラグ１５３に“ＯＮ”フラグを設定する。

【０２００】そして、送信局１ａは、次の送信間隔TTI-9において、再送RLC-PDU(Seq.No=2)３００ａと共に、新規RLC-PDU(Seq.No=34,35,36)３００ａを下り伝送路上のマルチキャストチャネルを使用して送信する。受信局２ｂでは、次の送信間隔TTI-10の期間において実施するプロトコル処理１１２－４ｂでのRLC-PDU受信処理において、再送RLC-PDU(Seq.No=2)３００ａの受信を確認する（ＳＮ＝２再送確認）。

【０２０１】このように、この実施の形態５によれば、マルチキャストデータパケットを送信する送信局は、複数の受信局から、状態通知メッセージ２００－４ｂと状態通知メッセージ２００－４ｃのように順番が入れ違って通知される再送要求や、状態通知メッセージ２００－４ａと状態通知メッセージ２００－４ｂのように重複して通知される再送要求に対して、マルチキャストデータパケットに対応した再送制御テーブルを使用することにより、重複して再送を実施することを抑制することができる。したがって、下り伝送路（無線伝送路あるいは有線伝送路）のリソースを無駄に消費することが防止できる。

【０２０２】実施の形態６．図１７は、この発明の実施の形態６であるマルチキャストデータパケットの再送制御方法を説明するシーケンス図である。この実施の形態６では、図１４に示したマルチキャストデータパケット伝送システムにおいて実施されるマルチキャストデータパケット再送制御動作の動作例２として、受信局から送信局への状態通知メッセージの送信理由に再送制御テーブルの設定値によらず無条件に再送の実施を要求するものが含まれる場合のマルチキャストデータパケット再送制御動作が示されている。なお、図１７では、各受信局は、送信局への状態通知メッセージの送信を上り共通チャネルを使用して行うとしている。また、この実施の形態６でも、図７、図１５、図２５、図２６に示したメッセージや再送制御テーブルは同様に使用される。

【０２０３】図１７において、送信局１ａは、送信間隔TTI-0の期間において４個のRLC-PDU（Seq.No=0,1,2,3）３００ａを送信する。受信局２ａは、次の送信間隔TTI-1にて実施するプロトコル処理１１０－５ａでのRLC-PDU受信処理において、送信局１ａが送信間隔TTI-0の期間において送信した４個のRLC-PDU（Seq.No=0,1,2,3）３００ａのうち、１個のRLC-PDU（Seq.No=1）３００ａの抜けが検出（ＳＮ＝１抜け検出）されたので、再送を要求するSTATUS-PDU（２００－５ａ）３１０－２を次のようにして作成する。

【０２０４】受信局２ｂでも、同じ送信間隔TTI-1にて実施するプロトコル処理１１０－５ｂでのRLC-PDU受信処理において、送信局１ａが送信間隔TTI-0の期間において送信した４個のRLC-PDU（Seq.No=0,1,2,3）３００ａのうち、２個のRLC-PDU（Seq.No=1,2）３００ａの抜けが検出（ＳＮ＝１，２抜け検出）されたので、再送を要求するSTATUS-PDU（２００－５ｂ）３１０－２を次のようにして作成する。

【０２０５】すなわち、STATUS-PDU（２００－５ａ）３１０－２とSTATUS-PDU（２００－５ｂ）３１０－２には、図７，図２５，図２６において、「ＬＳＮ」４１２に正常に受信できたシーケンス番号の上限値（「ＶＴＭｓ」と記述する）「３」の次の値（次に受信を期待するシーケンス番号）「４」が設定される。「ＳＮ」４２４に再送を要求するRLC-PDU３００ａの先頭のシーケンス番号「１」が設定される。「Ｌ」４２５には、受信局２ａのSTATUS-PDU（２００－５ａ）３１０－２では後続数「０」が設定され、受信局２ｂのSTATUS-PDU（２００－５ｂ）３１０－２では後続数「１」が設定される。また、送信理由「Cause」３１５には、受信局２ａのSTATUS-PDU（２００－５ａ）３１０－２では“送信シーケンス番号３０２の抜け検出”を示す「Miss」が設定され、受信局２ｂのSTATUS-PDU（２００－５ｂ）３１０－２では“無条件再送要求”を示す「Miss-A」が設定される。

【０２０６】受信局２ａ，２ｂは、共に、送信局１ａに対して再送を要求するために、次の送信間隔TTI-2の期間において上記のような内容を有するSTATUS-PDU（２００－５ａ）３１０－２，STATUS-PDU（２００－５ｂ）３１０－２を上り共通チャネル上に送信を試みる。つまり、上り共通チャネルへのアクセス権の獲得制御が実施される。その結果、受信局２ａが送信権を獲得し、送信間隔TTI-2の期間において、STATUS-PDU（２００－５ａ）３１０－２を上り共通チャネル上に送信する。また、受信局２ｂは、次の送信間隔TTI-3の期間において上り共通チャネル上への送信権を獲得し、STATUS-PDU（２００－５ｂ）３１０－２を上り共通チャネル上に送信する。

【０２０７】送信局１ａは、送信間隔TTI-3の期間にて実施するプロトコル処理１００－５でのSTATUS-PDU受信処理において、受信局２ａから受信されたSTATUS-PDU（２００－５ａ）３１０－２から１個のRLC-PDU(Seq.No=1)３００ａの再送要求を認識する。これによって、送信局１ａは、図１５に示す再送制御テーブル１５０をチェックし、再送要求されたSeq.No=1のRLC-PDU３００ａの再送状況を調べる。ＳＮ１５１におけるＳＮ＝１に対する再送フラグ１５３は、“ＯＦＦ”である。

【０２０８】そこで、送信局１ａは、再送未実施であると判断し、Seq.No=1のRLC-PDU３００ａの再送を準備する。再送制御テーブル１５０では、ＳＮ１５１におけるＳＮ＝１に対するＶＴＭｔ１５２の値を送信間隔TTI-3

の期間において送信されるシーケンス番号の上限値「１５」に設定し、再送フラグ１５３に“ＯＮ”フラグを設定する。そして、送信局１ａは、次の送信間隔TTI-4の期間において、再送RLC-PDU(Seq.No=1)３００ａと共に、新規RLC-PDU(Seq.No=16,17,18)３００ａを下り伝送路上のマルチキャストチャネルを使用して送信する。

【０２０９】さらに、送信局１ａは、この送信間隔TTI-4の期間にて実施するプロトコル処理１０１－５でのSTATUS-PDU受信処理において、受信局２ｂから受信されたSTATUS-PDU３１０－２（２００－５ｂ）から２個のRLC-PDU(Seq.No=1,2）３００ａの無条件再送要求を認識する。そのため、送信局１ａは、再送制御テーブル１５０のチェックは行わず、再送要求されたシーケンス番号(Seq.No=1,2）のRLC-PDU３００ａの再送を準備する。再送制御テーブル１５０では、ＳＮ１５１におけるＳＮ＝１，２のそれぞれに対するＶＴＭｔ１５２の値を送信間隔TTI-4の期間において送信されるシーケンス番号の上限値「１８」に設定し、再送フラグ１５３に“ＯＮ”フラグを設定する。

【０２１０】そして、送信局１ａは、次の送信間隔TTI-5の期間において、再送RLC-PDU(Seq.No=1,2)３００ａと共に、新規RLC-PDU(Seq.No=19,20)３００ａを下り伝送路上のマルチキャストチャネルを使用して送信する。この送信間隔TTI-5の期間では、受信局２ａでは、プロトコル処理１１１－５ａでのRLC-PDU受信処理において、送信局１ａが送信間隔TTI-4の期間において送信したSeq.No=1のRLC-PDU３００ａの受信が確認される（ＳＮ＝１再送確認）。同様に、受信局２ｂでは、プロトコル処理１１１－５ｂでのRLC-PDU受信処理において、送信局１ａが送信間隔TTI-4の期間において送信したSeq.No=1のRLC-PDU３００ａの受信が確認される（ＳＮ＝１再送確認）。

【０２１１】また、受信局２ｂでは、次の送信間隔TTI-6の期間にて実施するプロトコル処理１１２－５ｂでのRLC-PDU受信処理において、送信局１ａが送信間隔TTI-5の期間において送信したSeq.No=1,2のRLC-PDU３００ａの受信が確認される。Seq.No=1のRLC-PDU３００ａは、先の送信間隔TTI-5の期間において受信処理済みであるので、この送信間隔TTI-6の期間にて実施するプロトコル処理１１２－５ｂでのRLC-PDU受信処理では、今回受信が確認されたSeq.No=1のRLC-PDU３００ａは、廃棄処理される。すなわち、ＳＮ＝２の再送が確認される。

【０２１２】このように、この実施の形態６によれば、マルチキャストデータパケットを送信する送信局は、複数の受信局から重複して通知される再送要求に対して、マルチキャストデータパケットに対応した再送制御テーブルを使用することにより、重複して再送を実施することを抑制する一方、早急に送達確認を行いたい受信局に対しては、再送制御テーブルを使用しないとすることにより、不必要な遅延を発生させることなく再送を実施することができる。

【０２１３】実施の形態７．図１８は、この発明の実施の形態７であるマルチキャストデータパケットの再送制御方法を説明するシーケンス図である。この実施の形態７では、図１４に示したマルチキャストデータパケット伝送システムにおいて実施されるマルチキャストデータパケット再送制御動作の動作例３として、受信局から送信局への状態通知メッセージの送信に上り個別チャネルを使用する場合のマルチキャストデータパケット再送制御動作が示されている。なお、この実施の形態７でも、図７、図１５、図２５、図２６に示したメッセージや再送制御テーブルは同様に使用される。

【０２１４】図１８において、送信局１ａは、送信間隔TTI-0の期間において４個のRLC-PDU（Seq.No=0,1,2,3）３００ａを送信する。受信局２ａは、次の送信間隔TTI-1にて実施するプロトコル処理１１０－６ａでのRLC-PDU受信処理において、送信局１ａが送信間隔TTI-0の期間において送信した４個のRLC-PDU（Seq.No=0,1,2,3）３００ａのうち、１個のRLC-PDU（Seq.No=1）３００ａの抜けが検出（ＳＮ＝１抜け検出）されたので、再送を要求するSTATUS-PDU（２００－６ａ）３１０－２を次のようにして作成する。

【０２１５】受信局２ｂでも、同じ送信間隔TTI-1にて実施するプロトコル処理１１０－６ｂでのRLC-PDU受信処理において、送信局１ａが送信間隔TTI-0の期間において送信した４個のRLC-PDU（Seq.No=0,1,2,3）３００ａのうち、２個のRLC-PDU（Seq.No=1,2）３００ａの抜けが検出（ＳＮ＝１，２抜け検出）されたので、再送を要求するSTATUS-PDU（２００－６ｂ）３１０－２を次のようにして作成する。

【０２１６】すなわち、STATUS-PDU（２００－６ａ）３１０－２とSTATUS-PDU（２００－６ｂ）３１０－２には、図７，図２５，図２６において、送信理由「Cause」３１５に“送信シーケンス番号３０２の抜け検出”を示す「Miss」が設定される。「ＬＳＮ」４１２に正常に受信できたシーケンス番号の上限値（ＶＴＭｓ）「３」の次の値（次に受信を期待するシーケンス番号）「４」が設定される。「ＳＮ」４２４に再送を要求するRLC-PDU３００ａの先頭のシーケンス番号「１」が設定される。「Ｌ」４２５には、受信局２ａのSTATUS-PDU（２００－６ａ）３１０－２では後続数「０」が設定され、受信局２ｂのSTATUS-PDU（２００－６ｂ）３１０－２では後続数「１」が設定される。

【０２１７】受信局２ａ，２ｂは、共に、次の送信間隔TTI-2の期間において上記のような内容を有するSTATUS-PDU（２００－６ａ）３１０－２，STATUS-PDU（２００－６ｂ）３１０－２を上り個別チャネル上に送信し、送信局１ａに対して再送を要求する。送信局１ａは、次の送信間隔TTI-3の期間にて実施するプロトコル処理１００－６でのSTATUS-PDUの受信処理において、受信局２

ａ，２ｂからの再送要求を認識し、再送の要否を判断する。この判断は、順不同であるが、ここでは、受信局２ａ，２ｂの順に判断するとする。

【０２１８】すなわち、送信局１ａは、まず、受信局２ａからのSTATUS-PDU（２００－６ａ）３１０－２の受信処理において、１個のRLC-PDU(Seq.No=1)３００ａの再送要求を認識する。これによって、送信局１ａは、図１５に示す再送制御テーブル１５０をチェックし、再送要求されたSeq.No=1のRLC-PDU３００ａの再送状況を調べる。ＳＮ１５１におけるＳＮ＝１に対する再送フラグ１５３は、“ＯＦＦ”である。

【０２１９】そこで、送信局１ａは、再送未実施であると判断し、Seq.No=1のRLC-PDU３００ａの再送を準備する。再送制御テーブル１５０では、ＳＮ１５１におけるＳＮ＝１に対するＶＴＭｔ１５２の値を送信間隔TTI-3の期間において送信されるシーケンス番号の上限値「１５」に設定し、再送フラグ１５３に“ＯＮ”フラグを設定する。

【０２２０】次いで、送信局１ａは、受信局２ｂからのSTATUS-PDU（２００－６ｂ）３１０－２の受信処理において、２個のRLC-PDU(Seq.No=1,2）の再送要求を認識する。これによって、送信局１ａは、図１５に示す再送制御テーブル１５０をチェックし、再送要求されたSeq.No=1,2のRLC-PDU３００ａの再送状況を調べる。Seq.No=1のRLC-PDU３００ａについては、再送制御テーブル１５０でのＳＮ１５１におけるＳＮ＝１に対する再送フラグ１５３が“ＯＮ”になっている。

【０２２１】すなわち、再送済みであるので、再送の要否を調べるために、設定されているＶＴＭｔ１５２の値「１５」と、受信局２ｂからのSTATUS-PDU３１０－２（２００－６ｂ）に設定されているＶＴＭｓの値「３」との大小比較を行う。ＶＴＭｓ＜ＶＴＭｔであるので、再送不要と判断し、ＳＮ＝１（Seq.No=1のRLC-PDU３００ａ）の再送を再度準備することはしない。

【０２２２】しかし、Seq.No=2のRLC-PDU３００ａについては、ＳＮ１５１におけるＳＮ＝２に対する再送フラグ１５３は、“ＯＦＦ”である。そこで、送信局１ａは、再送未実施であると判断し、Seq.No=2のRLC-PDU３００ａの再送を準備する。再送制御テーブル１５０では、ＳＮ１５１におけるＳＮ＝２に対するＶＴＭｔ１５２の値を送信間隔TTI-3の期間において送信されるシーケンス番号の上限値「１５」に設定し、再送フラグ１５３に“ＯＮ”フラグを設定する。

【０２２３】そして、送信局１ａは、次の送信間隔TTI-4の期間において、再送RLC-PDU（Seq.No=1,2）と共に、新規RLC-PDU（Seq.No=16,17）を下り伝送路上のマルチキャストチャネルを使用して送信する。その結果、次の送信間隔TTI-5の期間において、受信局２ａでは、プロトコル処理１１１－６ａでのRLC-PDU受信処理において、送信局１ａが送信間隔TTI-4の期間において送信したSeq.No=1,2のRLC-PDU３００ａのうち、Seq.No=2のRLC-PDU３００ａは廃棄処理され、Seq.No=1のRLC-PDU３００ａの受信が確認される（ＳＮ＝１再送確認）。同様に、受信局２ｂでは、プロトコル処理１１１－６ｂでのRLC-PDU受信処理において、送信局１ａが送信間隔TTI-4の期間において送信したSeq.No=1,2のRLC-PDU３００ａの受信が確認される（ＳＮ＝１，２再送確認）。

【０２２４】このように、この実施の形態７によれば、マルチキャストデータパケットを送信する送信局は、複数の受信局から重複して通知される再送要求に対して、マルチキャストデータパケットに対応した再送制御テーブルを使用することにより、重複して再送を実施することを抑制することができる。したがって、下り伝送路（無線伝送路あるいは有線伝送路）のリソースを無駄に消費することが防止できる。

【０２２５】実施の形態８．図１９は、この発明の実施の形態８であるマルチキャストデータパケットの再送制御方法を説明するシーケンス図である。この実施の形態８では、図１４に示したマルチキャストデータパケット伝送システムにおいて実施されるマルチキャストデータパケット再送制御動作の動作例４として、送信局から受信局に再送したマルチキャストデータパケットが再度紛失した場合のマルチキャストデータパケット再送制御動作が示されている。なお、図１９では、各受信局は、送信局への状態通知メッセージの送信を上り個別チャネルを使用して行うとしている。また、この実施の形態８でも、図７、図１５、図２５、図２６に示したメッセージや再送制御テーブルは同様に使用される。

【０２２６】図１９において、送信局１ａは、送信間隔TTI-m0の期間において４個のRLC-PDU(Seq.No=2010,2011,2012,2013)３００ａを送信する。受信局２ａは、次の送信間隔TTI-m1にて実施するプロトコル処理１１０－７ａでのRLC-PDU受信処理において、送信局１ａが送信間隔TTI-m0の期間において送信した４個のRLC-PDU(Seq.No=2010,2011,2012,2013)３００ａのうち、１個のRLC-PDU（Seq.No=2011）３００ａの抜けが検出（ＳＮ＝２０１１抜け検出）されたので、再送を要求するSTATUS-PDU（２００－７ａ）３１０－２を次のようにして作成する。

【０２２７】すなわち、STATUS-PDU（２００－７ａ）３１０－２には、図７，図２５，図２６において、送信理由「Cause」３１５に“送信シーケンス番号３０２の抜け検出”を示す「Miss」が設定される。「ＬＳＮ」４１２に正常に受信できたシーケンス番号の上限値（ＶＴＭｓ）「2013」の次の値（次に受信を期待するシーケンス番号）「2014」が設定される。「ＳＮ」４２４に再送を要求するRLC-PDU３００ａの先頭のシーケンス番号「2011」が設定される。「Ｌ」４２５には、後続数「０」が設定される。

【０２２８】受信局２ａは、送信局に対して再送を要求

するために、次の送信間隔TTI-m2の期間において上記のような内容を有するSTATUS-PDU（２００－７ａ）３１０－２を上り個別チャネル上に送信し、再送確認タイマを起動する。

【０２２９】送信局１ａは、送信間隔TTI-m3の期間にて実施するプロトコル処理１００－７でのSTATUS-PDU受信処理において、受信局２ａから受信されたSTATUS-PDU（２００－７ａ）３１０－２から１個のRLC-PDU(Seq.No=2011)３００ａの再送要求を認識する。これによって、送信局１ａは、図１５に示す再送制御テーブル１５０をチェックし、再送要求されたSeq.No=2011のRLC-PDU３００ａの再送状況を調べる。ＳＮ１５１におけるＳＮ＝２０１１に対する再送フラグ１５３は、“ＯＦＦ”である。

【０２３０】そこで、送信局１ａは、再送未実施であると判断し、Seq.No=2011のRLC-PDU３００ａの再送を準備する。再送制御テーブル１５０では、ＳＮ１５１におけるＳＮ＝２０１１に対するＶＴＭｔ１５２の値を送信間隔TTI-m3の期間において送信されるシーケンス番号の上限値「２０２５」に設定し、再送フラグ１５３に“ＯＮ”フラグを設定する。そして、送信局１ａは、次の送信間隔TTI-m4の期間において、再送RLC-PDU(Seq.No=2011)３００ａと共に、新規RLC-PDU(Seq.No=2026,2027,2028)３００ａを下り伝送路上のマルチキャストチャネルを使用して送信する。

【０２３１】ここで、送信局が送信間隔TTI-m4の期間において再送したRLC-PDU（SN=2011）３００ａを受信局２ａが再度正しく受信できなかったとする。受信局２ａでは、送信間隔TTI-n1の期間にて実施するプロトコル処理１１１－７ａでのRLC-PDU受信処理において、再送確認タイマのタイムアウトが認識され、再度再送を要求するSTATUS-PDU（２０１－７ａ）３１０－２が作成される。

【０２３２】すなわち、このSTATUS-PDU（２０１－７ａ）３１０－２には、図７，図２５，図２６において、送信理由「Cause」３１５に“送信シーケンス番号３０２の抜け検出”を示す「Miss」が設定される。「ＬＳＮ」４１２に正常に受信できたシーケンス番号の上限値（「ＶＴＭｓ」）「１０」の次の値（次に受信を期待するシーケンス番号）「１１」が設定される。「ＳＮ」４２４に再送を要求するRLC-PDU３００ａの先頭のシーケンス番号「２０１１」が設定される。「Ｌ」４２５には後続数「０」が設定される。

【０２３３】そして、受信局２ａは、送信局に対して再送を要求するために、次の送信間隔TTI-n2の期間において上記のような内容を有するSTATUS-PDU（２０１－７ａ）３１０－２を上り個別チャネル上に送信し、再送確認タイマを起動する。送信局１ａは、次の送信間隔TTI-n3にて実施するプロトコル処理１０１－７でのSTATUS-PDU受信処理において、受信局２ａから受信されたSTATUS-PDU（２０１－７ａ）３１０－２から１個のRLC-PDU(Seq.No=2011)３００ａの再送要求を認識する。これによって、送信局１ａは、図１５に示す再送制御テーブル１５０をチェックし、再送要求されたSeq.No=2011のRLC-PDU３００ａの再送状況を調べる。

【０２３４】再送制御テーブル１５０でのＳＮ１５１におけるＳＮ＝２０１１に対する再送フラグ１５３が“ＯＮ”になっているので、再送実施済みである。そこで、再送の要否を調べるため、再送制御テーブル１５０でのＶＴＭｔ１５２に設定されている上限値ＶＴＭｔと、STATUS-PDU（２０１－７ａ）３１０－２から上限値ＶＴＭｓの大小比較を行う。シーケンス番号は一巡したので、ＶＴＭｓ＝２０４８＋１０であるのに対し、ＶＴＭｔ＝２０２８であり、ＶＴＭｓ＞ＶＴＭｔとなる。すなわち、送信局１ａは、再送要求されたSeq.No=2011のRLC-PDU３００ａの再送を準備する。再送制御テーブル１５０では、ＳＮ１５１におけるＳＮ＝２０１１に対応するＶＴＭｔ１５２の値に送信間隔TTI-n3の期間において送信されるシーケンス番号の上限値「２２」に設定する。

【０２３５】そして、送信局１ａは、次の送信間隔TTI-n4の期間において、再送RLC-PDU（Seq.No=2011）と共に、新規RLC-PDU（Seq.No=23,24,25）を下り伝送路上のマルチキャストチャネルを使用して送信する。受信局２ａは、次の送信間隔TTI-n5の期間にて実施するプロトコル処理１１２－７ａでのRLC-PDU受信処理において、先に再送を要求したRLC-PDU（Seq.No=2011）の受信を確認し（ＳＮ＝２０１１再送確認）、再送確認タイマを停止する。

【０２３６】このように、この実施の形態８によれば、マルチキャストデータパケットを送信する送信局は、複数の受信局から重複して通知される再送要求に対して、マルチキャストデータパケットに対応した再送制御テーブルを使用することにより、重複して再送を実施することを抑制することができるので、下り伝送路（無線伝送路あるいは有線伝送路）のリソースを無駄に消費することが防止できる。加えて、再送マルチキャストデータパケットを再度紛失または誤りが発生した場合には、再度再送することができるので、確実なマルチキャストデータパケット伝送が実現できる。

【０２３７】実施の形態９．図２０と図２１は、この発明の実施の形態９であるマルチキャストデータパケット再送制御方法を説明するフローチャートである。この実施の形態９では、実施の形態５～８で説明したマルチキャストデータパケット再送制御動作を含み、送信局が行う一般的なマルチキャストデータパケット再送制御動作が示されている。以下、図７，図１６～１９，図２５，図２６を適宜参照して説明する。

【０２３８】図２０と図２１において、送信局では、受信局から送られてくるパケット（ＰＤＵ）がチェックされ（ステップＳＴ３０）、「D/C」３０１ならびに「PDU-Type」３１１によって状態通知メッセージの受信か否

かが判断される（ステップＳＴ３１）。状態通知メッセージの受信ではない場合には、判定結果は否定（ステップＳＴ３１：Ｎｏ）となり、ステップＳＴ４９に進み、データパケットの送信処理（ステップＳＴ４７、ＳＴ４８）が実行される。また、状態通知メッセージの受信である場合には、判定結果は肯定（ステップＳＴ３１：Ｙｅｓ）となり、ステップＳＴ３２に進み、再送制御処理（ステップＳＴ３２～ＳＴ４４）が実行される。

【０２３９】再送制御処理（ステップＳＴ３２～ＳＴ４４）について説明する。ステップＳＴ３２では、受信した状態通知メッセージから再送制御に必要な情報が読み出され、保持される。すなわち、受信した状態通知メッセージから「Cause」「ＬＳＮ－１」「ＳＮ」「Ｌ」が読み出され、「Cause」はそのまま「Cause」として保持されるが、「ＬＳＮ－１」は「ＶＴＭｓ」として保持され、「ＳＮ」は「ＲｅＳＮ」として保持され、「Ｌ」は「Len」として保持されるとしている。

【０２４０】そして、ステップＳＴ３３にて、状態通知メッセージの送信理由「Cause」が「無条件再送」か否かが判断される。「無条件再送」である場合は（ステップＳＴ３３：Ｙｅｓ）、ステップＳＴ３４に進む。一方、「無条件再送」でない場合は（ステップＳＴ３３：Ｎｏ）、ステップＳＴ３８に進む。

【０２４１】ステップＳＴ３４～ＳＴ３７では、「無条件再送」を要求されたマルチキャストデータパケット（RLC-PDU）の全てについて拾い出す処理が実行される。すなわち、先頭のシーケンス番号「ＲｅＳＮ」が保持され（ステップＳＴ３４）、再送制御テーブルの当該シーケンス番号「ＲｅＳＮ」に対応する上限値「VTMt」と「再送フラグ」とが設定される（ステップＳＴ３５）。そして、状態通知メッセージで再送を要求された次のシーケンス番号「ＲｅＳＮ」が算出され（ステップＳＴ３６）、次のシーケンス番号があるか否かが判断される（ステップＳＴ３７）。次のシーケンス番号がある場合は（ステップＳＴ３７：Ｙｅｓ）、ステップＳＴ３４に戻り、再度ステップＳＴ３４～ＳＴ３７が実行される。

【０２４２】このようにして再送制御テーブルの各シーケンス番号に対応する上限値「VTMt」と「再送フラグ」とが設定される（ステップＳＴ３５）。状態通知メッセージで「無条件再送」を要求された全てのマルチキャストデータパケット（RLC-PDU）について再送制御テーブルの設定が終了すると（ステップＳＴ３７：Ｎｏ）、ステップＳＴ４６に進み、保持しているシーケンス番号「ＲｅＳＮ」から再送データパケット（ＰＤＵ）を準備し、上位レイヤから送られて来た新規に送信するデータパケット（ＰＤＵ）（ステップＳＴ４９：Ｙｅｓ）も含めた送信処理（ステップＳＴ４７、ＳＴ４８）が実行される。

【０２４３】一方、ステップＳＴ３３の判断処理において、状態通知メッセージの送信理由「Cause」が「無条件再送」ではない場合は（ステップＳＴ３３：Ｎｏ）、ステップＳＴ３８に進み、再送制御テーブルを使用した再送制御（ステップＳＴ３８～ＳＴ４４）が実施される。

【０２４４】ステップＳＴ３８では、状態通知メッセージで再送を要求されたデータパケットのシーケンス番号「ＲｅＳＮ」に対応する再送制御テーブルの上限値「ＶＴＭｔ」と「再送フラグ」とが読み出され、保持される。そして、ステップＳＴ３９にて、当該シーケンス番号に対する「再送フラグ」に“ＯＮ”フラグが設定されているか、“ＯＦＦ”フラグが設定されているかが判断される。当該シーケンス番号に対する「再送フラグ」が“ＯＮ”フラグでない場合は（ステップＳＴ３９：Ｎｏ）、すなわち、これまでに再送を実施していない場合は、ステップＳＴ４１に進み、当該シーケンス番号「ＲｅＳＮ」が再送用に保持され、ステップＳＴ４２にて、対応する再送制御テーブルの上限値「ＶＴＭｔ」が設定され、「再送フラグ」に“ＯＮ”フラグが設定され、ステップＳＴ４３に進む。

【０２４５】一方、ステップＳＴ３９の判断処理において、当該シーケンス番号「ＲｅＳＮ」に対する「再送フラグ」に“ＯＮ”フラグが設定されている場合は（ステップＳＴ３９：Ｙｅｓ）、すなわち、これまでに再送を実施している場合は、ステップＳＴ４０に進み、状態通知メッセージに含まれる「ＬＳＮ」から算出される上限値「ＶＴＭｓ」と当該シーケンス番号「ＲｅＳＮ」に対応する再送制御テーブルに設定された上限値「ＶＴＭｔ」とが大小比較される。ＶＴＭｓがＶＴＭｔよりも大きい場合には（ステップＳＴ４０：Ｙｅｓ）、当該状態通知メッセージは、送信局が再送を実施した時点よりも後に送信したデータパケットを受信した後に作成されたことを示し、当該シーケンス番号の再送が必要であるので、ステップＳＴ４１に進む。

【０２４６】また、ステップＳＴ４０の判断処理において、ＶＴＭｓがＶＴＭｔ以下の場合には（ステップＳＴ４０：Ｎｏ）、当該状態通知メッセージは、送信局が再送を実施した時点よりも前に作成されたことを示し、当該シーケンス番号の再送とすれ違いであるので、再送は実施せず、ステップＳＴ４３に進む。ステップＳＴ４３では、次のシーケンス番号が算出される。その結果、次のシーケンス番号「ＲｅＳＮ」があるか否かが判断される（ステップＳＴ４４）。次のシーケンス番号「ＲｅＳＮ」があれば（ステップＳＴ４４：Ｙｅｓ）、ステップＳＴ３８に戻り、次のシーケンス番号「ＲｅＳＮ」についてステップＳＴ３８～ＳＴ４３の処理が同様に実行される。

【０２４７】ステップＳＴ４４の判断処理において、次のシーケンス番号「ＲｅＳＮ」がなければ（ステップＳＴ４４：Ｎｏ）、すなわち、状態通知メッセージで再送

が要求されたマルチキャストデータパケット（RLC-PDU）の全てについて再送要否の判断処理が終了すると、再送すべきデータパケット（ＰＤＵ）の有無が判断される（ステップＳＴ４５）。再送すべきデータパケット（ＰＤＵ）が存在する場合は（ステップＳＴ４５：Ｙｅｓ）、ステップＳＴ４６～ＳＴ４８にて、新規に送信するデータパケットも含めた送信処理が実行される。

【０２４８】また、ステップＳＴ４５の判断処理において、再送すべきデータパケット（ＰＤＵ）が存在しない場合は（ステップＳＴ４５：Ｎｏ）、ステップＳＴ４９にて、上位レイヤから新規のデータパケット（ＰＤＵ）が送られてくるか否かが判断される。新規のデータパケット（ＰＤＵ）が送られてくると（ステップＳＴ４９：Ｙｅｓ）、ステップＳＴ４７、ＳＴ４８にて、再送データパケットがあればそれも含めて新規に送信するデータパケットの送信処理が実行される。また、上位レイヤから新規ＰＤＵが送られてこない場合は（ステップＳＴ４９：Ｎｏ）、そのまま処理を終了する。なお、再送制御テーブルでは、「再送フラグ」に設定された“ＯＮ”フラグは、同番のシーケンス番号を持つ新規のデータパケット（ＰＤＵ）が送信されると、リセットされ、“ＯＦＦ”フラグが設定されるようになっている。

【０２４９】このように、実施の形態９によれば、マルチキャストデータパケットを送信する送信局は、複数の受信局から重複して通知される再送要求に対して、マルチキャストに対応した再送制御テーブルを使用することにより、重複して再送を実施することを抑制することができるため、下り伝送路（無線伝送路あるいは有線伝送路）のリソースを無駄に消費することが防止できる。

【０２５０】

【発明の効果】以上説明したように、この発明によれば、データパケット送信装置では、受信側から状態通知メッセージが受信された場合に、まず判断手段にて再送制御テーブルの存在有無が判断される。その結果、再送制御テーブルが存在する場合は、判定手段にて当該再送制御テーブルが参照され、状態通知メッセージに含まれるシーケンス番号上限値が再送制御テーブルに含まれるシーケンス番号上限値未満であるとき、再送制御テーブルと状態通知メッセージとに含まれるデータパケットに関する情報の差分が抽出され、再送の要否が判定される。具体的には、差分がないときは、既に再送を実施したデータパケットの送達確認待ちであることから再送は実施せず、差分がある場合に、当該差分に関わるデータパケットについて再送を実施すると判定される。したがって、再送の実施とすれ違いに受信された再送要求に起因する無駄な再送を効果的に抑制することができ、真に必要な再送のみを実施することができる。

【０２５１】つぎの発明によれば、データパケット送信装置では、上記の発明において、再送制御テーブルが存在する場合に、削除手段にて、再送制御テーブルが参照され、状態通知メッセージに含まれるシーケンス番号上限値が再送制御テーブルに含まれるシーケンス番号上限値を超えるとき、当該再送制御テーブルが削除される。これによって、再送に成功した場合や再送に失敗して新たなテーブルが必要となる場合に、不要なテーブルを削除することができる。

【０２５２】つぎの発明によれば、データパケット送信装置では、受信側に状態通知メッセージの送信を要求する状態通知要求メッセージが送信されるたびにカウンタがインクリメントされ、要求番号付加手段によって、そのカウンタのカウント値が要求番号として上記送信される状態通知要求メッセージに付加される。状態通知メッセージが受信されると、まず判断手段にて再送制御テーブルの存在有無が判断される。その結果、再送制御テーブルが存在する場合には、判定手段にて当該再送制御テーブルが参照され、状態通知メッセージと再送制御テーブルとに含まれるシーケンス番号上限値が一致する場合には、状態通知メッセージの送信理由が送信局からの状態通知要求メッセージの受信であり当該状態通知メッセージに含まれる要求番号が再送制御テーブルに含まれる要求番号以下のとき、または、状態通知メッセージの送信理由が周期タイマのタイムアウトであり当該送信理由が再送制御テーブルに含まれる送信理由と一致しないとき、あるいは、状態通知メッセージの送信理由が送信局からの状態通知要求メッセージの受信でなく、かつ周期タイマのタイムアウトでもないとき、再送制御テーブルと状態通知メッセージとに含まれるデータパケットに関する情報の差分が抽出され、再送の要否が判定される。具体的には、差分がないときは、既に再送を実施したデータパケットの送達確認待ちであることから再送は実施せず、差分がある場合に、当該差分に関わるデータパケットについて再送を実施すると判定される。したがって、送信するデータパケットのシーケンス番号が同番となる状況下において、再送の実施とすれ違いに受信された再送要求に起因する無駄な再送を効果的に抑制することができ、真に必要な再送のみを実施することができる。

【０２５３】つぎの発明によれば、データパケット送信装置では、再送制御テーブルが存在する場合に、削除手段にて、再送制御テーブルが参照され、状態通知メッセージに含まれるシーケンス番号上限値が再送制御テーブルに含まれるシーケンス番号上限値と一致する場合には、前記状態通知メッセージに含まれる要求番号が再送制御テーブルに含まれる要求番号よりも大きいとき、ないしは、状態通知メッセージの送信理由が周期タイマのタイムアウトであり当該送信理由が再送制御テーブルに含まれる送信理由と一致するとき、当該再送制御テーブルが削除される。これによって、送信するデータパケットのシーケンス番号が同番となる状況下において、再送に成功した場合や再送に失敗して新たなテーブルが必要

となる場合に、不要なテーブルを削除することができる。

【０２５４】つぎの発明によれば、データパケット送信装置では、再送制御テーブルが存在しない場合には、再送を実施すると決定された場合に、テーブル設定手段にて、再送処理実行決定時までに受信側に送信したデータパケットのシーケンス番号の上限値および該当する場合は要求番号と状態通知メッセージから読み出した送信理由および送信するデータパケットに関する情報とが設定され、その後、再送手段にて、当該再送制御テーブルに設定されている送信するデータパケットに関する情報に基づきそのデータパケットについての再送が実施される。これによって、再送制御テーブルを利用して適切な再送制御が行えるようになる。

【０２５５】つぎの発明によれば、データパケット受信装置では、状態通知メッセージの送信原因が発生すると、送信理由作成手段にて、状態通知要求メッセージの受信であるか、誤りの検出であるか、周期タイマのタイムアウトであるかの送信理由が作成され、送信理由付加手段にて、その作成された送信理由と当該送信理由が状態通知要求メッセージの受信であるときは受信した状態通知要求メッセージから読み出した要求番号とが状態通知メッセージに付加され、データパケット送信装置に向けて送信される。これによって、同番のシーケンス番号の付与されたデータパケットが送信される場合でもデータパケット送信装置での再送制御が正しく行えるようになる。

【０２５６】つぎの発明によれば、データパケット伝送システムにおけるデータパケット送信装置において、状態通知メッセージが受信された場合には、まず判断手段にて再送制御テーブルの存在有無が判断される。その結果、再送制御テーブルが存在する場合には、判定手段にて当該再送制御テーブルが参照され、状態通知メッセージに含まれるシーケンス番号上限値が再送制御テーブルに含まれるシーケンス番号上限値未満のとき、再送制御テーブルと状態通知メッセージとに含まれるデータパケットに関する情報の差分が抽出され、再送の要否が判定される。具体的には、差分がないときは、既に再送を実施したデータパケットの送達確認待ちであることから再送は実施せず、差分がある場合に、当該差分に関わるデータパケットについて再送を実施すると判定される。したがって、再送の実施とすれ違いに受信された再送要求に起因する無駄な再送を効果的に抑制することができ、真に必要な再送のみを実施することができる。

【０２５７】つぎの発明によれば、データパケット伝送システムにおけるデータパケット送信装置において、再送制御テーブルが存在する場合に、削除手段にて、再送制御テーブルが参照され、状態通知メッセージに含まれるシーケンス番号上限値が再送制御テーブルに含まれるシーケンス番号上限値を超えるとき、当該再送制御テーブルが削除される。これによって、再送に成功した場合や再送に失敗して新たなテーブルが必要となる場合に、不要なテーブルを削除することができる。

【０２５８】つぎの発明によれば、データパケット伝送システムにおけるデータパケット送信装置において、受信側に状態通知メッセージの送信を要求する状態通知要求メッセージが送信されるたびにカウンタがインクリメントされ、要求番号付加手段によってそのカウンタのカウント値が要求番号として上記送信する状態通知要求メッセージに付加される。状態通知メッセージが受信されると、まず判断手段にて再送制御テーブルの存在有無が判断される。その結果、再送制御テーブルが存在する場合には、判定手段にて当該再送制御テーブルが参照され、状態通知メッセージと再送制御テーブルとに含まれるシーケンス番号上限値が一致する場合には、状態通知メッセージに含まれる要求番号が再送制御テーブルに含まれる要求番号以下のとき、または、状態通知メッセージの送信理由が周期タイマのタイムアウトであり当該送信理由が再送制御テーブルに含まれる送信理由と一致しないとき、あるいは、状態通知メッセージの送信理由が送信局からの状態通知要求メッセージの受信でなく、かつ周期タイマのタイムアウトでもないとき、再送制御テーブルと状態通知メッセージとに含まれるデータパケットに関する情報の差分が抽出され、再送の要否が判定される。具体的には、差分がないときは、既に再送を実施したデータパケットの送達確認待ちであることから再送は実施せず、差分がある場合に、当該差分に関わるデータパケットについて再送を実施すると判定される。したがって、送信するデータパケットのシーケンス番号が同番となる状況下において、要再送の実施とすれ違いに受信された再送要求に起因する無駄な再送を効果的に抑制することができ、真に必要な再送のみを実施することができる。

【０２５９】つぎの発明によれば、データパケット伝送システムにおけるデータパケット送信装置では、再送制御テーブルが存在する場合に、削除手段にて、再送制御テーブルが参照され、状態通知メッセージと再送制御テーブルとに含まれるシーケンス番号上限値が一致する場合には、状態通知メッセージに含まれる要求番号が再送制御テーブルに含まれる要求番号よりも大きいとき、ないしは、状態通知メッセージの送信理由が周期タイマのタイムアウトであり当該送信理由が再送制御テーブルに含まれる送信理由と一致するとき、当該再送制御テーブルが削除される。これによって、送信するデータパケットのシーケンス番号が同番となる状況下において、再送に成功した場合や再送に失敗して新たなテーブルが必要となる場合に、不要なテーブルを削除することができる。

【０２６０】つぎの発明によれば、データパケット伝送システムにおけるデータパケット送信装置において、再

送制御テーブルが存在しない場合には、再送を実施すると決定された場合に、テーブル設定手段にて、再送処理実行決定時までに受信側に送信したデータパケットのシーケンス番号の上限値および該当する場合は要求番号と状態通知メッセージから読み出した送信理由および送信するデータパケットに関する情報とが設定され、その後、再送手段にて、当該再送制御テーブルに設定されている送信されるデータパケットに関する情報に基づき当該データパケットについての再送が実施される。これによって、再送制御テーブルを利用して適切な再送制御が行えるようになる。

【０２６１】つぎの発明によれば、データパケット伝送システムにおけるデータパケット受信装置において、状態通知メッセージの送信原因が発生すると、送信理由作成手段にて、状態通知要求メッセージの受信であるか、誤りの検出であるか、周期タイマのタイムアウトであるかの送信理由が作成され、送信理由付加手段にて、その作成された送信理由と当該送信理由が状態通知要求メッセージの受信であるときは受信した状態通知要求メッセージから読み出した要求番号とが状態通知メッセージに付加され、データパケット送信装置に向けて送信される。これによって、同番のシーケンス番号の付与されたデータパケットが送信される場合でもデータパケット送信装置での再送制御が正しく行えるようになる。

【０２６２】つぎの発明によれば、データパケット送信装置では、受信側から状態通知メッセージが受信された場合に、まず判断工程にて再送制御テーブルの存在有無が判断される。その結果、再送制御テーブルが存在する場合には、判定工程にて当該再送制御テーブルが参照され、状態通知メッセージに含まれるシーケンス番号上限値が再送制御テーブルに含まれるシーケンス番号上限値未満であるとき、再送制御テーブルと状態通知メッセージとに含まれるデータパケットに関する情報の差分が抽出され、再送の要否が判定される。具体的には、差分がないときは、既に再送を実施したデータパケットの送達確認待ちであることから再送は実施せず、差分がある場合に、当該差分に関わるデータパケットについて再送を実施すると判定される。したがって、再送の実施とすれ違いに受信された再送要求に起因する無駄な再送を効果的に抑制することができ、真に必要な再送のみを実施することができる。

【０２６３】つぎの発明によれば、データパケット送信装置において、再送制御テーブルが存在する場合に、削除工程にて、再送制御テーブルが参照され、状態通知メッセージに含まれるシーケンス番号上限値が再送制御テーブルに含まれる前記シーケンス番号上限値を超えるとき、当該再送制御テーブルが削除される。これによって、再送に成功した場合や再送に失敗して新たなテーブルが必要となる場合に、不要なテーブルを削除することができる。

【０２６４】つぎの発明によれば、データパケット送信装置では、データパケット受信装置に状態通知メッセージの送信を要求する状態通知要求メッセージが送信されるたびにカウンタがインクリメントされ、要求番号付加工程にてそのカウンタのカウント値が要求番号として上記送信する状態通知要求メッセージに付加される。状態通知メッセージが受信されると、まず判断工程にて再送制御テーブルの存在有無が判断される。その結果、再送制御テーブルが存在する場合には、判定工程にて当該再送制御テーブルが参照され、状態通知メッセージと再送制御テーブルとに含まれるシーケンス番号上限値が一致する場合には、状態通知メッセージに含まれる要求番号が再送制御テーブルに含まれる要求番号以下のとき、または、状態通知メッセージの送信理由が周期タイマのタイムアウトであり当該送信理由が再送制御テーブルに含まれる送信理由と一致しないとき、あるいは、状態通知メッセージの送信理由が送信局からの状態通知要求メッセージの受信でなく、かつ周期タイマのタイムアウトでもないとき、再送制御テーブルと状態通知メッセージとに含まれるデータパケットに関する情報の差分が抽出され、再送の要否が判定される。具体的には、差分がないときは、既に再送を実施したデータパケットの送達確認待ちであることから再送は実施せず、差分がある場合に、当該差分に関わるデータパケットについて再送を実施すると判定される。したがって、送信するデータパケットのシーケンス番号が同番となる状況下において、再送の実施とすれ違いに受信された再送要求に起因する無駄な再送を効果的に抑制することができ、真に必要な再送のみを実施することができる。

【０２６５】つぎの発明によれば、データパケット送信装置において、再送制御テーブルが存在する場合に、削除工程にて、再送制御テーブルが参照され、状態通知メッセージと再送制御テーブルとに含まれるシーケンス番号上限値が一致する場合には、状態通知メッセージに含まれる要求番号が再送制御テーブルに含まれる要求番号よりも大きいとき、ないしは、状態通知メッセージの送信理由が周期タイマのタイムアウトであり当該送信理由が再送制御テーブルに含まれる送信理由と一致するとき、当該再送制御テーブルが削除される。これによって、送信するデータパケットのシーケンス番号が同番となる状況下において、再送に成功した場合や再送に失敗して新たなテーブルが必要となる場合に、不要なテーブルを削除することができる。

【０２６６】つぎの発明によれば、データパケット送信装置において、再送制御テーブルが存在しない場合には、再送を実施すると決定された場合に、テーブル設定工程にて、再送処理実行決定時までに受信側に送信したデータパケットのシーケンス番号の上限値および該当する場合は要求番号と状態通知メッセージから読み出した送信理由および送信するデータパケットに関する情報と

が設定され、その後、再送工程にて、当該再送制御テーブルに設定されている送信するデータパケットに関する情報に基づき当該データパケットについての再送が実施される。これによって、再送制御テーブルを利用して適切な再送制御が行えるようになる。

【０２６７】つぎの発明によれば、データパケット受信装置において、状態通知メッセージの送信原因が発生すると、送信理由作成工程にて、状態通知要求メッセージの受信であるか、誤りの検出であるか、周期タイマのタイムアウトであるかの送信理由が作成され、送信理由付加工程にて、その作成された送信理由と当該送信理由が状態通知要求メッセージの受信であるときは受信した状態通知要求メッセージから読み出した要求番号とが状態通知メッセージに付加され、データパケット送信装置に向けて送信される。これによって、同番のシーケンス番号の付与されたデータパケットが送信される場合でもデータパケット送信装置での再送制御が正しく行えるようになる。

【０２６８】つぎの発明によれば、マルチキャストでデータパケットを送信するデータパケット送信装置では、再送を要求する状態通知メッセージが受信されると、その状態通知メッセージに含まれるシーケンス番号に基づき再送制御テーブルの対応するシーケンス番号に関する内容が参照され、再送未実施であるとき、再送実施手段にて、当該シーケンス番号のマルチキャストデータパケットについて再送が実施される。そして、テーブル設定手段にて、再送が実施されたマルチキャストデータパケットのシーケンス番号と対応付けてその再送を実施した時点で送信済みのシーケンス番号の上限値が前記再送制御テーブルに設定される。つまり、再送制御テーブルには、当初は、当該シーケンス番号のマルチキャストデータパケットが再送未実施であると表示されているが、再送が実施されると、その再送の実施状況が設定され、再送実施済みであることが表示される。このように、再送制御テーブルには、当該シーケンス番号のマルチキャストデータパケットについての再送実施に関する情報が蓄積される。

【０２６９】つぎの発明によれば、マルチキャストでデータパケットを送信するデータパケット送信装置では、上記の発明において、前記状態通知メッセージに含まれるシーケンス番号に基づき参照した前記再送制御テーブルの対応するシーケンス番号に関する内容が再送実施済みであるとき、前記状態通知メッセージに含まれる当該受信装置が正常に受信したマルチキャストデータパケットのシーケンス番号の上限値が、前記再送制御テーブルに設定されている再送を実施した時点で送信済みのシーケンス番号の上限値よりも大きい場合にのみ、再送実施手段にて、当該シーケンス番号のマルチキャストデータパケットについて再送が実施される。これによって、重複した再送要求があっても無駄な再送を実施しないようにすることができる。また、再度紛失した場合や再度誤りがあった場合での再送要求では、確実に再送を実施することができる。

【０２７０】つぎの発明によれば、マルチキャストでデータパケットを送信するデータパケット送信装置では、上記の発明において、前記状態通知メッセージに含まれる送信理由が無条件再送要求である場合には、再送実施手段にて、前記再送制御テーブルの内容によらず、当該状態通知メッセージに含まれるシーケンス番号のマルチキャストデータパケットについて再送が実施される。これによって、早急に送達確認を行う必要がある場合に、不必要な遅延を発生させることなく再送を実施することができる。

【０２７１】つぎの発明によれば、マルチキャストでデータパケットを送信するデータパケット送信装置では、上記の発明において、テーブルリセット手段にて、前記再送制御テーブルにおいて再送実施済みのシーケンス番号と同番の新規データパケットが送信されたとき、当該シーケンス番号に関する内容を再送未実施に戻す処理が行われる。これによって、再送制御テーブルを用いて不必要再送を抑制する再送制御を円滑に実施することができる。

【０２７２】つぎの発明によれば、マルチキャストでデータパケットを受信する各データパケット受信装置では、状態通知メッセージを送信する際に、送信理由作成手段にて、その送信する状態通知メッセージに無条件に再送を要求する送信理由と無条件ではない再送を要求する送信理由とを含ませることが行われる。これによって、各データパケット受信装置では、送達確認への応答を早急に行う必要のあるデータパケットの受信ができなかった場合に、送信理由に無条件再送要求を設定して送ることにより、遅れなく再送を受けることができ、迅速に送達確認への応答を行うことができるようになる。

【０２７３】つぎ発明によれば、マルチキャストでデータパケットの授受を行うデータパケット伝送システムにおけるデータパケット送信装置では、状態通知メッセージが受信されると、その状態通知メッセージに含まれるシーケンス番号に基づき再送制御テーブルの対応するシーケンス番号に関する内容が参照され、再送未実施であるとき、再送実施手段にて、当該シーケンス番号のマルチキャストデータパケットについて再送が実施される。そして、テーブル設定手段にて、再送が実施されたマルチキャストデータパケットのシーケンス番号と対応付けてその再送を実施した時点で送信済みのシーケンス番号の上限値が前記再送制御テーブルに設定される。つまり、再送制御テーブルには、当初は、当該シーケンス番号のマルチキャストデータパケットが再送未実施であると表示されているが、再送が実施されると、その再送の実施状況が設定され、再送実施済みであることが表示される。このように、再送制御テーブルには、当該シーケ

ンス番号のマルチキャストデータパケットについての再送実施に関する情報が蓄積される。

【０２７４】つぎ発明によれば、マルチキャストでデータパケットの授受を行うデータパケット伝送システムにおけるデータパケット送信装置では、上記の発明において、前記状態通知メッセージに含まれるシーケンス番号に基づき参照した前記再送制御テーブルの対応するシーケンス番号に関する内容が再送実施済みであるとき、前記状態通知メッセージに含まれる当該受信装置が正常に受信したマルチキャストデータパケットのシーケンス番号の上限値が、前記再送制御テーブルに設定されている再送を実施した時点で送信済みのシーケンス番号の上限値よりも大きい場合にのみ、再送実施手段にて、当該シーケンス番号のマルチキャストデータパケットについて再送が実施される。これによって、重複した再送要求があっても無駄な再送を実施しないようにすることができる。また、再度紛失した場合や再度誤りがあった場合での再送要求では、確実に再送を実施することができる。

【０２７５】つぎの発明によれば、マルチキャストでデータパケットの授受を行うデータパケット伝送システムにおけるデータパケット送信装置では、上記の発明において、前記状態通知メッセージに含まれる送信理由が無条件再送要求である場合には、再送実施手段にて、前記再送制御テーブルの内容によらず、当該状態通知メッセージに含まれるシーケンス番号のマルチキャストデータパケットについて再送が実施される。これによって、早急に送達確認を行う必要がある場合に、不必要な遅延を発生させることなく再送を実施することができる。

【０２７６】つぎの発明によれば、マルチキャストでデータパケットの授受を行うデータパケット伝送システムにおけるデータパケット送信装置では、上記の発明において、テーブルリセット手段にて、前記再送制御テーブルにおいて再送実施済みのシーケンス番号と同番の新規データパケットが送信されたとき、当該シーケンス番号に関する内容を再送未実施に戻す処理が行われる。これによって、再送制御テーブルを用いて不必要再送を抑制する再送制御を円滑に実施することができる。

【０２７７】つぎの発明によれば、マルチキャストでデータパケットの授受を行うデータパケット伝送システムにおけるデータパケット受信装置では、上記の発明において、状態通知メッセージを送信する際に、送信理由作成手段にて、その送信する状態通知メッセージに無条件に再送を要求する送信理由と無条件ではない再送を要求する送信理由とを含ませることが行われる。これによって、各データパケット受信装置では、送達確認への応答を早急に行う必要のあるデータパケットの受信ができなかった場合に、送信理由に無条件再送要求を設定して送ることにより、遅れなく再送を受けることができ、迅速に送達確認への応答を行うことができるようになる。

【０２７８】つぎの発明によれば、マルチキャストでデータパケットの授受を行う際に、データパケット送信装置では、再送を要求する状態通知メッセージが受信されると、その状態通知メッセージに含まれるシーケンス番号に基づき再送制御テーブルの対応するシーケンス番号に関する内容が参照され、再送未実施であるとき、再送工程にて、当該シーケンス番号のマルチキャストデータパケットについて再送が実施される。そして、テーブル設定工程にて、再送が実施されたマルチキャストデータパケットのシーケンス番号と対応付けてその再送を実施した時点で送信済みのシーケンス番号の上限値が前記再送制御テーブルに設定される。つまり、再送制御テーブルには、当初は、当該シーケンス番号のマルチキャストデータパケットが再送未実施であると表示されているが、再送が実施されると、その再送の実施状況が設定され、再送実施済みであることが表示される。このように、再送制御テーブルには、当該シーケンス番号のマルチキャストデータパケットについての再送実施に関する情報が蓄積される。

【０２７９】つぎの発明によれば、上記の発明において、データパケット送信装置では、再送を要求する状態通知メッセージが受信されると、前記状態通知メッセージに含まれるシーケンス番号に基づき参照した前記再送制御テーブルの対応するシーケンス番号に関する内容が再送実施済みであるとき、前記状態通知メッセージに含まれる当該受信装置が正常に受信したマルチキャストデータパケットのシーケンス番号の上限値が、前記再送制御テーブルに設定されている再送を実施した時点で送信済みのシーケンス番号の上限値よりも大きい場合にのみ、再送実施工程にて、当該シーケンス番号のマルチキャストデータパケットについて再送が実施される。これによって、重複した再送要求があっても無駄な再送を実施しないようにすることができる。また、再度紛失した場合や再度誤りがあった場合での再送要求では、確実に再送を実施することができる。

【０２８０】つぎの発明によれば、上記の発明において、データパケット送信装置では、再送を要求する状態通知メッセージが受信されると、前記状態通知メッセージに含まれる送信理由を調べ、その送信理由が無条件再送要求である場合には、再送実施手段にて、前記再送制御テーブルの内容によらず、当該状態通知メッセージに含まれるシーケンス番号のマルチキャストデータパケットについて再送が実施される。これによって、早急に送達確認を行う必要がある場合に、不必要な遅延を発生させることなく再送を実施することができる。

【０２８１】つぎの発明によれば、上記の発明において、データパケット送信装置では、テーブルリセット工程にて、前記再送制御テーブルにおいて再送実施済みのシーケンス番号と同番の新規データパケットが送信されたとき、当該シーケンス番号に関する内容を再送未実施に戻す処理が行われる。これによって、再送制御テーブ

ルを用いて不必要再送を抑制する再送制御を円滑に実施することができる。

【0282】つぎの発明によれば、上記の発明において、マルチキャストでデータパケットを受信する各データパケット受信装置では、状態通知メッセージを送信する際に、送信理由作成工程にて、その送信する状態通知メッセージに無条件に再送を要求する送信理由と無条件ではない再送を要求する送信理由とを含ませることが行われる。これによって、各データパケット受信装置では、送達確認への応答を早急に行う必要のあるデータパケットの受信ができなかった場合に、送信理由に無条件再送要求を設定して送ることにより、遅れなく再送を受けることができ、迅速に送達確認への応答を行うことができるようになる。

【図面の簡単な説明】

【図1】 この発明の実施の形態1であるデータパケット伝送システムの構成を示すブロック図である。

【図2】 図1に示す送信局の構成を示すブロック図である。

【図3】 図1に示す送信局が送信するデータパケットのフォーマット例を示す図である。

【図4】 図1に示す送信局が再送制御のために備える再送制御テーブルの構成例を示す図である。

【図5】 図1に示す受信局の構成を示すブロック図である。

【図6】 図1に示す受信局が状態通知要求メッセージ受信に対して送信する状態通知メッセージのフォーマット例を示す図である。

【図7】 図1に示す受信局がシーケンス番号の抜けを検出したときや周期タイマのタイムアウトによって送信する状態通知メッセージのフォーマット例を示す図である。

【図8】 図1に示すデータパケット伝送システムにおいて実施されるデータパケット再送制御動作を説明するシーケンス図である。

【図9】 この発明の実施の形態2であるデータパケット再送制御方法を説明するシーケンス図である。

【図10】 この発明の実施の形態3であるデータパケット再送制御方法を説明するシーケンス図である。

【図11】 この発明の実施の形態4であるデータパケット再送制御方法を説明するフローチャートである(その1)。

【図12】 この発明の実施の形態4であるデータパケット再送制御方法を説明するフローチャートである(その2)。

【図13】 この発明の実施の形態4であるデータパケット再送制御方法を説明するフローチャートである(その3)。

【図14】 この発明の実施の形態5であるマルチキャストデータパケット伝送システムの構成を示すブロック図である。

【図15】 図14に示す送信局が再送制御のために備える再送制御テーブルの構成例を示す図である。

【図16】 図14に示すマルチキャストデータパケット伝送システムにおいて実施されるマルチキャストデータパケットの再送制御動作を説明するシーケンス図である(受信局から送信局への状態通知メッセージの送信に上り共通チャネルを使用する場合)。

【図17】 この発明の実施の形態6であるマルチキャストデータパケットの再送制御方法を説明するシーケンス図である(受信局から送信局への状態通知メッセージの送信に上り共通チャネルを使用する場合で、送信理由に無条件再送要求が含まれる場合)。

【図18】 この発明の実施の形態7であるマルチキャストデータパケットの再送制御方法を説明するシーケンス図である(受信局から送信局への状態通知メッセージの送信に上り個別チャネルを使用する場合)。

【図19】 この発明の実施の形態8であるマルチキャストデータパケットの再送制御方法を説明するシーケンス図である。

【図20】 この発明の実施の形態9であるマルチキャストデータパケットの再送制御方法を説明するフローチャートである(その1)。

【図21】 この発明の実施の形態9であるマルチキャストデータパケットの再送制御方法を説明するフローチャートである(その2)。

【図22】 従来のデータパケット再送制御方法を説明するシーケンス図である。

【図23】 従来および実施の形態5の送信局が送信するデータパケットのフォーマット例を示す図である。

【図24】 従来および実施の形態1の受信局が送信する状態通知メッセージのフォーマット例を示す図である。

【図25】 受信局が送信する状態通知メッセージに含まれる送達確認情報要素のフォーマット例を示す図である。

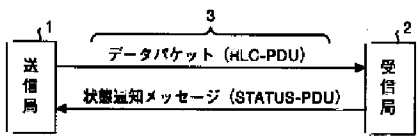
【図26】 受信局が送信する状態通知メッセージに含まれる再送要求情報要素のフォーマット例を示す図である。

【符号の説明】

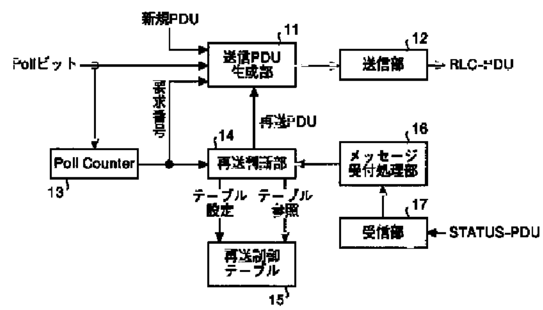
1，1a 送信局(データパケット送信装置)、2、2a，2b，2c 受信局(データパケット受信装置)、3，3a，3b，3c，4a，4b，4c 伝送路、11 送信PDU生成部、13 Poll Counter、14 再送判断部、15，150 再送制御テーブル、16 メッセージ受付処理部、22 シーケンス監視部、23 周期タイマ、24 送信理由作成部、25 状態通知メッセージ作成部、300 データパケット(RLC-PDU)、300a マルチキャストデータパケット(RLC-PDU)、306，316，401 Poll Counter、310

−1，310−2　状態通知メッセージ（STATUS-PDU）、315，402　Cause、403　VT（M）、404　LENGTH、405−1～405−L　SN_1～SN_{LENGTH}、406−1～406−L　L_1～L_{LENGTH}、410　送達確認情報要素、420再送要求情報要素、TTI-0～TTI-10，TTI-m0～TTI-m4，TTI-n0～TTI-n5　送信間隔、VTMt　再送制御テーブルに設定されるシーケンス番号上限値、VTMs　状態通知メッセージに設定されるシーケンス番号上限値。

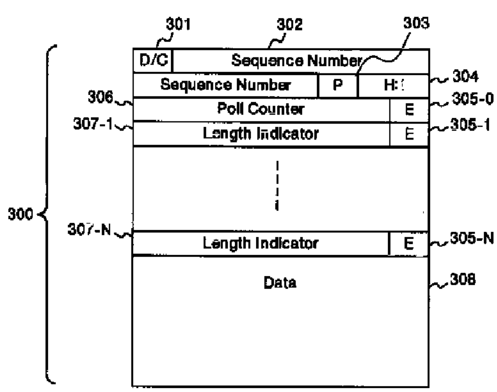
【図1】



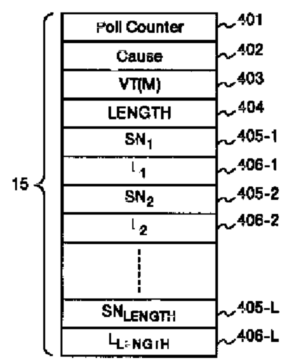
【図2】



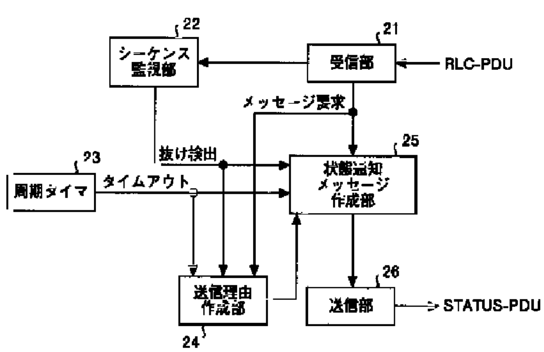
【図3】



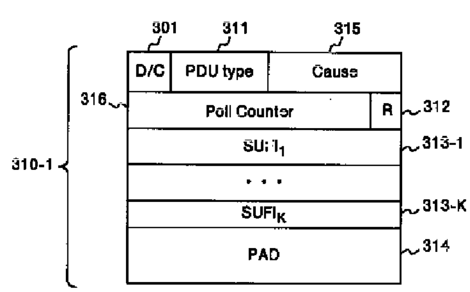
【図4】



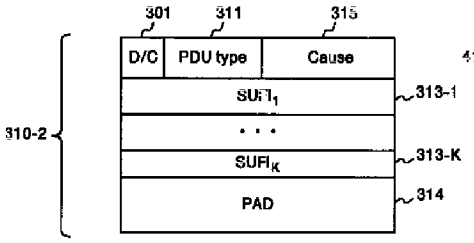
【図5】



【図6】



【図7】



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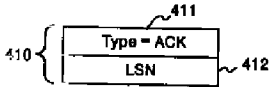
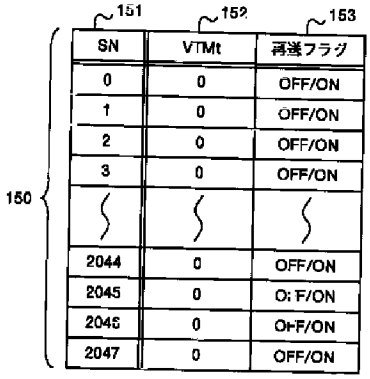
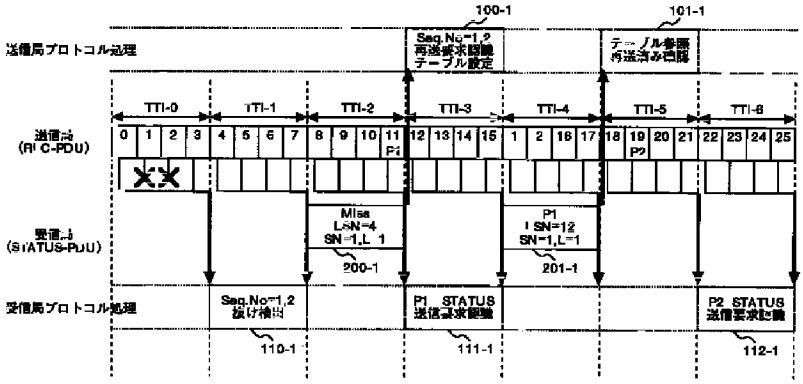


【図15】



【図8】



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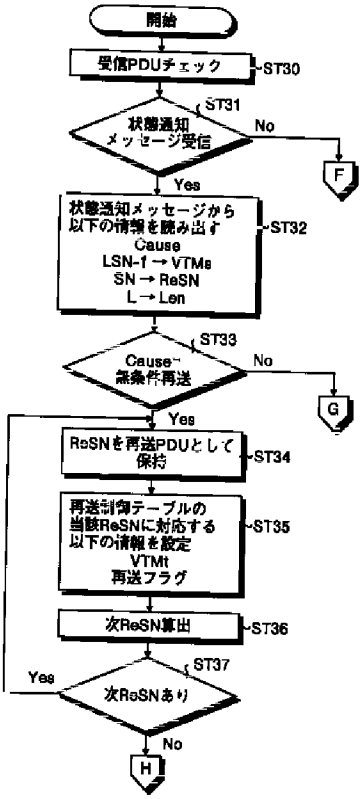

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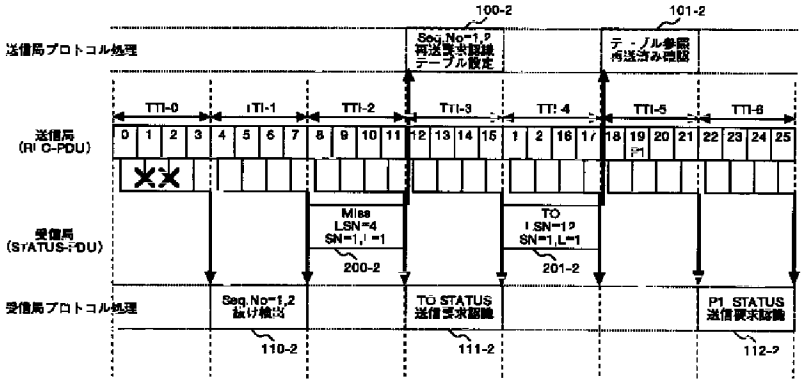

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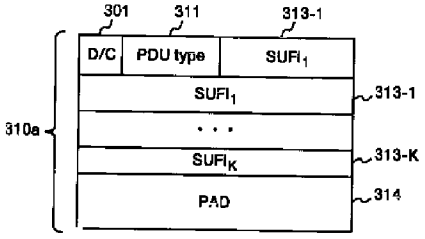
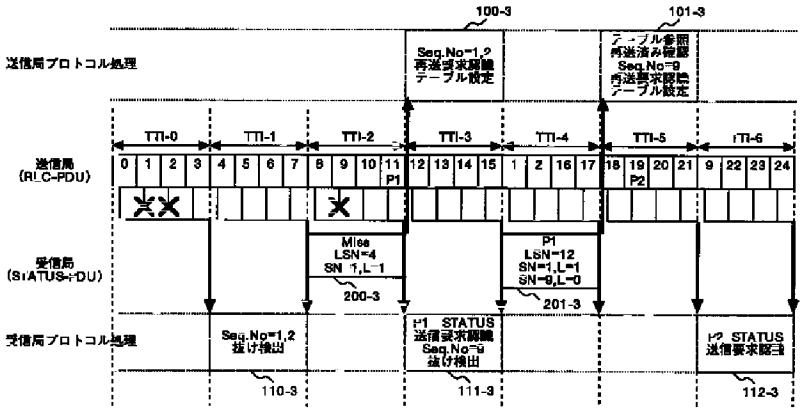
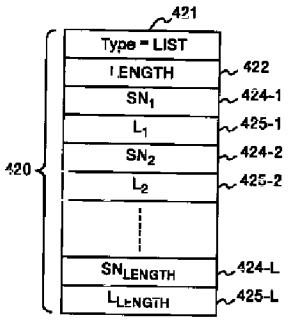


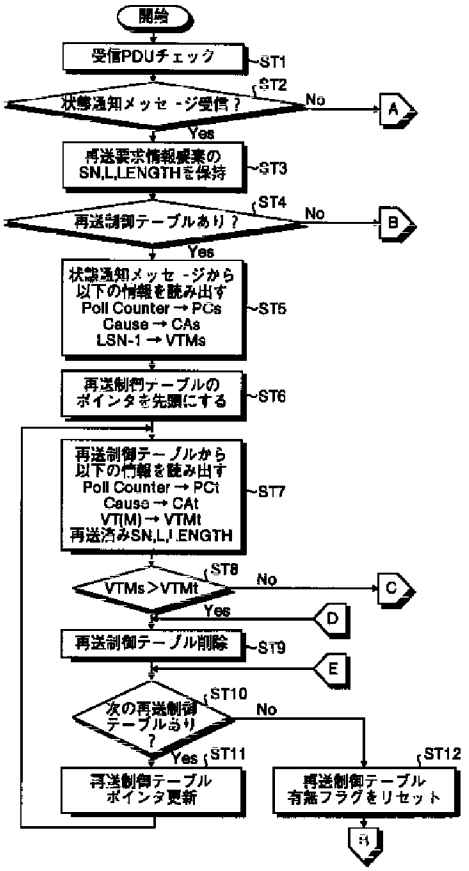
【図10】



【図26】



【図11】



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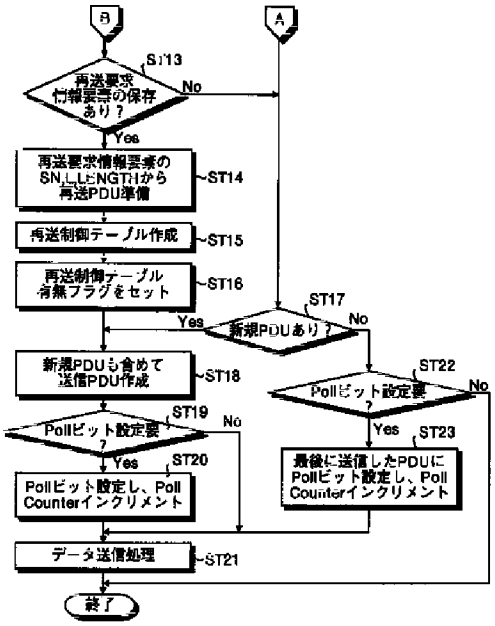
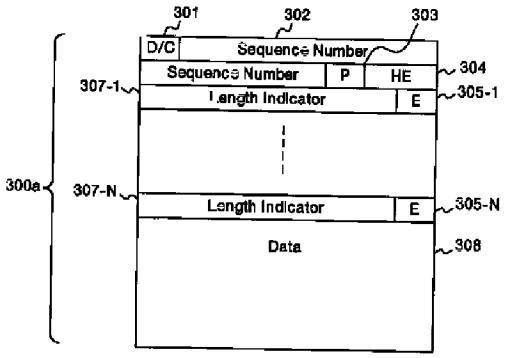
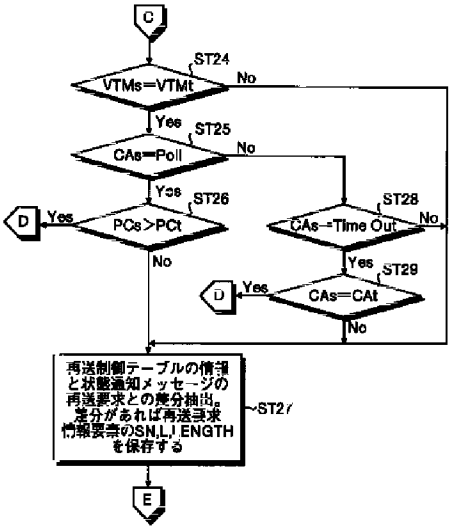


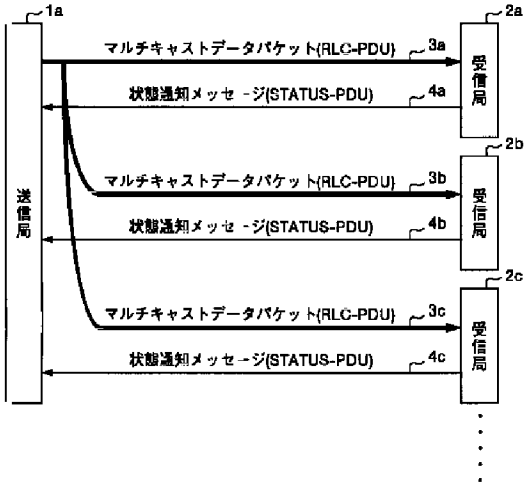
【図23】



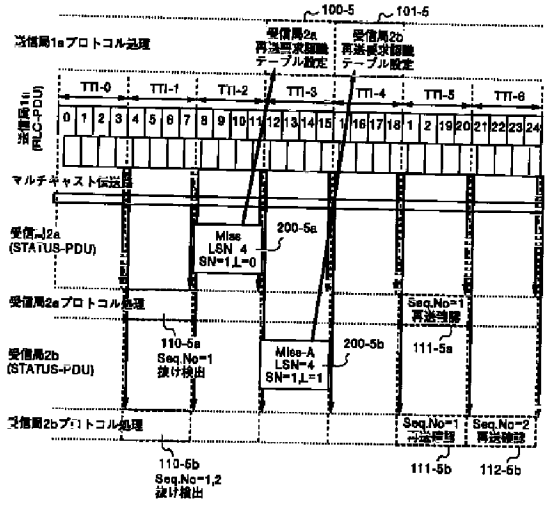
【図13】



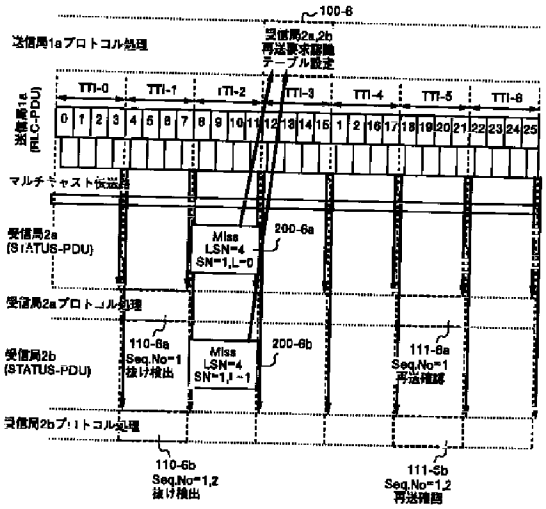
【図14】



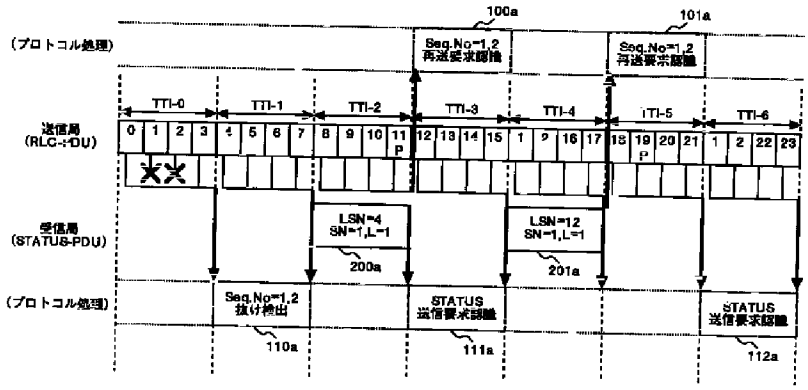
【図17】



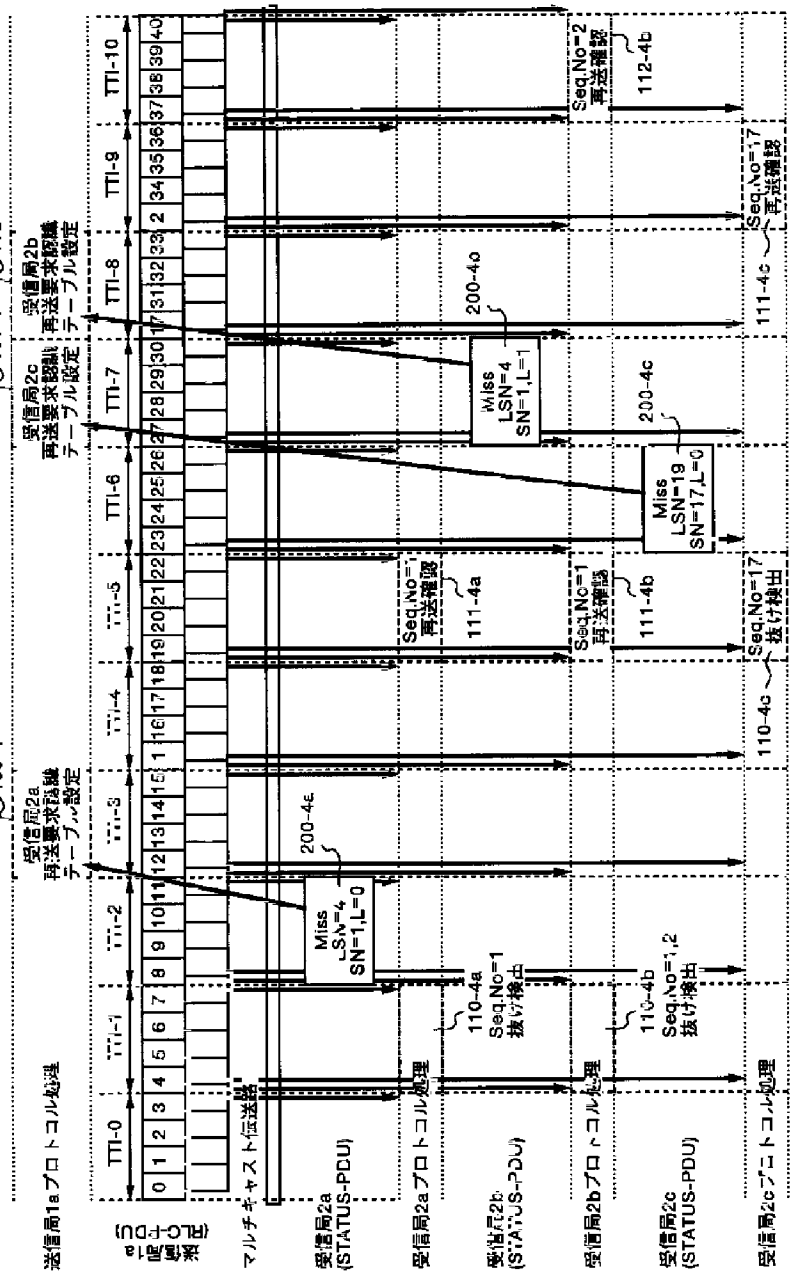
【図18】



【図22】



【図16】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受信局2a 再送要求設定 テーブル設定
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受信局2c 再送要求設定 テーブル設定
100-4
101-4
102-4
TTI-0
TTI-1
TTI-2
TTI-3
TTI-4
TTI-5
TTI-6
TTI-7
TTI-8
TTI-9
TTI-10
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
HS-PDSCH
マルチキャスト伝送路
受信局2a (STATUS-PDU)
受信局2aプロトコル処理
受信局2b (STATUS-PDU)
受信局2bプロトコル処理
受信局2c (STATUS-PDU)
受信局2cプロトコル処理
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110-4a Seq.No=1 抜け検出
Seq.No=1 再送確認
111-4a
Miss LSN=4 SN=1,L=1
200-4o
Seq.No=1 再送確認
111-4b
110-4b Seq.No=1,2 抜け検出
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Seq.No=2 再送確認
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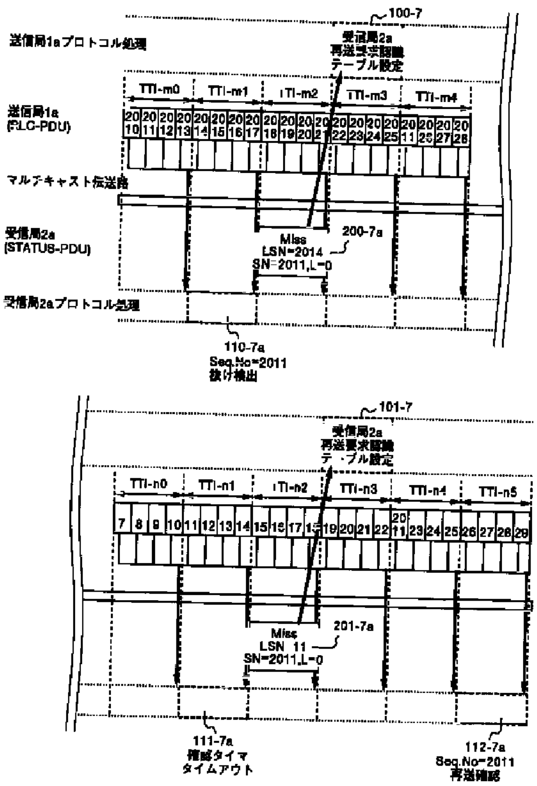
111-4c Seq.No=17 再送確認

【図19】


100-7
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受信局2a
再送要求認識
テーブル設定
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TTI-m1
TTI-m2
TTI-m3
TTI-m4
送信局1a
(RLC-PDU)
マルチキャスト伝送路
受信局2a
(STATUS-PDU)
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SN=2011,L=0
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Seq.No=2011
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101-7
受信局2a
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テーブル設定
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TTI-n1
TTI-n2
TTI-n3
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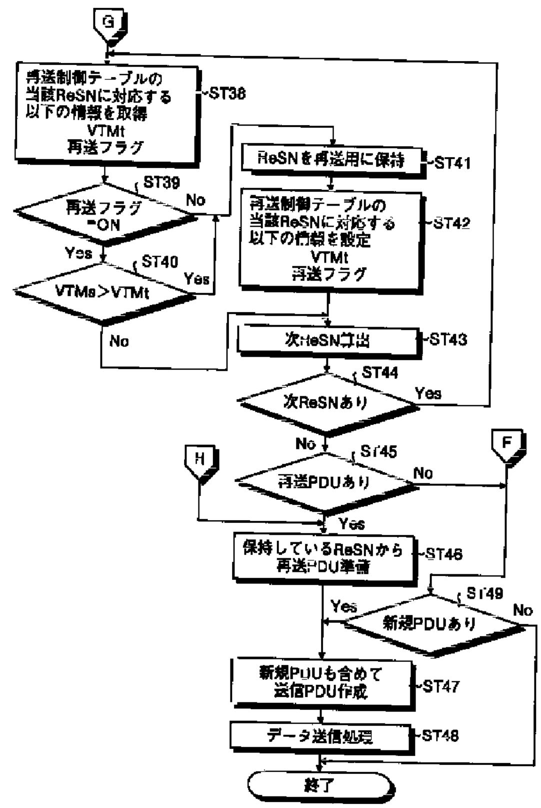
【図21】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ST38
ST39
再送フラグ
=ON
No
Yes
ST40
VTMs＞VTMt
Yes
No
ReSNを再送用に保持
ST41
再送制御テーブルの
当該ReSNに対応する
以下の情報を設定
VTMt
再送フラグ
ST42
次ReSN算出
ST43
ST44
次ReSNあり
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No
ST45
再送PDUあり
No
H
F
Yes
保持しているReSNから
再送PDU準備
ST46
ST49
新規PDUあり
Yes
No
新規PDUも含めて
送信PDU作成
ST47
データ送信処理
ST48
終了

Electronic Acknowledgement Receipt

EFS ID:	10602421
Application Number:	12159841
International Application Number:	
Confirmation Number:	3203
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Customer Number:	35884
Filer:	Sevan Savsa
Filer Authorized By:	
Attorney Docket Number:	2101-3515
Receipt Date:	26-JUL-2011
Filing Date:	22-OCT-2008
Time Stamp:	17:44:18
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	2101-3515_072111_IDSForm.pdf	612314 4c987c8db8f205405f31e5c91b78bbaea90b66af	no	4

Warnings:	
Information:	

A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.

2	Foreign Reference	F1_JP2003174470.pdf	8002722 61d37aa853d832c48372a04b8b595da03db8161f	no	46
Warnings:					
Information:					
3	Non Patent Literature	N1_R2-020769.pdf	75505 2967ce9f36fd66909f20c81a9b0df378737919ba	no	7
Warnings:					
Information:					
		Total Files Size (in bytes):	8690541		

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

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PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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	1					

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2009106289	RU		2010-08-27	Qualcomm Inc.		☐

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

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	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

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EXAMINER SIGNATURE

Examiner Signature		Date Considered	

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[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

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☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Harry Lee/	Date (YYYY-MM-DD)	2011-07-25
Name/Print	Harry Lee	Registration Number	56,814

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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

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	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

	1		☐

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Examiner Signature		Date Considered	

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	Application Number	12159841
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☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

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Signature	/Harry Lee/	Date (YYYY-MM-DD)	2011-07-25
Name/Print	Harry Lee	Registration Number	56,814

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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Espacenet

Bibliographic data: RU 2005115869 (A)

RANDOM ACCESS FOR WIRELESS COMMUNICATION SYSTEMS WITH MULTIPLE ACCESS

Publication date:	2005-10-10
Inventor(s):	UOLTON DZH. RODNI, ; KETCHUM DZHON V, ; UOLLEHJS MARK, ; GOVARD STIVEN DZH
Applicant(s):	KVEHLKOMM INKORPOREJTED
Classification:	- international: ***H04L12/28;*** (IPC1-7): H04L12/28 - European:
Application number:	RU20050115869 20031024
Priority number(s):	US20020421309P 20021025; US20020432440P 20021210
Also published as:	• RU 2359412 (C2) • RU 2009106289 (A)

Abstract of RU 2359412 (C2)

FIELD: physics, communication. ^ SUBSTANCE: invention is related to data transfer. Random access channel (RACH) is determined as created by "fast" random access channel (F-RACH) and "slow" random access channel (S-RACH). F-RACH and S-RACH may efficiently support user terminals in different operational conditions. F-RACH may be used by user terminals, which are registered in system and may compensate their delays in case of propagation in both ends (RTD) with the help of according change of timing of their transfer. F-RACH may be used for fast access to system. S-RACH may be used by user terminals, which may be registered or not registered in system and may be able or unable to compensate their RTD. S-RACH is more reliable and may support user terminals under different operational conditions and modes.; User terminals may use F-RACH, S-RACH or both channels to obtain access to system. ^ EFFECT: facilitation of random access to communication resources in wireless communication systems with random access. ^ 17 cl, 16 dwg, 6 tbl

РОССИЙСКАЯ ФЕДЕРАЦИЯ

(19) **RU** (11) **2009 106 289** (13) **A**

(51) МПК
H04W 74/00 (2009.01)

ФЕДЕРАЛЬНАЯ СЛУЖБА
ПО ИНТЕЛЛЕКТУАЛЬНОЙ СОБСТВЕННОСТИ,
ПАТЕНТАМ И ТОВАРНЫМ ЗНАКАМ

(12) ЗАЯВКА НА ИЗОБРЕТЕНИЕ

(21), (22) Заявка: **2009106289/09, 24.02.2009**

(30) Конвенционный приоритет:
25.10.2002 US 60/421,309
10.12.2002 US 60/432,440
23.10.2003 US 10/693,532

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Адрес для переписки:
129090, Москва, ул.Б.Спасская, 25, стр.3, ООО "Юридическая фирма Городисский и Партнеры", пат.пов. А.В.Мицу, рег.№ 364

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(54) ПРОИЗВОЛЬНЫЙ ДОСТУП ДЛЯ БЕСПРОВОДНЫХ КОММУНИКАЦИОННЫХ СИСТЕМ С МНОЖЕСТВЕННЫМ ДОСТУПОМ

(57) Формула изобретения

1. Способ произвольного доступа в беспроводной коммуникационной системе с множественным доступом, содержащий этапы, на которых

обрабатывают первый канал произвольного доступа, используемый зарегистрированными терминалами для получения доступа в систему;

обрабатывают второй канал произвольного доступа, используемый зарегистрированными и не зарегистрированными терминалами для получения доступа в систему.

2.Способ по п.1, в котором обработка для каждого из первого и второго каналов произвольного доступа включает в себя обнаружение присутствия передач по каналу произвольного доступа.

3. Способ по п.2, в котором обнаружение основывается на пилот-сигнале, который включен в каждую передачу по первому и второму каналам произвольного доступа.

4. Способ по п.2, дополнительно содержащий определение задержки распространения в оба конца для терминала, чья передача была обнаружена по второму каналу произвольного доступа.

5. Способ по п.1, в котором передачи по первому каналу произвольного доступа являются компенсированными на задержку распространения, причем обработка первого канала произвольного доступа включает в себя обнаружение присутствия передачи в каждом из множества слотов; доступных для первого канала

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произвольного доступа.

6. Способ по п.5, в котором обнаружение основано на решающем детекторе.

7. Способ по п.1, в котором обработка второго канала произвольного доступа включает в себя

обнаружение присутствия передач во втором канале

произвольного доступа, выполняя скользящую корреляцию.

8. Канал произвольного доступа для беспроводной коммуникационной системы с множественным доступом с множеством входов и множеством выходов (MIMO), содержащий

первый канал произвольного доступа для использования

зарегистрированными терминалами для получения доступа в систему;

второй канал произвольного доступа для использования

зарегистрированными и не зарегистрированными терминалами для получения доступа в систему;

9. Канал произвольного доступа по п.8, в котором передачи по первому каналу произвольного доступа компенсируют задержку распространения.

10. Канал произвольного доступа по п.8, в котором по упомянутому каналу произвольного доступа передают кадр, причем первый канал произвольного доступа связан с первым сегментом упомянутого кадра, и второй канал произвольного доступа связан со вторым сегментом упомянутого кадра.

11. Канал произвольного доступа по п.10, в котором первый и второй сегменты реализованы с возможностью конфигурирования для каждого кадра.

12. Канал произвольного доступа по п.10, в котором и первый, и второй сегменты разделены на множество слотов.

13. Канал произвольного доступа по п.10, в котором продолжительность каждого из множества слотов для второго сегмента определена как превышающая, чем наибольшая ожидаемая задержка распространения в оба конца для терминалов в системе.

14 Канал произвольного доступа по п.8, в котором первый и второй каналы произвольного доступа связаны с первым и вторым блоками данных протокола (БДП, PDU), соответственно.

15. Канал произвольного доступа по п.14, в котором первый и второй PDU связаны с различными длинами.

16. Канал произвольного доступа по п.14, в котором первый и второй PDU связаны с первой и второй ссылочными частями.

17. Канал произвольного доступа по п.14, в котором первый PDU содержит ссылочную часть и часть сообщения, которые мультиплексированы с разделением времени.

18. Канал произвольного доступа по п.14, в котором второй PDU содержит ссылочную часть и часть сообщения, которые мультиплексированы в различных наборах поддиапазонов.

19. Канал произвольного доступа по п.14, в котором первый и второй PDU связаны с различными наборами полей данных.

20. Канал произвольного доступа по п.19, в котором каждый из первого и второго PDU включает в себя поле идентификатора.

21. Канал произвольного доступа по п.19, в котором второй PDU включает в себя поле циклического избыточного кода (CRC)

22. Канал произвольного доступа по п.14, в котором первый и второй PDU связаны с различными схемами кодирования.

23.Устройство в беспроводной коммуникационной системе с множественным

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доступом, содержащее

средство обработки первого канала произвольного доступа, используемого зарегистрированными терминалами для получения доступа в систему;

средство обработки второго канала произвольного доступа, используемого зарегистрированными и не зарегистрированными терминалами для получения доступа в систему.

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Electronic Acknowledgement Receipt

EFS ID:	10593112
Application Number:	12159841
International Application Number:	
Confirmation Number:	3203
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Customer Number:	35884
Filer:	Harry Sung Lee/Neeti Rajput
Filer Authorized By:	Harry Sung Lee
Attorney Docket Number:	2101-3515
Receipt Date:	25-JUL-2011
Filing Date:	22-OCT-2008
Time Stamp:	18:49:36
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	2101-3515_071411_IDSform_FR.pdf	612262 99c97543925f60bdcb349554dd29de710be6e1fd	no	4

Warnings:	
Information:	

A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.

2	Information Disclosure Statement (IDS) Form (SB08)	2101-3515_071411_IDSform_US.pdf	612243 192d529b227a4c8dd949598984d4d631592bc339	no	4
Warnings:					
Information:					
3	Foreign Reference	RU2009106289.pdf	382037 b5e71d5f652dcc41ec60573f1fc9ebe8dc2221da	no	4
Warnings:					
Information:					
			Total Files Size (in bytes):	1606542	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/159,841	10/22/2008	Young Dae Lee	2101-3515	3203

35884 7590 07/22/2011

LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017

EXAMINER	
CHO, UN C	

ART UNIT	PAPER NUMBER
2617	

NOTIFICATION DATE	DELIVERY MODE
07/22/2011	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

uspto@lhlaw.com
ip.lhlaw@gmail.com
ip.lhlaw@live.com

Office Action Summary	Application No.	Applicant(s)
	12/159,841	LEE, YOUNG DAE
	Examiner	Art Unit
	UN C. CHO	2617

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01 July 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11,13 and 14* is/are rejected.

7)☒ Claim(s) *12* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *01 July 2008* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)	
1) ☒ Notice of References Cited (PTO-892)	4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)	5) ☐ Notice of Informal Patent Application
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *See Continuation Sheet*.	6) ☐ Other: _____.

Continuation of Attachment(s) 3). Information Disclosure Statement(s) (PTO/SB/08), Paper No(s)/Mail Date :12/19/08,12/22/08,3/26/09,5/9/09,7/7/09,8/25/09,9/16/09,9/29/09,12/22/09,1/14/10,5/4/10,5/6/10,6/25/10,6/29/10,8/24/10,9/9/10,12/14/10,12/21/10,2/25/11,3/1/11,3/11/11,3/18,11,4/11/11,4/14/11,4/21/11,5/25/11,7/13/11.

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on 12/19/2008, 12/22/2008, 3/26/2009, 5/9/2009, 7/7/2009, 8/25/2009, 9/16/2009, 9/29/2009, 12/22/2009, 1/14/2010, 2/8/2010, 2/12/2010, 4/14/2010, 5/4/2010, 5/6/2010, 6/25/2010, 6/29/2010, 8/24/2010, 9/9/2010, 12/14/2010, 12/21/2010, 2/25/2011, 3/1/2011, 3/11/2011, 3/18/2011, 4/11/2011, 4/14/2011, 4/21/2011, 5/25/2011 and 7/13/2011 have been placed in record and considered by the examiner.

Double Patenting

3. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140

F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

4. Claims 1 – 10 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1 – 8 of U.S. Patent No. 7,826,859 B2. Although the conflicting claims are not identical, they are not patentably distinct from each other because the claims of the current applicant contain subject matter that are similar in scope and encompass the limitations of the patented claims with a broader recitation.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 11 and 13 are rejected under 35 U.S.C. 102(e) as being anticipated by Billon et al. (US 2004/0147271 A1).

Regarding claims 11 and 13, Billon teaches receiving from a network paging indication information (PICH) including a UE identification information (an identifier for identifying a mobile station) and scheduling information for a paging channel (PCH) on which a paging message is transmitted (each paging message transmitted is preceded by a paging indication message PICH; see Abstract); obtaining the paging indication information when the UE identification information is identical to an identity of the UE (paging message is transmitted to the identified mobile station intended to receive a request contained in the paging message; Page 1, Paragraph 0011); and receiving a paging message using the paging indication information by combining a plurality of paging channels from a plurality of cells (the infrastructure transmits paging messages for mobile stations as it is shown in Figs. 3 and 4, and the mobile station sees the paging indicator associated with its sub-group amongst 18 sub-groups, wherein the PICH frame shows a combination of paging message; Page 1, Paragraph 0011 and Page 3, Paragraph 0037).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Billon in view of Choi et al. (US 2004/0180675 A1).

Regarding claim 14, Billon does not specifically teach wherein the plurality of cells are included in one tracking area (TA). In an analogous art, Choi teaches wherein the plurality of cells are included in on tracking area (Page 14, Paragraphs 0158 and 0159). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the technique of Choi to the system of Billon in order to provide an effective method of transmitting the paging message by minimizing interference and use of uplink resource.

Allowable Subject Matter

9. The following is a statement of reasons for the indication of allowable subject matter:

Regarding claim 12, Billon and Choi either alone or in combination fails to teach wherein the scheduling information includes allocation information of a time-frequency region through which the paging message is transmitted.

Claim 12 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to UN C. CHO whose telephone number is (571)272-7919. The examiner can normally be reached on 9:00AM - 6:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, George Eng can be reached on 571-272-7495. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/UN C. CHO/
Primary Examiner, Art Unit 2617

Notice of References Cited	Application/Control No. 12/159,841	Applicant(s)/Patent Under Reexamination LEE, YOUNG DAE	
	Examiner UN C. CHO	Art Unit 2617	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-7,826,859 B2	11-2010	Lee et al.	455/458
*	B	US-2004/0147271 A1	07-2004	Billon et al.	455/458
*	C	US-2004/0180675 A1	09-2004	Choi et al.	455/458
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12159841	LEE, YOUNG DAE
	Examiner	Art Unit
	UN C CHO	2617

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	07/18/2011								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
	8	✓								
	9	✓								
	10	✓								
	11	✓								
	12	O								
	13	✓								
	14	✓								

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12159841	LEE, YOUNG DAE
	Examiner	Art Unit
	UN C CHO	2617

SEARCHED

Class	Subclass	Date	Examiner
455	458,447,450,515	7/18/2011	UC

SEARCH NOTES

Search Notes	Date	Examiner
East Search including keywords, class/subclass, inventor, assignee	7/18/2011	UC

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner

	/UN C CHO/ Primary Examiner.Art Unit 2617

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(**Not for submission under 37 CFR 1.99)**

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	Cho, Un C
Attorney Docket Number	2101-3515

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Patent citation information please click the Add button.

U.S.PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20030035440		2003-02-20	Casaccia, et al.	
	2	20040143676		2004-07-22	Baudry, et al.	
	3	20060011953		2006-01-19	Nakahasi, et al.	

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	1	2004-349884	JP		2004-12-09	Mitsubishi Electric Corp.		☐

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	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	Cho, Un C
	Attorney Docket Number	2101-3515

	2	2000-032088	JP		2000-01-28	Lucent Technologies Inc.		☐
	3	2002/43403	WO		2002-05-30	AT&T Wireless Services, Inc.		☐
	4	1441473	EP		2004-07-28	Avaya Technologies Corp.		☐
	5	2005/109837	WO		2005-11-17	Motorola, Inc.		☐
	6	2006-14372	JP		2006-01-12	Mitsubishi Electric Corp.		☐
	7	9-327072	JP		1997-12-16	Hitachi Ltd.		☐
	8	2001-95031	JP		2001-04-21	Toshiba Corp.		☐
	9	11-308671	JP		1999-11-05	NEC Corporation		☐
	10	6-013959	JP		1994-01-21	Hitachi Ltd.		☐
	11	2000-184428	JP		2000-06-30	Nokia Mobile Phones Ltd.		☐
	12	2005-517369	JP		2005-06-09	Motorola, Inc.		☐

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	Attorney Docket Number	2101-3515

	13	2005-244958	JP		2005-09-08	Matsushita Electric Ind Co., Ltd.		☐

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	1	CHINA MOBILE, "RRC States Analysis In LTE," 3GPP TSG RAN WG2#48, R2-052140, August 29, 2005.	☐
	2	PANASONIC, "E-UTRA Transport And Logical Channels," 3GPP TSG RAN WG2#49, R2-052860, November 7, 2005.	☐
	3	SIEMENS, "States In E-UTRAN," 3GPP TSG-RAN WG RAN2#48, R2-052501, August 29, 2005.	☐
	4	QUALCOMM EUROPE, "Signaling Optimization For E-UTRAN," 3GPP TSG-RAN WG2 Meeting #48-bis, R2-052407, October 10, 2005.	☐

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	1	I228008	TW		2005-02-11	Benq Corporation		☐
	2	I229268	TW		2005-03-11	Momenta Taiwan Inc.		☐
	3	I229514	TW		2005-03-11	Qualcomm Incorporated		☐

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	1	20040077357		2004-04-22	Nakada	
	2	20030236085		2003-12-25	Ho	
	3	20050190728		2005-09-01	Han et al.	

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	1	6138158		2000-10-24	Boyle, et al.	

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	1	20040004954		2004-01-08	Terry, et al.	
	2	20050073987		2005-04-07	Wu	
	3	20060059186		2006-03-16	Backlund	

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	1	2005/109695	WO		2005-11-17	Samsung Electronics Co., Ltd.		☐

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	Examiner Name	Cho, Un C
	Attorney Docket Number	2101-3515

	2	2005-236988	JP		2005-09-02	Samsung Electronics Co., Ltd.		☐
	3	1663158	CN		2005-08-31	Qualcomm, Inc.		☐
	4	1411668	CN		2003-04-16	Samsung Electronics Co., Ltd.		☐

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First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	Bost, Dwayne D.
Attorney Docket Number	2101-3515

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	1	2002-075442	WO		2002-09-26	Dow Global Technologies Inc.		☐
	2	2005-099125	WO		2005-10-20	LG Electronics Inc.		☐

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	2	20080095105		2008-04-24	Sundberg et al.	

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	1	2005055472	WO		2005-06-16	LG Electronics Inc.		☐

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	1	6882727		2005-04-19	Vialen, et al.	
	2	7359345		2008-04-15	Chang, et al.	
	3	7535886		2009-05-19	Lee, et al.	
	4	6694148		2004-02-17	Frodigh, et al.	
	5	6907005		2005-06-14	Dahlman, et al.	

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	1	20030210669		2003-11-13	Vayanos, et al.	

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	2	20050213605		2005-09-29	Kim, et al.	
	3	20040116143		2004-06-17	Love, et al.	
	4	20050243767		2005-11-03	Zhang, et al.	

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	1	0978958	EP		2000-02-09	NTT Mobile Communications Network		☐

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	1	Haardt, M., et al., "The TD-CDMA Based UTRA TDD Mode," IEEE Journal on Selected Areas in Communications, Vol. 18, No. 8, pp. 1375-85, August 2000.	☐

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	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	Bost, Dwayne D.
	Attorney Docket Number	2101-3515

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	1	7145895		2006-12-05	Mueckenheim, et al.	
	2	7443816		2008-10-28	Chen, et al.	

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	1	2003-008635	JP		2003-01-10	Lucent Technologies, Inc.		☐
	2	2004-128967	JP		2004-04-22	NTT DoCoMo, Inc.		☐

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	3	2002-374321	JP		2002-12-26	NTT DoCoMo, Inc.		☐
	4	2005-539462	JP		2005-12-22	Motorola, Inc.		☐
	5	2004/030393	WO		2004-04-08	Motorola, Inc.		☐

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	1	6317430		2001-11-13	Knisely, et al.	

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	1	2003/056723	WO		2003-07-10	NOKIA		☐
	2	2003/007636	WO		2003-01-23	QUALCOMM		☐
	3	2002/047417	WO		2002-06-13	NOKIA		☐

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	4	2003043259	WO		2003-05-22	NOKIA		☐
	5	2003017691	WO		2003-02-27	QUALCOMM		☐
	6	2005088886	WO		2005-09-22	SAMSUNG		☐
	7	2005074312	WO		2005-08-12	SAMSUNG		☐

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	1	MOTOROLA: "Paging Channel Design for E-UTRA", 3GPP TSG-RAN WG1,R1-061712 [online] June 27, 2006	☐
	2	SARKA, S. et al.: Common-Channel Soft Handoff in cdma2000-The Paging Channel. IEEE Transactions on Microwave Theory and Techniques. June 2000	☐
	3	NTT DOCOMO, et al.: "Paging Channel Structure for E-UTRA Downlink", 3GPP TSG-RAN WG1, R1-060034 [online], January 23, 2006	☐
	4	PHILLIPS: "Envolved Paging Indicators for LTE"; 3GPP TSG-RAN WG2 Meeting #49, Seoul, Korea, November 7-11, 2005	☐
	5	LG ELECTRONICS INC.: "Framing in the MAC entity", 3GPP TSG-RAN WG2 #52 R2-061012, March 27-31, 2006, Athens, Greece	☐

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	6	LG ELECTRONICS INC.: "HARQ and ARQ Operation"; 3GPP TSG-RAN WG2 #50, R2-060106, January 9-13, 2006, Sophia Antipolis, France.	☐
	7	HUAWEL: "Further considerations on multiplexing method of shared Control Channel in Uplink Single-Carrier FDMA", TSG-RAN WG1#43, R1-051430; Seoul Korea, November 7-11, 2005.	☐

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	1	NTT DOCOMO et al. "Multiplexing method of shared control channeil in uplink single-carrier FDMA radio access" TSG-RAN WG1 #42bis, R1-051143, October 14, 2005.	☐

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	1	6381229		2002-04-30	Narvinger, et al.	
	2	7075971		2006-07-11	Parsa, et al.	
	3	7436801		2008-10-14	Kanterakis	
	4	6480525		2002-11-12	Parsa, et al.	

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	1	20020032884		2002-03-14	Kobata, et al.	
	2	20040117860		2004-06-17	Yi, et al.	

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	3	20070147326		2007-06-28	Chen	
	4	20050157696		2005-07-21	Yamamoto	
	5	20100014430		2010-01-21	Oka	
	6	20030103476		2003-06-05	Choi, et al.	
	7	20090052388		2009-02-26	Kim, et al.	
	8	20090109912		2009-04-30	DiGirolamo, et al.	
	9	20090163211		2009-06-25	Kitazoe, et al.	
	10	20090201948		2009-08-13	Patwardhan, et al.	
	11	20090238141		2009-09-24	Damnjanovic, et al.	

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	Attorney Docket Number	2101-3515

	1	2232477	RU		2004-10-07	Samsung Electronics Co., Ltd.		☐
	2	03/096571	WO		2003-11-20	Telefonaktiebolaget LM Ericsson (publ)		☐
	3	2270526	RU		2006-02-20	Siemens Aktiengesellshaft		☐
	4	2232469	RU		2004-07-10	Telefonaktiebolaget LM Ericsson (publ)		☐
	5	2168278	RU		2001-05-27	Samsung Electronics Co., Ltd.		☐
	6	2237380	RU		2004-09-27	Telefonaktiebolaget LM Ericsson (publ)		☐
	7	2191479	RU		2002-10-20	Samsung Electronics Co., Ltd.		☐
	8	200605549	TW		2006-02-01	Nokia Corporation		☐
	9	407407	TW		2000-10-01	Telefonaktiebolaget LM Ericsson		☐
	10	586283	TW		2004-05-01	Qualcomm Incorporated		☐
	11	589818	TW		2004-06-01	Chung-Shan Institute of Science and Technology		☐

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	12	590340	TW		2004-06-01	Interdigital Technology Corporation		☐
	13	200536318	TW		2005-11-01	Interdigital Technology Corporation		☐
	14	552815	TW		2003-09-11	Interdigital Technology Corporation		☐
	15	592412	TW		2004-06-11	Interdigital Technology Corporation		☐

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	1	XU, H., et al.; "Performance Analysis on the Radio Link Control Protocol of UMTS System"; 2002 IEEE 56th Vehicular Technology Conference Proceedings; pp. 2026-30; September 2002.	☐

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	1	20050288026		2005-12-29	Byun et al.	

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	1	1605724	EP		2005-12-14	Samsung Electronics Co., Ltd.		☐
	2	1684538	EP		2006-07-26	Samsung Electronics Co., Ltd.		☐
	3	2004045234	WO		2004-05-27	Siemens Aktiengesellschaft		☐

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	1	7778599		2010-08-17	Li, et al.	

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	2	20070121543		2007-05-31	Kuchibhotla, et al.	

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	2	2002-135231	JP		2002-05-10	Canon KK		☐

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	1	LG ELECTRONICS INC., "UE state transition in LTE_ACTIVE," 3GPP TSG-RAN WG2 #52, R2-061002, March 27, 2006, XP050130928	☐
	2	ERICSSON, "LTE States in E-UTRAN," 3GPP TSG-RAN WG2 Meeting #48bis, R2-052425, October 10, 2005, XP050129534	☐

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6785510		2004-08-31	Larsen	
	2	6850504		2005-02-01	Cao et al.	
	3	7385952		2008-06-10	Mantha et al.	

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	2	20040264550		2004-12-30	Dabak	
	3	20060062196		2006-03-23	Cai et al.	

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	First Named Inventor	Young Dae Lee
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	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

	4	20040116143		2004-06-17	Love et al.	
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	6	20060007886		2006-01-12	Lee et al.	

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	1	98/47302	WO		1998-10-22	Nokia Telecommunications OY		☐
	2	01/05121	WO		2001-01-18	Telefonaktiebolaget LM Ericsson		☐
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	6	2005278167	JP		2005-10-06	Mitsubishi Electric Information Technology		☐

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	7	2005/006660	WO		2005-01-20	NTT CORP		☐
	8	2005119941	WO		2005-12-15	LG Electronics Inc.		☐
	9	2263415	RU		2005-10-27	Telefonaktiebolaget LM Ericsson		☐
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	1	Motorola et al., "MAC-e/es header and functional split," R2-042360, 3GPP TSG RAN WG2 Meeting#45, November 2004.	☐
	2	Ericsson, "User plane protocol enhancements," R2-052749, TSG-RAN WG2 Meeting #48bis, October 2005.	☐
	3	LG Electronics Inc., "MAC Enhancement," R2-060561, 3GPP TSG-RAN WG2 #51, February 2006.	☐

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	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

	4	Qualcomm, "Need for MAC-hs segmentation mechanism," R2-020769, 3GPP TSG-RAN WG2 Meeting #28, April 2002.	☐
	5	3rd Generation Partnership Project (3GPP), "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA) Medium Access Control (MAC) Protocol Specification (Release 8)," 3GPP TS 36.321 v8.4.0, January 2009.	☐

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CONFIRMATION NO. 3203

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/159,841	10/22/2008	455	2617	2101-3515

APPLICANTS
Young Dae Lee, GYEONGGI-DO, KOREA, REPUBLIC OF;

**** CONTINUING DATA ***************************
This application is a 371 of PCT/KR2007/000078 01/05/2007
which claims benefit of 60/757,063 01/05/2006
and claims benefit of 60/783,250 03/16/2006
and claims benefit of 60/784,680 03/21/2006
and claims benefit of 60/797,402 05/02/2006

**** FOREIGN APPLICATIONS ***************************
REPUBLIC OF KOREA 10-207-0000936 01/04/2007

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****
05/20/2009

Foreign Priority claimed ☑ Yes ☐ No 35 USC 119(a-d) conditions met ☑ Yes ☐ No Verified and Acknowledged /UN C CHO/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		KOREA, REPUBLIC OF	8	14	3

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LEE, HONG, DEGERMAN, KANG & WAIMEY
660 S. FIGUEROA STREET
Suite 2300
LOS ANGELES, CA 90017
UNITED STATES

TITLE

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Examiner Name	BOST, DWAYNE D
Attorney Docket Number	2101-3515

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6965580		2005-11-15	Takagi, et al.	

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First Named Inventor	Lee, Young Dae
Art Unit	2617
Examiner Name	Not Assigned yet
Attorney Docket Number	2101-3515

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	1	10-2001-0111637	KR		2001-12-20	LG Information & Communications LTD.		☐

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	Examiner Name	Not Assigned yet
	Attorney Docket Number	2101-3515

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Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	Bost, Dwayne D.
Attorney Docket Number	2101-3515

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	1	7426175		2008-09-16	Zhuang, et al.	

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	1	20030156624		2003-08-21	Null	
	2	20020160744		2002-10-31	Choi, et al.	
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	5	20040008658		2004-01-15	DAHLMAN, et al.	
	6	20020021714		2002-02-21	SEGUIN	

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	1	10-2004-0048675	KR		2004-06-10	ELECTRONICS AND TELECOMM. RESEARCH INSTITUTE		☐
	2	10-2004-0064867	KR		2004-07-21	SAMSUNG ELECTRONICS CO., LTD.		☐
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	6	1557968	EP		2005-07-27	MATSUSHITA ELECTRIC INDUSTRIAL CO. LTD.		☐
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	Examiner Name	Not assigned
	Attorney Docket Number	2101-3515

	8	1361514	EP		2003-11-12	SWISSCOM MOBILE AG		☐
	9	2004/075442	WO		2004-09-02	FLARION TECHNOLOGIES, INC		☐
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	11	1999/044383	WO		1999-09-02	SIEMENS AKTIENGESELLSCHAFT		☐

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	1	ZDARSKY, F.A., et al.,"Handover in Mobile Communication Networks: Who Is In Control Anyway?", Proceedings of the 30th Annual EUROMICRO Conference, Aug. 31, 2004, XP10723593.	☐
	2	ERICSSON, "E-UTRA Random Access," 3GPP TSG-RAN WG1, R1-051445, XP003020958, Nov. 7, 2005.	☐
	3	DERRYBERRY, R.T., et al.,"On CDMA 2000 Evolution - Reverse High-Speed Packet Data Physical Layer Enhancements In CDMA 2000 1xEV-DV," IEEE Communications Magazine, Volume 43, Issue 4, pp. 41-47, XP001228792, April 18, 2005.	☐
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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20060018289		2006-01-26	Schulist, et al.	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	Cho, Un C.
	Attorney Docket Number	2101-3515

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EAST Search History

EAST Search History (Prior Art)

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S25	29	PICH same (UE near3 identif$5)	US-PGPUB; USPAT	OR	OFF	2011/07/18 07:52
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L1	614	(455/447).CCLS.	US-PGPUB; USPAT	OR	OFF	2011/07/18 10:21
L8	385	PICH same PCH	US-PGPUB; USPAT	OR	OFF	2011/07/18 10:22
L7	3	4 and 3	US-PGPUB; USPAT	OR	OFF	2011/07/18 10:22
L6	29	4 and 2	US-PGPUB; USPAT	OR	OFF	2011/07/18 10:22
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L4	352	(receiv$3 with (pag$5 near3 message)) same UE	US-PGPUB; USPAT	OR	OFF	2011/07/18 10:22
L3	794	(455/515).CCLS.	US-PGPUB; USPAT	OR	OFF	2011/07/18 10:22
L12	825	(LEE near3 YOUNG).in. and LG.as.	US-PGPUB; USPAT	OR	OFF	2011/07/18 10:23
L11	12	8 and 3	US-PGPUB; USPAT	OR	OFF	2011/07/18 10:23
L10	26	8 and 2	US-PGPUB; USPAT	OR	OFF	2011/07/18 10:23
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EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	
First Named Inventor	Young Lee
Art Unit	2617
Examiner Name	
Attorney Docket Number	2101-3515

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	1	WO1999/063713	WO		1999-12-09	TANTIVY COMMUNICATIONS		☐
	2	EP1599063	EP		2005-11-23	SAMSUNG ELECTRONICS		☐
	3	WO2004/034656	WO		2004-04-22	GOLDEN BRIDGE TECHNOLOGY, INC.		☐

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	12159841 12159841 - GAU: 2617
	Filing Date	
	First Named Inventor	Young Lee
	Art Unit	2617
	Examiner Name	
	Attorney Docket Number	2101-3515

	4	WO2002/039760	WO		2002-05-16	NOKIA		☐
	5	EP1261222	EP		2002-11-27	ALCATEL		☐

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[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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PTO/SB/08a (04-09)
Approved for use through 05/31/2009. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Application Number	12159841
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First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	Not assigned
Attorney Docket Number	2101-3515

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20050185608	A1	2005-08-25	Lee et al.	

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	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	Not assigned
	Attorney Docket Number	2101-3515

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[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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PTO/SB/08a (01-10)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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Examiner Name	Bost, Dwayne D.
Attorney Docket Number	2101-3515

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	1	7031708		2006-04-18	Sarkkinen, et al.	
	2	RE39454		2007-01-02	Cantoni, et al.	

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	1	20020021714		2002-02-21	Seguin	
	2	20040157602		2004-08-12	Khawand	
	3	20040006643		2004-01-08	Dolson, et al.	
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(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	Cho, Un C.
Attorney Docket Number	2101-3515

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6859445		2005-02-22	Moon, et al.	

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	1	20030007510		2003-01-09	Yeo, et al.	
	2	20070206531		2007-09-06	Pajukoski, et al.	

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	1	2006-505998	JP		2006-02-16	Philips Intellectual Property & Standards GMBH		☐
	2	2005-536168	JP		2005-11-24	LG Electronics Inc.		☐

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	Attorney Docket Number	2101-3515

	3	2005-237013	JP		2005-09-02	Samsung Electronics Co., Ltd.		☐
	4	2006-020044	JP		2006-01-19	NEC Corp.		☐

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Examiner Name	Bost, Dwayne D
Attorney Docket Number	2101-3515

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	1	20040157602	A1	2004-08-12	Khawand, Charbel	
	2	20030076812	A1	2003-04-24	Benedittis, Rosella De	
	3	20010024956	A1	2001-09-27	You, et al	

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	1	9960729	WO		1999-11-25	Telefonaktiebolaget LM Ericsson		☐

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	Attorney Docket Number	2101-3515

	2	2168278	RU		2001-05-27	Samsung Electronics, CO., LTD.		☐

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	1	7496113		2009-02-24	Cai, et al.	

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	1	7151758		2006-12-19	Kumaki, et al.	
	2	7359349		2008-04-15	Kayama, et al.	

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	1	20070135080		2007-06-14	Islam, et al.	
	2	20060168343		2006-07-27	Ma, et al.	

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	1	6597668		2003-07-22	Schafer et al	
	2	6795412		2004-09-21	Lee	

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	1	20020071480		2002-06-13	Marjelund et al.	
	2	20040014452		2004-01-22	Lim et al.	
	3	20040198369		2004-10-07	Kwak et al.	

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	Art Unit	2617
	Examiner Name	Bost, Dwayne D
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	1	10337828	DE		2005-04-21	Siemens AG		☐

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	1	5828677		1998-10-27	Sayeed et al.	
	2	6088342		2000-07-11	Cheng et al.	
	3	6571102		2003-05-27	Hogberg et al.	
	4	6597675		2003-07-22	Esmailzadeh et al.	
	5	6728225		2004-04-27	Ozluturk	
	6	6907015		2005-06-14	Moulsley et al.	
	7	6947394		2005-09-20	Johansson et al.	
	8	6950420		2005-09-27	Sarkkinen et al.	

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	9	7430206		2008-09-30	Terry et al.	
	10	7664059		2010-02-16	Jiang	

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	1	20040114606		2004-06-17	Haddad	
	2	20050025039		2005-02-03	Hwang et al.	
	3	20050281212		2005-12-22	Jeong et al.	
	4	20050020260		2005-01-27	Jeong et al.	
	5	20050249141		2005-11-10	Lee et al.	
	6	20040202140		2004-10-14	Kim et al.	
	7	20020181436		2002-12-05	Mueckenheim et al.	

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	8	20050260997		2005-11-24	Korale et al.	
	9	20040185860		2004-09-23	Marjelund et al.	
	10	20020191559		2002-12-19	Chen et al.	
	11	20020044527		2002-04-18	Jiang et al.	
	12	20050041573		2005-02-24	Eom et al.	
	13	20020187789		2002-12-12	Diachina et al.	
	14	20050014508		2005-01-20	Moulsley et al.	
	15	20020090004		2002-07-11	Rinchiuso	
	16	20020093940		2002-07-18	Toskala et al.	
	17	20020021698		2002-02-21	Lee et al.	
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	19	20100034095		2010-02-11	Ho et al.	
	20	20090175241		2009-07-09	Ohta et al.	
	21	20040028078		2004-02-12	Beckmann et al.	
	22	20030147371		2003-08-07	Choi et al.	
	23	20050026623		2005-02-03	Fisher	
	24	20030223393		2003-12-04	Lee	

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	1	94/09597	WO		1994-04-28	Nokia Telecommunications OY		☐
	2	2002-102110	WO		2002-12-19	Telefonaktiebolaget LM Ericsson		☐
	3	2004-089030	WO		2004-10-14	LG Electronics Inc.		☐

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	4	2005-125125	WO		2005-12-29	LG Electronics Inc.		☐
	5	1041850	EP		2000-10-04	Nortel Matra Cellular		☐
	6	1392074	EP		2004-02-25	Samsung Electronics Co., Ltd.		☐

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	2	6717925		2004-04-06	Leppisaari, et al.	

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	1	20030139170		2003-07-24	Heo	
	2	20040264497		2004-12-30	Wang, et al.	
	3	20030050097		2003-03-13	Amirijoo, et al.	
	4	20050059407		2005-03-17	Reed, et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /U.C./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	12159841
	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	Cho, Un C.
	Attorney Docket Number	2101-3515

	5	20050207374		2005-09-22	Petrovic, et al.	
	6	20040180675		2004-09-16	Choi, et al.	
	7	20040001452		2004-01-01	Day, et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	I237478	TW		2005-08-11	Wistron Corporation		☐
	2	I239731	TW		2005-09-11	G-Tek Electronics Corp.		☐
	3	I239756	TW		2005-09-11	Nebo Wireless, LLC		☐
	4	2000-151494	JP		2000-05-30	Sony Int'l Europe GMBh		☐
	5	2000-175271	JP		2000-06-23	Korea Electronics Telecommunications		☐
	6	2001-298770	JP		2001-10-26	LG Electronics Inc.		☐

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /U.C./

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	Filing Date	2008-10-22
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	Art Unit	2617
	Examiner Name	Cho, Un C.
	Attorney Docket Number	2101-3515

	7	2004-320165	JP		2004-11-11	NTT Docomo Inc.		☐
	8	2001/035586	WO		2001-05-17	Motorola, Inc.		☐
	9	I242951	TW		2005-11-01	Interdigital Technology Corporation		☐
	10	200522579	TW		2005-07-01	Qualcomm Incorporated		☐
	11	1478203	EP		2004-11-17	Samsung Electronics Co., Ltd.		☐

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1		☐

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Examiner Signature	/Un Cho/	Date Considered	07/12/2011

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[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Application Number	12159841
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Art Unit	2617
Examiner Name	Cho, Un C
Attorney Docket Number	2101-3515

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20030003920		2003-01-02	Sebastian	
	2	20030043741		2003-03-06	Mukai, et al.	
	3	20030054829		2003-03-20	Moisio	
	4	20040002334		2004-01-01	Lee, et al.	
	5	20040125772		2004-07-01	Wu, et al.	

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	Application Number	12159841
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	Art Unit	2617
	Examiner Name	Cho, Un C
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	6	20040147266		2004-07-29	Hwang, et al.	
	7	20040229626		2004-11-18	Yi, et al.	
	8	20050197134		2005-09-08	McKenna, et al.	
	9	20060045047		2006-03-02	Choi, et al.	
	10	20050054368		2005-03-10	Amerga	
	11	20070099619		2007-05-03	Parekh, et al.	
	12	20040097192		2004-05-20	Schiff	
	13	20040127223		2004-07-01	Li, et al.	
	14	20050118947		2005-06-02	Ames, et al.	

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FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]

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	Filing Date	2008-10-22
	First Named Inventor	Young Dae Lee
	Art Unit	2617
	Examiner Name	Cho, Un C
	Attorney Docket Number	2101-3515

	1	98/49857	WO		1998-11-05	Telefonaktiebolaget LM Ericsson		☐
	2	01/05068	WO		2001-01-18	SAMSUNG ELECTRONICS CO LTD		☐
	3	2004312771	JP		2004-11-04	SAMSUNG ELECTRONICS CO LTD		☐
	4	2005217743	JP		2005-08-11	HITACHI LTD		☐
	5	03/055142	WO		2003-07-03	Qualcomm Inc.		☐
	6	2005/018269	WO		2005-02-24	LG Electronics Inc.		☐
	7	2005/036917	WO		2005-04-21	Qualcomm Inc.		☐
	8	2006/012946	WO		2006-02-09	Matsushita Electric Industrial Co., Ltd.		☐

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
	1		☐

If you wish to add additional non-patent literature document citation information please click the Add button Add

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Attorney Docket Number	2101-3515

EXAMINER SIGNATURE			
Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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	Art Unit	2617
	Examiner Name	Cho, Un C
	Attorney Docket Number	2101-3515

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Sevan Savsa/	Date (YYYY-MM-DD)	2011-07-20
Name/Print	Sevan Savsa	Registration Number	61,718

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

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1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

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4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

INTELLECTUAL PROPERTY OFFICE

Espacenet

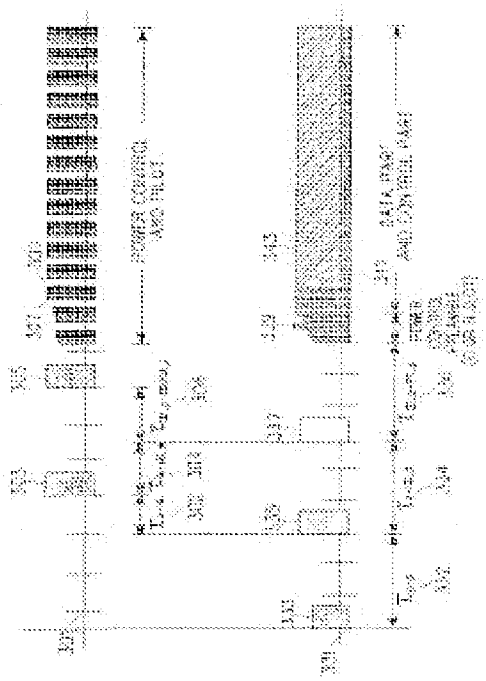
Bibliographic data: JP 2004312771 (A)

CHANNEL ASSIGNMENT APPARATUS AND METHOD FOR COMMON PACKET CHANNEL IN WIDE BAND CODE DIVISION MULTIPLE ACCESS MOBILE COMMUNICATION SYSTEM

Publication date:	2004-11-04
Inventor(s):	MOON HI-CHAN; AHN JAE-MIN; LEE HYUN-SEOK; KANG HEE-WON; PARK SEONG IL; CHOI HO-KYU; HWANG SUNG-OH; KOO CHANG-HOI; LEE HYUN-WOO; CHOI SUNG-HO; KIM JAE-YOEL; MUN HYUN-JUNG; KIM KYOU-WOONG ±
Applicant(s):	SAMSUNG ELECTRONICS CO LTD ±
Classification: - international:	***H04B1/69; H04B7/005; H04J11/00; H04J13/00; H04J13/04; H04L12/56; H04W52/50; H04W74/08; H04B1/707; H04B7/26; H04W72/04;*** (IPC1-7): H04J13/00; H04Q7/38
Classification: - european:	H04J11/00; H04L12/56B; H04Q7/38C2U; H04W52/50; H04W74/08D4F
Application number:	JP20040171840 20040609
Priority number (s):	KR19990027166 19990707; KR19990029658 19990721; KR19990032862 19990811; KR19990034489 19990819; KR19990035058 19990823; KR19990045178 19991014; KR20000000984 20000110; KR20000007195 20000211; KR20000007166 20000215
Also published as:	• JP 3967339 (B2) • WO 0105050 (A1) • US 6859445 (B1) • PT 1443667 (E) • PT 1353448 (E) • more

Abstract of JP 2004312771 (A)

PROBLEM TO BE SOLVED: To disclose an assignment method for a common packet channel in a CDMA communication system. SOLUTION: The method comprises the steps of: transmitting an access preamble signal including channel information to be used for accessing a base station; receiving an access preamble acquisition indicator signal received from the base station in response to the access preamble signal; transmitting a collision detection preamble for detecting a collision in response to the received access preamble acquisition indicator signal; receiving a first signal indicating the supplement of the collision detecting preamble and a second signal indicating channel assignment which are transmitted from the base station in response to the collision preamble; and assigning the common packet channel according to information designated by the second signal when the first signal is received. ; COPYRIGHT: (C) 2005,JPO&NCIPI



Last updated: 26.04.2011 Worldwide Database 5.7.22; 92p

(19)日本国特許庁(JP)　(12)公開特許公報(A)　(11)特許出願公開番号
特開2004-312771
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(43)公開日　平成16年11月4日(2004.11.4)

(51)Int.Cl.[7]	F I		テーマコード（参考）
H04Q 7/38	H04B 7/26	109N	5K022
H04J 13/00	H04J 13/00	A	5K067

審査請求 有　請求項の数 22　OL　（全 68 頁）

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(22)出願日　平成16年6月9日 (2004.6.9)
(62)分割の表示　特願2001-509167 (P2001-509167)の分割
原出願日　平成12年7月7日 (2000.7.7)
(31)優先権主張番号　1999/27166
(32)優先日　平成11年7月7日 (1999.7.7)
(33)優先権主張国　韓国 (KR)
(31)優先権主張番号　1999/29658
(32)優先日　平成11年7月21日 (1999.7.21)
(33)優先権主張国　韓国 (KR)
(31)優先権主張番号　1999/32862
(32)優先日　平成11年8月11日 (1999.8.11)
(33)優先権主張国　韓国 (KR)

(71)出願人　594001292
サムスン　エレクトロニクス　カンパニー　リミテッド
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弁理士　渡邊　隆
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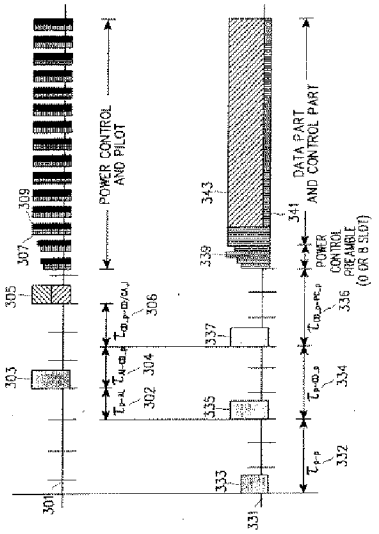
大韓民国・ソウル・１３８－０４０・ソンパーグ・ブンナプ－ドン・３９１

最終頁に続く

(54)【発明の名称】広帯域符号分割多重接続移動通信システムにおける共通パケットチャンネルのチャンネル割当て装置及び方法

(57)【要約】
【課題】　ＣＤＭＡ通信システムの共通パケットチャンネルの割当て方法を開示する。
【解決手段】　この方法は、基地局をアクセスするために使用されるチャンネル情報を有するアクセスプリアンブル信号を伝送するステップと、アクセスプリアンブル信号に応じて基地局から受信したアクセスプリアンブル補足表示信号を受信するステップと、受信されたアクセスプリアンブル補足表示信号に応じて衝突を検出する衝突検出プリアンブルを伝送するステップと、基地局が衝突検出プリアンブルに応じて伝送した衝突検出プリアンブルの補足を示す第１信号及びチャンネル割当てを示す第２信号を受信するステップと、第１信号の受信のとき、第２信号が指定した情報によって共通パケットチャンネルを割り当てるステップとからなる。
【選択図】　図３



【特許請求の範囲】
【請求項1】
ＣＤＭＡ通信システムにおけるチャンネル割当て方法において、
ＵＥが基地局をアクセスするために使用するチャンネル特性を有するアクセスプリアンブル信号を受信するステップと、
前記アクセスプリアンブル信号の受信のとき、前記受信されたアクセスプリアンブル信号に応答してアクセスプリアンブル補足表示信号を生成するステップと、
前記生成されたアクセスプリアンブル補足表示信号を伝送するステップと、
前記アクセスプリアンブル補足表示信号に応答して、前記ＵＥから衝突検出プリアンブル信号を受信するステップと、
前記衝突検出プリアンブルに応答して、前記衝突検出プリアンブルの補足を示す第１表示信号と前記チャンネルの割当てを示す第２表示信号とを生成するステップと、
前記生成された第１及び第２表示信号を伝送するステップと
からなることを特徴とするＣＤＭＡ通信システムにおけるチャンネル割当て方法。
【請求項2】
前記衝突検出プリアンブル信号は、所定個数のシグネチャーのうち、前記使用者端末により無作為に選択された一つのシグネチャー(Randomly Selected a Signature)を含むことを特徴とする請求項１記載のチャネル割当て方法。
【請求項3】
前記アクセスプリアンブル信号によるチャンネル情報と前記第２表示信号内の情報との組合せによって決定されるチャンネルを通じてアップリンクチャンネルデータを受信するステップをさらに備えることを特徴とする請求項１記載のチャンネル割当て方法。
【請求項4】
ＣＤＭＡ通信システムのメッセージを伝送する方法において、
前記メッセージの伝送のために使用されるチャンネル特性に対応するシグネチャーを選択するステップと、
前記チャンネル特性に対応する前記選択されたシグネチャーを有するアクセスプリアンブルを生成するステップと、
前記生成されたアクセスプリアンブルを伝送するステップと、
前記アクセスプリアンブルに対する応答信号を受信するステップと、
前記応答信号の受信のとき、衝突検出プリアンブルに使用するシグネチャーを選択するステップと、
前記選択されたシグネチャーを含む衝突検出プリアンブルを生成するステップと、
前記生成された衝突検出プリアンブルを伝送するステップと、
前記衝突検出プリアンブルに対する応答信号を受信するステップと、
共通パケットチャンネルに対する前記メッセージの伝送に使用されるチャンネル情報を有するチャンネル割当て信号を受信するステップと、
前記割り当てられた共通パケットチャンネルを通じて前記メッセージを伝送するステップと
からなることを特徴とするメッセージ伝送方法。
【請求項5】
前記シグネチャーは所定個数のシグネチャーのうち、無作為に選択された一つのシグネチャーであることを特徴とする請求項４記載のメッセージ伝送方法。
【請求項6】
前記メッセージ伝送ステップは、
前記メッセージに対する適切な電力レベルを調整するために電力制御プリアンブルを伝送するステップと、
前記メッセージを伝送するステップと
からなることを特徴とする請求項４記載のメッセージ伝送方法。
【請求項7】

ＣＤＭＡ通信システムにおけるチャンネル割当て方法において、
使用しようとするチャンネルの伝送率に対応するシグネチャーを含むアクセスプリアンブルを受信するステップと、
前記アクセスプリアンブルに含まれたシグネチャーを利用して応答信号を生成するステップと、
前記生成された応答信号を伝送するステップと、
衝突検出プリアンブルを受信するステップと、
前記衝突検出プリアンブルに対応するシグネチャーを利用して応答信号を生成するステップと、
前記伝送率を有する利用可能のチャンネルを割り当てるためのシグネチャーを含むチャンネル割当て信号を生成するステップと、
前記生成された応答信号及び前記生成されたチャンネル割当て信号を伝送するステップと、
前記チャンネル割当て信号に対応するシグネチャーと前記アクセスプリアンブルに含まれたシグネチャーとの組合せを利用して前記チャンネルを割り当てるステップと、
前記割り当てられたチャンネルを通じてメッセージを受信するステップと
からなることを特徴とするチャンネル割当て方法。
【請求項8】
ＣＤＭＡ通信システムにおけるチャンネルを通じたメッセージ伝送方法において、
伝送されるメッセージが生成される場合、サービス可能な最大伝送率を確認するステップと、
使用しようとする伝送率に対するシグネチャーを選択するステップと、
使用しようとする伝送率に対する前記選択されたシグネチャーを含むアクセスプリアンブルを生成するステップと、
前記生成されたアクセスプリアンブルを伝送するステップと、
前記アクセスプリアンブルに対応するアクセスプリアンブル補足表示信号を受信するステップと、
衝突検出シグネチャーのうち１つのシグネチャーを選択するステップと、
前記選択されたシグネチャーを含む衝突検出プリアンブルを生成するステップと、
前記生成された衝突検出プリアンブルを伝送するステップと、
前記衝突検出プリアンブルに対応する衝突検出表示信号及びチャンネル割当てを指定するためのシグネチャーを含むチャンネル割当て表示信号を受信するステップと、
前記チャンネル割当て表示信号と前記アクセスプリアンブルシグネチャーとの組合せでチャンネルを確認するステップと、
前記確認されたチャンネルを通じてメッセージを伝送するステップと
からなることを特徴とするメッセージ伝送方法。
【請求項9】
前記シグネチャーは所定個数のシグネチャーのうち、無作為に選択された一つのシグネチャーであることを特徴とする請求項８記載のメッセージ伝送方法。
【請求項10】
前記衝突検出プリアンブルを伝送するステップは、前記アクセスプリアンブルに対するスクランブリングコードとは異なるスクランブリングコードを利用して、前記生成された衝突検出プリアンブルを伝送するステップを備えることを特徴とする請求項８記載の方法。
【請求項11】
前記チャンネルを確認するステップは、前記アクセスプリアンブル信号に含まれたシグネチャーに対応する伝送率を有するチャンネルのうち、前記チャンネル割当て表示信号に含まれたシグネチャーによって指定されたチャンネルを確認するステップを備えることを特徴とする請求項８記載のメッセージ伝送方法。
【請求項12】

ＣＤＭＡ通信システムにおけるチャンネル割当て方法において、
移動局が使用しようとする伝送率に対応するシグネチャーを含むアクセスプリアンブルを受信するステップと、
前記アクセスプリアンブルの受信のとき、前記アクセスプリアンブル内のシグネチャーに対応するシグネチャーを含むアクセスプリアンブル補足表示信号を伝送するステップと、
前記アクセスプリアンブル補足表示信号の伝送の後、衝突検出プリアンブルを受信するステップと、
前記衝突検出プリアンブルの受信のとき、衝突検出表示信号及びチャンネル割当てを指定するシグネチャーを含むチャンネル割当て表示信号を伝送するステップと、
前記アクセスプリアンブル内のシグネチャーによって決定された前記指定されたチャンネル及び前記チャンネル割当て表示信号を通じてメッセージを受信するステップと
からなることを特徴とするチャンネル割当て方法。
【請求項13】
前記アクセスプリアンブル補足表示信号は、共通パケットチャンネルがサービス可能な伝送率に関する情報を含むことを特徴とする請求項１２記載の方法。
【請求項14】
前記アクセスプリアンブル補足表示信号は、伝送率に関する情報及び利用可能な多重符号に関する情報を含むことを特徴とする請求項１２記載の方法。
【請求項15】
ＣＤＭＡ通信システムにおけるチャンネル割当て方法において、
前記チャンネルを通じて伝送されるメッセージが発生する場合、使用しようとする伝送率に対するシグネチャーを選択するステップと、
前記選択されたシグネチャーを含むアクセスプリアンブルを生成するステップと、
前記生成されたアクセスプリアンブルを伝送するステップと、
チャンネル割当て表示信号の受信のとき、前記チャンネル割当て表示信号に含まれたシグネチャーを検査するステップと、
前記アクセスプリアンブルが示したシグネチャーに対応するチャンネルのグループから、前記チャンネル割当て表示信号に含まれたシグネチャーに対応するチャンネルを選択するステップと
からなることを特徴とするチャンネル割当て方法。
【請求項16】
ＣＤＭＡ通信システムにおけるチャンネル割当て方法において、
移動局が使用しようとする伝送率に対するシグネチャーを含むアクセスプリアンブルを受信するステップと、
前記アクセスプリアンブルに含まれたシグネチャーに対応する伝送率を有するチャンネルのうち、利用可能なチャンネルがあるとき、前記利用可能なチャンネルの番号に対応するシグネチャーを選択するステップと、
前記選択されたシグネチャーを含むチャンネル割当て表示信号を生成するステップと、
前記生成されたチャンネル割当て表示信号を伝送するステップと
からなることを特徴とするチャンネル割当て方法。
【請求項17】
ＣＤＭＡ通信システムにおけるメッセージ伝送装置において、
前記メッセージの伝送に使用される伝送率に対応するシグネチャーを選択し、前記伝送率に対応する前記選択されたシグネチャーを含むアクセスプリアンブルを生成して伝送するアクセスチャンネル送信器と、
前記アクセスプリアンブルに対する応答信号を受信するアクセスプリアンブル補足表示チャンネル受信器と、
前記応答信号の受信のとき、衝突検出プリアンブルに使用するシグネチャーを選択した後、前記衝突検出プリアンブルに使用する前記選択されたシグネチャーを含む前記衝突検

出プリアンブルを生成して伝送する衝突検出チャンネル送信器と、
　前記衝突検出プリアンブルに対する応答信号と前記メッセージの伝送に使用される伝送率を有するチャンネルのチャンネル割当て信号とを受信する表示チャンネル受信器と、
　前記受信されたチャンネル割当て信号に含まれたシグネチャー及び前記アクセスプリアンブルに使用するシグネチャーを決定して、前記割り当てられたチャンネルを通じてメッセージを伝送するチャンネル送信器と
からなることを特徴とするメッセージ伝送装置。
【請求項18】
　前記衝突検出プリアンブルに使用するシグネチャーは、所定個数のシグネチャーのうち、無作為に選択された一つのシグネチャーであることを特徴とする請求項１７記載のメッセージ伝送方法。
【請求項19】
　ＣＤＭＡ通信システムにおけるチャンネル割当て装置において、
　移動局が使用しようとするチャンネルの伝送率に対応するシグネチャーを含むアクセスプリアンブルを受信するアクセスチャンネル受信器と、
　前記アクセスプリアンブルに含まれたシグネチャーを利用して補足表示信号を生成し、前記生成された補足表示信号を伝送するアクセスプリアンブル補足表示チャンネル送信器と、
　衝突検出プリアンブルを受信する衝突検出プリアンブルチャンネル受信器と、
　前記衝突検出プリアンブルに含まれたシグネチャーに対応するシグネチャーを利用して表示信号を生成し、メッセージの伝送に使用される伝送率を有する利用可能なチャンネルを割り当てるためのシグネチャーを含むチャンネル割当て表示信号を生成し、前記生成された表示信号及び前記チャンネル割当て表示信号を伝送する表示チャンネル送信器と、
　前記伝送されたチャンネル割当て表示信号に含まれたシグネチャー及び前記アクセスプリアンブルに使用するシグネチャーによって示された前記チャンネルを割り当て、前記割り当てられたチャンネルを通じてメッセージを受信するチャンネル受信器と
からなることを特徴とするチャンネル割当て装置。
【請求項20】
　前記衝突検出プリアンブルに含まれたシグネチャーは、所定個数のシグネチャーのうち、無作為に選択された一つのシグネチャーであることを特徴とする請求項１９記載のメッセージ伝送方法。
【請求項21】
　ＣＤＭＡ通信システムにおけるチャンネル割当て装置において、
　前記チャンネルを通じて伝送されるメッセージの生成のとき、使用しようとする伝送率に対するシグネチャーを選択し、前記選択されたシグネチャーを含むアクセスプリアンブルを生成して伝送するアクセスプリアンブルチャンネル送信器と、
　前記チャンネル割当て表示信号を受信するチャンネル割当て表示チャンネル受信器と、
　前記チャンネル割当て表示信号に含まれたシグネチャーを検査した後、前記アクセスプリアンブルに含まれたシグネチャーに対応する複数のチャンネルのうち、前記チャンネル割当て表示信号に含まれたシグネチャーに対応するチャンネルを選択するチャンネル送信器と
からなることを特徴とするチャンネル割当て装置。
【請求項22】
　ＣＤＭＡ通信システムにおけるチャンネル割当て装置において、
　移動局が使用しようとする伝送率に対するシグネチャーを含むアクセスプリアンブルを受信するアクセスチャンネル受信器と、
　前記アクセスプリアンブルに含まれたシグネチャーに対応する伝送率を有するチャンネルのうち、使用可能なチャンネルがあるとき、前記使用可能なチャンネルのチャンネル番号に対応するシグネチャーを選択し、前記選択されたシグネチャーを含むチャンネル割当て表示信号を生成して伝送するチャンネル割当て表示チャンネル送信器と、

前記アクセスプリアンブルのシグネチャーに対応する伝送率を有するチャンネルのうち、前記チャンネル割当て表示信号に対応するチャンネルを受信するチャンネル受信器とからなることを特徴とするチャンネル割当て装置。

【発明の詳細な説明】

【技術分野】

【0001】

本発明は、符号分割多重接続（Code Division Multiple Access；以下、ＣＤＭＡと略称する。）通信システムの共通チャンネル通信装置及び方法に関し、特に、広帯域ＣＤＭＡ移動通信システムにおける共通パケットチャンネルのチャンネル割当て装置及び方法に関する。

【背景技術】

【0002】

次世代移動通信システムであるＵＭＴＳ(Universal Mobile Telecommunications System)W-ＣＤＭＡ(Wideband Code Division Multiple Access)通信システムのような広帯域ＣＤＭＡ通信システムでは、アップリンク（または逆方向（reverse））共通チャンネル（Uplink Common Channel）として、ランダムアクセスチャンネル（Random Access Channel；以下、“ＲＡＣＨ”と略称する。）及び共通パケットチャンネル（Common Packet Channel；以下、“ＣＰＣＨ”と略称する。）が使用される。

【0003】

図１は、Ｗ－ＣＤＭＡ通信システムでアップリンク共通チャンネルのうちの１つであるＲＡＣＨを通じてメッセージを送受信する方法を示す図である。

【0004】

図１において、参照番号１５１は、アップリンクチャンネルの信号伝送手順を示し、このとき使用されるチャンネルは、ＲＡＣＨになることができる。前記ＲＡＣＨは、前記加入者装置(ＵＥまたは移動局)がＵＭＴＳテレストリアルラジオアクセスネットワーク(Terrestrial Radio Access Network)(ＵＴＲＡＮまたは基地局)に信号を伝送する共通チャンネルのうちの１つである。そして、参照番号１１１は、ダウンリンクチャンネル(またはフォーワード(forward))の信号伝送手順を示し、このとき、使用されるチャンネルは、アクセスプリアンブル補足表示チャンネル（Access preamble-Acquisition Indicator Channel；以下、“ＡＩＣＨ”と略称する。）になることができる。前記ＡＩＣＨは、前記ＲＡＣＨを通じて伝送されたプリアンブル信号をＵＴＲＡＮが受信し、前記受信されたプリアンブル信号に応答するチャンネルである。前記ＲＡＣＨを通じて伝送されるプリアンブルは、アクセスプリアンブル（Access Preamble；以下、“ＡＰ”と略称する。）であり、多数のＲＡＣＨ用シグネチャーのうちの１つを任意に選択して作られる。

【0005】

前記ＲＡＣＨは、プリアンブルパート(preamble part)及びメッセージパート(message part)で構成される。前記ＲＡＣＨを通じてメッセージを伝送するためには、伝送データのタイプによって、アクセスサービスクラス（Access Service Class；以下、“ＡＳＣ”と略称する。）を選択し、前記ＡＳＣ案に定義されているＲＡＣＨ下位チャンネルグループ(ＲＡＣＨ sub-channel group)を選択し、前記選択されたＲＡＣＨ下位チャンネルでＡＰをＵＴＲＡＮに伝送する。その後、前記ＡＰ信号は、ＵＴＲＡＮから獲得するチャンネルである。ＵＴＲＡＮは、ＡＩＣＨを通じてＡＰ信号に応答する。ＵＥがＵＴＲＡＮからアクノリッジメントＡＩＣＨ信号を受信する場合、ＲＡＣＨメッセージ部の信号をＵＴＲＡＮへ伝送する。

【0006】

図１を参照すると、ＵＥは、１６２のようにシグネチャー(signature)を使用して一定の長さのＡＰを伝送した後、ＵＴＲＡＮからの応答を一定の時間τ_{p-p}待機する。ＵＴＲＡＮから一定の時間τ_{p-p}応答がなければ、ＵＥは、図１の参照番号１６４に示すように、送信電力を特定のレベルに増加させて前記ＡＰを再伝送する。ＵＴＲＡＮは、前記ＲＡＣＨを通じて伝送されるＡＰを検出すると、１２２のように、一定の時間$\tau_{p-AP-AI}$の後

前記検出されたＡＰのシグネチャーをダウンリンク(downlink)ＡＩＣＨを通じて伝送する。ＡＰを伝送した後、ＵＥは、ＡＰに使用されるシグネチャーを検出するためにＡＩＣＨを検査する。この場合、前記ＲＡＣＨを通じて伝送されたＡＰに使用されるシグネチャーが検出されると、ＵＥは、ＵＴＲＡＮがＡＰを検出したものと判断し、前記ＲＡＣＨを通じて１７０のように一定の時間$\tau_{AP-AI-MSG}$の後ＲＡＣＨメッセージ及び制御部を伝送する。

【0007】

しかし、ＡＰ１６２を伝送した後、設定された時間(τ_{p-p})内にＵＴＲＡＮが伝送したＡＩＣＨ信号を受信できないか、または受信されたＡＩＣＨ信号から自分の伝送したシグネチャーを検出できないと、ＵＥは、ＵＴＲＡＮが前記ＡＰを検出できなかったものと判断し、予め設定された時間(τ_{p-p})が経過した後前記ＡＰを再伝送する。このとき、参照番号１６４に示すように、ＡＰは、以前伝送されたＡＰの送信電力より△Ｐ(ｄＢ)だけ増加させた送信電力で再伝送される。このとき再伝送されるＡＰは、ＵＥが選択したＡＳＣ案に定義されている複数のシグネチャーから任意に選択されたシグネチャーを使用することができる。ＵＥは、ＡＰを伝送した後、ＵＴＲＡＮから伝送されたシグネチャーを利用するＡＩＣＨ信号を受信できなかったら、設定された時間(τ_{p-p})が経過した後、ＡＰの送信電力及びシグネチャーを変化させて前記のような動作を反復して遂行する。ＵＥは、前記ＡＰを伝送し、ＡＩＣＨ信号を受信する過程において、自分の伝送したシグネチャーが受信されると、予め設定された時間($\tau_{p-AP-AI}$)が経過した後、ＲＡＣＨメッセージ１７０を前記シグネチャーで使用するスクランブリングコードで拡散し、予め設定されたチャンネル区分コード(Channelization code)を使用して、ＡＰ送信電力を考慮して決定された送信電力で前記拡散されたＲＡＣＨメッセージを伝送する。

【0008】

前述したように、ＲＡＣＨを利用してＡＰを伝送すると、ＵＴＲＡＮがＡＰを効率的に検出でき、アップリンク共通チャンネルメッセージに対する初期電力を容易に設定することができる。しかし、前記ＲＡＣＨのような逆方向共通チャンネルは電力を制御できないので、伝送データの伝送率が高いか、または伝送データの量が多いので、ＵＥは、伝送時間が長いパケットデータを伝送し難い。また、ただ１度のＡＰ_ＡＩＣＨ（Access Preamble Acqusition Indicator Channel）を通じてチャンネルを割り当てるので、同一のシグネチャーを利用してＡＰを伝送したＵＥは、同一のチャンネルを割り当てることができる。この場合、相互異なるＵＥが伝送したデータが相互衝突してＵＴＲＡＮがデータを受信できないこともある。

【0009】

このような問題を解決するために、W-ＣＤＭＡ方式にてアップリンク共通チャンネルを電力制御し、ＵＥ間の衝突を減少させることができる方式が提案されてきた。このような方式を共通パケットチャンネル（Common Packet Channel；ＣＰＣＨ）に適用している。前記ＣＰＣＨは、アップリンク共通チャンネルの電力制御を可能にし、相互異なるＵＥにチャンネルを割り当てる方法において、ＲＡＣＨより高信頼性の方法を使用する。そして、前記ＣＰＣＨは、ＵＥが高い伝送率のデータを一定の時間の間(数十乃至数百ｍｓ程度)伝送できる共通チャンネルである。前記ＣＰＣＨを使用する目的は、ＵＥが専用チャンネル（Dedicated Channel）を使用せず、特定の値より小さいアップリンク伝送メッセージを迅速にＵＴＲＡＮへ伝送できるようにするためである。

【0010】

すなわち、前記専用チャンネルを設定するためには、関連した複数の制御メッセージがＵＥとＵＴＲＡＮとの間に送受信されなければならなく、また、制御メッセージの送受信に長時間が要求される。従って、小さいサイズのデータ(例えば、数十または数百ｍｓの比較的少ない量のデータ)を伝送するために専用チャンネルを割り当てるようになると、前記専用チャンネルが割り当てられる間多い制御メッセージの交換は、大きいオーバーヘッド(overhead)となる。その結果、小さいサイズのデータを伝送する場合は、ＣＰＣＨを利用することがさらに効果的である。

【0011】
しかし、前記ＣＰＣＨは、多数のＵＥが前記ＣＰＣＨの使用権を獲得するために、幾つかのシグネチャーを使用してプリアンブルを伝送するので、ＵＥのＣＰＣＨ信号間の衝突が発生することができ、このような現象を避けるために、ＵＥにＣＰＣＨの使用権を割り当てることができる方法を使用すべきである。

【0012】
Ｗ－ＣＤＭＡ通信システムは、ＵＴＲＡＮ間を区別するためにダウンリンクスクランブリングコードを使用し、ＵＥ間を区別するためにアップリンクスクランブリングコードを使用する。また、ＵＴＲＡＮから伝送したチャンネルは、直交（Orthogonal Variable Spreading Factor；以下、ＯＶＳＦと略称する。）符号を使用して区別され、ＵＥが伝送するチャンネルも、ＯＶＳＦコードを使用して区別される。

【0013】
従って、ＣＰＣＨを使用するためにＵＥが要求する情報は、アップリンク（または逆方向）ＣＰＣＨチャンネルのメッセージ部に使用されるスクランブリングコード、アップリンクＣＰＣＨメッセージ部（ＵＬ_ＤＰＣＣＨ）で使用するＯＶＳＦコード、データ部(ＵＬ_ＤＰＤＣＨ)で使用するＯＶＳＦコード、アップリンクＣＰＣＨの最大伝送速度、及びＣＰＣＨの電力制御のために使用されるダウンリンク(または順方向)専用物理制御チャンネル(ＤＬ_ＤＰＣＣＨ)のチャンネル区分コードを含む。前記情報は、ＵＴＲＡＮとＵＥとの間の専用チャンネルが設定される場合も通常に必要な情報である。また、専用チャンネルが設定される前、多数のシグナリング信号の伝送を通じて前記のような情報(オーバーヘッド)がＵＥに伝送される。しかし、ＣＰＣＨは、専用チャンネルではない共通チャンネルであるので、前記情報をＵＥに割り当てるために、従来技術では、ＡＰで使用されるシグネチャーとＲＡＣＨで使用される下位チャンネル（sub-channel）の概念を導入したＣＰＣＨ下位チャンネルとの組合せで前記情報を表示する。

【0014】
図２は、従来技術によるダウンリンク及びアップリンクチャンネル信号の信号伝送手順を示す。図２において、ＲＡＣＨで使用されるＡＰを伝送する方式に加えて、相互異なるＵＥからＣＰＣＨ信号間の衝突を防止するために、衝突検出プリアンブル（Collision Detection Preamble；以下、“ＣＤ_Ｐ”と略称する。）を使用する。

【0015】
図２において、参照番号２１１は、ＵＥがＣＰＣＨの割当てを要求する場合遂行されるアップリンクチャンネルの動作手順を示す。そして、参照番号２０１は、ＣＰＣＨをＵＥに割り当てるためのＵＴＲＡＮの動作手順を示す。図２において、ＵＥは、ＡＰ２１３を伝送する。前記ＡＰ２１３を構成するシグネチャーは、前記ＲＡＣＨで使用されるシグネチャーグループまたは同一のシグネチャーから選択されることができる。ＣＰＣＨのシグネチャーがＲＡＣＨシグネチャーと同一である場合、ＣＰＣＨのシグネチャーは、異なるスクランブリングコードを利用してＲＡＣＨのシグネチャーと区分されることができる。前記ＡＰを構成するシグネチャーは、ＲＡＣＨが任意にシグネチャーを選択する方式とは異なり、前述したような情報に基づきＵＥによって選択される。すなわち、それぞれのシグネチャーは、ＵＬ_ＤＰＣＣＨに使用されるＯＶＳＦコード、ＵＬ_ＤＰＤＣＨに使用されるＯＶＳＦコード、ＵＬスクランブリングコード及びＤＬ_ＤＰＣＣＨに使用するＯＶＳＦコード、最大フレーム数、及び伝送率がマッピングされている。従って、ＵＥで１個のシグネチャーを選択することは、該当シグネチャーにマッピングされた６種類の情報を選択するものと同一である。また、ＵＥは、前記ＡＰを伝送する前にＡＰ_ＡＩＣＨの末尾部を利用して伝送されるＣＰＣＨ状態表示チャンネル（ＣＰＣＨ Status Indicator Channel；以下、“ＣＳＩＣＨ”と略称する。）を通じて、ＵＥの属したＵＴＲＡＮ内で現在使用できるＣＰＣＨチャンネルの状態を確認する。その後、ＵＥが現在使用できるＣＰＣＨチャンネルのうち自分の使用しようとするチャンネルのシグネチャーを選択して前記ＣＳＩＣＨを通じてＡＰを伝送する。前記ＡＰ２１３は、ＵＥが設定した初期送信電力を使用してＵＴＲＡＮへ伝送される。図２において、時間２１２内にＵＴＲＡＮからの応答

がなければ、ＵＥは、ＡＰ２１５によって示されたＡＰをさらに高い送信電力で再伝送する。前記ＡＰの再伝送回数及び待機時間２１２は、ＣＰＣＨチャンネルを獲得する過程を開始する前に設定される。そして、前記再伝送回数が設定値を超過するようになると、ＵＥは、ＣＰＣＨチャンネルの獲得過程を中止する。

【0016】

ＡＰ２１５の受信のとき、ＵＴＲＡＮは、前記受信されたＡＰを他のＵＥから受信されたＡＰと比較する。ＡＰ２１５を選択する場合、ＵＴＲＡＮは、時間２０２が経過した後ＡＰ_ＡＩＣＨ２０３をＡＣＫとして伝送する。ＵＴＲＡＮが前記受信されたＡＰと比較してＡＰ２１５を選択する幾つかの基準がある。例えば、ＵＥがＡＰを通じてＵＴＲＡＮに要請したＣＰＣＨの使用が可能であるか、または、ＵＴＲＡＮが受信したＡＰの受信電力がＵＴＲＡＮの要求した最小受信電力値を満足する場合がその基準になることができる。ＡＰ_ＡＩＣＨ２０３は、ＵＴＲＡＮが選択したＡＰ２１５を構成するシグネチャー値を含む。

【0017】

ＵＥの自分が伝送したシグネチャーが前記ＡＰ２１５を伝送した後受信されたＡＰ_ＡＩＣＨ２０３に含まれていると、ＵＥは、時間２１４が経過した後、衝突検出プリアンブル(ＣＤ_Ｐ)２１７を伝送する。前記ＣＤ_Ｐ２１７を伝送する理由は、様々のＵＥから伝送チャンネル間の衝突を防止するためである。すなわち、ＵＴＲＡＮに属した複数のＵＥは、同一のＡＰをＵＴＲＡＮに同時に伝送して同一のＣＰＣＨに対する使用権を要求することができ、その結果、同一のＡＰ_ＡＩＣＨを受信するＵＥは、同一のＣＰＣＨを使用することができ、これにより、衝突を発生させる。このような衝突を防止するために、ＵＥは、ＣＤ_Ｐを伝送し、ＵＴＲＡＮは、同一のＡＰ及び異なるＣＤ_Ｐを伝送した複数のＵＥから１つのＵＥを選択する。ＵＥ及びＵＴＲＡＮの詳細な動作は次のようである。衝突を防止するために、同一のＡＰを同時に伝送したＵＥのそれぞれがＣＤ_Ｐに使用するシグネチャーを選択してＣＤ_Ｐを伝送する。前記多数のＣＤ_Ｐを受信するとき、ＵＴＲＡＮは、受信されたＣＤ_Ｐのうちの１つを選択して応答できる。例えば、前記ＣＤ_Ｐを選択する基準は、ＵＴＲＡＮから受信されたＣＤ_Ｐの受信電力レベルになることができる。前記ＣＤ_Ｐ２１７を構成するシグネチャーは、ＡＰに使用されるシグネチャーのうちの１つを使用することができ、前記ＲＡＣＨと同一の方式にて選択されることができる。すなわち、ＣＤ_Ｐに使用するシグネチャーのうちの１つを任意に選択して伝送できる。また、１つのシグネチャーのみがＣＤ_Ｐに使用されることができる。１つのシグネチャーのみがＣＤ_Ｐに使用される場合、ＵＥは、一定の時間の間、任意の時点でＣＤ_Ｐを伝送する。このような方法は、異なる伝送時点を使用するが、ＣＤ_Ｐに１つのシグネチャーのみを使用する複数のＵＥを区別することができる。

【0018】

ＣＤ_Ｐ２１７の受信のとき、ＵＴＲＡＮは、前記受信されたＣＤ_Ｐを他のＵＥから受信されたＣＤ_Ｐと比較してＣＰＣＨを使用することができるＵＥを選択するようになる。このとき、ＣＤ_Ｐ２１７を選択する場合、ＵＴＲＡＮは、衝突検出表示チャンネル（Collision Detection Indicator Channel；以下、“ＣＤ_ＩＣＨ”と略称する。）２０５を時間２０６が経過した後にＵＥへ伝送する。ＣＤ_ＩＣＨは、ＲＡＣＨ伝送のときＡＰ_ＡＩＣＨと同一の構造及び機能を有する。しかし、ＣＤ_ＩＣＨは、１つのＡＣＫのみを伝送する。前記ＵＴＲＡＮから伝送されたＣＤ_ＩＣＨ２０５を受信すると、ＵＥは、それらの自分(すなわち、ＣＤ_ＡＣＫ)が伝送したＣＤ_Ｐに使用されたシグネチャー値がＣＤ_ＩＣＨ２０５に含まれているか否かを確認する。もしも、含まれていると、時間２１６が経過した後に電力制御プリアンブル（Power Control Preamble；以下、“ＰＣ_Ｐ”と略称する。）２１９を伝送する。前記ＰＣ_Ｐ２１９は、ＵＥがＡＰに使用するシグネチャーを決定しつつ定められたアップリンクスクランブリングコードと、ＣＰＣＨが伝送される間、制御部（ＵＬ_ＤＰＣＣＨ）２２１として同一のチャンネル区分コード（ＯＶＳＦ）とを使用する。前記ＰＣ_Ｐ２１９は、パイロットビット、電力制御命令語ビット、及びフィードバック情報ビットからなる。前記ＰＣ_Ｐ２１９は、０または８スロット

の長さを有する。前記スロットは、ＵＭＴＳシステムが物理チャンネルを通じて伝送する場合に使用される基本的な伝送単位であり、ＵＭＴＳシステムが３，８４Ｍｃｐｓのチップレートを使用する場合、２，５６０チップの長さを有する。前記ＰＣ_Ｐ２１９の長さが０スロットの場合は、ＵＴＲＡＮとＵＥとの間の現在の無線環境がよいので、ＣＰＣＨメッセージ部の送信電力を調節する必要がなく、ＣＤ_Ｐの送信電力を考慮してＵＥが決定した送信電力で伝送されることができる。ＰＣ_Ｐ２１９の長さが８スロットである場合、ＣＰＣＨメッセージ部の送信電力を調節する必要がある。

【0019】

ＡＰ２１５及びＣＤ_Ｐ２１７は、同一の初期値を有するスクランブリングコードを使用することができる。しかし、異なる開始ポイントを有する。例えば、ＡＰは、４，０９６の長さを有する０番目～４，０９５番目のスクランブリングコードを使用することができ、ＣＤ_Ｐは、４，０９６の長さを有する４，０９６番目～８，１９１番目のスクランブリングコードを使用することができる。前記ＡＰ及びＣＤ_Ｐは、同一の初期値を有するスクランブリングコードの同一の部分を使用することができ、このような方法は、Ｗ-ＣＤＭＡシステムがアップリンク共通チャンネルに使用するシグネチャーをＲＡＣＨ用及びＣＰＣＨ用シグネチャーに区分する場合に利用可能である。ＰＣ_Ｐ２１９に使用されるスクランブリングコードの場合、ＡＰ２１５及びＣＤ_Ｐ２１７に使用されるスクランブリングコードと同一の初期値を有する０番目～２１，４２９番目値のスクランブリングコードを使用することができる。また、前記ＡＰ２１５及びＣＤ_Ｐ２１７に使用されるスクランブリングコードと１：１にマッピングされる異なるスクランブリングコードを使用することもできる。

【0020】

参照番号２０７及び２０９は、ダウンリンク専用物理チャンネル（DownlinkDedicated Physical Channel；以下、“ＤＬ_ＤＰＣＨ”と略称する。）の一部分である専用物理制御チャンネル（Dedicated Physical Control Channel；以下、“ＤＬ_ＤＰＣＣＨ”と略称する。）のパイロットフィールド及び電力制御命令語フィールドをそれぞれ示す。前記ＤＬ_ＤＰＣＣＨは、ＵＴＲＡＮを区別するためのダウンリンク一次的スクランブリングコード(Primary Downlink Scrambling Code)を使用することができ、ＵＴＲＡＮの容量を拡張するための二次的スクランブリングコード(Secondary Scrambling Code)を使用することもできる。前記ＤＬ_ＤＰＣＣＨに使用されるチャンネル区分コードＯＶＳＦは、ＡＰに対するシグネチャーを選択するＵＥが使用される場合チャンネル区分コードを決定する。前記ＤＬ_ＤＰＣＣＨは、ＵＴＲＡＮがＵＥから伝送されたＰＣ_ＰまたはＣＰＣＨメッセージに対する電力制御を遂行する場合使用される。ＵＴＲＡＮは、前記ＰＣ_Ｐ２１９の受信のとき、ＰＣ_Ｐ２１９のパイロットフィールドの受信電力を測定する。そして、電力制御命令語２０９を利用して、ＵＥが伝送したアップリンク伝送チャンネルの送信電力を制御する。ＵＥは、ＵＴＲＡＮから受信したＤＬ_ＤＰＣＣＨ信号の電力を測定し、そして、ＰＣ_Ｐ２１９の電力制御フィールドに電力制御命令語を入力してＵＴＲＡＮに伝送し、ＵＴＲＡＮから来るダウンリンクチャンネルの送信電力を制御する。

【0021】

参照番号２２１及び２２３は、ＣＰＣＨメッセージの制御部ＵＬ_ＤＰＣＣＨ及びデータ部ＵＬ_ＤＰＤＣＨをそれぞれ示す。図２のＣＰＣＨメッセージを拡散するために使用されるスクランブリングコードは、ＰＣ_Ｐ２１９で使用するスクランブリングコードと同一のスクランブリングコードを使用し、１０ｍｓ単位で３８，４００の長さを有する０番目～３８，３９９番目スクランブリングコードを使用する。図２のメッセージで使用するスクランブリングコードは、ＡＰ２１５及びＣＤ_Ｐ２１７で使用するスクランブリングコードと同一であることもでき、または、１：１にマッピングされる他のスクランブリングコードになることもできる。

【0022】

ＣＰＣＨメッセージのデータ部２２３が使用するチャンネルコードＯＶＳＦは、ＵＴＲＡＮとＵＥとが予め約束した方式によって決定される。すなわち、ＡＰに使用されるシグ

ネチャーとＵＬ_ＤＰＤＣＨに使用されるＯＶＳＦコードはマッピングされているので、使用されるＡＰシグネチャーを決定すると、前記ＵＬ_ＤＰＤＣＨに使用されるＯＶＳＦコードが決定される。制御部（ＵＬ_ＤＰＤＣＨ）２２１が使用するチャンネル区分コードは、ＰＣ_Ｐが使用するＯＶＳＦコードと同一のチャンネル区分コードを使用する。前記制御部（ＵＬ_ＤＰＤＣＨ）２２１が使用するチャンネル区分コードは、前記ＵＬ_ＤＰＤＣＨに使用されるＯＶＳＦコードが決定されると、ＯＶＳＦコードツリー構造によって決定される。

【0023】

図２を参照すると、従来技術は、ＣＰＣＨの効率を高めるために、チャンネルの電力制御を可能にし、ＣＤ_Ｐ及びＣＤ_ＩＣＨを使用して、相互異なるＵＥからのアップリンク信号間の衝突の可能性を減少させる。しかし、従来技術において、ＵＥは、ＵＴＲＡＮでＣＰＣＨの現在の状態を伝送するＣＳＩＣＨを分析することによって、あるＣＰＣＨチャンネルの割当てを要求し、ＣＰＣＨを通じて伝送したデータを考慮して前記情報を予め決定する。すなわち、ＣＰＣＨの割当ては、ＵＥによって行われ、ＵＴＲＡＮによらない。従って、ＵＴＲＡＮは、ＵＥが要求した同一の特性を有するＣＰＣＨを有するとしても、ＵＥが特定のＣＰＣＨを要求する場合、ＵＴＲＡＮは、ＵＥにＣＰＣＨを割り当てることができない。そこで、ＣＰＣＨチャンネルの割当てに対する制約及びＣＰＣＨチャンネルの獲得にかかる時間の遅延が発生する。

【0024】

前記ＣＰＣＨチャンネルの割当てに対する制約は、次のようである。ＵＴＲＡＮで使用可能のＣＰＣＨ数が多数存在するとしても、ＵＴＲＡＮ内のＵＥが同一のＣＰＣＨを要求する場合、同一のＡＰを選択するようになる。同一のＡＰ_ＡＩＣＨを受信し、ＣＤ_Ｐを再伝送するとしても、非選択されたＣＤ_Ｐを伝送したＵＥは、最初からＣＰＣＨを割り当てるための過程を開始しなければならない。また、ＣＤ_Ｐの選択過程を遂行しても、やはり、多数のＵＥが同一のＣＤ_ＩＣＨを受信してＣＰＣＨのアップリンクの伝送が行われる間、衝突が発生する確率を増加させる。また、ＣＳＩＣＨを確認し、ＵＥがＣＳＩＣＨを通じて伝送した現在のＣＰＣＨ状態を考慮してＣＰＣＨの割当てを要求しても、ＣＰＣＨを利用しようとするＵＴＲＡＮ内のすべてのＵＥは同一のＣＳＩＣＨを受信する。従って、ＣＰＣＨのうちで使用可能のチャンネルの割当てを要求するとしても、多数のＵＥが特定のＣＰＣＨのチャンネル割当てを同時に要求する場合がある。前記のような場合、ＵＴＲＡＮは、割当て可能の他のＣＰＣＨがあるとしても、１つのＵＥにのみ多数のＵＥが要求したＣＰＣＨを割り当てるほかない。これは、ＵＥが決定したチャンネル割当てによる。

【0025】

前記チャンネルの獲得にかかる時間遅延について、前記ＣＰＣＨチャンネルの割当ての制約を参照して説明された場合が発生すると、ＵＥは、所望のＣＰＣＨチャンネルの割当てのためにＣＰＣＨの割当て要求を繰り返して遂行しなければならない。従来技術において、システムの複雑度を減少させるために導入した１つのＣＤ_Ｐに１つのシグネチャーのみを使用して、一定の時間、任意の時点でＣＤ_Ｐを伝送する方法を使用する場合、１つのＵＥのＣＤ_ＩＣＨを伝送して処理する間、他のＵＥのＣＤ_ＩＣＨを処理することができない。

【0026】

また、従来技術は、ＡＰに使用される１つのシグネチャーに関連して１つのアップリンクスクランブリングコードを使用する。従って、ＵＴＲＡＮで使用するＣＰＣＨの数が増加するときごとに、アップリンクスクランブリングコードの数が増加する。これは、資源浪費を発生させる。

【発明の開示】

【発明が解決しようとする課題】

【0027】

従って、本発明の目的は、一番目、ＣＤＭＡ通信システムで、共通チャンネルを通じて

メッセージを伝送する装置及び方法を提供することにある。

【0028】

二番目、移動局の受信器が低い複雑度で補足表示チャンネルを通じて受信できるダウンリンク補足表示チャンネル(ＡＩＣＨ)を提供することにある。

【0029】

三番目、移動局がダウンリンク補足表示チャンネルを通じて伝送される複数のシグネチャーを簡単に検出できるＵＴＲＡＮの受信方法を提供することにある。

【0030】

四番目、ＣＤＭＡ通信システムで、共通チャンネルを通じてメッセージを伝送するアップリンク共通チャンネルの効率的な電力制御を遂行するチャンネル割当て方法を提供することにある。

【0031】

五番目、ＣＤＭＡ通信システムで、共通チャンネルを通じてメッセージを伝送するアップリンク共通チャンネルを迅速に割り当てるためのチャンネル割当て方法を提供することにある。

【0032】

六番目、ＣＤＭＡ通信システムで、共通チャンネルを通じてメッセージを伝送するアップリンク共通チャンネルを割り当てるための信頼性あるチャンネル割当て方法を提供することにある。

【0033】

七番目、ＣＤＭＡ通信システムで、共通チャンネルを通じてメッセージを伝送するアップリンク共通チャンネル割当て方法で発生したエラーを訂正するための方法を提供することにある。

【0034】

八番目、ＣＤＭＡ通信システムで、共通チャンネルを通じてメッセージを伝送するアップリンク共通チャンネル通信方法でＵＥ間のアップリンクの衝突を検出して管理するための方法を提供することにある。

九番目、W-ＣＤＭＡ通信システムで、アップリンク共通チャンネルを通じてメッセージを伝送できるようにチャンネルを割り当てるための装置及び方法を提供することにある。

【0035】

十番目、ＣＤＭＡ通信システムで、 共通チャンネルを通じてメッセージを伝送するアップリンク共通チャンネル通信方法でチャンネル割当てメッセージまたはチャンネル使用要求メッセージで発生したエラーを検出できる装置及び方法を提供することにある。

【0036】

十一番目、ＣＤＭＡ通信システムで、共通チャンネルを通じてメッセージを伝送するアップリンク共通チャンネル通信方法でチャンネル割当てメッセージまたはチャンネル使用要求メッセージで発生したエラーを訂正するための方法を提供することにある。

【0037】

十二番目、ＣＤＭＡ通信システムで、共通チャンネルを通じてメッセージを伝送するアップリンク共通チャンネル通信方法でチャンネル割当てメッセージまたはチャンネル使用要求メッセージで発生したエラーを検出するために、電力制御プリアンブルを使用するための装置及び方法を提供することにある。

【0038】

十三番目、アップリンク共通チャンネルを多数のグループに分割して各グループを効率的に管理するための方法を提供することにある。

【0039】

十四番目、アップリンク共通チャンネルに割り当てられた無線資源を動的に管理するための方法を提供することにある。

【0040】

十五番目、アップリンク共通チャンネルに割り当てられたアップリンクスクランブリングコードを効率的に管理するための方法を提供することにある。

【0041】

十六番目、アップリンク共通チャンネルの現在状態をＵＴＲＡＮがＵＥに通報するための方法を提供することにある。

十七番目、アップリンク共通チャンネルの現在状態をＵＴＲＡＮがＵＥに通報するとき使用された情報を高信頼度で伝送するための装置及び方法を提供することにある。

【0042】

十八番目、アップリンク共通チャンネルの現在状態をＵＴＲＡＮがＵＥに通報するとき使用された情報を高信頼度で伝送するための符号化装置及び方法を提供することにある。

【0043】

十九番目、ＵＴＲＡＮから伝送したアップリンク共通チャンネルの現在状態をＵＥが迅速に認識できるようにする装置及び方法を提供することにある。

【0044】

二十番目、ＵＴＲＡＮが伝送したアップリンク共通チャンネルの状態を考慮して、ＵＥがアップリンク共通チャンネルを利用するか否かを決定する方法を提供することにある。

【課題を解決するための手段】

【0045】

前記のような目的を達成するために、本発明は、ＣＤＭＡ通信システムの共通パケットチャンネルの割当て方法を提供する。このような方法は、基地局をアクセスするために使用するチャンネル情報を有するアクセスプリアンブル信号を伝送するステップと、前記アクセスプリアンブル信号に応じて前記基地局から受信したアクセスプリアンブル補足表示信号を受信するステップと、前記受信されたアクセスプリアンブル補足表示信号に応じて衝突を検出する衝突検出プリアンブルを伝送するステップと、前記衝突検出プリアンブルに応じて、前記衝突検出プリアンブルの補足を示す第１信号とチャンネル割当てを示す第２信号とを受信するステップと、前記第１信号の受信のとき、前記第２信号が指定した情報によって共通パケットチャンネルを割り当てるステップとからなる。

【発明の効果】

【0046】

以上から述べてきたように、本発明によると、ＵＴＲＡＮは、ＵＥが要求したＣＰＣＨを能動的に割り当てることができ、ＣＰＣＨの設定に要求される時間を短縮させることができる。また、多数のＵＥがＣＰＣＨを要求するとき発生可能な衝突の確率を減少させることができ、無線資源の浪費を防止することができる。さらに、ＵＥとＵＴＲＡＮとの間にＰＣ_Ｐを通じて安定した共通パケットチャンネルを割り当てることができ、共通パケットチャンネルの使用においても安定性を提供することができる。

【発明を実施するための最良の形態】

【0047】

以下、本発明による好適な実施形態を添付図面を参照しつつ詳細に説明する。下記説明において、本発明の要旨のみを明瞭にするために公知の機能及び構成に対する詳細な説明は省略する。

本発明の好適な実施形態によるＣＤＭＡ通信システムにおいて、アップリンク共通チャンネルを通じてＵＴＲＡＮにメッセージを伝送するために、ＵＥは、ＣＳＩＣＨを通じてアップリンク共通チャンネルの状態を確認した後、自分が所望するＡＰをＵＴＲＡＮに伝送する。その後、ＵＴＲＡＮは、前記伝送されたＡＰを捕捉してアクセスプリアンブル捕捉表示チャンネル(ＡＰ_ＡＩＣＨ)を通じてＵＥに伝送した応答信号(または、アクセスプリアンブル捕捉表示信号)を伝送する。ＵＥは、前記アクセスプリアンブル捕捉表示信号を受信した後、前記受信されたアクセスプリアンブル捕捉表示信号が許可(ＡＣＫ)信号であると、衝突検出プリアンブル(ＣＤ_Ｐ)をＵＴＲＡＮに伝送する。

【0048】

ＵＴＲＡＮは前記衝突検出プリアンブルＣＤ_Ｐを受信した後、前記受信された衝突検

出信号に対する応答信号(または、衝突検出表示チャンネル(ＣＤ_ＩＣＨ)信号及びアップリンク共通チャンネルに対するチャンネル割り当て(ＣＡ)信号をＵＥに伝送する。この場合、ＵＥは、ＵＴＲＡＮから伝送された前記ＣＤ_ＩＣＨ信号及びチャンネル割り当て信号を受信した後、ＣＤ_ＩＣＨ信号がＡＣＫ信号である場合、ＵＴＲＡＮが割り当てたアップリンク共通チャンネルを通じてアップリンク共通チャンネルメッセージを伝送する。前記メッセージの伝送の前、電力制御プリアンブル(ＰＣ_Ｐ)を伝送することもできる。また、ＵＴＲＡＮは、前記電力制御プリアンブル及び前記アップリンク共通チャンネルメッセージに対する電力制御信号を伝送し、ＵＥは、ダウンリンクチャンネルを通じて受信された電力制御命令によって前記電力制御プリアンブル及び前記アップリンク共通チャンネルメッセージの送信電力を制御する。

【0049】

前記説明において、もし、ＵＥが伝送することができる多数のＡＰを有すると、ＵＥが伝送したプリアンブルはその中の一つのＡＰになることができ、ＵＴＲＡＮは前記ＡＰに応答してＡＰ_ＡＩＣＨを発生させ、前記ＡＰ_ＡＩＣＨを伝送した後、前記のようなチャンネルを割り当てるためのＣＡ_ＩＣＨを伝送することもできる。

【0050】

図３は、本発明の実施形態による逆方向共通パケットチャンネル(ＣＰＣＨ)、またはアップリンク共通チャンネルを設定するためのＵＥとＵＴＲＡＮとの間の信号フローを示す。本発明の実施形態において、前記アップリンク共通チャンネルに逆方向共通パケットチャンネルを使用すると仮定する。しかし、前記アップリンク共通チャンネルは、前記共通パケットチャンネル以外の他の共通チャンネルにも使用されることができる。

【0051】

図３を参照すると、ＵＥは、アップリンク放送チャンネル(Downlink Broadcasting Channel)を通じてダウンリンクのタイム同期を遂行した後、前記アップリンク共通チャンネルまたはＣＰＣＨに関連した情報を獲得する。前記アップリンク共通チャンネルに関連した情報は、ＡＰに使用されるスクランブリングコード及びシグネチャーの数、及びダウンリンクのＡＩＣＨタイミングなどに関する情報を含む。参照番号３０１は、ＵＴＲＡＮからＵＥに伝送されるダウンリンク信号を示し、参照番号３３１は、ＵＥからＵＴＲＡＮに伝送されるアップリンク信号を示す。前記ＵＥがＣＰＣＨを通じて信号を伝送しようとする場合、先ずＣＰＣＨ状態表示チャンネル（ＣＰＣＨ Status Indicator Channel：以下、ＣＳＩＣＨと略称する。）を通じてＵＴＲＡＮ内のＣＰＣＨの状態に関する情報を受信する。従来技術において、前記ＣＰＣＨの状態に関する情報とは、ＵＴＲＡＮ内のＣＰＣＨに関する情報、すなわち、ＣＰＣＨの数と使用可能性などに関する情報を意味する。しかし、本発明の好適な実施形態では、各ＣＰＣＨに使用可能な最大データ伝送速度と、ＵＥが一つのＣＰＣＨを通じた多重符号の伝送を遂行する場合、いくつかの多重符号を伝送することができるかに関する情報を意味する。本発明は、従来技術のように、各ＣＰＣＨチャンネルの使用可能性に関する情報を伝送する場合でさえ、本発明によるチャンネル割当て方法を使用することができる。前述したような使用可能なデータ伝送速度は、次世代非同期移動通信システム(W-ＣＤＭＡ、すなわち、非同期移動通信の第三世代移動通信システム)でチャンネルの当たり最小１５Ksps(symbols per second)から最大９６０Kspsであり、多重符号の数は１個から６個までである。

【0052】

ＣＰＣＨ状態表示チャンネル(ＣＳＩＣＨ)

図４Ａ及び図４Ｂは、本発明の実施形態によるＣＳＩＣＨのチャンネル構造及び生成構造を示す。前記ＣＳＩＣＨは、W-ＣＤＭＡ方式で、アップリンク共通チャンネルのチャンネル獲得に対するＡＣＫまたはＮＡＫを伝送するために使用されるＡＰ補足表示チャンネル(ＡＩＣＨ)のうち、使用されていない後部分の８ビットを使用してＵＴＲＡＮ内のＣＰＣＨの状態に関する情報を伝送するチャンネルである。

【0053】

図４Ａは、使用されないＡＩＣＨ部を使用するＣＳＩＣＨのチャンネル構造を示す。Ａ

ＩＣＨの長さは、W-ＣＤＭＡ方式で４０ビットである。前記ＡＰ_ＡＩＣＨは、ＡＩＣＨの３２ビットを使用し、ＣＳＩＣＨは、使用されないＡＩＣＨ部を使用する。これらは、ＡＰの伝送及びＡＰ_ＡＩＣＨの受信の基準になる１つのアクセススロットで伝送される。前記アクセススロットは、５,１２０チップの長さを有し、１５個のアクセススロットは、２０ｍｓフレームである。

【0054】

図４Ｂは、ＣＳＩＣＨの生成構造を示す。図４Ｂにおいて、参照番号４０３は、ＡＰ_ＡＩＣＨ及びＣＳＩＣＨが１つのアクセススロットに伝送される構造を示す。前記ＡＰ_ＡＩＣＨ部に伝送するデータがないと、ＡＰ_ＡＩＣＨ部は伝送されない。前記ＡＰ_ＡＩＣＨ及びＣＳＩＣＨは、乗算器４０２によってチャンネル区分コードで拡散される。前記チャンネル区分コード４０５は、ＵＴＲＡＮで指定するチャンネル区分コードであり、前記ＡＰ_ＡＩＣＨ及びＣＳＩＣＨは、同一のチャンネル区分コードを使用する。前記チャンネル区分コードは、ＵＴＲＡＮによって割り当てられ、本発明の実施形態において、チャンネル区分コードの拡散率(Spreading Factor；ＳＦ)を２５６であると仮定する。前記拡散率とは、一つのシンボルごとに拡散率の長さを有するＯＶＳＦコードにＡＰ_ＡＩＣＨ及びＣＳＩＣＨが乗算されることを意味する。W-ＣＤＭＡ方式で、ＡＰ_ＡＩＣＨ及びＣＳＩＣＨの１つのシンボルは２ビットで構成される。参照番号４０７は、ＡＰ_ＡＩＣＨ及びＣＳＩＣＨのフレーム構造を示し、７６,８００チップの長さを有する２０ｍｓフレームを示し、１５個のアクセススロットで構成される。フレーム４０７は、毎アクセススロットごとＡＰ_ＡＩＣＨ及びＣＳＩＣＨを通じて異なる情報を伝送することができ、２０ｍｓフレームごとに伝送されるＣＳＩＣＨに関する情報は１２０ビットになる(８ビット＊１５スロット／フレーム=１２０ビット／フレーム)。前記説明において、ＣＳＩＣＨを通じてＣＰＣＨチャンネル状態情報を伝送するとき、ＡＰ_ＡＩＣＨのうちの使用されない後部分の８ビットを利用する。しかし、ＣＤ_ＩＣＨの構造は前記ＡＰ_ＡＩＣＨの構造と同一であるので、前記ＣＳＩＣＨを通じて伝送されるＣＰＣＨチャンネル状態情報を、前記ＣＤ_ＩＣＨを通じて伝送することもできる。

【0055】

本発明の実施形態において、ＣＳＩＣＨに伝送した情報は、ＣＰＣＨの最大使用可能な伝送速度の７種類(ＳＦ４～ＳＦ２５６)に関する情報と、多重符号の伝送が１つのＣＰＣＨで使用される場合、使用された多重符号の数に関する情報とを含む。下記＜表１＞は、このような方法の応用例を示す。

【0056】

＜表１＞で、多重符号は拡散率４を有し、Ｗ－ＣＤＭＡシステムでは、ＵＥが多重符号の伝送を遂行すると、ＵＥのチャンネル区分コードのために拡散率４のみを使用することができるように規定している。＜表１＞に示すように、本発明の実施形態において、ＣＳＩＣＨを通じて伝送されたＣＰＣＨの最大データ伝送速度情報は４ビットで表現されることができる。ＣＳＩＣＨを通じてＣＰＣＨを使用しようとするＵＥに伝送する方法として、ＣＳＩＣＨに割り当てられた１個の８ビットアクセススロット内に２回反復して前記４ビットを伝送することができ、または(８，４)符号化方法を使用して伝送することもできる。

【0057】

【表1】

情報	ビット表現
伝送速度 15Ksps (SF256)	0000(000)
伝送速度 30Ksps (SF128)	0001(001)
伝送速度 60Ksps (SF64)	0010(010)
伝送速度 120Ksps (SF32)	0011(011)
伝送速度 240Ksps (SF16)	0100(100)
伝送速度 480Ksps (SF8)	0101(101)
伝送速度 960Ksps (SF4)	0110(110)
多重符号の数 2	0111
多重符号の数 3	1000
多重符号の数 4	1001
多重符号の数 5	1010
多重符号の数 6	1011

前記説明で、ＵＥがＣＰＣＨの最大使用可能な伝送速度を通報するのに４ビットを使用し、多重符号の数を使用する。しかし、多重符号が使用されない場合、(８,３)コーディングを使用して１つのスロットに８シンボルを伝送するか、または３ビットを２回反復し、前記３ビットのうち１シンボルをもう一回反復することもできる。

【0058】

前述した符号化を使用する伝送方法は、ＣＰＩＣＨを通じて伝送される状態表示（Status Indicator：以下、ＳＩと略称する。）情報の信頼度を高めるためにエラー訂正符号で符号化し、アクセスフレームのアクセススロットに８個の符号化シンボルを入力した後、アクセスフレームごとに総１２０個の符号化シンボルを伝送する。このとき、ＳＩ情報ビットの数、各状態情報の意味、及び伝送方法に対しては、ＵＴＲＡＮ及びＵＥが予め設定する。そして、放送チャンネル(Broadcasting channel：ＢＣＨ)を通じてシステムパラメータとして伝送されることもできる。このような場合、ＵＥも前記ＳＩ情報ビットの数及び伝送方法を予め知っており、ＵＴＲＡＮから受信されたＣＳＩＣＨ信号を復号化する。

【0059】

図５は、ＳＩ情報ビットを伝送するためのＣＳＩＣＨ符号器の構造を示す。

図５を参照すると、ＵＴＲＡＮは、アップリンクＣＰＣＨの現在の使用状態、すなわち、現在のアップリンクチャンネルのデータ伝送速度及びチャンネル状態を確認した後、ＣＳＩＣＨチャンネルの最大データ伝送速度を決定する。その後、前記<表２>に示すような該当情報ビットをＣＳＩＣＨを通じてＣＰＣＨの最大データ伝送速度で伝送する。前記情報ビットは、下記<表３>に示す入力ビットである。前記入力ビットを符号化する方法は、伝送方法によって多様であることができる。すなわち、符号化方法は、チャンネル状態情報をフレーム単位またはスロット単位に提供するか否かによって変わることができる。

【0060】

まず、チャンネル状態情報をフレーム単位で伝送する場合を説明する。前記入力情報(ＳＩビット)及び前記ＳＩビット数に対する制御情報は、反復器５０１に同時に入力される。このとき、入力情報ビットの数をＵＴＲＡＮ及びＵＥが予め知っている場合、前記ＳＩビット数に対する制御情報は不要である。その後、前記反復器５０１は、前記ＳＩビットを前記ＳＩビット数に対する制御情報によって反復する。図５のＣＳＩＣＨ符号器の動作について説明する。３個のＳＩビットＳ０、Ｓ１、及びＳ２を受信すると、前記反復器５０１は、ＳＩのビット数が３個であることを示す制御情報によって前記受信されたＳＩビットを反復し、Ｓ０、Ｓ１、Ｓ２、Ｓ０、Ｓ１、Ｓ２、．．．、Ｓ０、Ｓ１、Ｓ２のような形態の６０個の反復されたビット列を出力する。前記反復された６０個のビット列が４ビット単位で符号器５０３に入力されると、前記符号器５０３は、前記４ビット単位で入力されるビット列のビットを(８，４)両直交符号(Bi-orthogonal code)で符号化し、８

個ずつの符号化シンボルを出力する。このような方式において、前記６０個の入力ビット列を符号化すると、前記符号器５０３から１２０個のシンボルが出力される。従って、一つのＣＳＩＣＨのスロットごとに８個のシンボルを伝送すると、一つのＣＳＩＣＨフレームで１２０個のシンボルを伝送することができる。例えば、入力情報が４ビットである場合、入力４ビットは反復器５０１によって１５回反復され、６０個のビットとして出力される。前記出力された６０個のビットは、(８，４)両直交符号器５０３によって４ビット単位で両直交符号に符号化され、出力シンボルは８シンボルである。従って、入力ＳＩビット及び出力ＳＩシンボルの数を考慮すると、１つのフレーム内の各スロットに入力情報を伝送することもできる。このような方法は、反復器を除去し、入力４ビットを８シンボルの両直交符号で出力してスロットごとに(または１５個のスロット)同一の両直交符号を伝送することと同一である。

【0061】

入力が３ビットであり、(８，３)符号器を使用する場合でも、前記反復器５０１は意味がない。従って、具現の時、反復器５０１を除去することができ、入力３ビットに対する８個のシンボルを出力することにより、スロットごとに(１５個のスロット)同一の符号化シンボルを伝送することができる。前述したように、スロットごとに同一のシンボルを伝送することができれば、ＵＴＲＡＮは、スロット単位でＵＥにＰＣＰＣＨチャンネル状態情報を伝送することができる。すなわち、ＵＴＲＡＮは、スロット単位でＵＥにデータを伝送する最大データ伝送速度を決定することができ、前記決定された最大データ伝送速度に該当する入力ビットをスロット単位で決定することができる。そして、前記決定された入力ビットをスロット単位で伝送する。この場合、ＵＴＲＡＮは、スロット単位でアップリンクチャンネルのデータ伝送速度及び状態を検査しなければならない。これは、ＵＴＲＡＮの複雑度を増加させることができる。そこで、ＵＴＲＡＮの複雑度を減少させるために、幾つのスロット単位で最大データ伝送速度を伝送することもできる。

【0062】

このとき、符号化に使用される(８，４)両直交エラー訂正符号は、下記＜表２＞に示すような４入力ビットと８出力シンボルとの間の関係を有する。

【0063】

【表2】

入力ビット	符号化シンボル
0000	0000 0000
0001	0101 0101
0010	0011 0011
0011	0110 0110
0100	0000 1111
0101	0101 1010
0110	0011 1100
0111	0110 1001
1000	1111 1111
1001	1010 1010
1010	1100 1100
1011	1001 1001
1100	1111 0000
1101	1010 0101
1110	1100 0011
1111	1001 0110

図６は、図５のＣＳＩＣＨ符号器に対応するＣＳＩＣＨ復号器の構造を示すもので、図５の符号器を説明する順序で復号器の動作を説明する。

【0064】

一番目の例として、まず、入力が３ビットであり、前記入力３ビットを２０回反復して６０ビットを生成する反復器を有する(８，４)両直交符号器に対応する復号器の動作を説明する。前記復号器は、前記反復された６０ビットを４ビット単位で受信する。受信信号が８シンボルずつ入力されると、相関度計算器６０１は、前記受信信号と(８，４)両直交符号との相関度を計算し、＜表２＞に示す前記受信信号と１６個の値との１６個の相関値を出力する。前記出力相関値がＬＬＲ(Likelihood Ratio)値計算器６０３に入力されると、確率Ｐ０と確率Ｐ１との比を計算して４ビットＬＬＲ値を出力する。ここで、確率Ｐ０とは、ＳＩビット数によって決定された制御情報に従って、ＵＴＲＡＮから伝送した４個の情報ビットに対する復号化された各ビットが０になる確率を意味し、確率Ｐ１とは、前記復号化ビットが１になる確率を意味する。すると、前記ＬＬＲ値は、ＬＬＲ値累算器６０５に入力される。次のスロットで８個のシンボルが受信されると、復号器は、前述したような過程を反復してＬＬＲ計算器６０３から出力される４ビットを既存値に加算する。１５個のスロットのＬＬＲ値を受信してすべて計算した後、前記復号器は、ＬＬＲ値累算器６０５に貯蔵された１６個の相関値のうち一番大きい相関値を選択して状態情報を判断する。

【0065】

二番目に、入力が４または３ビットであり、(８，４)または(８，３)符号器を使用し、反復器を使用しない場合について説明する。受信信号が相関度計算器６０１に８個のシンボル単位で入力されると、前記相関度計算器６０１は、前記受信された信号と(８，４)または(８，３)両直交符号との相関度を計算する。このとき、スロット単位でＵＴＲＡＮから状態情報が常に受信されると、前記復号器は、前記相関度によって最大相関値を利用してＵＴＲＡＮから伝送した状態情報を判断する。

【0066】

三番目に、ＵＴＲＡＮが１５個のスロット(一つのフレーム)単位で同一の状態情報を反復して伝送する場合について説明する。受信信号が相関度計算器６０１に８個のシンボルずつ入力されると、前記相関度計算器６０１は、前記受信された信号と(８，４)または(８，３)両直交符号との相関度を計算し、前記計算された相関値をＬＬＲ値計算器６０３に出力する。その後、前記ＬＬＲ値計算器６０３は、確率Ｐ０と確率Ｐ１との比を計算して４ビットのＬＬＲ値を出力する。ここで、確率Ｐ０は、ＳＩビット数に基づき決定される制御情報によってＵＴＲＡＮから伝送した４情報ビットの復号化されたビットが０になる確率を示し、確率Ｐ１は、前記復号化されたビットが１になる確率を示す。すると、前記ＬＬＲ値は、ＬＬＲ値累算器６０５に累算される。次のスロットで受信された８個のシンボルの場合、前記復号器は、前記過程を反復して前記計算された値を既存のＬＬＲ値に累算する。このような方式で、前記復号器は、前記ＬＬＲ値累算器６０５に累算された値を利用してＵＴＲＡＮから伝送した前記状態情報を判断する。

【0067】

ＣＳＩＣＨを通じて伝送される情報ビットを符号化する従来技術の方法に比べて、より向上した性能を提供する他の実施形態について説明する。本発明の理解を助けるために、ＣＳＩＣＨに伝送すべき情報ビットが４個であると仮定する。前記情報ビットは、Ｓ０、Ｓ１、Ｓ２、及びＳ３の順に表れる。従来技術において、前記情報ビットは単純に反復されて伝送される。すなわち、一つのフレーム内に１２０個のビットが伝送されると、Ｓ０、Ｓ１、及びＳ２のそれぞれは３０回反復され、Ｓ３も３０回反復される。従来技術での問題点は、ＵＥが一つのフレームを完全に受信した後にのみ、必要なＣＰＣＨ情報を受信することができるということにある。従って、ＣＳＩＣＨ情報ビットを伝送する本発明の他の実施形態では、前記情報ビットを伝送する手順を変えてタイムダイバーシティを獲得し、一つのフレームのＣＰＣＨが完全に受信されないとしても、ＵＥは、ＣＰＣＨ状態を分かる。前記情報ビットの伝送手順をＳ０、Ｓ１、Ｓ２、Ｓ３、Ｓ０、Ｓ１、Ｓ２、Ｓ３、Ｓ０、Ｓ１、Ｓ２、Ｓ３、．．．．、Ｓ０、Ｓ１、Ｓ２、及びＳ３とすると、加算性白色ガウス雑音（Additive White Gaussian Noise：以下、ＡＷＧＮと略称する。）環境では、同一の符号の利得を有する。しかし、移動通信システムで必ず発生するフェーディング

環境では、タイムダイバーシティの利得を有するので、本発明は、従来技術に比べてさらに向上した符号利得を有する。また、ＣＳＩＣＨの一つのスロット(情報ビットの数が４個以下である場合)のみを受信しても、ＵＥは、ＵＴＲＡＮ内のＣＰＣＨ状態を分かる。一方、ＣＳＩＣＨに伝送される情報ビットが多い場合でも、従来技術よりはもっと迅速にＵＴＲＡＮ内のＣＰＣＨに関する情報を分かる。

【0068】

従来技術では、ＵＴＲＡＮで使用した各ＣＰＣＨの状態に関する情報がＣＳＩＣＨを通じて伝送されるので、ＵＴＲＡＮは、ＣＰＣＨの数に対応するＳＩビットを必要とし、一つのＣＳＩＣＨスロット内に前記情報を伝送することができない。しかし、前記情報を一つのフレームの全体スロットに区分して伝送する。従って、ＣＰＣＨを使用しようとするＵＥは、ＵＴＲＡＮ内のＣＰＣＨ状態を知るために、このような実施形態よりずっと長い時間ＣＳＩＣＨを受信すべきである。また、ＵＥがＣＳＩＣＨ情報を認識するためには、各ＣＳＩＣＨ情報が開始するスロットに関する情報及び各ＣＳＩＣＨ情報が終了するスロットに関する情報をかならず必要とする。しかし、本発明の実施形態では、ＣＰＣＨが支援する最大データ伝送速度、そして、多重符号を使用する場合、ＣＰＣＨごとに使用されることができる多重符号の数が伝送されるので、前記ＣＰＣＨの状態情報は、ＵＴＲＡＮが使用するＣＰＣＨの数に関わらず、単純に４ビットで表現されることができる。図５及び図６において、最大使用可能なデータ伝送速度がＣＳＩＣＨ情報に使用される場合、ＣＰＣＨデータ伝送速度の種類が７個であるので、ＣＳＩＣＨ情報を３ビットで表現することができる。多重符号が使用され、多重符号の数がＣＳＩＣＨ情報に加えられる場合、ＣＳＩＣＨ情報の種類が１２個であるので、従来の情報を４ビットで表現することができる。

【0069】

従って、十進数で表現された１３、１４、１５、及び１６である使用されないＳＩ情報ビットが他の情報に割り当てられることもできる(例えば、ＣＰＣＨメッセージ部の伝送に使用される最大使用可能のフレーム数を示すことができるＮＦＭ(Number of Frame Max))。ＵＴＲＡＮは、前述したように、ＣＰＣＨごとに１つのＮＦＭを設定することができる。また、前記ＮＦＭは、ＣＡに対応することができ、またはダウンリンクＤＰＣＣＨに対応することができる。前記ＮＦＭを選択するために、ＵＥは、ＡＰに対応することができ、またはＡＰ下位チャンネルに対応することができる。他の方法において、ＮＦＭを使用せずスーパービジョン(supervision)を利用することもできる。すなわち、伝送するデータがない場合、ＵＥは伝送を中断し、ＵＴＲＡＮは、これを感知した後チャンネルを解除する。なお他の方法において、前記ＮＦＭは、ダウンリンクＤＰＤＣＨを利用してＵＥに伝送されることもできる。

【0070】

ＡＰ／ＡＰ_ＡＩＣＨ

図４のＣＳＩＣＨを通じてＵＴＲＡＮ内のＣＰＣＨに関する情報を受信すると、ＵＥは、ＣＰＣＨチャンネル使用権及びＣＰＣＨチャンネル使用に関する情報を獲得するために、図３のＡＰ３３３を伝送するように準備する。

【0071】

ＡＰ３３３を伝送するために、ＵＥは、ＡＰ用シグネチャーを選択すべきであり、本発明の好適な実施形態では、シグネチャーの選択の前にＣＳＩＣＨを通じて獲得したＵＴＲＡＮ内のＣＰＣＨに関する情報と、ＵＥがＣＰＣＨを通じて伝送するデータの特性に基づいて適切なＡＳＣを選択することもできる。例えば、前記ＡＳＣは、ＵＥの等級に従って区別されることができ、ＵＥが要求したデータ伝送速度、または、ＵＥが選択したサービスの種類に従って区別されることもできる。前記ＡＳＣに関する情報は、放送チャンネルを通じてＵＴＲＡＮによってＵＥに伝送され、ＵＥは、ＣＳＩＣＨ及びＣＰＣＨを通じて伝送されるデータの特性に従って適切なＡＳＣを選択する。前記ＡＳＣを選択した後、ＵＥは、ＡＳＣ案で定義されているＡＰ下位チャンネルグループのうちの一つを任意に選択する。また、ＵＥは、下記＜表３＞を利用して、使用可能のアクセススロット及び現在の

ダウンリンクフレームがＵＴＲＡＮから伝送したｎ番目フレームであることを示すシステムフレーム番号（System Frame Number：以下、ＳＦＮと略称する。）を誘導し、前記誘導されたアクセススロットの１つを任意に選択する。ＵＴＲＡＮから伝送したフレームに使用されるＳＦＮをＫとして定義すると、ＵＥは、(Ｋ＋１)及び(Ｋ＋２)番目フレームで使用可能なアクセススロットを誘導する。その後、ＵＥは、前記選択されたアクセススロットでＡＰ３３３を伝送する。前記“ＡＰ下位チャンネルグループ”とは、下記＜表３＞に示すような１２個の下位チャンネルグループを意味する。

【0072】

【表3】

	下位チャンネル番号											
ＳＦＮ mod 8	0	1	2	3	4	5	6	7	8	9	10	11
0	0	1	2	3	4	5	6	7				
1									8	9	10	11
2	12	13	14									
3				0	1	2	3	4	5	6	7	
4	9	10	11	12	13	14						8
5	6	7					0	1	2	3	4	5
6	3	4	5	6	7							
7						8	9	10	11	12	13	14

図３のＡＰ３３１を伝送するために使用したアクセススロットの構造は、図７に示されている。参照番号７０１はアクセススロットを示し、５，１２０チップの長さを有する。前記アクセススロットは、２０ｍｓフレーム、すなわち２つの無線フレーム(radio frame)の間１５回伝送される。W-CDMA方式で、１つの無線フレームは１０ｍｓの長さを有し、基本伝送単位であり、２，５６０チップのスロット長さを１５回反復して構成する。前記アクセススロット番号は、０番から１４番まで反復される構造を有する。参照番号７０３は、０番目～１４番目のアクセススロットを通じて伝送される２つの無線フレームを示す。

【0073】

図７を参照すると、０番目アクセススロットの開始は、ＳＦＮが１０ｍｓの単位を有するので、ＳＦＮが偶数であるフレームの開始と同一であり、１４番目アクセススロットの終了は、ＳＦＮが奇数であるフレームの終了と同一である。

【0074】

前述したような方式にて、ＵＥは、有効なシグネチャーまたはＣＰＣＨ用下位チャンネルグループで定義されているシグネチャーのうちの１つを任意に選択する。前記下位チャンネルグループは、ＵＴＲＡＮが割り当てたＡＳＣ案に定義されている。ＵＥは、前記選択されたシグネチャーを利用してＡＰ３３１を構成した後、ＵＴＲＡＮのタイミングと同期してＵＴＲＡＮに伝送する。シグネチャーの選択及びＡＰの生成方法は、前述したようである。

【0075】

前記ＡＰ３３１は、ＡＰに使用するＡＰシグネチャーによって区分される。各シグネチャーは、最大データ伝送速度にのみマッピングされることができ、または、最大データ伝送速度及びＮＦＭにマッピングされることもできる。従って、ＡＰが示す情報は、ＵＥが使用しようとするＣＰＣＨの最大データ伝送速度、またはＣＰＣＨメッセージ部の伝送に使用されるフレーム数、または前記２種類の情報の組合せを意味する。例えば、ＡＰ３３１を伝送した後、ＵＥは、一定の時間(すなわち、３または４スロットに該当する時間)３３２の間、ＵＴＲＡＮからＡＰ_ＡＩＣＨ信号の受信を待機する。前記ＡＰ_ＡＩＣＨ信号を受信すると、前記ＡＰ_ＡＩＣＨ信号は、ＵＥが伝送したＡＰシグネチャーに対する応答を含んでいるか否かを確認する。ＡＰ_ＡＩＣＨ信号が時間３３２内で受信されず、ま

たはＡＰ_ＡＩＣＨ信号がＮＡＫ信号である場合、前記ＡＰ３３５の送信電力を増加させ、前記増加された送信電力でＡＰ３３５をＵＴＲＡＮに伝送する。ＵＴＲＡＮがＡＰ３３５を受信し、ＵＥが要求した伝送速度を有するＣＰＣＨを割り当てることができる場合、ＵＴＲＡＮは、受信されたＡＰ３３５の応答として、予め約束された時間３０２が経過した後ＡＰ_ＡＩＣＨ３０３をＵＥに伝送する。この場合、ＵＴＲＡＮの全体アップリンク容量が所定値を超過するか、またはこれ以上の復調がない場合、ＵＴＲＡＮは、ＮＡＫ信号を伝送してアップリンク共通チャンネルを通じたＵＥの伝送を一時中断させる。また、ＵＴＲＡＮがＡＰの検出に失敗した場合、ＵＴＲＡＮは、前記ＡＰ_ＡＩＣＨ３０３のようなＡＩＣＨにＡＣＫ信号またはＮＡＫ信号を伝送することができない。従って、本発明の実施形態では、何も伝送されないと仮定する。

【0076】

ＣＤ　前記ＡＰ_ＡＩＣＨ３０３を通じてＡＣＫ信号を受信すると、ＵＥは、ＣＤ_Ｐ３３７を伝送する。前記ＣＤ_Ｐの構造はＡＰの構造と同一であり、ＣＤ_Ｐの構成に使用したシグネチャーは、ＡＰに使用したシグネチャーグループと同一のシグネチャーグループから選択されることもできる。ＡＰと同一のシグネチャーグループのうちでＣＤ_Ｐに使用するシグネチャーを使用する場合、ＡＰとＣＤ_Ｐとを区別するために、ＡＰとＣＤ_Ｐに異なるスクランブリングコードを使用する。前記スクランブリングコードは、ＡＰとＣＤ_Ｐとを区別するために、同一の初期値を有するが、異なるスタート点を有する。また、ＡＰ及びＣＤ_Ｐのスクランブリングコードは、異なる初期値を有することができる。前記のように、任意に選択されたシグネチャーを利用してＣＤ_Ｐを伝送する理由は、二つまたはそれ以上のＵＥが同時に同一のＡＰを伝送し、ＡＰ_ＡＩＣＨを通じてＡＣＫを受信した場合、同一のＣＤ_Ｐを選択する確率を減少させるためである。従来技術では、所定の伝送時点で伝送された一つのＣＤ_Ｐが異なるＵＥ間のアップリンク衝突の確率を減少させるために使用される。しかし、前記方法で、他のユーザーが予め伝送したユーザーと同一のＣＤ_Ｐを使用してＵＴＲＡＮにＣＰＣＨの使用権を要求し、ＵＴＲＡＮが予め伝送したＣＤ_Ｐに対する応答を伝送する時間がないと、ＵＴＲＡＮは、後にＣＤ_Ｐを伝送したＵＥに応答することができない。ＵＴＲＡＮが後にＣＤ_Ｐを伝送した他のＵＥに応答するとしても、先ず、ＣＤ_Ｐを伝送したＵＥ間のアップリンク衝突の確率、及び後にＣＤ_Ｐを伝送した他のＵＥが増加することができる。

【0077】

図３において、ＵＴＲＡＮは、ＵＥが伝送したＣＤ_Ｐ３３７に対する応答としてＣＤ/ＣＡ_ＩＣＨ３０５を伝送する。まず、前記ＣＤ/ＣＡ_ＩＣＨのうちのＣＤ_ＩＣＨについて説明する。前記ＣＤ_ＩＣＨは、ＣＤ_Ｐの生成に使用されるシグネチャーを利用して、ＵＥにＡＣＫ信号を伝送するダウンリンクチャンネルである。前記ＣＤ_ＩＣＨは、ＡＰ_ＡＩＣＨと異なる直交チャンネル区分コードを利用して拡散されることができる。従って、前記ＣＤ_ＩＣＨ及びＡＰ_ＡＩＣＨは、異なる物理チャンネルを通じて伝送されることができ、または、一つの直交チャンネルを時分割して同一の物理チャンネルを通じて伝送されることもできる。本発明の好適な実施形態において、前記ＣＤ_ＩＣＨをＡＰ_ＡＩＣＨと異なる物理チャンネルを通じて伝送すると仮定する。すなわち、前記ＣＤ_ＩＣＨ及びＡＰ_ＡＩＣＨのそれぞれは、長さ２５６の異なる直交拡散符号で拡散され、独立した物理チャンネルを通じて伝送される。

【0078】

ＣＡ　図３において、ＣＡ_ＩＣＨは、ＵＴＲＡＮがＵＥに割り当てるＣＰＣＨのチャンネル情報とＣＰＣＨの電力制御を割り当てるダウンリンクチャンネルの割当て情報を含む。アップリンク送信電力を制御するために、ダウンリンクチャンネルを割り当てる方法では、利用可能の方法が多数ある。

【0079】

ＣＰＣＨの送信電力を制御する第１方法でダウンリンク共通電力制御チャンネル(downlink shared power control channel)を使用する。前記共通電力制御チャンネルを利用してチャンネルの送信電力を制御する方法は、本願出願人により先出願された韓国特許出願

第１９９８－１０３９４号に詳細に開示されている。また、前記共通電力制御チャンネルを利用して前記ＣＰＣＨに対する電力制御命令を伝送することができる。前記ダウンリンク共通電力制御チャンネルの割当て方法は、電力制御に使用するダウンリンク共通電力制御のチャンネル番号及びタイムスロットに関する情報を含むことができる。

【0080】

ＣＰＣＨの送信電力を制御する第２方法で、メッセージ及び電力制御命令に時分割されたダウンリンク制御チャンネルを使用することができる。W-ＣＤＭＡシステムでは、ダウンリンク共通チャンネルの制御のために前記チャンネルを定義している。このようにデータ及び電力制御命令を時分割して伝送する場合でも、チャンネル情報は、ダウンリンク制御チャンネルのチャンネル番号及びタイムスロットに関する情報を含む。

【0081】

ＣＰＣＨの送信電力を制御する第３方法で、一つのダウンリンクチャンネルをＣＰＣＨの制御のために割り当てることができる。このようなチャンネルを通じて電力制御命令及び制御命令が共に伝送されることができる。この場合、チャンネル情報は、ダウンリンクチャンネルのチャンネル番号になる。

【0082】

本発明の好適な実施形態において、ＣＤ/ＣＡ_ＩＣＨが同時に伝送されると仮定する。しかし、ＣＤ_ＩＣＨを伝送した後ＣＡ_ＩＣＨを伝送することができる。ＣＤ_ＩＣＨ/ＣＡ_ＩＣＨを同時に伝送するとしても、これらを異なるチャンネル区分コードまたは同一のチャンネル区分コードで伝送することもできる。また、上位階層からのメッセージの処理による遅延を短縮させるために、ＣＡ_ＩＣＨを通じて伝送されたチャンネル割当て命令は、ＣＤ_ＩＣＨと同一な形態で伝送されると仮定する。このような場合、１６個のシグネチャー及び１６個のＣＰＣＨが存在すると、それぞれのＣＰＣＨは、シグネチャーのうちの１つに該当する。例えば、ＵＴＲＡＮがＵＥにメッセージを伝送するために５番目のＣＰＣＨを割り当てようとする場合、ＵＴＲＡＮは、チャンネル割当て命令で５番目のＣＰＣＨに該当する５番目のシグネチャーを伝送する。

【0083】

チャンネル割当て命令を通じて伝送されるＣＡ_ＩＣＨのフレームが２０ｍｓの長さを有し、１５個のスロットを含むと仮定すると、この構造は、ＡＰ_ＡＩＣＨ及びＣＤ_ＩＣＨの構造と同一である。前記ＡＰ_ＡＩＣＨとＣＤ_ＩＣＨを伝送するフレームは１５個のスロットで構成され、各スロットは２０個のシンボルで構成されることができる。一つのシンボル周期(または区間)が２５６チップの長さを有し、ＡＰ、ＣＤ、及びＣＡに応答する部分が１６個のシンボル区間でのみ伝送されると仮定する。

【0084】

従って、図３に示すように伝送されたチャンネル割当て命令は、１６個のシンボルで構成されることができ、各シンボルは、２５６個のチップの長さを有する。また、前記シンボルごとに１ビットのシグネチャー及び拡散符号が乗じられ、その後、ダウンリンクを通じて伝送され、前記各シグネチャー間には、直交性(orthogonal property)が保証される。

【0085】

本発明の好適な実施形態において、１つのＣＡメッセージに対してＣＡ_ＩＣＨを通じて１個のシグネチャーを伝送することができ、または、１つのＣＡメッセージに対してＣＡ_ＩＣＨを通じて２個または４個のシグネチャーを伝送することもできる。すなわち、チャンネル割当て命令に使用される複数のシグネチャーは、ＣＡ_ＩＣＨを通じて伝送されることができる。

【0086】

図３において、ＵＴＲＡＮから伝送されたＣＤ/ＣＡ_ＩＣＨ３０５を受信すると、ＵＥは、ＣＤ_ＩＣＨがＡＣＫ信号を含むか否かを確認し、ＣＡ_ＩＣＨを通じて伝送されたＣＰＣＨチャンネルの使用に関する情報を分析する。前記２種類の情報は、順次的にまたは同時に分析されることができる。図３に示すように、前記受信されたＣＤ/ＣＡ_ＩＣＨ３

０５の中でＣＤ_ＩＣＨを通じてＡＣＫ信号を受信すると、ＵＥは、ＵＴＲＡＮが割り当てたＣＰＣＨのチャンネル情報によってＣＰＣＨのデータ部３４３及び制御部３４１を構成する。また、前記ＣＰＣＨのデータ部３４３及び制御部３４１を伝送する前、前記ＣＤ/ＣＡ_ＩＣＨが受信される時点から一定の時間が経過した後、ＵＥは、電力制御プリアンブル(ＰＣ_Ｐ)３３９をＵＴＲＡＮに伝送する。

【0087】

ＰＣ_Ｐ

Ｗ-ＣＤＭＡ方式において、前記電力制御プリアンブルＰＣ_Ｐが０または８スロットの長さを有するとしても、本発明の好適な実施形態で、前記電力制御プリアンブルＰＣ_Ｐ３３９が８個のスロットを伝送すると仮定する。前記電力制御プリアンブルＰＣ_Ｐの第１目的は、前記電力制御プリアンブルのパイロットフィールドを利用して、ＵＴＲＡＮがＵＥのＣＰＣＨの初期送信電力を設定できるようにする。しかし、本発明の実施形態では、他の用度として、前記電力制御プリアンブルは、ＵＥで受信したチャンネル割当てメッセージの再確認のために使用することができる。前記チャンネル割当てメッセージを再確認する理由は、ＵＥで受信したＣＡ_ＩＣＨにエラーがあるので、ＵＥがＣＰＣＨを不適に設定して他のＵＥが使用したＣＰＣＨと衝突することを防止するためである。前記チャンネル割当てメッセージを再確認する目的で電力制御プリアンブルを使用する場合、電力制御プリアンブルは、８個のスロットの長さを有しなければならない。

【0088】

前記再確認方法は、幾つの方法にて区分されることができる。(１) ＵＥが受信したＣＡ_ＩＣＨのシグネチャーを電力制御プリアンブルのパイロットビットに１：１に対応させて伝送する方法、(２) 受信されたＣＡシグネチャーをチップレベルで電力制御プリアンブルに乗算して伝送する方法、(３) 前記ＣＡシグネチャー及びＰＣ_Ｐに使用されるチャンネル区分コードを１：１に対応させ、前記受信されたＣＡシグネチャーに対応するチャンネル区分コードで電力制御プリアンブルをチャンネル拡散して伝送する方法、(４) 前記ＣＡシグネチャー及びＰＣ_Ｐに使用されるアップリンクスクランブリングコードを１：１に対応させて前記受信されたＣＡシグネチャーに対応するアップリンクスクランブリングコードで電力制御プリアンブルを拡散して伝送する方法などがある。前記ＣＡメッセージの再確認方法が電力制御プリアンブルに使用されるとしても、ＵＴＲＡＮは、電力制御プリアンブルに使用されるパイロットビットのパターンをすでに知っているので、電力測定及びＣＡメッセージに対する確認に難しさがない。

【0089】

前記電力制御プリアンブル３３９が伝送される時期と類似な時期に、ＵＴＲＡＮは、該当ＵＥに対するＣＰＣＨのアップリンク電力制御のためのダウンリンク専用チャンネルを伝送し始める。前記ダウンリンク専用チャンネルに対するチャンネル区分コードはＣＡメッセージを通じてＵＥに伝送され、前記ダウンリンク専用チャンネルは、パイロットフィールド、電力制御命令語フィールド、及びメッセージフィールドで構成される。前記メッセージフィールドは、ＵＴＲＡＮがＵＥに伝送すべきデータがある場合にのみ伝送される。図３の参照番号３０７は、アップリンク電力制御命令語フィールドを示し、参照番号３０９はパイロットフィールドを示す。

【0090】

図３の電力制御プリアンブル３３９が電力制御だけではなく、ＣＡ(Channel Allocation)メッセージを再確認するのに使用される場合、ＵＴＲＡＮがＰＣ_Ｐを通じて受信したＣＡ再確認メッセージが、ＵＴＲＡＮがＣＤ／ＣＡ_ＩＣＨ３０５を通じて伝送したＣＡメッセージと異なると、ＵＴＲＡＮは、設定されたダウンリンク専用チャンネルの電力制御フィールドを利用して、送信電力ダウン命令語（transmission power-decreasing command）をＵＥに継続的に伝送し、順方向アクセスチャンネル（Forward Access Channel：以下、ＦＡＣＨと略称する。）または設定されたダウンリンク専用チャンネルを通じて伝送したＣＰＣＨ伝送中断メッセージをＵＥに伝送する。

【0091】

図３の電力制御プリアンブル３３９を伝送した後、すぐにＣＰＣＨメッセージ部３４３を伝送する。ＣＰＣＨメッセージ部が伝送される間、ＵＥは、ＵＴＲＡＮからＣＰＣＨ伝送中断命令が受信されると、直ちにＣＰＣＨの伝送を中断する。ＣＰＣＨの伝送の間ＣＰＣＨ伝送中断命令が受信されないと、ＵＥは、ＣＰＣＨの伝送を完了した後、ＵＴＲＡＮからＣＰＣＨに対するＡＣＫまたはＮＡＫを受信する。

【0092】

スクランブリングコードの構造

図８Ａは、従来技術で使用したアップリンクスクランブリングコードの構造を示し、図８Ｂは、本発明の実施形態で使用するアップリンクスクランブリングコードの構造を示す。

【0093】

さらに具体的に言うと、図８Ａは、従来技術でＣＰＣＨを初期に設定して伝送する過程で使用したアップリンクスクランブリングコードの構造を示す。参照番号８０１は、ＡＰに使用されるアップリンクスクランブリングコードを示し、参照番号８０３は、ＣＤ_Ｐに使用されるアップリンクスクランブリングコードを示す。前記ＡＰに使用されるアップリンクスクランブリングコード及びＣＤ_Ｐに使用されるアップリンクスクランブリングコードは、同一の初期値、すなわち、同一のシード値(seed value)から生成されるアップリンクスクランブリングコードになることができる。例えば、ＡＰ部分には０番目～４，０９５番目の値が使用されることができ、ＣＤ_Ｐ部分には４，０９６番目の値～８，１９１番目の値が使用されることができる。ＵＥは、ＵＴＲＡＮがブロードキャストした前記ＡＰ及びＣＤ_Ｐに使用されるアップリンクスクランブリングコード、またはＵＴＲＡＮが予め設定したアップリンクスクランブリングコードを使用することができる。また、前記アップリンクスクランブリングコードは、長さ２５６のショートシーケンスを使用することができ、前記ＡＰまたはＣＤ_Ｐの区間の間、反復されないロングコードを使用することもできる。図８ＡのＡＰ及びＣＤ_Ｐで、同一のアップリンクスクランブリングコードが使用されることができる。すなわち、同一の初期値から生成したアップリンクスクランブリングコードの特定の部分を使用してＡＰ及びＣＤ_Ｐを同一に使用することができる。このような場合、ＡＰに使用されるシグネチャー及びＣＤ_Ｐに使用されるシグネチャーは、異なるシグネチャーグループから選択される。このような例で、所定のアクセスチャンネルに使用される１６個のシグネチャーのうちで８個がＡＰに割り当てられ、残りの８個のシグネチャーは、ＣＤ_Ｐに割り当てられる。

【0094】

図８Ａの参照番号８０５及び８０７は、それぞれ電力制御プリアンブルＰＣ_Ｐ及びＣＰＣＨのメッセージ部に使用されるアップリンクスクランブリングコードを示す。同一の初期値を有するアップリンクスクランブリングコードで使用する部分を異なるようにしてＰＣ_Ｐ及びＣＰＣＨメッセージ部に使用する。前記ＰＣ_Ｐ部分及びＣＰＣＨメッセージ部分に使用されるアップリンクスクランブリングコードは、ＡＰ及びＣＤ_Ｐに使用されるアップリンクスクランブリングコードと同一のスクランブリングコードになることができ、または、ＵＥが伝送するＡＰに対するシグネチャーと一対一に対応するアップリンクスクランブリングコードになることもできる。図８ＡのＰＣ_Ｐスクランブリングコード８０５は、アップリンクスクランブリングコード＃ｂの０番目～２０，４７９番目の値を使用し、メッセージスクランブリングコード８０７は、アップリンクスクランブリングコードのＰＣ_Ｐに使用されるスクランブリングコードの終了点で始める３８，４００の長さを有するスクランブリングコードを使用する。また、前記ＰＣ_Ｐ及びＣＰＣＨメッセージ部に使用されるスクランブリングコードの場合も、長さ２５６を有するスクランブリングコードを使用することができる。

【0095】

図８Ｂは、本発明の実施形態で使用されるアップリンクスクランブリングコードの構造を示す。参照番号８１１及び８１３は、それぞれＡＰ及びＣＤ_Ｐで使用されるアップリンクスクランブリングコードを示す。前記ＵＬ_スクランブリングコード８１１及び８１

３は、従来技術と同一の方式を使用する。前記アップリンクスクランブリングコードは、ＵＴＲＡＮによってＵＥに知られるか、または、システム内で予め約束される。

【0096】

図８Ｂの参照番号８１５は、ＰＣ_Ｐ部分に使用されるＵＬ_スクランブリングコードを示す。前記ＰＣ_Ｐ部分に使用されるＵＬ_スクランブリングコードは、前記ＡＰ及びＣＤ_Ｐに使用されるＵＬ_スクランブリングコードと同一のスクランブリングコードになることができ、または、前記ＡＰに使用されるシグネチャーと一対一に対応するスクランブリングコードになることもできる。図８Ｂの参照番号８１５は、ＰＣ_Ｐ部分に使用される０番目～２０，４７９番目の値を有するスクランブリングコードを示す。図８Ｂの参照番号８１７は、ＣＰＣＨメッセージ部に使用されるＵＬ_スクランブリングコードを示す。前記スクランブリングコードは、ＰＣ_Ｐに使用されるスクランブリングコードと同一の符号を使用することができ、または、前記ＰＣ_Ｐに使用されるスクランブリングコードと一対一に対応するか、前記ＡＰに使用されるシグネチャーと一対一に対応するスクランブリングコードを使用することもできる。前記ＣＰＣＨメッセージ部は、３８，４００の長さを有するスクランブリングコードを使用する。

【0097】

図８Ａ及び図８Ｂについての説明を要約すると、従来技術で、１個のスクランブリングコードは、ＡＰ、ＣＤ_Ｐ、ＰＣ_Ｐ、及びＣＰＣＨのメッセージ部に使用されることができ、または２個のスクランブリングコードは、ＡＰ、ＣＤ_Ｐ、ＰＣ_Ｐ、及びＣＰＣＨのメッセージ部に使用されることもできる。言い換えれば、１つは、ＡＰ及びＣＤ_Ｐに使用され、他の１つは、ＰＣ_Ｐ及びＣＰＣＨのメッセージ部に使用される。本発明において、ＡＰ及びＣＤ_Ｐに使用されるスクランブリングコード、ＰＣ_Ｐに使用されるスクランブリングコード、及びＣＰＣＨのメッセージ部に使用されるスクランブリングコードは異なることができ、柔軟に使用されることができる。例えば、ＡＰ及びＣＤ_Ｐに使用されるスクランブリングコードは、ＵＥの複雑度を減少させる目的でＵＴＲＡＮによって予め決定されることができる。ＰＣ_Ｐに使用されるスクランブリングコードは、ＡＰの生成に使用されるシグネチャーにマッピングされることができ、ＣＰＣＨのメッセージ部に使用されるスクランブリングコードは、ＰＣ_Ｐに使用されるスクランブリングコードまたはＡＰに使用されるシグネチャーにマッピングされることができる。もちろん、ＰＣ_Ｐに使用されるスクランブリングコード及びＣＰＣＨのメッセージ部に使用されるスクランブリングコードは、ＣＡメッセージにマッピングされることができる。

【0098】

本発明の実施形態によるスクランブリングコードの構造を説明するのに使用されたすべてのスクランブリングコードの場合、ＡＰ、ＣＤ_Ｐ、ＰＣ_Ｐ、及びＣＰＣＨメッセージ部の区間の間、反復されない長いスクランブリングコードが使用される。しかし、２５６の長さを有する短いスクランブリングコードを使用することもできる。

【0099】

ＡＰの詳細な説明

図９Ａ及び図９Ｂは、本発明の実施形態によるＣＰＣＨアクセスプリアンブルのチャンネル構造及び生成構造を示す。さらに具体的に言うと、図９Ａは、ＡＰのチャンネル構造を示し、図９Ｂは、一つのＡＰスロットを生成する構造を示す。

【0100】

図９Ａの参照番号９０１は、アクセスプリアンブルＡＰの長さを示し、前記ＡＰのサイズは、ＡＰ用シグネチャー９０３の長さを一つのスロット内で２５６回反復したものと同一である。前記ＡＰ用シグネチャー９０３は、長さ１６を有する直交符号である。図９Ａのシグネチャー９０３で示した変数‘Ｋ’は、０～１５になることができる。すなわち、本発明の実施形態では、１６種類のシグネチャーが提供される。一例として、下記<表４>はＡＰ用シグネチャーを示す。ＵＥでシグネチャー９０３を選択する方法は次のようである。ＵＴＲＡＮが伝送するＣＳＩＣＨを通じてＵＴＲＡＮ内のＣＰＣＨが支援することができる最大データ伝送速度、及び、一つのＣＰＣＨ内で使用することができる多重符号

の数を確認した後、ＣＰＣＨを通じて伝送されるデータの特性、伝送速度、及び伝送長さなどを考慮して、適切なＡＳＣを選択する。その後、選択されたＡＳＣで定義されたシグネチャーのうちで、ＵＥのデータトラヒックに対する適切なシグネチャーを選択する。

【0101】

【表4】

	n															
シグネチャー	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
$P_0(n)$	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
$P_1(n)$	A	-A	A	-A	A	-A	A	-A	A	-A	A	-A	A	-A	A	-A
$P_2(n)$	A	A	-A	-A	A	A	-A	-A	A	A	-A	-A	A	A	-A	-A
$P_3(n)$	A	-A	-A	A	A	-A	-A	A	A	-A	-A	A	A	-A	-A	A
$P_4(n)$	A	A	A	A	-A	-A	-A	-A	A	A	A	A	-A	-A	-A	-A
$P_5(n)$	A	-A	A	-A	-A	A	-A	A	A	-A	A	-A	-A	A	-A	A
$P_6(n)$	A	A	-A	A	-A	-A	A	A	A	A	-A	A	-A	-A	A	A
$P_7(n)$	A	-A	-A	A	-A	A	A	-A	A	-A	-A	A	-A	A	A	-A
$P_8(n)$	A	A	A	A	A	A	A	A	-A	-A	-A	-A	-A	-A	-A	-A
$P_9(n)$	A	-A	A	-A	A	-A	A	-A	-A	A	-A	A	-A	A	-A	A
$P_{10}(n)$	A	A	-A	-A	A	A	-A	-A	-A	-A	A	A	-A	-A	A	A
$P_{11}(n)$	A	-A	-A	A	A	-A	-A	A	-A	A	A	-A	-A	A	A	-A
$P_{12}(n)$	A	A	A	A	-A	-A	-A	-A	-A	-A	-A	-A	A	A	A	A
$P_{13}(n)$	A	-A	A	-A	-A	A	-A	A	-A	A	-A	A	A	-A	A	-A
$P_{14}(n)$	A	A	-A	A	-A	-A	A	A	-A	-A	A	-A	A	A	-A	-A
$P_{15}(n)$	A	-A	-A	A	-A	A	A	-A	-A	A	A	-A	A	-A	-A	A

図９Ｂのアクセスプリアンブル９０５は、９０１と同一のサイズを有する。前記アクセスプリアンブル９０５は、乗算器９０６によってダウンリンクスクランブリングコード９０７で拡散されてＵＴＲＡＮに伝送される。前記ＡＰが伝送される時点は、図７及び＜表３＞を参照して説明され、前記スクランブリングコード９０７は、図８Ｂを参照して説明される。

【0102】

図９ＢのＡＰを通じてＵＥがＵＴＲＡＮに伝送する情報は、ＵＥが要求するＣＰＣＨの伝送速度、またはＵＥが伝送するフレーム数を含むか、または前記２種類の情報の結合をシグネチャーと一対一に対応させて生成した情報である。従来技術で、ＵＥがＡＰを通じてＵＴＲＡＮに伝送する情報は、ＣＰＣＨの使用に必要なアップリンクスクランブリングコード及びデータ伝送速度、ＣＰＣＨ電力制御のためのダウンリンク専用チャンネルのチャンネル区分コード及びデータ伝送速度、及び伝送されるデータフレームの数である。ＵＥは、前記情報を考慮して該当シグネチャーを選択してＡＰを通じてＵＴＲＡＮに伝送する。前記のような方法にて、ＡＰを通じて伝送する情報を決定すると、ＵＴＲＡＮは、ＵＥが要求したチャンネルに対する使用許可または使用禁止の機能のみを有する。従って、使用可能なＣＰＣＨがＵＴＲＡＮ内に存在するとしても、従来技術は、ＵＥにＣＰＣＨを割り当てることができない。同一の条件を有するＣＰＣＨを要求するＵＥが多い場合、異なるＵＥ間にＣＰＣＨ獲得のための衝突が発生し、これにより、ＵＥがチャンネル獲得に必要な時間を増加させる。しかし、本発明の実施形態において、ＵＥは、ＵＴＲＡＮにＣＰＣＨの伝送可能な最大データ伝送速度、または前記最大データ伝送速度及び伝送するデータフレームの数のみを伝送し、その後、ＵＴＲＡＮは、ＣＡを通じてアップリンクスクランブリングコード、ダウンリンク専用チャンネルのチャンネル区分コードなどのＣＰＣＨを利用するための他の情報を決定する。従って、本発明の実施形態において、ＵＥにＣＰＣＨ使用権を付加することができるので、ＵＴＲＡＮ内のＣＰＣＨを柔軟でありかつ効率的に割り当てることができる。ＵＴＲＡＮが一つのＰＣＰＣＨ(物理ＣＰＣＨ)内に多数のチャンネル区分コードを使用する多重チャンネルコードの伝送を支援する場合、前記Ａ

Ｐの伝送に使用されるＡＰシグネチャーは、多重符号の伝送に使用されるスクランブリングコードを示すことができ、または、ＵＥがＰＣＰＣＨ内に使用される多重符号の数を選択することができると、ＵＥが所望する多重符号の数を示すこともできる。前記ＡＰシグネチャーが多重符号用アップリンクスクランブリングコードを示す場合、ＵＴＲＡＮがＵＥに伝送するチャンネル割当てメッセージは、ＵＥが使用する多重符号の数を示すことができ、ＡＰシグネチャーがＵＥの使用しようとする多重符号の数を示す場合、チャンネル割当てメッセージは、ＵＥが多重符号の伝送に使用するアップリンクスクランブリングコードを示すこともできる。

【0103】

ＣＤ_Ｐの詳細な説明

図１０Ａ及び図１０Ｂは、本発明の実施形態による衝突検出プリアンブルＣＤ_Ｐのチャンネル構造及び生成構造をそれぞれ示す。前記ＣＤ_Ｐのチャンネル構造及び生成構造は、図９Ａ及び図９ＢのＡＰのチャンネル構造及び生成構造と同一である。図１０Ｂのアップリンクスクランブリングコードは、図８Ｂに示したＡＰスクランブリングコードとは異なることができる。

【0104】

図１０Ａの参照番号１００１は、ＣＰ_Ｐの長さを示し、＜表４＞に示すＡＰに対してシグネチャー１００３を２５６回反復したものである。前記シグネチャー１００３の変数‘ｊ’は０～１５になることができる。すなわち、ＣＤ_Ｐに対して１６個のシグネチャーが提供される。図１０Ａのシグネチャー１００３は、１６個のシグネチャー中で任意に選択される。前記シグネチャーを任意に選択する１つの理由は、同一のＡＰをＵＴＲＡＮに伝送した後、ＡＣＫ信号を受信したＵＥ間の衝突を防止するためのものであり、これにより、もう一度ＵＴＲＡＮから確認過程を遂行するためである。図１０Ａのシグネチャー１００３を使用するとき、従来技術は、ＣＤ_Ｐに使用する１つのシグネチャーのみを規定するか、または所定のアクセスチャンネルでＡＰを伝送する場合に使用される方法を利用する。一つのシグネチャーのみを使用してＣＤ_Ｐを伝送する従来方法は、同一のシグネチャーを使用する代わり、ＣＤ_Ｐの伝送時点を任意にしてＵＥ間の衝突を防止する目的がある。

【0105】

しかし、従来方法は、ＵＴＲＡＮが一つのＵＥから受信した以前のＣＤ_Ｐに対するＡＣＫを伝送しない時点で他のＵＥがＵＴＲＡＮにＣＤ_Ｐを伝送すると、ＵＴＲＡＮは、先ず受信されたＣＤ_Ｐに対するＡＣＫを処理する以前には、他のＵＥが伝送したＣＤ_Ｐに対して適切な動作を行うことができない。すなわち、ＵＴＲＡＮは、一つのＵＥからＣＤ_Ｐを処理する間、他のＵＥからＣＤ_Ｐを処理することができない。ＵＴＲＡＮにＣＤ_Ｐを伝送するまた他の従来方法では、ランダムアクセスチャンネルでＡＰを伝送する構造と同一のものを使用する。前述したように、ＵＥがＲＡＣＨ伝送でＡＰをＵＴＲＡＮに伝送する場合、ＵＥは、ＡＰが伝送される適切な位置を待機しなければならない。従って、このような方法は、ＵＥがＣＤ_Ｐを伝送するためのアクセススロットを検出するまで長い時間を要求し、これにより、ＣＤ_Ｐの伝送のとき多い遅延時間が発生するという点で不利である。

【0106】

本発明の実施形態において、ＡＰ_ＡＩＣＨを受信した後、ＵＥは、一定の時間が経過した後、所定のシグネチャーを選択してＵＴＲＡＮに伝送する。

【0107】

図１０ＢのＣＤ_Ｐ１００５は、図１０Ａの１００１と同一のサイズを有する。前記ＣＤ_Ｐ１００５は、乗算器１００６によってＵＬ_スクランブリングコード１００７で拡散され、その後、前記ＡＰ_ＡＩＣＨが受信された時点から所定の時間が経過した後にＵＴＲＡＮに伝送される。前記スクランブリングコード１００７は、図８Ｂを参照して説明されている。

【0108】

ＣＤ/ＣＡ_ＩＣＨ

図１１Ａは、表示チャンネルのチャンネル構造を示す。表示チャンネルの種類は３個である。ＵＴＲＡＮが受信されたＡＰに応じてＡＣＫまたはＮＡＫを伝送することができるアクセスプリアンブル捕捉表示チャンネル(ＡＰ_ＡＩＣＨ)、受信されたＣＤ_Ｐに応じてＡＣＫまたはＮＡＫを伝送することができる衝突検出表示チャンネル(ＣＤ_ＩＣＨ)、またはＵＴＲＡＮがＵＥにＣＰＣＨチャンネル割当て命令を伝送するチャンネル割当て表示チャンネル(ＣＡ_ＩＣＨ)がある。図１１Ｂは生成構造を示す。

【0109】

図１１Ａの参照番号１１０１は、ＵＴＲＡＮが捕捉したＡＰ、ＣＤ_Ｐ及びＣＡ関連命令語に対するＡＣＫ及びＮＡＫを伝送するための表示部分を示す。参照番号１００３は、ＣＰＣＨ状態表示チャンネル(ＣＳＩＣＨ)部を示す。前記ＣＳＩＣＨのチャンネル構造及び生成構造は、図４Ａ及び図４Ｂを参照して説明されている。図１１Ｂの参照番号１１１１は、表示チャンネル(ＩＣＨ)のフレーム構造を示す。示すように、一つのＩＣＨフレームは２０ｍｓの長さを有し、１６個のスロットで構成される。また、前記各スロットは、前記＜表４＞に示した１６個のシグネチャー中の０個または一つ以上のシグネチャーを伝送することができる。図１１ＢのＣＰＣＨ状態表示チャンネル(ＣＳＩＣＨ)１１０７のサイズは図１１Ａの１１０３のそれと同一であり、図１１Ｂの参照番号１１０９はチャンネル区分コードを示し、ＡＰ_ＡＩＣＨ、ＣＤ_ＩＣＨ、及びＣＡ_ＩＣＨは、それぞれ異なるチャンネル区分コードを使用することができ、ＣＤ_ＩＣＨ及びＣＡ_ＩＣＨは、同一のチャンネル区分コードを使用することができる。前記ＣＰＣＨ状態表示チャンネル１１０７の信号は、乗算器１１０８によってチャンネル区分コード１１０９で拡散され、１つのＩＣＨフレームを構成する前記拡散された１６個のスロットは、乗算器１１１２によってダウンリンクスクランブリングコード１１１３で拡散されて伝送される。

【0110】

図１２は、ＣＤ_ＩＣＨ及びＣＡ_ＩＣＨ命令語を生成するためのＡＩＣＨ生成器を示す。前述したように、ＡＩＣＨフレームの各スロットに１６個のシグネチャーのうち対応するシグネチャーを割り当てる。

【0111】

図１２を参照すると、乗算器１２０１～１２１６は、対応する直交符号W_1～W_{16}を第１入力として受信し、また、それぞれ対応する捕捉表示AI_1～AI_{16}を第２入力として受信する。前記各ＡＩは、１、０、または－１の値を有し、ＡＩが１である場合はＡＣＫを意味し、ＡＩが－１である場合はＮＡＫを意味し、ＡＩが０である場合は、ＵＥから伝送された該当シグネチャーの捕捉に失敗したことを意味する。従って、前記乗算器１２０１～１２１６は、対応する直交符号を対応する捕捉表示ＡＩにそれぞれ乗じ、加算器１２２０は、前記乗算器１２０１～１２１６の出力を加算して、その結果値をＡＩＣＨ信号として出力する。

【0112】

下記に例として挙げられる幾つの方法にて、ＵＴＲＡＮは、図１２の前記ＡＩＣＨ生成器を通じてチャンネル割当て命令を伝送することができる。

【0113】

１．第１チャンネル割当て方法

このような方法では、一つのダウンリンクチャンネルを割り当てて前記割り当てられたチャンネルを通じてチャンネル割当て命令を伝送する。図１３Ａ及び１３Ｂは、前記第１方法にて具現されるＣＤ_ＩＣＨ及びＣＡ_ＩＣＨの構造を示す。図１３Ａは、ＣＤ_ＩＣＨ及びＣＡ_ＩＣＨのスロット構造を、図１３Ｂは、ＣＤ_ＩＣＨ及びＣＡ_ＩＣＨを伝送する方法を示す。図１３Ａの参照番号１３０１は、ＣＤ_Ｐに対する応答信号を伝送するＣＤ_ＩＣＨの伝送スロット構造を示す。参照番号１３１１は、チャンネル割当て命令を伝送するＣＡ_ＩＣＨの伝送スロット構造を示す。参照番号１３３１は、ＣＤ_Ｐに対する応答信号を伝送するＣＤ_ＩＣＨの伝送フレーム構造を示す。参照番号１３４１は、前記ＣＤ_ＩＣＨフレームを伝送した後、τ時間遅延してＣＡ_ＩＣＨを通じてチャンネル割当

て命令を伝送するフレーム構造を示す。参照番号１３０３及び１３１３はＣＳＩＣＨ部分を示す。

【0114】

図１３Ａ及び図１３Ｂに示すように、チャンネルを割り当てる方法は、次のような利点を有する。ＣＤ_ＩＣＨ及びＣＡ_ＩＣＨは、それぞれダウンリンクチャンネルが異なるので物理的に分離される。従って、ＡＩＣＨが１６個のシグネチャーを有すると、前記第１チャンネル割当て方法は、ＣＤ_ＩＣＨに１６個のシグネチャーを使用することができ、ＣＡ_ＩＣＨにも１６個のシグネチャーを使用することができる。この場合、シグネチャーの符号を使用して伝送することができる情報の種類は２倍になることができる。従って、ＣＡ_ＩＣＨの‘＋１’、または‘－１’の符号を使用することにより、３２個のシグネチャーをＣＡ_ＩＣＨに使用することができる。この場合、同種のチャンネルを同時に要求した多数の使用者に異なるチャンネルを次のような手順にて割り当てることができる。先ず、ＵＴＲＡＮ内のＵＥ＃１、ＵＥ＃２、及びＵＥ＃３がＡＰ＃３をＵＴＲＡＮに同時に伝送してＡＰ＃３に該当するチャンネルを要求し、ＵＥ＃４がＵＴＲＡＮにＡＰ＃５を伝送してＡＰ＃５に該当するチャンネルを要求すると仮定する。この仮定は、下記＜表５＞の第１コラムに該当する。このような場合、ＵＴＲＡＮはＡＰ＃３及びＡＰ＃５を認識する。このとき、予め定義された基準により、ＵＴＲＡＮは、受信されたＡＰに対する応答としてＡＰ_ＡＩＣＨを生成する。予め定義された基準の一例として、ＵＴＲＡＮは、前記ＡＰの受信電力比によって受信されたＡＰに応答することができる。ここで、ＵＴＲＡＮが前記ＡＰ＃３を選択すると仮定する。すると、ＵＴＲＡＮはＡＰ＃３にＡＣＫを伝送し、ＡＰ＃５にはＮＡＫを伝送する。これは、＜表５＞の第２コラムに該当する。

【0115】

その後、ＵＴＲＡＮが伝送したＡＣＫを受信したＵＥ＃１、＃２、＃３は、それぞれランダムにＣＤ_Ｐを生成する。３個のＵＥがＣＤ_Ｐを生成した場合(少なくとも２個のＵＥが一つのＡＰ_ＡＩＣＨに対してＣＤ_Ｐを生成する場合)、各ＵＥは、所定のシグネチャーを使用して前記ＣＤ_Ｐを生成し、ＵＴＲＡＮに伝送した前記ＣＤ_Ｐは異なるシグネチャーを有する。ここで、ＵＥ＃１はＣＤ_Ｐ＃６、ＵＥ＃２はＣＤ_Ｐ＃２、そしてＵＥ＃３はＣＤ_Ｐ＃９をそれぞれ生成すると仮定する。このようにそれぞれのＵＥが伝送したＣＤ_Ｐが受信されると、ＵＴＲＡＮは、３個のＣＤ_Ｐが受信されることを認知し、ＵＥが要求したＣＰＣＨが使用可能であるか否かを検査する。ＵＴＲＡＮ内にＵＥの要求に対応する３個以上のＣＰＣＨがある場合、ＣＤ_ＩＣＨ＃２、ＣＤ_ＩＣＨ＃６、及びＣＤ_ＩＣＨ＃９にＡＣＫを伝送し、ＵＴＲＡＮは、ＣＡ_ＩＣＨを通じて３個のチャンネル割当てメッセージを伝送する。このような場合、ＵＴＲＡＮがＣＡ_ＩＣＨを通じて＃４、＃６、及び＃１０のチャンネルを割り当てるメッセージを伝送すると、ＵＥは、下記のような過程を通じて自分に割り当てられたＣＰＣＨの番号を分かるようになる。ＵＥ＃１は、自分がＵＴＲＡＮに伝送したＣＤ_Ｐのシグネチャーを分かり、そのシグネチャー番号が６であることも分かる。このような方式にて、ＵＴＲＡＮがＣＤ_ＩＣＨに多数のＡＣＫを伝送する場合も、いくつのＡＣＫが伝送されたかを分かる。

【0116】

本発明の実施形態では、＜表５＞に示したような場合と仮定して詳細に説明される。まず、ＵＴＲＡＮは、ＣＤ_ＩＣＨを通じて３個のＡＣＫをＵＥに伝送し、ＣＡ_ＩＣＨにも３個のチャンネル割当てメッセージを伝送する。前記伝送されたチャンネル割当てメッセージは、チャンネル番号＃２、＃６、及び＃９に対応する。前記のようなＣＤ_ＩＣＨ及びＣＡ_ＩＣＨをすべて受信すると、ＵＥ＃１は、ＵＴＲＡＮ内の３個のＵＥが同時にＣＰＣＨチャンネルを要求し、ＵＥ＃１のそれ自体は、ＣＤ_ＩＣＨのＡＣＫ手順によって、ＣＡ_ＩＣＨを通じて伝送されたチャンネル割当てメッセージのうち、二番目のメッセージの内容によってＣＰＣＨを使用することができることを分かる。

【0117】

【表5】

UE No	AP No	AP_AICH	CD_P No	CA_ICH
1	3	ACK#3	6 (Second)	#6 (Second)
2	3	ACK#3	2 (First)	#4 (First)
3	3	ACK#3	9 (Third)	#10 (Third)
4	5	NAK#5		

前記のような過程を通じて、ＵＥ＃２はＣＤ_Ｐ＃２を伝送したので、ＣＡ_ＩＣＨが伝送したチャンネル割当てメッセージのうち、ＣＡメッセージ＃４を使用することができる。同一の方式にて、ＵＥ＃３は、ＣＡメッセージ＃１０に対応するチャンネルが割り当てられる。このような方式にて、多数のチャンネルを多数の使用者に同時に割り当てることができる。

【0118】

２．第２チャンネル割当て方法

第２チャンネル割当て方法は、前記第１チャンネル割当て方法の修正された形態であって、ＣＤ_ＩＣＨフレーム及びＣＡ_ＩＣＨフレームの伝送時間差τを“０”に設定してＣＤ_ＩＣＨ及びＣＡ_ＩＣＨを同時に伝送する。Ｗ_ＣＤＭＡシステムは、拡散率２５６を使用してＡＰ_ＡＩＣＨの一つのシンボルを拡散させ、ＡＩＣＨの一つのスロットには１６シンボルを伝送する。ＣＤ_ＩＣＨ及びＣＡ_ＩＣＨを同時に伝送する方法は、それぞれ異なる長さのシンボルを使用して実現されることができる。すなわち、拡散率が異なる直交符号をＣＤ_ＩＣＨ及びＣＡ_ＩＣＨにそれぞれ割り当てる方法を使用することができる。前記第２方法の一例として、ＣＤ_Ｐに使用されるシグネチャーの数は全体１６個が可能であり、ＣＰＣＨが最大１６個まで割り当てられる場合、ＣＡ_ＩＣＨ及びＣＤ_ＩＣＨに５１２チップの長さを有するチャンネルをそれぞれ割り当てることができ、それぞれのＣＡ_ＩＣＨ及びＣＤ_ＩＣＨには５１２チップの長さを有するシンボルが８個ずつ伝送されることができる。このとき、互いに直交性のある８個のシグネチャーをＣＡ_ＩＣＨ及びＣＤ_ＩＣＨに割り当て、前記割り当てられた８個のシグネチャーに＋１/－１の符号を乗じることによって、１６個のシグネチャーを利用してＣＡ_ＩＣＨ及びＣＤ_ＩＣＨを伝送することができる。このような方法は、ＣＤ_ＩＣＨに使用した直交符号のみならず、別個の直交符号をＣＡ_ＩＣＨに割り当てる必要がないという点で有利である。

【0119】

前述したように、ＣＡ_ＩＣＨ及びＣＤ_ＩＣＨには、５１２チップの長さを有する直交符号を次のような方法にて割り当てることができる。２５６長さの一つの直交符号W_iをＣＡ_ＩＣＨ及びＣＤ_ＩＣＨに割り当てる。ＣＤ_ＩＣＨに割り当てた５１２長さの直交符号の場合、直交符号Ｗｉを２回反復して５１２長さの直交符号〔W_i W_i〕を生成する。また、ＣＡ_ＩＣＨに割り当てた５１２長さの直交符号の場合、反転直交符号$-W_i$は、直交符号W_iに連結されて直交符号〔W_i $-W_i$〕を生成する。別個の直交符号を割り当てることなく、前記生成された〔W_i W_i〕〔W_i $-W_i$〕を利用してＣＤ_ＩＣＨ及びＣＡ_ＩＣＨを同時に伝送することができる。

【0120】

図１４は、前記第２方法の他の実施形態を示すもので、同一の拡散率を有する異なるチャンネル区分コードを割り当てることにより、ＣＤ_ＩＣＨ及びＣＡ_ＩＣＨを同時に伝送する。図１４の参照番号１４０１及び１４１１は、それぞれＣＤ_ＩＣＨ部とＣＡ_ＩＣＨ部を示す。参照番号１４０３及び１４１３は、２５６の同一の拡散率を有する異なる直交チャンネル区分コードを示す。参照番号１４０５及び１４１５は、５，１２０チップの長さを有する１５個のアクセススロットでそれぞれ構成されたＣＤ_ＩＣＨフレーム及びＣＡ_ＩＣＨフレームを示す。

【0121】

図１４を参照すると、ＣＤ_ＩＣＨ部１４０１は、長さ１６のシグネチャーをシンボル単位で２回反復して得られたシグネチャーに、ＡＣＫ、ＮＡＫ、または捕捉失敗をそれぞ

れ示す‘１’、‘－１’、または‘０’をシンボル単位で乗じることによって生成される。前記ＣＤ_ＩＣＨ部１４０１は、多数のシグネチャーに対してＡＣＫ及びＮＡＫを同時に伝送することができる。前記ＣＤ_ＩＣＨ部１４０１は、乗算器１４０２を通じてチャンネル区分コード１４０３で拡散され、ＣＤ_ＩＣＨフレーム１４０５の一つのアクセススロットを構成する。前記ＣＤ_ＩＣＨフレーム１４０５は、乗算器１４０６によってダウンリンクスクランブリングコード１４０７で拡散されて伝送される。

【0122】

前記ＣＡ_ＩＣＨ部１４１１は、長さ１６のシグネチャーをシンボル単位で２回反復して得られたシグネチャーに、ＡＣＫ、ＮＡＫ、または捕捉失敗をそれぞれ示す‘１’、‘－１’、または‘０’をシンボル単位で乗じることによって生成される。前記ＣＡ_ＩＣＨ部１４１１は、多数のシグネチャーに対してＡＣＫ及びＮＡＫを同時に伝送することができる。前記ＣＡ_ＩＣＨ部１４１１は、乗算器１４１２を通じてチャンネル区分コード１４１３で拡散され、ＣＡ_ＩＣＨフレーム１４１５の一つのアクセススロットを構成する。前記ＣＡ_ＩＣＨフレーム１４１５は、乗算器１４１６によってダウンリンクスクランブリングコード１４１７で拡散されて伝送される。

【0123】

図１５は、前記第２方法のまた他の実施形態を示すもので、ＣＤ_ＩＣＨ及びＣＡ_ＩＣＨは、それぞれ異なるシグネチャー集合を生成した同一のチャンネル区分コードで拡散され、異なるシグネチャーグループを利用して同時に伝送される。

【0124】

図１５を参照すると、ＣＡ_ＩＣＨ部１５０１は、長さ１６のシグネチャーをシンボル単位で２回反復して得られたシグネチャーに、ＡＣＫ、ＮＡＫ、または捕捉失敗をそれぞれ示す‘１’、‘－１’、または‘０’をシンボル単位で乗じることによって生成される。前記ＣＡ_ＩＣＨ部１５０１は、多数のシグネチャーに対してＡＣＫ及びＮＡＫを同時に伝送することができる。ｋ番目のＣＡ_ＩＣＨ部１５０３は、一つのＣＰＣＨチャンネルに多数のＣＡシグネチャーが対応する場合に使用される。前記多数のＣＡシグネチャーを一つのＣＰＣＨチャンネルに対応させる理由は、ＵＴＲＡＮからＵＥにＣＡ_ＩＣＨが伝送される間発生したエラーのために、ＵＥは、ＵＴＲＡＮが割り当てないＣＰＣＨを使用する確率を減少させるためである。

【0125】

図１５の参照番号１５０５はＣＤ_ＩＣＨ部を示す。前記ＣＤ_ＩＣＨ部１５０５の物理的な構造はＣＡ_ＩＣＨと同一である。しかし、前記ＣＤ_ＩＣＨ部１５０５は、ＣＡ_ＩＣＨ部で使用するシグネチャーグループと異なるシグネチャーグループから選択したシグネチャーを使用するので、ＣＡ_ＩＣＨ部１５０１と互いに直交する。従って、ＵＴＲＡＮがＣＤ_ＩＣＨ及びＣＡ_ＩＣＨを同時に伝送しても、ＵＥは、ＣＤ_ＩＣＨをＣＡ_ＩＣＨと混同することがない。ＣＡ_ＩＣＨ部＃１　１５０１及びＣＡ_ＩＣＨ部＃ｋ　１５０３は、加算器１５０２によって加算される。前記ＣＤ_ＩＣＨ部１５０５は、加算器１５０４によって前記加算されたＣＡ_ＩＣＨ部に加算され、その後、乗算器１５０６によって直交チャンネル区分コード１５０７で拡散される。その結果、拡散値は、１個のＣＤ/ＣＡ_ＩＣＨスロットの表示部分を構成し、前記ＣＤ/ＣＡ_ＩＣＨは、乗算器１５０８によってダウンリンクスクランブリングコードで拡散されて伝送される。

【0126】

前記ＣＤ_ＩＣＨフレームとＣＡ_ＩＣＨフレームとの伝送時間差τを“０”に設定してＣＤ_ＩＣＨ及びＣＡ_ＩＣＨを同時に伝送する方法では、W-ＣＤＭＡ標準に定義された、＜表４＞に示したＡＩＣＨ用シグネチャーをそのまま使用することができる。ＣＡ_ＩＣＨの場合、ＵＴＲＡＮが多数のＣＰＣＨチャンネル中の一つをＵＥに指定するので、ＵＥの受信器は、多数のシグネチャーの検出を試みるべきである。既存のＡＰ_ＡＩＣＨ及びＣＤ_ＩＣＨで、ＵＥは１個のシグネチャーに対してのみ検出を遂行する。しかし、本発明の実施形態によるＣＡ_ＩＣＨを使用する場合、ＵＥの受信器は、すべての可能なシグネチャーに対して検出を試みるべきである。従って、ＵＥの受信器の複雑さを簡素化す

るように、ＡＩＣＨのシグネチャーの構造を設計するか、または再配置する方法が要求される。

【0127】

前述したように、１６個の可能なシグネチャー中の８個のシグネチャーにＣＤ_ＩＣＨに割り当てられた符号(＋１／－１)を乗じることによって生成された１６個のシグネチャーがＣＤ_ＩＣＨに割り当てられ、前記１６個の可能なシグネチャーのうち、残りの８個のシグネチャーに符号(＋１／－１)を乗じることによって生成された１６個のシグネチャーがＣＰＣＨの割当てのためにＣＡ_ＩＣＨに割り当てられると仮定する。

【0128】

前記W-ＣＤＭＡ標準案で使用するＡＩＣＨのシグネチャーは、アダマール(Hadamard)関数を使用する。前記アダマール関数は、下記のような形態で生成される。

```
Ｈｎ＝　　Ｈｎ－１　　Ｈｎ－１
　　Ｈｎ－１　　－Ｈｎ－１
Ｈ１＝　　１　　１
　　１　　－１
```

すると、本発明の実施形態で必要な長さ１６のアダマール関数は、次のようである。前記<表４>に示されたアダマール関数によって生成されたシグネチャーは、前記シグネチャーにＡＩＣＨのチャンネル利得Ａを乗じた後の形態であり、下記のシグネチャーは、前記シグネチャーにＡＩＣＨのチャンネル利得Ａを乗じる以前の形態である。

```
１ １ １ １ １ １ １ １　　１ １ １ １ １ １ １ １ =>Ｓ０
1-1 1-1 1-1 1-1　　1-1 1-1 1-1 1-1 =>Ｓ１
１ 1-1-1 １ 1-1-1　　１ 1-1-1 １ 1-1-1 =>Ｓ２
1-1-1 １ 1-1-1 １　　1-1-1 １ 1-1-1 １ =>Ｓ３
１ １ １ 1-1-1-1-1　　１ １ １ 1-1-1-1-1 =>Ｓ４
1-1 1-1-1 1-1 １　　1-1 1-1-1 1-1 １ =>Ｓ５
１ 1-1-1-1-1-1 １ １　　１ 1-1-1-1-1-1 １ １ =>Ｓ６
1-1-1 1-1 １ 1-1　　1-1-1 1-1 １ 1-1 =>Ｓ７
１ １ １ １ １ １ １ １　　-1-1-1-1-1-1-1-1 =>Ｓ８
1-1 1-1 1-1 1-1　　-1 1-1 1-1 1-1 １ =>Ｓ９
１ 1-1-1 １ 1-1-1　　-1-1 １ 1-1-1 １ １ =>Ｓ１０
1-1-1 １ 1-1-1 １　　-1 １ 1-1-1 １ 1-1 =>Ｓ１１
１ １ １ 1-1-1-1-1　　-1-1-1-1 １ １ １ １ =>Ｓ１２
1-1 1-1-1 1-1 １　　-1 1-1 １ 1-1 1-1 =>Ｓ１３
１ 1-1-1-1-1-1 １ １　　-1-1 １ １ １ 1-1-1 =>Ｓ１４
1-1-1 1-1 １ 1-1　　-1 １ 1-1 1-1-1 １ =>Ｓ１５
```

前記アダマール関数中で８個をＣＤ_ＩＣＨに割り当て、残りの８個のアダマール関数をＣＡ_ＩＣＨに割り当てる。このとき、ＦＨＴ(Fast Hadamard Transform)を簡単に遂行するために、ＣＡ_ＩＣＨのシグネチャーを次のような手順にて割り当てる。

{Ｓ１，Ｓ９，Ｓ５，Ｓ１３，Ｓ３，Ｓ７，Ｓ１１，Ｓ１５}

そして、ＣＤ_ＩＣＨに対するシグネチャーは、次のような手順にて割り当てられる。

{Ｓ２，Ｓ１０，Ｓ６，Ｓ１４，Ｓ４，Ｓ８，Ｓ１２，Ｓ１６}

ここで、ＣＡ_ＩＣＨのシグネチャーは、ＵＥがＦＨＴを遂行できるようにするために、左から右に割り当てられる。これにより、複雑度を最小にする。２個、４個、及び８個のシグネチャーが前記ＣＡ_ＩＣＨのシグネチャーから左から右に選択されると、最終列を除いた各列の１の数が－１の数と同一である。前述した方法で、ＣＤ_ＩＣＨ及びＣＡ_ＩＣＨに対するシグネチャーを割り当てることにより、使用されたシグネチャーの数に比べてＵＥの受信器の構造を簡単にすることができる。

【0129】

また、前記シグネチャーをＣＰＣＨまたは他の形態でＣＰＣＨを制御するダウンリンクチャンネルに対応させることができる。例えば、ＣＡ_ＩＣＨに対するシグネチャーは、

次のように割り当てられることができる。
〔１，９〕　　=> 最大２個のシグネチャーを使用
〔１，５，９，１３〕　　=> 最大４個のシグネチャーを使用
〔１，３，５，７，９，１１，１３，１５〕 => 最大８個のシグネチャーを使用
もし、全体ＮＵＭ_ＣＰＣＨ(ここで、１＜ＮＵＭ_ＣＰＣＨ≦１６)のＣＰＣＨを使用すると、ｋ番目(ｋ＝０、．．．．、ＮＵＭ_ＣＰＣＨ-1)ＣＰＣＨ(またはＣＰＣＨの制御のためのダウンリンクチャンネル)に対応するシグネチャーと乗じられる符号(＋１/－１)は、次のように与えられる。
ＣＡ_ｓｉｇｎ_ｓｉｇ〔ｋ〕＝(-1)〔ｋ ｍｏｄ ２〕
ここで、ＣＡ_ｓｉｇｎ_ｓｉｇ〔ｋ〕は、ｋ番目のシグネチャーと乗じられる＋１/－１の符号を意味し、〔ｋ ｍｏｄ ２〕は、‘ｋ’を‘２’に割った余りを意味する。‘ｘ’は、シグネチャーの次元を示す数として定義される。すなわち、次のように表現されることができる。
０＜ＮＵＭ_ＣＰＣＨ≦４の場合、ｘ=２。
４＜ＮＵＭ_ＣＰＣＨ≦８の場合、ｘ=４。
８＜ＮＵＭ_ＣＰＣＨ≦１６の場合、ｘ=８。
【0130】
そして、使用されるシグネチャーは次のようである。
【数1】
【表5】

$$CA\_sig[k]=(16/x)*\lfloor k/2 \rfloor+1$$

【数2】

$\lfloor y \rfloor$

は、ｙを超過しない最大の整数を意味する。例えば、４個のシグネチャーを使用する場合、次のようにシグネチャーを割り当てることができる。
Ｓ１ =>　１　１　１　１　１　１　１　１　　１　１　１　１　１　１　１　１
Ｓ５ =>　１　１　１　１-１-１-１-１　　１　１　１　１-１-１-１-１
Ｓ９ =>　１　１　１　１　１　１　１　１　-１-１-１-１-１-１-１-１
Ｓ１３ =>１　１　１　１-１-１-１-１　-１-１-１-１　１　１　１　１
前記から分かるように、本発明の実施形態に従ってシグネチャーを割り当てると、長さ４のアダマール符号を各４回反復した形態になる。このため、ＵＥの受信器は、ＣＡ_ＩＣＨを受信するとき、反復された４シンボルずつを加算した後、長さ４のＦＨＴを取る。これにより、ＵＥの複雑度を大いに減少させることができる。
【0131】
さらに、前記ＣＡ_ＩＣＨシグネチャーのマッピングで、各ＣＰＣＨに対するシグネチャー番号を一つずつ加算する形態で対応させることもできる。このような場合、連続する２ｉ及び(２ｉ＋１)番目のシンボルは反対符号を有し、ＵＥの受信器は、逆拡散した２個のシンボルのうち、前のシンボルから後のシンボルを引く。そこで、同じ具現として見なされることができる。
【0132】
反対に、ＣＤ_ＩＣＨに対するシグネチャーは、次のような手順にて割り当てられることができる。ｋ番目のＣＤ_ＩＣＨのシグネチャーを生成する一番容易な方法は、前記ＣＡ_ＩＣＨのシグネチャーを割り当てる前記方法でシグネチャー番号を一つずつ増加させるものである。他の方法は、次のように表現されることができる。
ＣＤ_ｓｉｇｎ_ｓｉｇ〔ｋ〕=(-1)〔ｋ ｍｏｄ ２〕
ＣＤ_ｓｉｇ〔ｋ〕=2*＋２
すなわち、前述したように、〔２，４，６，８，１０，１２，１４，１６〕の手順にてＣ

Ａ_ＩＣＨを割り当てる。

【0133】

図１６は、前記シグネチャー構造に対するＵＥのＣＡ_ＩＣＨの受信器構造の例を示す。

【0134】

図１６を参照すると、乗算器１６１１は、受信された信号にパイロットチャンネルに割り当てた拡散符号W_pを乗じて、前記受信信号を逆拡散した後、前記逆拡散された信号をチャンネル推定器１６１３に提供する。前記チャンネル推定器１６１３は、前記逆拡散されたパイロットチャンネル信号からダウンリンクチャンネルのサイズと位相を推定する。複素共役器１６１５は、チャンネル推定器１６１３の出力を複素共役する。乗算器１６１７は、受信信号にＡＩＣＨチャンネルに割り当てたウォルシュ拡散符号(Walsh Spreading code)を乗じ、累算器１６１９は、一定のシンボル区間(例えば、２５６チップの区間)の間、前記乗算器１６１７の出力を累算して前記逆拡散されたシンボルを出力する。乗算器１６２１は、累算器１６１９の出力に複素共役器１６１５の出力を乗じて前記入力値を復調する。その後、前記出力結果値をＦＨＴ変換器１６２９に提供する。前記復調されたシンボルを受信すると、前記ＦＨＴ変換器１６２９は、各シグネチャーに対する信号強度を出力する。制御及び判定器１６３１は、ＦＨＴ変換器１６２９の出力を受信して一番可能性が高いＣＡ_ＩＣＨのシグネチャーを判定する。本発明の実施形態では、ＣＡ_ＩＣＨのシグネチャー構造に対してW-ＣＤＭＡ標準案で規定されたシグネチャーを使用してＵＥの受信器の構造を簡単にする。他の割当て方法は、下記に説明される。これは、ＣＤ_ＩＣＨに対するシグネチャーの一部を使用する方法よりさらに効率的である。

【0135】

前記新たな割当て方法で、長さが2^Kである2^K個のシグネチャーが発生される(ここで、2^K個のシグネチャーが＋１/－１の符号と乗じられる場合、可能なシグネチャーの数は2^{K+1}になることができる。)。しかし、全体シグネチャーをすべて使用することではなく、シグネチャー中の一部のみを使用すると、ＵＥの受信器の複雑さを減少させるために、より効率的にシグネチャーを割り当てる必要がある。前記すべてのシグネチャーのうち、Ｍ個のシグネチャーのみを使用すると仮定する。ここで、$2^{L-1}<M\leqq 2^L$であり、$1\leqq L\leqq K$である。このとき、長さ2^KであるＭ個のシグネチャーは、長さ2^Lのアダマール関数の各ビットを2^{K-L}回だけ反復して伝送する形態に変換される。

【0136】

また、ＡＩＣＨを伝送するまた他の方法は、ＡＰに使用されるシグネチャーとは異なるシグネチャーを使用するものである。前記シグネチャーは、下記＜表６＞に示されている。

【0137】

本発明の第２実施形態では、下記＜表６＞に示すシグネチャーをそのまま使用し、ＵＥの受信器が低い複雑度でＣＡ_ＩＣＨを割り当てる。ＡＩＣＨシグネチャー間には直交性が保持される。従って、ＡＩＣＨに割り当てるシグネチャーを効率的に配置すると、ＵＥは、ＦＨＴ(Fast Hadamard Transform)などの方法を通じて容易にＣＤ_ＩＣＨを復調することができる。

【0138】

【表6】

	プリアンブルシンボル															
シグネチャー	P_0	P_1	P_2	P_3	P4	P_5	P_6	P_7	P8	P_9	P_{10}	P_{11}	P_{12}	P_{13}	P_{14}	P_{15}
1	A	A	A	-A	-A	-A	A	-A	-A	A	A	-A	A	-A	A	A
2	-A	A	-A	-A	A	A	A	-A	A	A	A	-A	-A	A	-A	A
3	A	-A	A	A	A	-A	A	A	-A	A	A	A	-A	A	-A	A
4	-A	A	-A	A	-A	-A	-A	-A	-A	A	-A	A	-A	A	A	A
5	A	-A	-A	-A	-A	A	A	-A	-A	-A	-A	A	-A	-A	-A	A
6	-A	-A	A	-A	A	-A	A	-A	A	-A	-A	A	A	A	A	A
7	-A	A	A	A	-A	-A	A	A	A	-A	-A	-A	-A	-A	-A	A
8	A	A	-A	-A	-A	-A	-A	A	A	-A	A	A	A	A	-A	A
9	A	-A	A	-A	-A	A	-A	A	A	A	-A	-A	-A	A	A	A
10	-A	A	A	-A	A	A	-A	A	-A	-A	A	A	-A	-A	A	A
11	A	A	A	A	A	A	-A	-A	A	A	-A	A	A	-A	-A	A
12	A	A	-A	A	A	A	A	A	-A	-A	-A	-A	A	A	A	A
13	A	-A	-A	A	A	-A	-A	-A	A	-A	A	-A	A	-A	A	A
14	-A	-A	-A	A	-A	A	A	A	A	A	A	A	A	-A	A	A
15	-A	-A	-A	-A	A	-A	-A	A	-A	A	-A	-A	A	-A	-A	A
16	-A	-A	A	A	-A	A	-A	-A	-A	-A	A	-A	A	A	-A	A

前記<表６>で、ｎ番目シグネチャーをＳｎと表示し、そして、ｎ番目シグネチャーに符号‘－１’を乗じることによって得られた値を－Ｓｎと表示する。本発明の第２実施形態によるＡＩＣＨシグネチャーは、次のように割り当てられる。

{Ｓ１、－Ｓ１、Ｓ２、－Ｓ２、Ｓ３、－Ｓ３、Ｓ１４、－Ｓ１４、
Ｓ４、－Ｓ４、Ｓ９、－Ｓ９、Ｓ１１、－Ｓ１１、Ｓ１５、－Ｓ１５}

もし、前述したＣＰＣＨの数が１６個より小さいと、ＵＥがＩＦＨＴを遂行できるように左から右へシグネチャーをＣＰＣＨに割り当てる。これにより、複雑度を最小化する。{１、２、３、１４、１５、９、４、１１}中で、左から２個、４個、８個のシグネチャーを選択すると、最終列を除いて各列のＡの数が－Ａの数と同一である。その後、各シンボルの手順を再配置(rearrangingまたはpermuting)し、前記再配置されたシンボルに任意のマスクを乗じることによって、前記シグネチャーは、ＩＦＨＴを遂行することができる直交符号に変換される。

【0139】

図１７は、本発明の第２実施形態によるシグネチャーを利用してＵＥの受信器の構造を示す。

【0140】

図１７を参照すると、ＵＥは、入力信号を２５６チップ区間の間逆拡散して、チャンネル補償したシンボルX_iを発生する。X_iがＵＥの受信器に入力されるｉ番目シンボルを意味すると仮定する場合、位置シフタ１７２３はX_iを次のように再配置する。

Ｙ＝{X_{15}、X_9、X_{10}、X_6、X_{11}、X_3、X_7、X_1
X_{13}、X_{12}、X_{14}、X_4、X_8、X_5、X_2、X_0}

そして、乗算器１７２７は、再配置された値Ｙにマスク発生器１７２５で発生した次のようなマスクＭを乗じる。

Ｍ＝{－１、－１、－１、－１、１、１、１、－１、１、－１、－１、１、１、１、－１、－１}

すると、前記Ｓ１、Ｓ２、Ｓ３、Ｓ１４、Ｓ１５、Ｓ９、Ｓ４、及びＳ１１のシグネチャーはそれぞれＳ’１、Ｓ’２、Ｓ’３、Ｓ’１４、Ｓ’１５、Ｓ’９、Ｓ’４、及びＳ’１１のように変換される。

Ｓ’１　＝１　１　１　１　　１　１　１　１　　１　１　１　１　　１　１　１　１
Ｓ’２　＝１　１　１　１　　１　１　１　１　-１-１-１-１　-１-１-１-１
Ｓ’３　＝１　１　１　１　-１-１-１-１　-１-１-１-１　　１　１　１　１
Ｓ’１４＝１　１　１　１　-１-１-１-１　　１　１　１　１　-１-１-１-１
Ｓ’１５＝１　１-１-１　　１　１-１-１　　１　１-１-１　　１　１-１-１

Ｓ’９　＝１　１-１-１　　１　１-１-１　-１-１　１　１　-１-１　１　１
Ｓ’４　＝１　１-１-１　-１-１　１　１　-１-１　１　１　　１　１-１-１
Ｓ’１１＝１　１-１-１　-１-１　１　１　　１　１-１-１　-１-１　１　１

前記から分かるように、入力シンボルの手順を再配置し、前記再配置されたシンボルに任意のマスクを乗じると、シグネチャーがＦＨＴを遂行することができる直交符号の形態に変換される。そして、長さ１６に対するＦＨＴを遂行する必要もなく、反復されたシンボルを加算してＦＨＴを遂行すると、受信器の複雑さをさらに減少させることができる。すなわち、５～８個のシグネチャーが使用される場合（すなわち、９～１６個のＣＰＣＨが使用される。）、２個のシンボルが反復される。従って、反復されるシンボルを加えると、長さ８に対してのみＦＨＴが遂行される。また、３～４個のシグネチャーが使用される場合（すなわち、５～８個のＣＰＣＨが使用される。）、４個のシンボルが反復されるので、前記反復されたシンボルを加えた後、ＦＨＴを遂行することができる。このような方式にて、既存のシグネチャーを効率的に配置することにより、受信器の複雑さを大幅に減少させることができる。

【0141】

図１７のＵＥの受信器は、逆拡散されたシンボルを再配置した後、前記再配置されたシンボルに特定のマスクＭを乗じる。しかし、先ず、逆拡散されたシンボルを特定のマスクＭと乗じてから再配置するとしても、同一の結果を得ることができる。この場合、マスクＭが異なる形態を有することを分かる。

【0142】

図１７に示す受信器の動作を説明すると、乗算器１７１１は、A/D変換器(図示せず)の出力信号を受信し、前記受信された信号にパイロットチャンネルに割り当てたチャンネル区分コードW_pを乗じて前記受信信号を逆拡散する。チャンネル推定器１７１３は、前記逆拡散されたパイロット信号からダウンリンクチャンネルのサイズと位相を推定する。そして、乗算器１７１７は、前記受信信号にＡＩＣＨチャンネルのウォルシュ拡散符号を乗じ、累算器１７１９は、前記乗算器１７１７の出力を一定のシンボル区間(例えば、２５６チップ区間)の間に累算して逆拡散されたシンボルを出力する。復調の場合、逆拡散されたＡＩＣＨシンボルは、チャンネル推定器１７１３の出力の複素共役を行う複素共役器１７１５の出力と乗じられる。前記復調されたシンボルは、位置シフタ１７２３に入力されるが、反復されるシンボルが互いに近接するように入力シンボルを再配置する。そして、位置シフタ１７２３の出力は、乗算器１７２７によってマスク発生器１７２５から出力されるマスクと乗じられてＦＨＴ変換器１７２９に入力される。乗算器１７２７の出力を受信した後、ＦＨＴ変換器１７２９は、各シグネチャーに対する信号強度を出力する。制御及び判定器１７３１は、ＦＨＴ変換器１７２９の出力を受信して可能性が一番高いＣＡ_ＩＣＨのシグネチャーを判定する。

【0143】

図１７において、位置シフタ１７２３、マスク発生器１７２５、及び乗算器１７２７の位置を置き換えても同一の結果を得ることができる。そして、ＵＥの受信器が位置シフタ１７２３を使用して入力シンボルの位置を再配置しなくても、各シンボルが伝送される位置を予め約束して、ＦＨＴの遂行のとき、位置情報を使用することもできる。

【0144】

本発明によるＣＡ_ＩＣＨシグネチャー構造の実施形態を要約すると、長さが2^Kである2^K個のシグネチャーが発生される(ここで、2^K個のシグネチャーが＋１/－１の符号と乗じられると、可能なシグネチャーの数は2^{K+1}になることができる。)。しかし、全体シグネチャーをすべて使用するものではなく、シグネチャー中の一部のみを使用すると、ＵＥの受信器の複雑さを減少させるために、より効率的にシグネチャーを割り当てる必要がある。全体シグネチャーのうちＭ個のシグネチャーのみを使用すると仮定する。ここで、$2^{L-1}<M\leq 2^L$であり、$1\leq L\leq K$である。このとき、長さが2^KであるＭ個のシグネチャーが各シンボルの位置を再配置(permutation)した後、特定のマスクまたは排他的論理和の処理が各ビットに加算された場合、長さ2^Lのアダマール関数の各ビットを2^{K-L}回だけ

反復して伝送する形態に変換される。従って、ＵＥの受信器で受信されたシンボルに特定のマスクを乗じて各シンボルの位置を再配置することにより、ＦＨＴを簡単に遂行できるようにすることにその目的がある。

【0145】

前記のようなＣＰＣＨチャンネルを割り当てるために使用する適切なシグネチャーを選択するだけではなく、アップリンクＣＰＣＨのデータチャンネル及び制御チャンネルを割り当て、アップリンクＣＰＣＨを制御するダウンリンク制御チャンネルを割り当てることも重要である。

【0146】

先ず、アップリンク共通チャンネルを割り当てる一番容易な方法は、ＵＴＲＡＮが電力制御情報を伝送するダウンリンク制御チャンネルとＵＥが制御メッセージを伝送するアップリンク共通制御チャンネルを一対一に対応させて割り当てる。前記のようにダウンリンク制御チャンネルとアップリンク共通制御チャンネルを一対一に割り当てる場合は、別に追加的なメッセージがなくても、一回のみ命令を伝送することにより、アップリンク共通制御チャンネル及びダウンリンク制御チャンネルをに割り当てることができる。すなわち、前記チャンネル割当て方法は、ＣＡ_ＩＣＨがダウンリンクチャンネル及びアップリンクチャンネルを指定する場合に提供される。

【0147】

二番目の方法は、ＵＥが伝送したＡＰのシグネチャー、ＡＰを伝送したアクセスチャンネルのスロット番号、そして、ＵＥが伝送したＣＤ_Ｐのシグネチャーなどの関数を利用してアップリンクチャンネルをマッピングさせる。例えば、アップリンク共通チャンネルをＣＤ_Ｐのシグネチャーとの時点でのスロット番号に対応するアップリンクチャンネルに対応させることができる。すなわち、前記のようなチャンネル割当て方法において、ＣＤ_ＩＣＨは、アップリンクに使用されるチャンネルを割り当て、前記ＣＡ_ＩＣＨは、ダウンリンクに使用するチャンネルを割り当てる。このような方法にて、ＵＴＲＡＮがダウンリンクチャンネルを割り当てると、ＵＴＲＡＮの資源を最大に活用することができ、これにより、チャンネルの活用効率性を高める。

【0148】

ＵＴＲＡＮ及びＵＥは、ＵＥが伝送したＡＰのシグネチャーとＵＥが受信したＣＡ_ＩＣＨ、すなわちチャンネル割当てメッセージとを認識することができるので、前記２個の変数を利用してアップリンクＣＰＣＨチャンネルを割り当てる。ＵＴＲＡＮは、ＵＥにＣＰＣＨを柔軟に割り当てることができる。これら方法の原則は次のようである。前記ＡＰに使用されるシグネチャーは、ＵＥが要求するデータ伝送速度にマッピングされ、前記ＣＡ_ＩＣＨは、ＵＥが要求したデータ伝送速度を支援することができるＣＰＣＨチャンネルのうち１つにマッピングされる。このとき、前記ＡＰのシグネチャー数をＭ個、ＣＡ_ＩＣＨの個数をＮ個とすると、選択可能な場合の数はＭ×Ｎ個である。

【0149】

ここで、下記＜表７＞に示すように、ＡＰシグネチャーの番号がＭ＝３個であり、ＣＡ_ＩＣＨの番号がＮ＝４個と仮定する。

【0150】

【表7】

チャンネル番号		ＣＡ_ＩＣＨを通じて受信したＣＡ番号			
		CA(1)	CA(2)	CA(3)	CA(4)
ＡＰ番号	AP(1)	1	2	3	4
	AP(2)	5	6	7	8
	AP(3)	9	10	11	12

前記＜表７＞において、ＡＰシグネチャーは、ＡＰ(１)、ＡＰ(２)、及びＡＰ(３)であり、前記ＣＡ_ＩＣＨによって割り当てられたチャンネル番号は、ＣＡ(１)、ＣＡ(２)、ＣＡ(３)、及びＣＡ(４)である。このとき、チャンネルを割り当てる場合、前記ＣＡ_Ｉ

ＣＨによってのみチャンネルを選択するようになると、利用可能のチャンネル数は４個である。すなわち、ＵＴＲＡＮがＵＥにＣＡ(３)を伝送し、これによって前記ＵＥがＣＡ(３)を受信すると、ＵＥは３番目チャンネルを割り当てる。しかし、ＵＥ及びＵＴＲＡＮがＡＰ及びＣＡ番号のシグネチャー番号を知っているので、これを組み合わせることができる。例えば、前記＜表７＞に示すようなＡＰ番号及びＣＡ番号を利用してチャンネルを割り当てる場合、前記ＵＥがＡＰ(２)を伝送し、ＵＴＲＡＮがＣＡ(３)を伝送すると、ＵＥは、チャンネル番号３を選択するのではなく、チャンネル番号７(２、３)を選択する。すなわち、前記ＡＰ=２、ＣＡ=３に該当するチャンネルは、前記＜表７＞から分かることができ、前記＜表７＞のような情報は、ＵＥ及びＵＴＲＡＮのすべてに貯蔵されている。従って、前記ＵＥ及びＵＴＲＡＮは、前記＜表７＞の第２行と第３列を選択すると、割り当てられたＣＰＣＨチャンネル番号が７であることを分かる。その結果、(２、３)に該当するＣＰＣＨのチャンネル番号は７になる。

【0151】

従って、前記のように、２個の変数を利用してチャンネルを選択する方法は、選択可能なチャンネル数を増加させる。ＵＥ及びＵＴＲＡＮは、上位階層の信号交換によって前記＜表７＞のような情報を有するか、または、式によって前記情報を計算することができる。すなわち、列ＡＰ番号と行ＣＡ番号を使用して互いに交差する地点と番号を判断することができる。

【0152】

このような動作を図１８及び図１９を参照して説明する。ＵＥの制御器１８２０及びＵＴＲＡＮの制御器１９２０は、前記＜表７＞のようなチャンネル割当て情報、または前述したような計算方法を利用することができる。図１８及び図１９の説明では、前記制御器１８２０及び１９２０が前記＜表７＞のような情報を含むと仮定する。

【0153】

先ず、ＵＥの制御器１８２０はＣＰＣＨを通じた通信が必要な場合、所望のデータ伝送速度に対応するＡＰシグネチャーを決定した後、前記決定されたＡＰシグネチャーにスクランブリングコードをチップ単位で乗じるプリアンブル発生器１８３１を通じて、前記決定されたＡＰシグネチャーを伝送する。すると、ＵＴＲＡＮは、前記ＡＰプリアンブルを受信してＡＰプリアンブルに使用したシグネチャーを確認する。前記受信されたシグネチャーが他のＵＥで使用されないと、ＵＴＲＡＮは、受信されたシグネチャーを利用してＡＰ_ＡＩＣＨを生成する。しかし、前記受信されたシグネチャーが他のＵＥで使用されていると、ＵＴＲＡＮは、前記受信されたシグネチャーの位相を反転して得られたシグネチャー値を利用してＡＰ_ＡＩＣＨを生成する。このとき、他のＵＥが異なるシグネチャーを使用したＡＰプリアンブルを受信すると、ＵＴＲＡＮは、前記受信されたシグネチャーが使用されたか否かを確認し、前記受信されたシグネチャーの位相反転、または同位相のシグネチャー値を利用してＡＰ_ＡＩＣＨを生成する。その後、ＵＴＲＡＮは、生成されたシグネチャーの値を加算してＡＰ_ＡＩＣＨ信号を生成し、これにより、各シグネチャーに対する状態を伝送することができる。

【0154】

伝送されたシグネチャーと同一のシグネチャーを使用するＡＰ_ＡＩＣＨを受信すると、ＵＥは、衝突検出のためのシグネチャー中の任意の一つを使用してＣＤ_Ｐを生成し、前記生成されたＣＤ_Ｐを伝送する。ＵＴＲＡＮは、ＵＥから前記ＣＤ_Ｐに含まれたシグネチャーを受信すると、前記ＣＤ_Ｐに使用されたシグネチャーと同一のシグネチャーを使用してＣＤ_ＩＣＨを伝送する。このとき、ＵＴＲＡＮがプリアンブル検出器１９１１を通じてＣＤ_Ｐを受信すると、ＵＴＲＡＮの制御器１９２０は、ＣＰＣＨの割当て要求を認識し、ＣＡ_ＩＣＨを生成してＵＥに伝送する。前述したように、前記ＣＤ_ＩＣＨとＣＡ_ＩＣＨは同時に伝送されることもでき、または別に伝送されることもできる。前記ＣＡ_ＩＣＨの生成動作を詳細に説明すると、ＵＴＲＡＮは、ＵＥが要求したデータ伝送速度に対応するスクランブリングコード中、使用されないスクランブリングコードを決定し、ＵＥが伝送したＡＰに使用されるシグネチャー、すなわち、前記＜表７＞の指定され

たＣＡ_ＩＣＨシグネチャーを決定する。前記決定されたＣＡ_ＩＣＨシグネチャーと前記ＡＰに使用されるシグネチャーとの組合せは、前記ＣＰＣＨのチャンネル割当て情報である。ＵＴＲＡＮの制御器１９２０は、前記決定されたＣＡ_ＩＣＨシグネチャーと前記受信されたＡＰのシグネチャーとを結合してＣＰＣＨを割り当てる。また、ＵＴＲＡＮは、前記ＡＩＣＨ発生器１９３１を通じて前記決定されたＣＡ_ＩＣＨシグネチャー情報を受信した後ＣＡ_ＩＣＨを発生させる。前記ＣＡ_ＩＣＨは、フレーム形成器１９３３を通じてＵＥに伝送される。そして、前記ＣＡ_ＩＣＨシグネチャー情報を受信したＵＥは、前記ＡＰに使用されたシグネチャー及び前記受信されたＣＡ_ＩＣＨシグネチャーを利用して、前記のような方法にてＵＥが使用するＣＰＣＨを認識する。

【0155】

図１８は、本発明の実施形態によるアップリンクＣＰＣＨを利用してＵＴＲＡＮと通信するＵＥの送受信器の構造を示す。

【0156】

図１８を参照すると、ＡＩＣＨ復調器１８１１は、制御器１８２０から提供されるチャンネル指定のための制御メッセージ１８２２によって、ＵＴＲＡＮのＡＩＣＨ発生器から伝送されるダウンリンクのＡＩＣＨ信号を復調する。前記制御メッセージ１８２２は、受信されているダウンリンク信号がＡＰ_ＡＩＣＨ、ＣＤ_ＩＣＨ、及びＣＡ_ＩＣＨのうち１つであることを示す。前記ＡＩＣＨ復調器１８１１は、ＡＰ_ＡＩＣＨ復調器、ＣＤ_ＩＣＨ復調器、及びＣＡ_ＩＣＨ復調器を備えることができる。このような場合、前記制御器１８２０は、ＵＴＲＡＮから伝送されるＡＰ_ＡＩＣＨ、ＣＤ_ＩＣＨ及びＣＡ_ＩＣＨをそれぞれ受信することができるように、前記各復調器のチャンネルを指定する。また、前記ＡＰ_ＡＩＣＨ、ＣＤ_ＩＣＨ、及びＣＡ_ＩＣＨを一つの復調器または別の復調器で実現することができる。このような場合、前記制御器１８２０は、時分割された各ＡＩＣＨを受信するために、スロットを割り当てることによりチャンネルを指定することができる。

【0157】

データ及び制御信号処理器１８１３は、前記制御器１８２０を通じてダウンリンクチャンネルを指定し、前記指定されたチャンネルを通じて受信されたデータまたは制御信号（電力制御命令を含む。）を処理する。チャンネル推定器１８１５は、ダウンリンクを通じて前記ＵＴＲＡＮから受信した信号強度を推定することができ、前記受信されたデータの位相補償及び利得を制御することにより、前記データ及び制御信号処理器１８１３の復調を助ける。

【0158】

制御器１８２０は、ＵＥのダウンリンクチャンネル受信器及びアップリンクチャンネル送信器の全般的な動作を制御する。本発明の実施形態で、前記制御器１８２０は、ＵＴＲＡＮをアクセスする間、プリアンブル発生制御信号１８２６を利用してアクセスプリアンブルＡＰ及び衝突検出プリアンブルＣＤ_Ｐの発生を制御する。前記制御器１８２０は、アップリンク電力制御信号１８２４を利用してアップリンクの送信電力を制御し、ＵＴＲＡＮから伝送されるＡＩＣＨ信号を処理する。すなわち、前記制御器１８２０は、図3の３０１に示すように、プリアンブル発生器１８３１を制御してアクセスプリアンブルＡＰ及び衝突検出プリアンブルＣＤ_Ｐを発生させる。そして、ＡＩＣＨ復調器１８１１を制御して、図3の３０１に示すように発生されるＡＩＣＨ信号を処理する。

【0159】

プリアンブル発生器１８３１は、前記制御器１８２０の制御の下で、図3の３３１に示すようにプリアンブルＡＰ及びＣＤ_Ｐを生成する。フレーム形成器１８３３は、前記プリアンブル発生器１８３１から出力されるプリアンブルＡＰ及びＣＤ_Ｐと、アップリンクのパケットデータ及びパイロット信号とを受信してフレームデータを形成し、アップリンクを通じたパケットデータ及びパイロット信号を伝送する。前記フレーム形成器１８３３は、前記制御器１８２０から出力される電力制御信号によってアップリンクの送信電力を制御する。前記フレーム形成器１８３３は、ＵＴＲＡＮからＣＰＣＨが割り当てられた

以後、電力制御プリアンブル及びデータのような他のアップリンク伝送信号１８３２を伝送することもできる。また、このような場合、ダウンリンクの送信電力を制御するために、アップリンクチャンネルを通じて伝送した電力制御命令語を伝送することもできる。

【0160】

図１９は、本発明の実施形態によるアップリンクＣＰＣＨ及びダウンリンクチャンネルを利用してＵＥと通信するためのＵＴＲＡＮの送受信器を示す。

【0161】

図１９を参照すると、ＡＩＣＨ検出器１９１１は、ＵＥから伝送されて図３の３３１に示すようなＡＰ及びＣＤ_Ｐを検出して制御器１９２０に出力する。データ及び制御信号処理器１９１３は、前記制御器１９２０の制御の下でアップリンクチャンネルを指定し、前記指定されたチャンネルを通じて受信したデータまたは制御信号を処理する。チャンネル推定器１９１５は、ダウンリンクを通じて前記ＵＥから受信された信号強度を推定して前記データ及び制御信号処理器１９１３の利得を制御する。

【0162】

前記制御器１９２０は、ＵＴＲＡＮのダウンリンクチャンネル送信器及びアップリンクチャンネル受信器の全般的な動作を制御する。前記制御器１９２０は、ＵＥによって発生したアクセスプリアンブルＡＰ及び衝突検出プリアンブルＣＤ_Ｐの検出を制御する。さらに、前記制御器１９２０は、プリアンブル選択制御命令語１９２２を利用して、前記ＡＰ、ＣＤ_Ｐ、及びチャンネル割当てメッセージに応答するＡＩＣＨ信号の発生を制御する。すなわち、前記ＡＰまたはＣＤ_Ｐがプリアンブル検出器１９１１を通じて検出されると、前記制御器１９２０は、ＡＩＣＨ発生制御命令１９２６を利用してＡＩＣＨ発生器１９３１を制御することにより、図３の３０１に示すようなＡＩＣＨ信号を発生させる。

【0163】

ＡＩＣＨ発生器１９３１は、制御器１９２０の制御の下で、前記プリアンブル信号に対する応答信号であるＡＰ_ＡＩＣＨ、ＣＤ_ＩＣＨ及びＣＡ_ＩＣＨを発生する。前記ＡＩＣＨ発生器１９３１は、ＡＰ_ＡＩＣＨ発生器、ＣＤ_ＩＣＨ発生器、及びＣＡ_ＩＣＨ発生器を備えることができる。このような場合、前記制御器１９２０は、図３の３０１に示すようなＡＰ_ＡＩＣＨ、ＣＤ_ＩＣＨ及びＣＡ_ＩＣＨをそれぞれ発生するように各発生器を指定する。また、前記ＡＰ_ＡＩＣＨ、ＣＤ_ＩＣＨ及びＣＡ_ＩＣＨは、一つの発生器または別の発生器で実現されることができる。前記ＡＰ_ＡＩＣＨ、ＣＤ_ＩＣＨ及びＣＡ_ＩＣＨが同一のＡＩＣＨ発生器から発生すると、前記制御器１９２０は、前記ＡＰ_ＡＩＣＨ、ＣＤ_ＩＣＨ、及びＣＡ_ＩＣＨを１つのフレーム内に伝送するように、前記ＡＰ_ＡＩＣＨ、ＣＤ_ＩＣＨ及びＣＡ_ＩＣＨにＡＩＣＨフレームの時分割されたスロットを割り当てることができる。

【0164】

フレーム形成器１９３３は、前記ＡＩＣＨ発生器１９３１から出力されるＡＰ_ＡＩＣＨ、ＣＤ_ＩＣＨ、及びＣＡ_ＩＣＨと、ダウンリンク制御信号を受信してフレームデータを形成する。前記フレーム形成器１９３３は、前記制御器１９２０から伝送した電力制御信号１９２４によってアップリンクの送信電力も制御する。また、ＵＥから受信したダウンリンクの電力制御命令が伝送されると、前記フレーム形成器１９３３は、ＵＥから受信した前記電力制御命令によって共通パケットチャンネルを制御するためのダウンリンクチャンネルの送信電力を制御することもできる。

【0165】

図２０は、ＵＥがＵＴＲＡＮに伝送する電力制御プリアンブルＰＣ_Ｐのスロット構造を示す。前記ＰＣ_Ｐは、０または８スロットの長さを有する。前記ＰＣ_Ｐの長さは、ＵＴＲＡＮとＵＥとの無線環境が良好であるので、アップリンクＣＰＣＨの初期電力を設定する必要がないか、またはシステム自体でＰＣ_Ｐを使用しない場合に０スロットになり、その以外の場合、ＰＣ_Ｐの長さは８スロットになることができる。図２０は、W-ＣＤＭＡ標準案で定義されたＰＣ_Ｐの基本構造を示す。前記ＰＣ_Ｐは、２個のスロット形態を有し、各スロットは１０ビットで構成される。図２０の参照番号２００１は、パイロッ

トフィールドを示し、ＰＣ_Ｐのスロット形態によって８ビットまたは７ビットで構成される。参照番号２００３は、ＵＴＲＡＮに伝送される情報がある場合に使用される帰還情報(Feedback Information)フィールドを示し、０または１ビットの長さを有する。参照番号２００５は、電力制御命令語を伝送するフィールドを示す。このようなフィールドは、ＵＥがダウンリンクの送信電力を制御する場合に使用され、２ビットの長さを有する。

【0166】

ＵＴＲＡＮは、前記ＰＣ_Ｐのパイロットフィールド２００１を利用してＵＥの送信電力を測定した後、アップリンクＣＰＣＨが設定される場合に設定されたダウンリンク専用チャンネルを通じて電力制御命令語を伝送してアップリンクＣＰＣＨの初期送信電力を制御する。前記電力制御過程で、ＵＴＲＡＮは、ＵＥの送信電力が低いと判断されると、電力上昇命令語(power-up command)を伝送し、送信電力が高いと判断されると、電力下降命令語(power-down command)を伝送する。

【0167】

本発明の好適な実施形態では、前記電力制御の目的に加えて、ＣＰＣＨの設定を確認する目的でＰＣ_Ｐを使用する方法を提示する。前記ＣＰＣＨの設定を確認する理由は、下記の説明のようである。ＵＴＲＡＮがＵＥにチャンネル割当てメッセージを伝送した場合、ＵＴＲＡＮとＵＥとの無線環境が悪いか、または多重経路(multi-path)環境がよくないので、チャンネル割当てメッセージにエラーが発生することができる。このような場合、ＵＥは、エラーを有するチャンネル割当てメッセージを受信してＵＴＲＡＮが指定しないＣＰＣＨを誤って使用する。これにより、該当ＣＰＣＨを使用する他のＵＥとアップリンクで衝突を起こすことができる。このような衝突は、チャンネルの使用権を要求する従来技術でも、ＵＥがＵＴＲＡＮから伝送されたＮＡＫをＡＣＫで誤認して発生することができる。従って、本発明の好適な実施形態では、ＵＥがＵＴＲＡＮにもう一度チャンネルメッセージに対する確認を要求する方法を提示することにより、アップリンクＣＰＣＨを使用するとき信頼度を高めることができる。

【0168】

ＵＥがＵＴＲＡＮにＰＣ_Ｐを使用してチャンネル割当てメッセージまたはチャンネル要求メッセージを確認するように要求する前記方法は、電力制御に対するアップリンクの受信電力を測定するＰＣ_Ｐの本来の目的に影響を与えない。前記ＰＣ_Ｐのパイロットフィールドは、ＵＴＲＡＮが知っている情報であり、また、ＵＥからＵＴＲＡＮに伝送するチャンネル割り当て確認メッセージに対する値も、ＵＴＲＡＮが知っている値であるので、アップリンクの受信電力を測定するのに難しさはない。従って、ＵＴＲＡＮは、前記ＰＣ_Ｐを通じて伝送したＣＡ確認メッセージを検査することにより、ＵＥがチャンネル割当てメッセージを正常的に受信したか否かを確認することができる。本発明の実施形態において、ＵＴＲＡＮがアップリンクの受信電力を測定する過程で、ＵＴＲＡＮが知っているパイロットビットが復調されないと、ＵＴＲＡＮは、ＵＥに伝送した従来技術の場合に使用したチャンネル割当てメッセージまたはＡＣＫメッセージにエラーが発生したものと判断し、アップリンクＣＰＣＨと一対一に対応するダウンリンク専用チャンネルを通じてアップリンクの送信電力を減少させる電力下降命令語を連続して伝送する。前記電力下降命令語は、現在W-ＣＤＭＡ標準案では、１個の１０ｍｓフレームに対して１６回伝送されなければならないと規定されており、エラーが発生した時点から１０ｍｓ内で少なくとも１５ｄＢだけの送信電力が減少するので、他のＵＥに深刻な影響を与えない。

【0169】

図２１は、図２０のＰＣ_Ｐの生成構造を示す。図２１を参照すると、参照番号２１０１はＰＣ_Ｐを示し、図２０と同一の構造を有する。参照番号２１０３はチャンネル区分コードを示し、乗算器２１０２によってＣＰ_Ｐと乗じられ、ＰＣ_Ｐを拡散させる。チャンネル区分コード２１０３は、２５６チップの拡散率を有し、ＵＴＲＡＮから伝送されたＣＡメッセージによって決定された規則によって設定される。参照番号２１０５はＰＣ_Ｐフレームを示し、８スロットで構成され、各スロットは、２，５６０チップの長さを有する。参照番号２１０７は、ＰＣ_Ｐに使用されるＵＬ_スクランブリングコードを示す。

乗算器２１０６は、前記ＵＬ_スクランブリングコード２１０７でＰＣ_Ｐフレーム２１０５を拡散させる。前記拡散されたＰＣ_Ｐフレームは、ＵＴＲＡＮに伝送される。

【0170】

図２２Ａは、前記ＰＣ_Ｐを利用して、ＵＥからＵＴＲＡＮにチャンネル割当て確認メッセージまたはチャンネル使用要求確認メッセージを伝送する方法を示す。図２２Ａにおいて、ＰＣ_Ｐ２２０１、チャンネル区分コード２２０３、ＰＣ_Ｐフレーム２２０５、及びＵＬ_スクランブリングコード２２０７は、図２１のＰＣ_Ｐ２１０１、チャンネル区分コード２１０３、ＰＣ_Ｐフレーム２１０５、及びＵＬ_スクランブリングコード２１０７と同一の構造及び動作を遂行する。また、乗算器２２０２及び２２０６も図２１の乗算器２１０２及び２１０６とそれぞれ同一の動作を遂行する。ＰＣ_Ｐを使用して、チャンネル割当て確認メッセージまたはチャンネル使用要求確認メッセージをＵＴＲＡＮに伝送するためには、ＰＣ_Ｐ２２０１のパイロットフィールドにＵＴＲＡＮから受信されたＣＡ_ＩＣＨのチャンネル番号またはシグネチャー番号を反復的に乗じて伝送する。図２２Ａの参照番号２２０９は、ＵＴＲＡＮからＵＥに伝送されたＣＡ_ＩＣＨで使用したシグネチャー番号またはＣＰＣＨチャンネル番号を含むＣＰＣＨ確認メッセージを示す。ここで、前記シグネチャー番号は、ＣＡ_ＩＣＨに使用されるシグネチャーがＣＰＣＨに一対一に対応する場合にＣＰＣＨ確認メッセージが使用され、前記ＣＰＣＨチャンネル番号は、多数のシグネチャーが１個のＣＰＣＨに対応する場合にＣＰＣＨ確認メッセージが使用される。前記ＣＰＣＨ確認メッセージ２２０９は、乗算器２２０８によってＰＣ_Ｐのパイロットフィールドを反復的に乗じて伝送する。

【0171】

図２２Ｂは、図２２Ａの方法を使用してＰＣ_Ｐを伝送する場合、ＵＴＲＡＮ内の多数のＵＥがＡＰ、ＣＤ_Ｐ、ＰＣ_Ｐ、及びＣＰＣＨメッセージ部に使用するアップリンクスクランブリングコードの構造を示す。前記ＰＣ_Ｐを利用してチャンネル割当て確認メッセージまたはチャンネル使用要求確認メッセージをＵＴＲＡＮに伝送するためには、ＵＴＲＡＮから受信したＣＡ_ＩＣＨのチャンネル数またはシグネチャー数をＣＰＣＨメッセージ部に使用されるスクランブリングコードに一対一にマッピングさせる。図２２Ｂの参照番号２２２１は、ＡＰに使用されるスクランブリングコードとして、ＵＴＲＡＮがＵＴＲＡＮ内のＵＥに放送チャンネルを通じて通報するスクランブリングコードまたはシステム全体内でＡＰ部分に同一に使用するスクランブリングコードである。ＣＤ_Ｐに使用されるスクランブリングコード２２２３は、スクランブリングコード２２２１と同一の初期値を有するスクランブリングコードであるが、異なるスタート点を有する。しかし、ＡＰとＣＤ_Ｐに使用されるシグネチャーグループが相互に異なる場合、ＡＰのスクランブリングコード２２２１と同一のスクランブリングコードを前記スクランブリングコード２２２３に使用する。参照番号２２２５は、ＰＣ_Ｐに使用されるスクランブリングコードとして、ＵＴＲＡＮがＵＥに通報するスクランブリングコードまたはシステム全体内でＰＣ_Ｐ部分に同一に使用するスクランブリングコードである。前記ＰＣ_Ｐ部分に使用されるスクランブリングコードは、前記ＡＰとＣＤ_Ｐ部分に使用したスクランブリングコードと同一の符号であることもでき、異なる符号であることもできる。参照番号２２２７、２２３７、及び２２４７は、ＵＴＲＡＮ内でＵＥ＃１、ＵＥ＃２、及びＵＥ＃ｋがＣＰＣＨを使用してＣＰＣＨメッセージ部を伝送する場合に使用するスクランブリングコードを示す。前記スクランブリングコード２２２７、２２３７、及び２２４７は、ＵＥから伝送したＡＰ、またはＵＴＲＡＮから伝送したＣＡ_ＩＣＨメッセージによって設定されることができる。ここで、‘ｋ’は、ＵＴＲＡＮ内でＣＰＣＨを同時に使用することができるＵＥの数、またはＵＴＲＡＮ内のＣＰＣＨ数を示す。

【0172】

図２２Ｂにおいて、ＵＴＲＡＮがＣＰＣＨに使用するアップリンクスクランブリングコードをＣＰＣＨチャンネルごとに、またはＵＥごとに割り当てない場合、前記メッセージ部に使用されるスクランブリングコードの数はＵＴＲＡＮ内でＣＰＣＨを同時に使用することができるＵＥの数、またはＵＴＲＡＮ内のＣＰＣＨ数より小さいことができる。

【0173】
図２３は、ＰＣ_Ｐを利用して、ＵＥからＵＴＲＡＮにチャンネル割当て確認メッセージまたはチャンネル使用要求確認メッセージを伝送する方法の他の例を示す。図２３において、ＰＣ_Ｐ２３０１、チャンネル区分コード２３０３、ＰＣ_Ｐフレーム２３０５、及びＵＬ_スクランブリングコード２３０７は、図２１のＰＣ_Ｐ２１０１、チャンネル区分コード２１０３、ＰＣ_Ｐフレーム２１０５、及びＵＬ_スクランブリングコード２１０７と同一の構造及び動作を遂行する。また、乗算器２３０２及び乗算器２３０６は、図２１の乗算器２１０２及び乗算器２１０６とそれぞれ同一の動作を遂行する。ＰＣ_Ｐを使用してチャンネル割当て確認メッセージまたはチャンネル使用要求確認メッセージをＵＴＲＡＮに伝送するためには、前記ＰＣ_Ｐフレーム２３０５にチップ単位でＣＰＣＨ確認メッセージ２３０９を乗じた後、スクランブリングコード２３０７で拡散させる。ここで、ＣＰＣＨ確認メッセージ及びスクランブリングコードにＰＣ_Ｐフレームを乗じる手順が逆になっても、同一の結果を得ることができる。前記ＣＰＣＨ確認メッセージは、ＵＴＲＡＮからＵＥに伝送したＣＡ_ＩＣＨで使用したシグネチャー番号またはＣＰＣＨチャンネル番号を含む。このとき、前記シグネチャー番号は、ＣＡ_ＩＣＨに使用されるシグネチャーがＣＰＣＨに一対一に対応する場合にＣＰＣＨ確認メッセージが使用される。そして、前記ＣＰＣＨチャンネル番号は、多数のシグネチャーが１個のＣＰＣＨに対応する場合にＣＰＣＨ確認メッセージが使用される。図２３の方法で、ＵＴＲＡＮ内のＵＥがスクランブリングコードを使用する環境は、図２２Ａ及び図２２Ｂの方法で提案された環境と同一である。

【0174】
図２４Ａは、ＰＣ_Ｐを利用して、ＵＥからＵＴＲＡＮにチャンネル割当て確認メッセージまたはチャンネル使用要求確認メッセージを伝送する方法のさらに他の例を示す。図２４Ａにおいて、ＰＣ_Ｐ２４０１、ＰＣ_Ｐフレーム２４０５、及びＵＬ_スクランブリングコード２４０７は、図２１のＰＣ_Ｐ２１０１、ＰＣ_Ｐフレーム２１０５、及びＵＬ_スクランブリングコード２１０７と同一の構造及び動作を遂行する。また、乗算器２４０２及び２４０６も図２１の乗算器２１０２及び２１０６とそれぞれ同一の動作を遂行する。前記ＰＣ_Ｐを利用して、チャンネル割当て確認メッセージまたはチャンネル使用要求確認メッセージをＵＴＲＡＮに伝送するためには、チャンネル区分コード２４０３は、ＵＥがＵＴＲＡＮから受信したＣＡ_ＩＣＨシグネチャーまたはＣＰＣＨチャンネル番号と一対一に対応し、前記チャンネル符号を使用してＰＣ_Ｐをチャンネル拡散させた後ＵＴＲＡＮに伝送する。図２４Ａの方法で、ＵＴＲＡＮ内のＵＥがスクランブリングコードを使用する環境は、図２２Ｂの方法で提案した環境と同一である。

【0175】
図２４Ｂは、ＣＡ_ＩＣＨシグネチャーまたはＣＰＣＨチャンネル番号と一対一に対応するＰＣ_Ｐチャンネルコードツリーの例を示す。前記チャンネルコードツリーは、W-CDMA標準案ではＯＶＳＦコードツリー(Orthogonal Variable Spreading Factor Code Tree)と言われ、前記ＯＶＳＦコードツリーは、拡散率による直交符号を定義する。

【0176】
図２４ＢのＯＶＳＦコードツリー２４３１で、ＰＣ_Ｐチャンネル区分コードとして使用するチャンネル区分コード２４３３は２５６の固定された拡散率を有し、ＰＣ_Ｐチャンネル区分コードとＣＡ_ＩＣＨシグネチャーまたはＣＰＣＨチャンネル番号を一対一に対応させる可能なマッピング(mapping)規則が多数ある。前記マッピング規則に対する一例に、拡散率２５６であるチャンネル区分コードのうち最下部分のチャンネル区分コードは、ＣＡ_ＩＣＨのシグネチャーまたはＣＰＣＨチャンネル番号と一対一に対応することもでき、最上部分のチャンネル区分コードは、チャンネル区分コードを変更させるか、または幾つのチャンネル区分コードをスキップすることにより、ＣＡ_ＩＣＨのシグネチャーまたはＣＰＣＨチャンネル番号と一対一に対応することもできる。図２４Ｂにおいて、‘ｎ’は、ＣＡ_ＩＣＨシグネチャーの数またはＣＰＣＨチャンネルの数になることができる。

【0177】
図２５Ａは、前記ＰＣ_Ｐを利用して、ＵＥからＵＴＲＡＮに伝送したチャンネル割当て確認メッセージまたはチャンネル使用要求確認メッセージを伝送する他の方法を示す。図２５Ａにおいて、ＰＣ_Ｐ２５０１、チャンネル符号２５０３、及びＰＣ_Ｐフレーム２５０５は、図２１のＰＣ_Ｐ２１０１、チャンネル区分コード２１０３、及びＰＣ_Ｐフレーム２１０５と同一の構造及び動作を遂行する。また、乗算器２５０２及び２５０６も図２１の乗算器２１０２及び２１０６とそれぞれ同一の動作を遂行する。前記ＰＣ_Ｐを利用して、チャンネル割当て確認メッセージまたはチャンネル使用要求確認メッセージをＵＴＲＡＮに伝送するためには、前記ＵＬ_スクランブリングコード２５０７は、ＵＴＲＡＮから受信したＣＡ_ＩＣＨのチャンネル番号またはシグネチャー番号に一対一に対応し、前記アップリンクスクランブリングコードでＰＣ_Ｐフレーム２５０５を拡散させて伝送する。前記ＵＥから伝送したＰＣ_Ｐフレームを受信すると、ＵＴＲＡＮは、ＰＣ_Ｐフレームに使用されたスクランブリングコードとＣＡ_ＩＣＨを通じて伝送したシグネチャーまたはＣＰＣＨチャンネル番号に一対一に対応するか否かを確認する。前記スクランブリングコードが前記シグネチャーまたはＣＰＣＨチャンネル番号に対応しないと、直ちに、ＵＴＲＡＮは、アップリンクＣＰＣＨと一対一に対応するダウンリンク専用チャンネルの電力制御命令語フィールドにアップリンクの送信電力を減少させる電力下降命令語を伝送する。
【0178】
図２５Ｂは、図２５Ａの方法を使用してＰＣ_Ｐを伝送する場合、ＵＴＲＡＮ内の多数のＵＥがＡＰ、ＣＤ_Ｐ、ＰＣ_Ｐ、及びＣＰＣＨメッセージ部に使用するアップリンクスクランブリングコードの構造を示す。図２５Ｂの参照番号２５２１は、ＡＰに使用されるスクランブリングコードとして、ＵＴＲＡＮによりＵＥに放送チャンネルを通じて通報するスクランブリングコード、またはシステム全体内でＡＰ部分に同一に使用するスクランブリングコードである。前記ＣＤ_Ｐに使用されるスクランブリングコード２５２３は、前記ＡＰに使用されるスクランブリングコード２５２１と同一の初期値を有するスクランブリングコードを使用するが、異なるスタート点を有する。しかし、ＡＰとＣＤ_Ｐに使用されるシグネチャーグループが相互に異なる場合は、ＡＰのスクランブリングコード２５２１と同一のスクランブリングコードは、スクランブリングコード２５２３に使用される。参照番号２５２５、２５３５、及び２５４５は、ＵＥ＃１、ＵＥ＃２、及びＵＥ＃ｋがＰＣ_Ｐを伝送する場合に使用されるスクランブリングコードを示し、このようなスクランブリングコードは、ＵＥがＵＴＲＡＮから受信したＣＡ_ＩＣＨのシグネチャーまたはＣＰＣＨチャンネルの番号と一対一に対応する。前記スクランブリングコードに対して、ＵＥは、ＰＣ_Ｐに使用されるスクランブリングコードを貯蔵することもでき、またはＵＴＲＡＮがＵＥに通報することもできる。前記ＰＣ_Ｐスクランブリングコード２５２５、２５３５、及び２５４５は、前記ＣＰＣＨメッセージ部で使用されるスクランブリングコード２５２７、２５３７、及び２５４７と同一のスクランブリングコードになることもでき、または一対一に対応するスクランブリングコードになることもできる。図２５Ｂにおいて、‘ｋ’はＵＴＲＡＮ内のＣＰＣＨの数を示す。
【0179】
図２６Ａ乃至図２６Ｃは、本発明の実施形態によるＵＥ内のＣＰＣＨチャンネルを割り当てる手順を示す。そして、図２７Ａ乃至図２７Ｃは、本発明の実施形態によるＵＴＲＡＮ内のＣＰＣＨチャンネルを割り当てる手順を示す。
【0180】
図２６Ａを参照すると、ステップ２６０１で、ＵＥはＣＰＣＨを通じて伝送されるデータを発生させると、ステップ２６０２で、ＣＳＩＣＨをモニタリングして使用可能な最大データ伝送速度に関する情報を獲得する。ステップ２６０２で、ＣＳＩＣＨを通じて伝送されることができる情報は、ＣＰＣＨが支援するデータ伝送速度が使用されることができるかに関する情報を含むことができる。ステップ２６０２で、ＵＴＲＡＮのＣＰＣＨ情報を獲得した後、ＵＥは、ステップ２６０３で、前記ＣＳＩＣＨを通じて獲得した情報及び

伝送データの特性に基づいて適切なＡＳＣを選択し、前記選択されたＡＳＣ内に有効なＣＰＣＨ_ＡＰ下位チャンネルグループを任意に選択する。その後、ステップ２６０４で、ＵＥは、ダウンリンクフレームのＳＦＮとＣＰＣＨの下位チャンネルグループ番号とを利用して、ＳＦＮ＋１及びＳＦＮ＋２のフレームから有効なアクセススロットを選択する。前記アクセススロットを選択した後、ＵＥは、ステップ２６０５で、ＵＥが伝送するデータの伝送速度に対して適切なシグネチャーを選択する。ここで、ＵＥは、前記情報を伝送するためのシグネチャー中の一つを選択する。その後、ステップ２６０６で、所望の伝送フォーマット(Transport Format；ＴＦ)選択、存続検査及びＡＰの伝送のための正確な初期遅延(initial delay)を遂行し、ステップ２６０７で、ＡＰの反復伝送回数及び初期送信電力を設定した後、ステップ２６０８でＡＰを伝送する。前記ＡＰを伝送した後、ＵＥは、ステップ２６０９で前記伝送されたＡＰに応じてＡＣＫを待機する。ＵＴＲＡＮから伝送されたＡＰ_ＡＩＣＨを分析することにより、ＡＣＫ信号が受信されたか否かを判断することができる。ステップ２６０９でＡＣＫを受信できないと、ステップ２６３１で、ＵＥは、ステップ２６０７で設定したＡＰ反復伝送回数が超過されたか否かを検査する。ステップ２６３１で、前記設定されたＡＰ反復伝送回数が超過された場合、ステップ２６３２で、ＵＥは、上位階層にエラー発生システム応答を伝送してＣＰＣＨアクセス過程を中断し、エラー復旧過程を遂行する。ＡＰ反復伝送回数が超過されたか否かは、タイマを利用して検査することができる。ステップ２６３１でＡＰ反復伝送回数が超過されなかったら、ステップ２６３３で、ＵＥは、ＣＰＣＨ_ＡＰ下位チャンネルグループに定義されている新たなアクセススロットを選択し、ステップ２６３４で、前記ＡＰに使用されるシグネチャーを選択する。ステップ２６３４でシグネチャーを選択するとき、ＵＥは、ステップ２６０３で選択されたＡＳＣ内の有効なシグネチャー中で新たなシグネチャーを選択するか、またはステップ２６０５で選択されたシグネチャーを選択する。その後、ステップ２６３５で、ＵＥはＡＰの送信電力を再設定した後、ステップ２６０８を繰り返して遂行する。

【0181】

ステップ２６０９でＡＣＫを受信すると、ＵＥは、ステップ２６１０で、プリアンブルのシグネチャーグループからＣＤ_Ｐに使用される任意のシグネチャー及びＣＤ_Ｐを伝送するアクセススロットを選択する。前記ＣＤ_Ｐを伝送するアクセススロットは、ＵＥがＡＣＫを受信した後の任意の時点を示すこともでき、または固定された時点を示すこともできる。前記ＣＤ_Ｐに対するシグネチャー及びアクセススロットを選択した後、ＵＥは、ステップ２６１１で前記選択されたアクセススロットで前記選択されたシグネチャーを使用するＣＤ_Ｐを伝送する。

【0182】

前記ＣＤ_Ｐを伝送した後、ＵＥは、図２６Ｂのステップ２６１２で、ＣＤ_Ｐに対するＡＣＫ及びチャンネル割当てメッセージが受信されたか否かを決定する。ＵＥは、ＣＤ_ＩＣＨを通じてＡＣＫが受信されたか否かによって異なる動作を遂行する。ステップ２６１２で、ＵＥは、ＣＤ_Ｐに対するＡＣＫ及びチャンネル割当てメッセージに対する受信時間をタイマを使用して検査することができる。前記タイマによって設定された時間内にＡＣＫが受信されないか、またはステップ２６１２で、ＵＥが伝送したＣＤ_Ｐに対するＮＡＫを受信すると、ＵＥは、ステップ２６４１に進行してＣＰＣＨアクセス手順を中断する。ステップ２６４１で、ＵＥは、上位階層にエラー発生システム応答(error occurrence system response)を伝送してＣＰＣＨアクセル手順を中断し、エラー復旧過程を遂行する。

【0183】

しかし、ステップ２６１２でＣＤ_Ｐに対するＡＣＫが受信されると、ＵＥは、ステップ２６１３でＣＡメッセージを分析する。前記ＣＤ_Ｐに対するＡＣＫとＣＡメッセージは、図１６及び１７のＡＩＣＨの受信器を使用することにより、同時に検出及び分析されることができる。

【0184】

ステップ２６１４で、ＵＥは、ステップ２６１３で分析されたＣＡメッセージによって共通パケット物理チャンネルのメッセージ部に対するアップリンクスクランブリングコード及びアップリンクチャンネル区分コードを決定し、ＣＰＣＨの電力制御のために設定されたダウンリンク専用チャンネルのチャンネル区分コードを決定する。その後、ステップ２６１５で、ＵＥは、電力制御プリアンブルＰＣ_Ｐのスロット数が８または０であるかを確認する。ステップ２６１５で、前記ＰＣ_Ｐのスロット数が０であると、ＵＥは、ステップ２６１９を遂行してＵＴＲＡＮから伝送したダウンリンク専用チャンネルの受信を開始する。一方、前記ＰＣ_Ｐのスロット数が８であると、ＵＥは、ステップ２６１７を遂行する。ステップ２６１７で、ＵＥは、アップリンクスクランブリングコード、アップリンクチャンネル区分コード、及びＰＣ_Ｐに使用されるスロットタイプによって電力制御プリアンブルＰＣ_Ｐのフォーマットを行う。前記ＰＣ_Ｐは二つのスロットタイプを有する。前記ＰＣ_Ｐに対するスクランブリングコードとチャンネル区分コードを選択した後、ステップ２６１８で、ＵＥはＰＣ_Ｐを伝送し、同時にダウンリンク専用チャンネルを受信してＵＴＲＡＮから伝送したアップリンクの電力制御命令語によってアップリンク送信電力を制御し、ＵＴＲＡＮにダウンリンク電力制御命令語を伝送するためのダウンリンクの送信電力を測定する。その後、ステップ２６２０で、ＵＥは、ステップ２６１３で分析されたＣＡメッセージによってＰＣＰＣＨメッセージ部のフォーマットを行い、ステップ２６２１で、ＣＰＣＨメッセージ部の伝送を開始する。その後、ステップ２６２２で、ＵＥは、ＣＰＣＨ伝送が承認モード伝送であるか否かを確認する。ステップ２６２２で、ＣＰＣＨ伝送が承認モード(Acknowledgement mode)で伝送されないと、ＣＰＣＨメッセージ部の伝送が完了した後、ステップ２６２５を遂行してＣＰＣＨ伝送終了状態応答(transmission end status response)を上位階層に伝送し、ステップ２６２６で、ＣＰＣＨを通じてデータを伝送する過程を終了する。しかし、ステップ２６２２で、ＣＰＣＨ伝送が承認モード伝送であると、ステップ２６２３で、ＵＥは、ＣＰＣＨメッセージ部のＡＣＫ信号を受信するためのタイマを設定し、ステップ２６２４で、ＣＰＣＨメッセージ部の伝送中と伝送後に順方向アクセスチャンネル(ＦＡＣＨ)をモニタリングしてＵＴＲＡＮからＣＰＣＨメッセージ部に対するＡＣＫまたはＮＡＫが受信されたか否かを確認する。ＵＴＲＡＮからＡＣＫまたはＮＡＫの受信のときＦＡＣＨのみならず、ダウンリンク専用チャンネルも使用されることができる。ステップ２６２４で、ＵＥは、ＦＡＣＨを通じて伝送したＣＰＣＨメッセージ部に対するＡＣＫを受信できないと、ステップ２６５１では、ステップ２６２３で設定されたタイマが終了されたか否かを確認する。前記タイマが終了されなかったら、ＵＥは、ステップ２６２４に戻ってＵＴＲＡＮからのＡＣＫまたはＮＡＫの伝送をモニタリングする。しかし、前記タイマが終了されたら、ステップ２６５２で伝送失敗状態応答を上位階層に伝送し、エラー復旧過程を遂行する。しかし、ステップ２６２４で、ＵＥがＡＣＫを受信したら、ＣＰＣＨメッセージ部のＡＣＫを受信した後ステップ２６２５に進行して、ＣＰＣＨ伝送終了状態応答を上位階層へ伝送する。その後、ステップ２６２６で、ＵＥは、ＣＰＣＨを通じてデータを伝送する過程を終了する。以下、図２７Ａ乃至図２７Ｃを参照して、ＵＴＲＡＮがＣＰＣＨを割り当てる動作を詳細に説明する。

【0185】

図２７Ａのステップ２７０１で、ＵＴＲＡＮは、ＣＳＩＣＨを使用してＣＰＣＨによって支援される最大データ伝送速度に関する情報または前記伝送速度に従ってＣＰＣＨが使用可能であるか否かに関する情報を伝送する。ステップ２７０２で、ＵＴＲＡＮは、ＵＥから伝送されたＡＰを受信するためのアクセススロットをモニタリングする。前記アクセススロットをモニタリングする間、ステップ２７０３で、ＵＴＲＡＮは、前記ＡＰが検出されたか否かを判断する。ステップ２７０３で、ＡＰを検出できないと、ＵＴＲＡＮは、ステップ２７０２に戻って前記過程を反復する。

【0186】

一方、ステップ２７０３でＡＰを検出したら、ＵＴＲＡＮは、ステップ２７０４で２個以上のＡＰが検出または受信されたか否かを判断する。もし、ステップ２７０４で、２個

以上のＡＰが検出されたら、ＵＴＲＡＮは、ステップ２７３１で前記検出されたＡＰのうち適切なＡＰを選択した後ステップ２７０５に進行する。一方、ステップ２７０４でただ一つのＡＰのみを受信し、前記受信されたＡＰの受信電力や受信されたＡＰのシグネチャーに含まれたＣＰＣＨに対する要求条件が適切であると、ＵＴＲＡＮはステップ２７０５を遂行する。ここで、前記“要求条件(requirement)”とは、ＵＥがＣＰＣＨに使用しようとするデータ伝送速度、または加入者が伝送するデータのフレーム数、または前記二つの要求条件の組合せを意味する。

【0187】

ステップ２７０４で一つのＡＰが検出されたか、またはステップ２７３１で適切なＡＰを選択した後であれば、ＵＴＲＡＮはステップ２７０５に進行して検出または選択されたＡＰに対するＡＣＫを伝送するＡＰ_ＡＩＣＨを生成した後、ステップ２７０６で生成されたＡＰ_ＡＩＣＨを伝送する。前記ＡＰ_ＡＩＣＨを伝送した後、ステップ２７０７で、ＵＴＲＡＮは、伝送されたＡＰを含むＵＥから伝送したＣＤ_Ｐを受信するアクセススロットをモニタリングする。前記ＣＤ_Ｐの受信及びアクセススロットのモニタリング過程でも、前記ＡＰを受信することができる。すなわち、ＵＴＲＡＮは、前記アクセススロットから前記ＡＰ、ＣＤ_Ｐ及びＰＣ_Ｐを検出することができ、前記検出されたプリアンブルに対する多数のＡＩＣＨを生成する。その結果、ＵＴＲＡＮは、前記ＣＤ_Ｐ及びＡＰを同時に受信することができる。本発明の実施形態は、図３に示したように、ＵＴＲＡＮが任意のＵＥが生成したＡＰを検出した後、ＣＰＣＨを割り当てる過程に焦点を合わせて説明される。従って、ＵＴＲＡＮが遂行した動作は、任意のＵＥから伝送したＡＰに対する、ＵＥが作った応答、伝送されたＡＰを含むＵＥから伝送したＣＤ_Ｐに対する応答、及び該当ＵＥから伝送したＰＣ_Ｐに対する応答の順に説明される。

【0188】

ステップ２７０８でＣＤ_Ｐを検出すると、ＵＴＲＡＮはステップ２７０９を遂行する。一方、ＣＤ_Ｐを検出できないと、ＵＴＲＡＮは、ステップ２７０７を遂行してＣＤ_Ｐの検出をモニタリングする。ＵＴＲＡＮは、２つのモニタリング方法を有する。１つの方法は、ＵＥがＡＰ_ＡＩＣＨの以後に固定された時間にＣＤ_Ｐを伝送すると、タイマが使用されることができ、他の方法は、ＵＥが任意の時点でＣＤ_Ｐを伝送すると、サーチャー(Searcher)が使用されることができる。ステップ２７０８でＣＤ_Ｐを検出すると、ＵＴＲＡＮは、ステップ２７０９で２個以上のＣＤ_Ｐが検出されたか否かを判断する。ステップ２７０９で２個以上のＣＤ_Ｐが検出されたら、ＵＴＲＡＮは、受信されたＣＤ_Ｐの中に適切なＣＤ_Ｐを選択して、ステップ２７１０でＣＤ_ＩＣＨ及びＣＡ_ＩＣＨを通じて伝送したチャンネル割当てメッセージを生成する。ステップ２７４１で、ＵＴＲＡＮは、前記受信されたＣＤ_Ｐの受信電力に基づいて適切なＣＤ_Ｐを選択することができる。ステップ２７０９で１個のＣＤ_Ｐが受信されたら、ＵＴＲＡＮは、ステップ２７１０に進行する。ステップ２７１０で、ＵＴＲＡＮは、ステップ２７４１で選択したＣＤ_Ｐまたはステップ２７０９で受信したＣＤ_Ｐを伝送したＵＥに伝送されるＣＡメッセージを生成する。その後、図２７Ｂのステップ２７１１で、ＵＴＲＡＮは、ステップ２７０８で検出されたＣＤ_Ｐに対するＡＣＫと、ステップ２７１０で生成したＣＡメッセージの伝送のためのＣＤ/ＣＡ_ＩＣＨを生成する。ＵＴＲＡＮは、図１３Ａ及び図１３Ｂを参照して説明した方法にて前記ＣＤ/ＣＡ_ＩＣＨを生成することができる。ＵＴＲＡＮは、ステップ２７１２で生成されたＣＡ/ＣＤ_ＩＣＨを図１４及び図１５を参照して説明した方法にて伝送する。

【0189】

前記ＣＤ/ＣＡ_ＩＣＨを伝送した後、ＵＴＲＡＮは、ステップ２７１３でアップリンクＣＰＣＨの送信電力を制御するためのダウンリンク専用チャンネル(ＤＬ_ＤＰＣＨ)を生成する。前記生成されたダウンリンク専用チャンネルは、ＵＥから伝送したアップリンクＣＰＣＨと一対一に対応することができる。ＵＴＲＡＮは、ステップ２７１４で生成したＤＬ_ＤＰＣＨを通じて伝送した命令を伝送し、ステップ２７１５で、ＵＥが伝送したＰＣ_Ｐを受信することにより、スロット数またはタイム情報を検査する。ステップ２７１

５で、ＵＥが伝送したＰＣ_Ｐのスロット数またはタイム情報が‘０’であれば、ＵＴＲＡＮは、ステップ２７１９で、ＵＥが伝送したＰＣＰＣＨのメッセージ部の受信を開始する。一方、ＵＥが伝送したＰＣ_Ｐのスロット数またはタイム情報が‘８’であれば、ＵＴＲＡＮは、ステップ２７１６に進行する。ステップ２７１６では、ＵＴＲＡＮは、ＵＥから伝送したＰＣ_Ｐを受信して、ＰＣ_Ｐの送信電力を制御するための電力制御命令語を生成する。前記ＰＣ_Ｐの送信電力を制御する目的は、ＵＥが伝送したアップリンクＰＣＰＣＨの初期送信電力を適切に調整するためである。ＵＴＲＡＮは、ステップ２７１６で生成した電力制御命令語をステップ２７１３で生成したダウンリンク専用チャンネルのうち、ダウンリンク専用物理制御チャンネル(ＤＬ_ＤＰＣＣＨ)の電力制御命令語フィールドを通じて伝送する。その後、ＵＴＲＡＮは、ステップ２７１８でＰＣ_Ｐが完全に受信されたか否かを判断する。ＰＣ_Ｐの受信が終了されなかったら、ＵＴＲＡＮはステップ２７１７に戻す。一方、ＰＣ_Ｐの受信が終了されたら、ＵＴＲＡＮは、ステップ２７１９を遂行する。前記ＰＣ_Ｐの受信が終了されたか否かは、タイマを使用して８個のＰＣ_Ｐスロットが到着したか否かを検査することにより判断されることができる。

【0190】

ＵＴＲＡＮは、ステップ２７１８でＰＣ_Ｐの受信が終了されたことを確認すると、ステップ２７１９でアップリンクＰＣＰＣＨメッセージ部の受信をスタートし、ステップ２７２０でアップリンクＰＣＰＣＨメッセージ部の受信が終了されたことを判断する。ＰＣＰＣＨメッセージ部の受信が終了されなかったら、ＵＴＲＡＮは、連続してＰＣＰＣＨを受信する。一方、ＰＣＰＣＨの受信が終了されたら、図２７Ｃのステップ２７２１に進行する。ステップ２７２１で、ＵＴＲＡＮは、ＵＥがＰＣＰＣＨを承認モードで伝送するか否かを判断する。ＵＥがＰＣＰＣＨを承認モードで伝送する場合、ＵＴＲＡＮはステップ２７２２を遂行し、一方、承認モードで伝送しない場合、ステップ２７２４を遂行してＣＰＣＨ受信を終了する。ステップ２７２１で、ＵＥがＰＣＰＣＨを承認モードで伝送するか否かを判断する。ＵＴＲＡＮは、ステップ２７２２で受信されたＰＣＰＣＨメッセージ部にエラーがあるか否かを検査する。前記受信されたＰＣＰＣＨメッセージ部がエラーを有していると、ＵＴＲＡＮは、ステップ２７５１で順方向アクセスチャンネル(ＦＡＣＨ)を通じてＮＡＫを伝送する。一方、前記受信されたＰＣＰＣＨメッセージ部にエラーがないと、ステップ２７２３で順方向アクセスチャンネルを通じてＡＣＫを伝送した後、ステップ２７２４でＣＰＣＨの受信を終了する。

【0191】

図２８Ａ及び図２８Ｂは、本発明の他の実施形態によるＵＥでＣＰＣＨを割り当てる手順を示す。図２８Ａの“ＳＴＡＲＴ”は、図２６Ａの“Ａ”に連結される。図２９Ａ乃至図２９Ｃは、本発明の他の実施形態によるＵＴＲＡＮでＣＰＣＨを割り当てる手順を示す。ここで、図２９Ａの“ＳＴＡＲＴ”は、図２７Ａの“Ａ”に連結される。図２８Ａ乃至図２８Ｂ及び図２９Ａ乃至図２９Ｃは、図２２乃至図２６を参照して説明したＰＣ_Ｐを使用して安定したＣＰＣＨを設定する方法に対して、ＵＥとＵＴＲＡＮの動作をそれぞれ説明した図である。

【0192】

図２８Ａを参照すると、ステップ２８０１で、ＵＥは、ＣＤ_ＩＣＨ及びＣＡ_ＩＣＨがＵＴＲＡＮから受信されたか否かを確認する。ステップ２８０１で、ＣＤ_ＩＣＨ及びＣＡ_ＩＣＨを受信できないと、ＵＥは、ステップ２８２１で上位階層にエラー発生システム応答(system response)を伝送してＣＰＣＨアクセス手順(access procedure)及びエラー復旧過程を終了する。“前記ＣＤ_ＩＣＨ及びＣＡ_ＩＣＨを受信できない”とは、ＣＡ_ＩＣＨが受信されるとしても、ＣＤ_ＩＣＨに対するＡＣＫが受信されない場合と、一定時間の内にＵＴＲＡＮからＣＡ_ＩＣＨが受信されない場合とを含むことを意味する。このとき、前記“一定時間”とは、ＣＰＣＨアクセス手順を開始する時に予め設定される時間であり、タイマを設定して動作されることができる。

【0193】

これに反して、ステップ２８０１でＣＤ/ＣＡ_ＩＣＨが受信され、前記ＣＤ_ＩＣＨか

らＡＣＫが検出されたと判断されれば、ＵＥは、ステップ２８０２で、ＵＴＲＡＮから伝送したＣＡメッセージを分析する。ステップ２８０２で、ＣＡメッセージを分析した後、ＵＥは、ステップ２８０３に進行して前記分析されたＣＡメッセージに従ってＰＣＰＣＨメッセージ部のアップリンクスクランブリングコード、アップリンクチャンネル区分コード、及びアップリンクＣＰＣＨを制御するのに使用するダウンリンク専用チャンネルのチャンネル区分コードを確認する。

【0194】

その後、ステップ２８０４で、ＵＥは、ステップ２８０３で設定されたアップリンクスクランブリングコード及びアップリンクチャンネル区分コードを利用して、スロットタイプに従ってＰＣ_Ｐを構成する。このとき、本発明の実施形態で前記ＰＣ_Ｐを使用してＣＰＣＨの安定性及び信頼度を高める方法では、前記ＰＣ_Ｐスロットの長さまたはタイミング情報が常に８スロットで設定されることである。

【0195】

ステップ２８０５で、ＵＥは、ＵＴＲＡＮから受信されたＣＡメッセージの検証のために、ＰＣ_ＰにＣＡ確認メッセージ(Channel Assignment Confirmation Message)を挿入する。ＵＥは、前記ＰＣ_ＰにＣＡ確認メッセージを図２２乃至図２５を参照して説明した方法にて挿入することができる。図２２で使用される方法は、ＰＣ_Ｐのパイロットビットにユーザ端末が受信したＣＡメッセージまたはシグネチャー番号を乗じて伝送する方法であり、図２３で使用される方法は、ＰＣ_Ｐスロットにチップレベルでユーザ端末が受信したＣＡメッセージまたはシグネチャー番号を乗じて伝送する方法である。また、図２４で使用される方法は、ＵＥが受信したＣＡメッセージまたはシグネチャー番号に対応するチャンネル区分コードにＰＣ_Ｐをチャンネル化して伝送する方法であり、図２５で使用される方法は、ＵＥが受信したＣＡメッセージまたはシグネチャー番号に対応するスクランブリングコードにＰＣ_Ｐを拡散させた後ＵＴＲＡＮに伝送させる方法である。多重シグネチャーを使用してＣＡメッセージを伝送する場合、ＵＴＲＡＮは、ＵＥに割り当てたＣＰＣＨに対するＣＡメッセージを使用する。一つのシグネチャーを使用してＣＰＣＨを割り当てる場合、ＵＴＲＡＮは、ＣＡメッセージに対するシグネチャーを使用する。

【0196】

その後、ステップ２８０６で、ＵＥは、ステップ２８０５で生成されたＰＣ_ＰをＵＴＲＡＮに伝送し、ステップ２８０７で、ＵＴＲＡＮから伝送したＤＬ_ＤＰＣＨの受信を開始する。また、前記ＤＬ_ＤＰＣＨのパイロットフィールドを利用してダウンリンクの受信電力を測定し、前記測定された受信電力によってＰＣ_Ｐの電力制御命令語部にダウンリンクの送信電力を制御するための命令語を挿入する。

【0197】

ＰＣ_ＰをＵＴＲＡＮに伝送してＤＬ_ＤＰＣＨを受信する間、ＵＥは、ステップ２８０８でＵＥが分析したＣＡメッセージに対するエラー信号またはＣＰＣＨ解除を要求する特定のＰＣＢ(Power Control Bit)パターンがＵＴＲＡＮから受信されるか否かを検査する。ステップ２８０８で、前記分析されたＣＡにエラーが発生するかまたはＰＣＢパターンがＣＰＣＨ解除を示すと判断されると、ＵＥは、ステップ２８３１でＰＣ_Ｐの伝送を終了した後、ステップ２８３２で上位階層にＰＣＰＣＨの伝送中断状態応答を伝送してエラー復旧過程を遂行する。

【0198】

しかし、ステップ２８０８で、ＵＴＲＡＮからＣＡメッセージに対するエラー信号または特定のＰＣＢパターンが受信されないものと判断される場合、ステップ２８０９に進行して、前記分析されたＣＡメッセージに従ってＰＣＰＣＨメッセージ部を構成する。

【0199】

図２８Ｂのステップ２８１０に連続して、ＵＥは、ステップ２８０９で生成されたＰＣＰＣＨメッセージ部の伝送を開始する。一方、前記ＰＣＰＣＨメッセージ部を伝送する間、ＵＥは、図２８Ａのステップ２８０８と同一なステップ２８１１を遂行する。ステップ２８１１で、ＵＴＲＡＮからＣＡメッセージに対するエラー確認メッセージまたはチャン

ネル解除要求メッセージ(例えば、ＰＣＢパターン)を受信すると、ＵＥは、ステップ２８４１及びステップ２８４２を遂行する。ステップ２８４１で、ＵＥはＰＣＰＣＨメッセージ部の伝送を中断し、ステップ２８４２に進行して上位階層にＰＣＰＣＨ伝送中断状態応答を伝送した後にエラー復旧過程を遂行する。前記チャンネル解除要求メッセージには二つの異なる種類がある。チャンネル解除要求メッセージの第１タイプは、現在設定されたＣＰＣＨに対するＣＡメッセージの確認作業が遅延し、ＰＣＰＣＨの伝送が開始された後、ＵＴＲＡＮが現在設定されたＣＰＣＨと他のＵＥのＣＰＣＨと衝突が発生したことを分かるようになって伝送することである。チャンネル解除要求メッセージの第２タイプは、ＵＴＲＡＮからのＣＰＣＨを利用する他のＵＥで受信したＣＡメッセージにエラーがあるから、現在ＵＥがＵＴＲＡＮと通信しているＣＰＣＨに他のＵＥが伝送を開始し、ＵＴＲＡＮがこれを感知して現在正しく使用しているＵＥに他の使用者との衝突を示す衝突メッセージを伝送することである。いずれにしても、チャンネル解除メッセージを受信すると、ＵＴＲＡＮは、ＣＰＣＨを正しく使用するＵＥ及びエラーを有するＣＡメッセージを受信した他のＵＥにアップリンクＣＰＣＨを利用して中断するように指示する。

【0200】

しかし、ステップ２８１１で、ＵＴＲＡＮからＣＡメッセージに対するエラー信号、またはチャンネル解除を要求する特定のＰＣＢパターンを受信しない場合、ＵＥはステップ２８１２に進行してＰＣＰＣＨメッセージ部を連続して伝送し、ステップ２８１３で前記ＰＣＰＣＨメッセージ部の伝送が終了されたか否かを判断する。前記ＰＣＰＣＨメッセージ部の伝送が終了されない場合、ステップ２８１２に戻して前述した動作を遂行し続ける。一方、前記ＰＣＰＣＨメッセージ部の伝送が終了されたら、ＵＥは、ステップ２８１４の動作を遂行する。

【0201】

ステップ２８１４で、ＵＥは承認モードで伝送されるか否かを確認する。前記承認モードで伝送されないと、ＵＥは、ＰＣＰＣＨメッセージ部の伝送を完了した後、ステップ２８１７を遂行してＰＣＰＣＨ伝送中止状態応答を上位階層に伝送した後、ＣＰＣＨを通じたデータ伝送過程を終了する。しかし、ステップ２８１４で承認モードで伝送されると、ＵＥは、ステップ２８１５でＣＰＣＨメッセージ部のＡＣＫを受信するためのタイマを設定する。その後、ＵＥは、ステップ２８１６でＣＰＣＨメッセージ部の伝送中と伝送後に順方向アクセスチャンネル(ＦＡＣＨ)をモニタリングしてＵＴＲＡＮからＣＰＣＨメッセージ部に対するＡＣＫまたはＮＡＫの伝送を確認する。ＵＴＲＡＮは、ＦＡＣＨのみならず、ダウンリンクチャンネルを通じてもＡＣＫまたはＮＡＫを伝送することができる。ステップ２８１６でＦＡＣＨを通じてＣＰＣＨメッセージ部に対するＡＣＫが受信されないと、ＵＥは、ステップ２８５１で、ステップ２８１５で設定されたタイマが終了されたか否かを確認する。ステップ２８１５でタイマが終了されなかったら、ＵＥは、ステップ２８１６に戻してＵＴＲＡＮからＡＣＫまたはＮＡＫの伝送をモニタリングする。一方、ステップ２８１５でタイマが終了されたら、ＵＥは、ステップ２８５２で、ＰＣＰＣＨ伝送失敗状態応答を上位階層に伝送してエラー復旧過程を遂行する。しかし、ステップ２８１６でＡＣＫを受信すると、ＵＥは、ステップ２８１７を遂行した後、ＣＰＣＨの伝送を終了する。

【0202】

以下、図２９Ａ乃至図２９Ｃを参照してＵＴＲＡＮの動作を説明する。ここで、図２９Ａの“ＳＴＡＲＴ”は図２７Ａの“Ａ”に連結される。

【0203】

図２９Ａのステップ２９０１で、ＵＴＲＡＮは、図２７Ａのステップ２７０８で検出されたＣＤ_Ｐに対するＡＣＫと、ステップ２７１０で生成されたＣＡメッセージを伝送するためのＣＤ/ＣＡ_ＩＣＨを生成する。前記ＣＤ/ＣＡ_ＩＣＨは、図１３Ａ及び図１３Ｂを参照して説明した方法にて生成されることができる。ステップ２９０２で、ＵＴＲＡＮは、ステップ２９０１で生成されたＣＡ/ＣＤ_ＩＣＨを図１４と図１５の方法を参照して説明した方法にて伝送する。前記ＣＤ/ＣＡ_ＩＣＨを伝送した後、ＵＴＲＡＮは、アップ

リンクＣＰＣＨの送信電力を制御するためのダウンリンク専用チャンネルを生成する。前記生成されるダウンリンク専用チャンネルは、ＵＥが伝送するアップリンクＣＰＣＨと一対一に対応している。ＵＴＲＡＮは、ステップ２９０３で生成したＤＬ_ＤＰＣＨをステップ２９０４で伝送し、ステップ２９０５で前記ＵＥが伝送したＰＣ_Ｐを受信し、前記受信されたＣＡメッセージに対する確認メッセージを分析する。ステップ２９０５で分析された結果に基づいて、ＵＴＲＡＮは、ステップ２９０６でＵＥが伝送したＣＡ確認メッセージとＵＴＲＡＮが伝送したＣＡメッセージとが一致するか否かを判断する。ステップ２９０６で一致すると判断されると、ＵＴＲＡＮはステップ２９０７を遂行し、一致しないと判断されると、ステップ２９２１に進行する。

【0204】

ＵＥは、ＰＣ_Ｐを利用してＵＴＲＡＮにＣＡメッセージを図２２乃至図２５を参照して説明した方法にて伝送することができる。図２２で使用される方法は、ＰＣ_Ｐのパイロットビットに ＵＥが受信したＣＡメッセージまたはシグネチャー番号を乗じて伝送する方法であり、図２３で使用される方法は、ＰＣ_Ｐスロットにチップレベルで ＵＥが受信したＣＡメッセージまたはシグネチャー番号を乗じて伝送する方法である。また、図２４で使用される方法は、ＵＥが受信したＣＡメッセージまたはシグネチャー番号に対応するチャンネル区分コードにＰＣ_Ｐをチャンネル化して伝送する方法であり、図２５で使用される方法は、ＵＥが受信したＣＡメッセージまたはシグネチャー番号に対応するスクランブリングコードにＰＣ_Ｐを拡散させてＵＴＲＡＮに伝送させる方法である。多重のシグネチャーを使用してＣＡメッセージを伝送する場合、ＵＴＲＡＮは、ＵＥに割り当てられたＣＰＣＨに対するＣＡメッセージを使用する。一つのシグネチャーを使用してＣＰＣＨを割り当てる場合、ＵＴＲＡＮは、ＣＡ確認メッセージに対するシグネチャーを使用する。

【0205】

図２９Ｂのステップ２９２１で、ＵＴＲＡＮは、ステップ２９０５で受信したＣＡ確認メッセージに対応するＣＰＣＨを他のＵＥが使用しているか否かを判断する。ステップ２９２１で他のＵＥが前記ＣＰＣＨを使用していないと判断されると、ＵＴＲＡＮはステップ２９２５を遂行する。ステップ２９２５で、ＵＴＲＡＮは、上位階層にＰＣＰＣＨ伝送中断状態応答を伝送した後、エラー復旧過程を遂行する。ＵＴＲＡＮが遂行する“エラー復旧過程”とは、現在ＵＥが使用しているダウンリンク専用チャンネルを通じてＣＰＣＨ伝送中断メッセージをＵＥに伝送するか、ＦＡＣＨを通じてＣＰＣＨ伝送中断メッセージをＵＥに伝送するか、またはＵＥと予め約束された特定のビットパターンを持続的に伝送することにより、ＵＥがＣＰＣＨの伝送を中断するように指示する方法を意味する。また、前記エラー復旧過程は、ＵＥが受信するＤＬ_ＤＰＣＨを通じてアップリンクの送信電力を減少させる命令をＵＴＲＡＮが持続的に伝送する方法も含まれることができる。

【0206】

ステップ２９２１で、ステップ２９０５で受信したＣＡ確認メッセージに対応するＣＰＣＨを他のＵＥが使用していると判断されると、ＵＴＲＡＮは、ステップ２９２２で、二つのＵＥが共通に使用しているＤＬ_ＤＰＣＨを通じて送信電力下降命令語を伝送する。その後、ステップ２９２３で、ＵＴＲＡＮは、ＦＡＣＨを通じて二つのＵＥにチャンネル解除メッセージまたは特定のＰＣＢパターンを伝送してチャンネルを解除する。前記チャンネル解除メッセージまたは特定のＰＣＢパターンを伝送するとき、ＦＡＣＨのみならず、ダウンリンク専用チャンネルも使用されることができる。ステップ２９２３を遂行した後、ＵＴＲＡＮは、ステップ２９２４でＵＥへのＤＬ_ＤＰＣＨの伝送を中断した後、ステップ２９２５でＣＰＣＨの受信を終了する。

【0207】

一方、ステップ２９０６で、ＵＥから受信したＣＡ確認メッセージがＵＴＲＡＮによって割り当てられたＣＡメッセージと一致すると、ＵＴＲＡＮはステップ２９０７を遂行する。ステップ２９０７で、ＵＴＲＡＮは、ＵＥが伝送したＰＣ_Ｐを受信してＰＣ_Ｐの送信電力を制御するための電力制御命令語を生成する。前記ＰＣ_Ｐの送信電力を制御する

目的は、ＵＥが伝送したアップリンクＰＣＰＣＨの初期送信電力を適切に調整するためである。ステップ２９０８で、ＵＴＲＡＮは、ステップ２９０３で生成されたダウンリンク専用チャンネルのうち、ダウンリンク専用物理制御チャンネル(ＤＬ_ＤＰＣＣＨ)の電力制御命令語フィールドを通じて前記生成された電力制御命令語を伝送する。ＵＴＲＡＮは、ステップ２９０９でＰＣ_Ｐの受信が終了されたか否かを判断する。前記ＰＣ_Ｐの受信が終了されなかったら、ＵＴＲＡＮはステップ２９０８に戻し、前記ＰＣ_Ｐの受信が終了されたら、ステップ２９１０を遂行する。前記ＰＣ_Ｐの受信が終了されたか否かは、タイマを使用して８個のＰＣ_Ｐスロットが受信されたか否かを検査する方法で判断されることができる。ステップ２９０９でＰＣ_Ｐの受信が終了されると、ステップ２９１０でアップリンクＰＣＰＣＨのメッセージ部の受信を開始し、ステップ２９１１でアップリンクＰＣＰＣＨのメッセージ部の受信が終了されたか否かを判断する。もし、ＰＣＰＣＨメッセージ部の受信が終了されなかったら、ＵＴＲＡＮはＰＣＰＣＨを連続して受信し、ＰＣＰＣＨメッセージ部の受信が終了されたら、図２９Ｃのステップ２９２１を遂行する。ステップ２９１２で、ＵＴＲＡＮは、ＵＥがＰＣＰＣＨを承認伝送モードで伝送したか否かを判断する。ＵＥが承認伝送モードでＰＣＰＣＨを伝送した場合、ＵＴＲＡＮはステップ２９３１を遂行し、ＵＥが承認伝送モードでＰＣＰＣＨを伝送しなかったら、ステップ２９１５を遂行する。

【0208】

ステップ２９１２で、ＵＥがＰＣＰＣＨを承認伝送モードで伝送したら、ＵＴＲＡＮは、ステップ２９１３で受信されたＰＣＰＣＨのメッセージ部にエラーがあるか否かを検査する。前記受信されたＰＣＰＣＨメッセージ部にエラーがあると、ＵＴＲＡＮは、ステップ２９３１でＦＡＣＨを通じてＮＡＫを伝送する。前記受信されたＰＣＰＣＨメッセージ部にエラーがないと、ＵＴＲＡＮは、ステップ２９１４を遂行して前記ＦＡＣＨを通じてＡＣＫを伝送した後、ステップ２９１５でＣＰＣＨの受信を終了する。

【0209】

前述の如く、本発明の詳細な説明では具体的な実施形態を参照して詳細に説明してきたが、本発明の範囲は前記実施形態によって限られるべきではなく、本発明の範囲内で様々な変形が可能であるということは、当該技術分野における通常の知識を持つ者には明らかである。

【図面の簡単な説明】

【0210】

【図1】従来技術による非同期式アップリンク共通チャンネルのうち、ＲＡＣＨを通じた通信信号の送受信を説明する図である。

【図2】従来技術によるダウンリンク及びアップリンクチャンネルの信号伝送手順を示す図である。

【図3】本発明の実施形態によるアップリンク共通チャンネルを設定するＵＥとＵＴＲＡＮとの間の信号フローを示す図である。

【図4A】本発明の一実施形態によるＣＳＩＣＨチャンネルの構造を示す図である。

【図4B】本発明の一実施形態によるＣＳＩＣＨの生成構造を示す図である。

【図5】本発明の一実施形態によるＳＩビットを伝送するためのＣＳＩＣＨ符号器を示すブロック図である。

【図6】図５のＣＳＩＣＨ符号器に対応するＣＳＩＣＨ復号器を示すブロック図である。

【図7】本発明の一実施形態によるアクセスプリアンブルを伝送するために使用されるアクセススロットの構造を示す図である。

【図8A】従来技術によるアップリンクスクランブリングコードの構造を示す図である。

【図8B】従来技術によるアップリンクスクランブリングコードの構造を示す図である。

【図9A】本発明の一実施形態によるアップリンクスクランブリングコードの構造を示す図である。

【図9B】一つのＡＰスロットを生成する構造を示す図である。

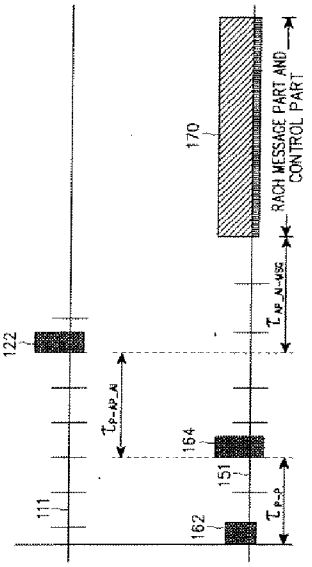
【図10A】本発明の一実施形態による衝突検出プリアンブルのチャンネル構造及び生成構

造を示す図である。
【図10B】本発明の一実施形態による衝突検出プリアンブルのチャンネル構造及び生成構造を示す図である。
【図11A】本発明の一実施形態によるチャンネル割当て表示チャンネル(ＣＡ_ＩＣＨ)の構造及び生成構造を示す図である。
【図11B】本発明の一実施形態によるチャンネル割当て表示チャンネル(ＣＡ_ＩＣＨ)の構造及び生成構造を示す図である。
【図12】本発明の一実施形態によるＡＩＣＨ生成器を示す図である。
【図13A】本発明の一実施形態によるＣＡ_ＩＣＨを示す図である。
【図13B】本発明の一実施形態によるＣＡ_ＩＣＨを示す図である。
【図14】本発明の一実施形態による同一の拡散率を有する相互異なるチャンネル区分コードを割り当ててＣＤ_ＩＣＨ及びＣＡ_ＩＣＨを同時に伝送する方法を示す図である。
【図15】本発明の他の実施形態によるＣＤ_ＩＣＨ及びＣＡ_ＩＣＨを同一のチャンネル区分コードで拡散して相互異なるシグネチャーグループを利用して拡散チャンネルを同時に伝送する方法を示す図である。
【図16】本発明の一実施形態によるシグネチャー構造に対するＵＥのＣＡ_ＩＣＨ受信器を示す図である。
【図17】本発明の他の実施形態による受信器の構造を示す図である。
【図18】本発明の一実施形態によるＵＥの送受信器の構造を示す図である。
【図19】本発明の一実施形態によるＵＴＲＡＮの送受信器の構造を示す図である。
【図20】本発明の一実施形態による電力制御プリアンブルのスロット構造を示す図である。
【図21】図２０に示したＰＣ_Ｐの構造を示す図である。
【図22A】本発明の実施形態によるＰＣ_Ｐを利用してＵＥからＵＴＲＡＮへチャンネル割当て確認メッセージまたはチャンネル使用要求確認メッセージを伝送する方法を示す図である。
【図22B】図２２Ａで使用されるアップリンクスクランブリングコードの構造を示す図である。
【図23】本発明の他の実施形態によるＰＣ_Ｐを利用してＵＥからＵＴＲＡＮへチャンネル割当て確認メッセージまたはチャンネル使用要求確認メッセージを伝送する方法を示す図である。
【図24A】本発明の一実施形態によるＰＣ_Ｐを利用してＵＥからＵＴＲＡＮへチャンネル割当て確認メッセージまたはチャンネル使用要求確認メッセージを伝送する方法を示す図である。
【図24B】本発明の一実施形態によるＣＡ_ＩＣＨのシグネチャーまたはＣＰＣＨチャンネル番号に一対一に対応してＰＣ_Ｐチャンネル区分コードのツリー構造を示す図である。
【図25A】本発明の他の実施形態によるＰＣ_Ｐを利用してＵＥからＵＴＲＡＮへチャンネル割当て確認メッセージまたはチャンネル要求確認メッセージを伝送する方法を示す図である。
【図25B】図２５Ａの方法を利用してＰＣ_Ｐを伝送する方法を示す図である。
【図26A】本発明の一実施形態によるＵＥで共通パケットチャンネルを割り当てる手順を示すフローチャートである。
【図26B】本発明の一実施形態によるＵＥで共通パケットチャンネルを割り当てる手順を示すフローチャートである。
【図26C】本発明の一実施形態によるＵＥで共通パケットチャンネルを割り当てる手順を示すフローチャートである。
【図27A】本発明の一実施形態によるＵＴＲＡＮで共通パケットチャンネルを割り当てる手順を示すフローチャートである。
【図27B】本発明の一実施形態によるＵＴＲＡＮで共通パケットチャンネルを割り当てる手順を示すフローチャートである。

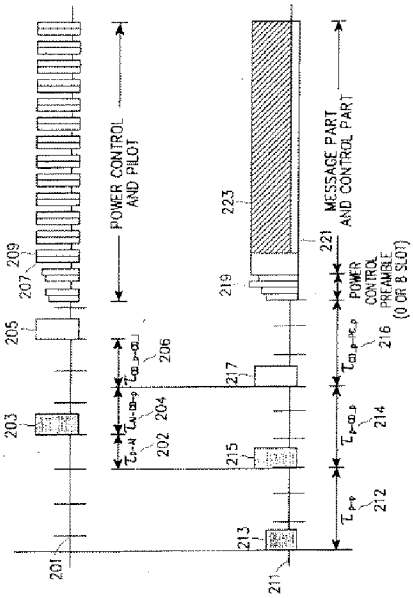
【図27C】本発明の一実施形態によるＵＴＲＡＮで共通パケットチャンネルを割り当てる手順を示すフローチャートである。
【図28A】本発明の一実施形態によるＰＣ_Ｐを利用して安定したＣＰＣＨを設定してＵＥで遂行する手順を示すフローチャートである。
【図28B】本発明の一実施形態によるＰＣ_Ｐを利用して安定したＣＰＣＨを設定してＵＥで遂行する手順を示すフローチャートである。
【図29A】本発明の一実施形態によるＰＣ_Ｐを利用して安定したＣＰＣＨを設定してＵＴＲＡＮで遂行する手順を示すフローチャートである。
【図29B】本発明の一実施形態によるＰＣ_Ｐを利用して安定したＣＰＣＨを設定してＵＴＲＡＮで遂行する手順を示すフローチャートである。
【図29C】本発明の一実施形態によるＰＣ_Ｐを利用して安定したＣＰＣＨを設定してＵＴＲＡＮで遂行する手順を示すフローチャートである。
【符号の説明】
【0211】
３０３　ＡＰ_ＡＩＣＨ
３０５　ＣＤ／ＣＡ_ＩＣＨ
３０７　アップリンク電力制御コマンドフィールド
３０９　パイロットフィールド
３３３，３３５　ＡＰ
３３７　ＣＤ_Ｐ
３３９　電力制御プリアンブル(ＰＣ_Ｐ)
３４１　制御部
３４３　データ部
５０１　反復器
５０３　復号器
６０１　相関度計算器
６０３　ＬＬＲ値計算器
６０５　ＬＬＲ値累算器
８０１，８０３，８１１，８１３，８１７，９０７，１００７，２１０７，２２０７，２３０７，２４０７，２５０７　ＵＬ_スクランブリングコード
８０５　ＰＣ_Ｐスクランブリングコード
８０７　メッセージスクランブリングコード
９０３　ＡＰ用シグネチャー
９０５　アクセスプリアンブル
９０６，１００６，１２０１～１２１６，１４０２，１４１２，１４１６，１５０６，１６１１，１６１７，１６２１，１７１１，１７１７，１７２１，１７２７，２１０２，２１０６，２２０２，２２０６，２２０８，２３０６，２４０２，２５０２，２５０６　乗算器
１００３　シグネチャー
１００５　衝突検出プリアンブル(ＣＤ_Ｐ)
１１０７　ＣＰＣＨ状態表示チャンネル
１１０９，１４０３，１４１３，１５０７，２１０３，２２０３，２３０３，２４０３，２４３３，２５０３　チャンネル区分コード
１１１３，１４０７，１４１７，１５１０　ＤＬ_スクランブリングコード
１２２０　加算器
１３０１，１３１１　衝突検出表示部
１３０３，１３１３　ＣＳＩＣＨ部
１４０１，１５０５　衝突検出(ＣＤ_ＩＣＨ)部
１４０５　ＣＤ_ＩＣＨフレーム
１４１１，１５０１，１５０３　チャンネル割当て(ＣＡ_ＩＣＨ)部

１４１５　ＣＡ_ＩＣＨフレーム
１４０２，１４０６，１４１２，１４１６，１５０２，１５０４，１５０６，１５０８　加算器
１６１３，１７１３，１８１５，１９１５　チャンネル推定器
１６１５，１７１５　複素共役器
１６１９，１７１９　累算器
１６２９，１７２９　ＦＨＴ変換器
１６３１，１７３１　制御及び判定器
１７２３　位置シフタ
１７２５　マスク発生器
１８１１　ＡＩＣＨ復調器
１８１３，１９１３　データ及び制御信号処理器
１８２０，１９２０　制御器
１８２４　アップリンク電力制御信号
１８２６　プリアンブル発生制御信号
１８３１　プリアンブル発生器
１８３２　他のアップリンク伝送信号
１８３３，１９３３　フレーム形成器
１９１１　プリアンブル検出器
１９２２　プリアンブル選択制御コマンド
１９２４　電力制御コマンド
１９２６　ＡＩＣＨ発生制御コマンド
１９３１　ＡＩＣＨ発生器
１９３２　ダウンリンク制御信号
２００１　パイロットフィールド
２００３　フィードバック情報フィールド
２００５　伝送電力制御フィールド
２１０１　電力制御プリアンブル部
２２０１，２３０１，２４０１，２５０１　ＰＣ_Ｐ
２１０５，２２０５，２３０５，２４０５，２５０５　ＰＣ_Ｐフレーム
２２０９，２３０９　ＣＰＣＨ確認メッセージ
２２２１，２２２３，２２２５，２２２７，２２３７，２２４７，２５２１，２５２３，２５２５，２５２７，２５３５，２５３７，２５４５，２５４７　スクランブリングコード
２４３１　ＯＶＳＦコードツリー
２５２５，２５３５，２５４５　ＰＣ_Ｐスクランブリングコード

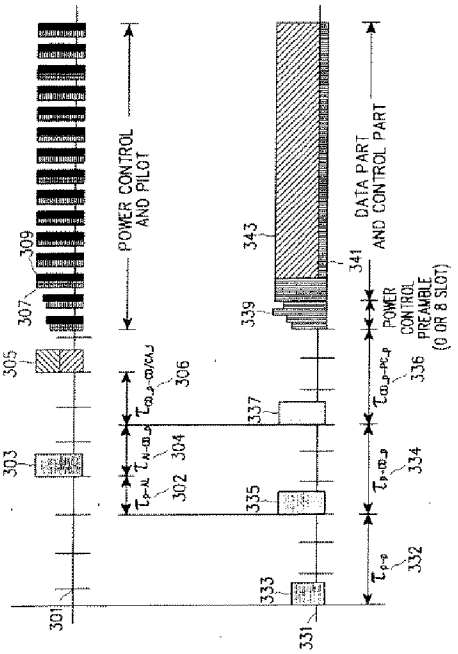
【図1】


RACH MESSAGE PART AND CONTROL PART
170
122
164
151
162
111

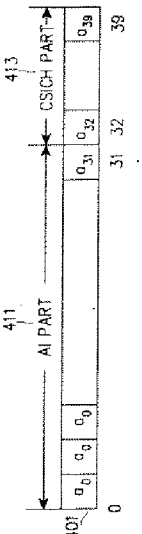
【図2】


POWER CONTROL AND PILOT
MESSAGE PART AND CONTROL PART
POWER CONTROL PREAMBLE (0 OR 8 SLOT)
201
203
205
207
209
202
204
206
211
213
215
217
219
221
223
212
214
216

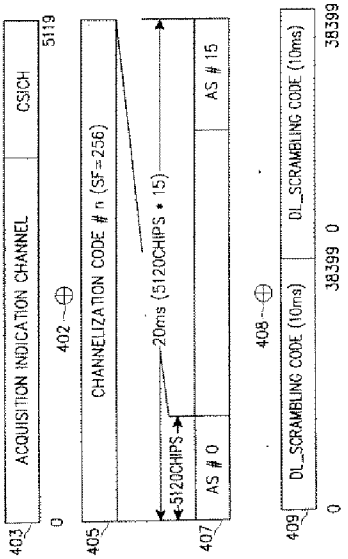
【図3】


POWER CONTROL AND PILOT
DATA PART AND CONTROL PART
POWER CONTROL PREAMBLE (0 OR 8 SLOT)
301
303
305
307
309
302
304
306
331
333
335
337
339
341
343
332
334
336

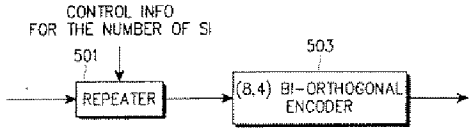
【図4A】


AI PART
CSICH PART
411
413
401
0
31
32
39

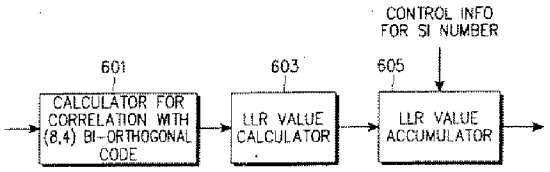
【図4B】



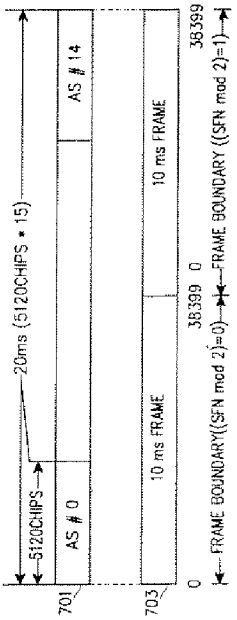
【図5】



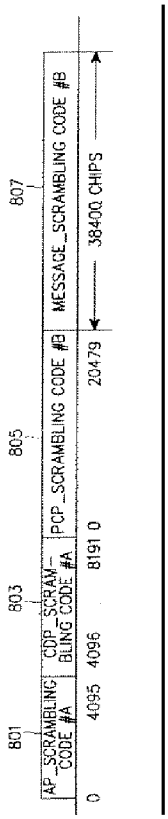
【図6】



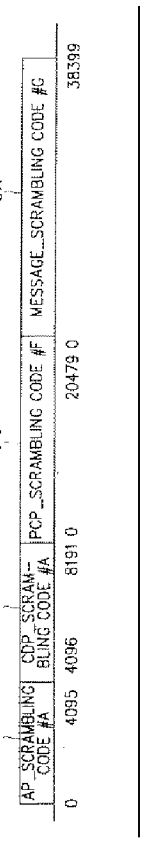
【図7】



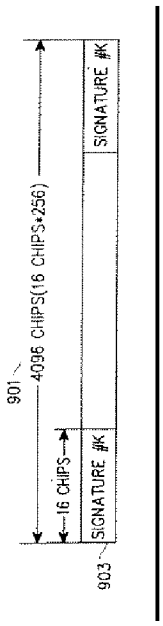
【図8A】



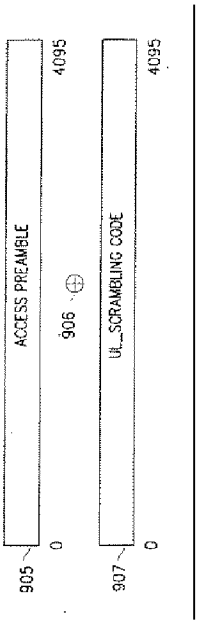
【図8B】



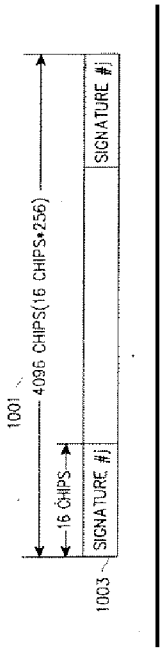
【図9A】



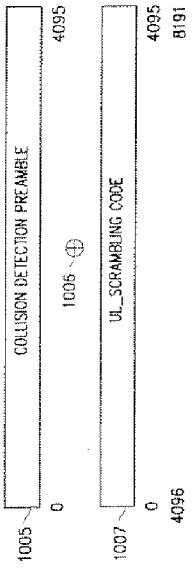
【図9B】



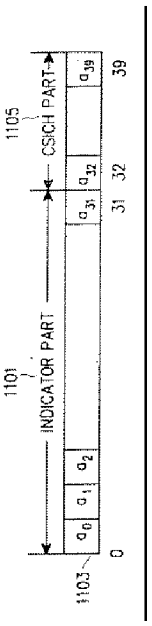
【図10A】



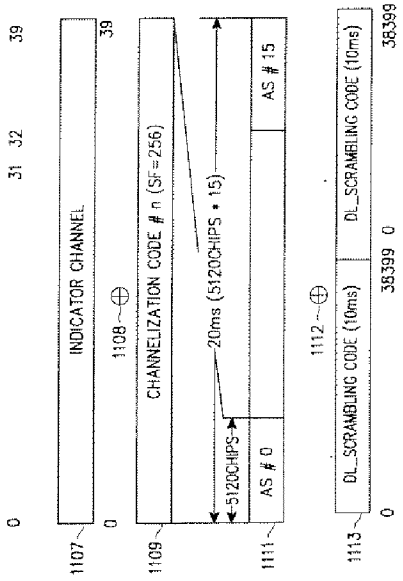
【図10B】



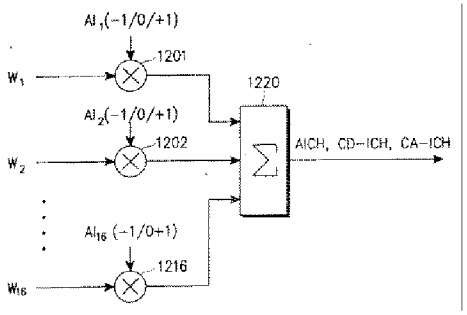
【図11A】



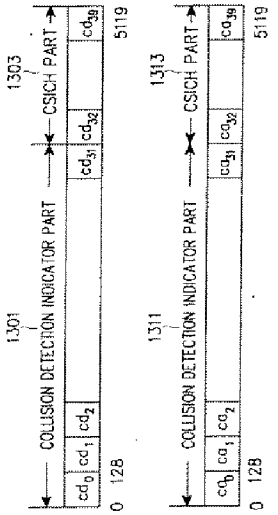
【図11B】



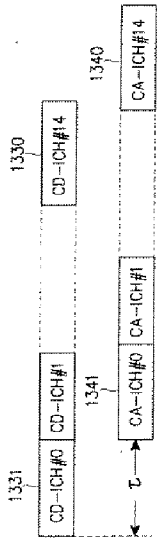
【図12】



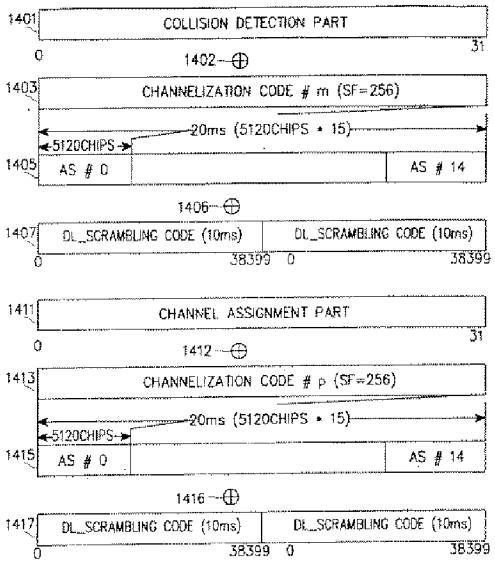
【図13A】



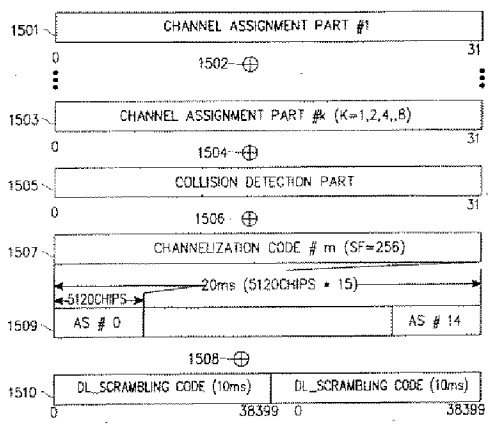
【図13B】



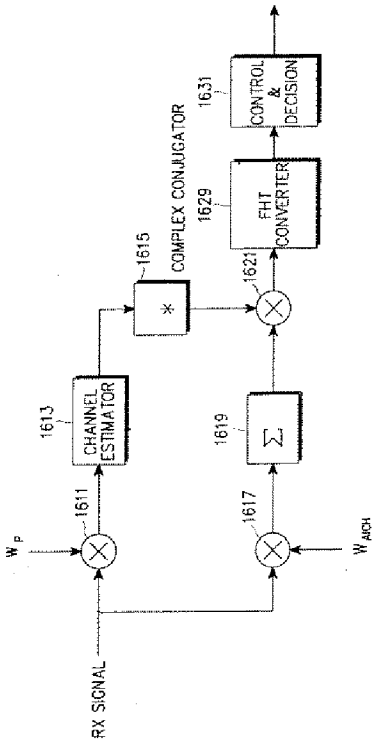
【図14】



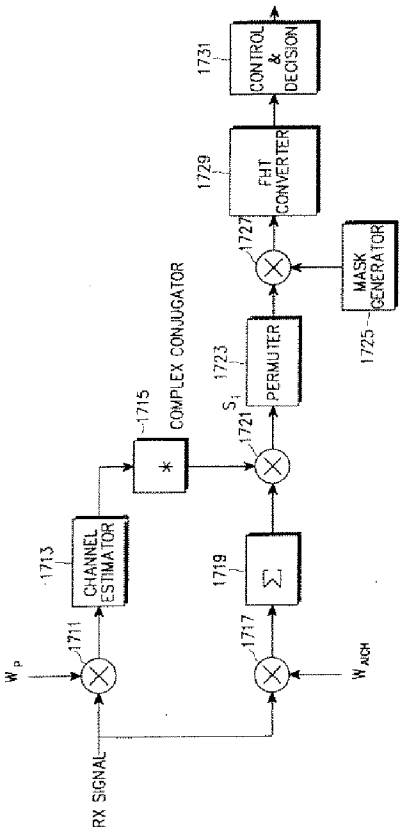
【図15】



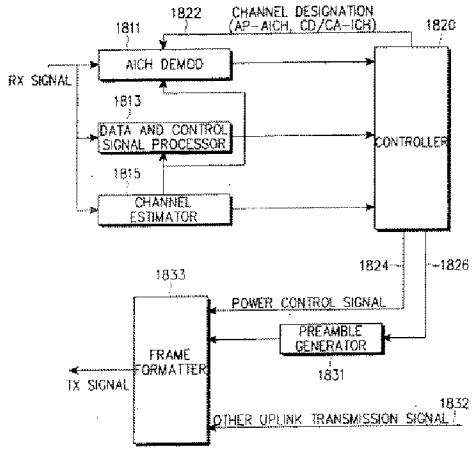
【図16】



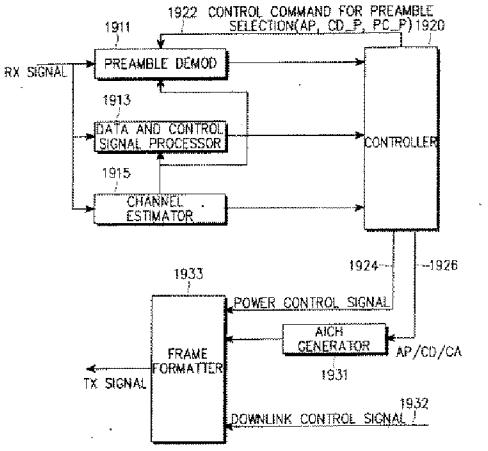
【図17】



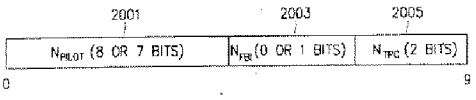
【図18】



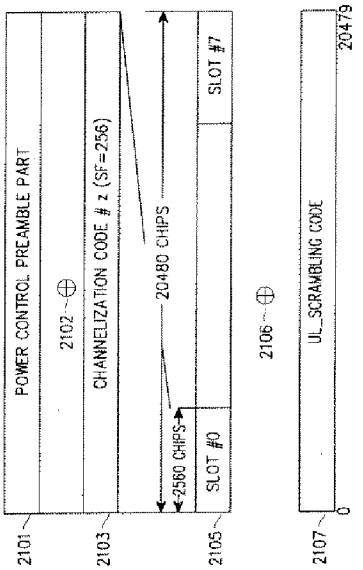
【図19】



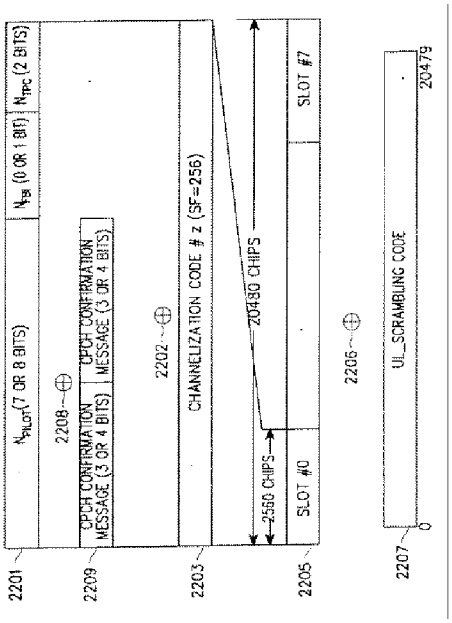
【図20】



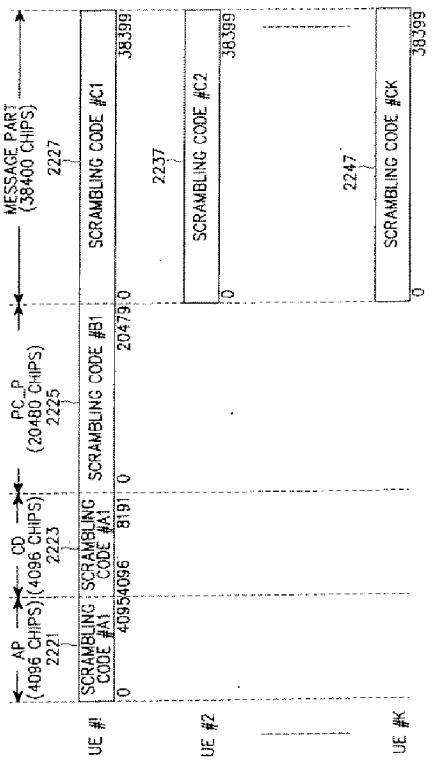
【図21】



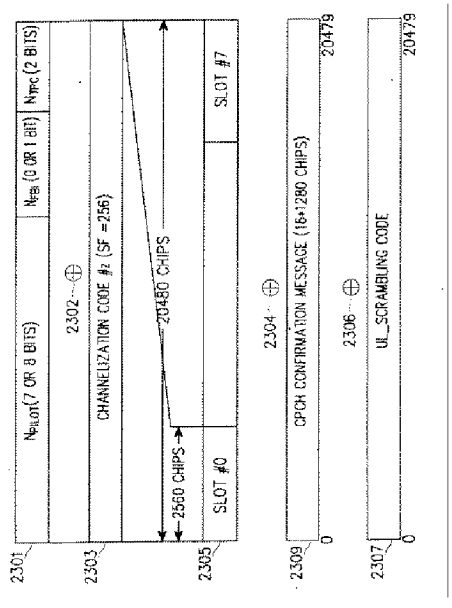
【図22A】



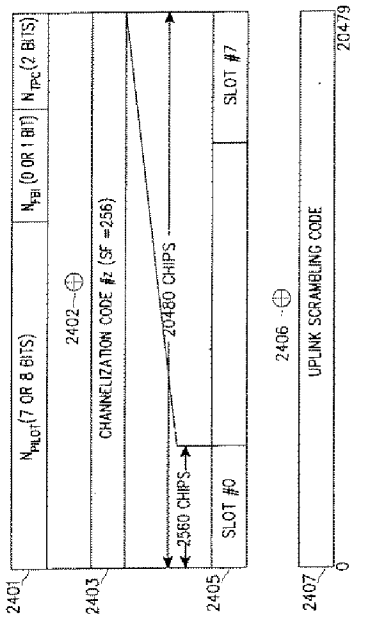
【図22B】



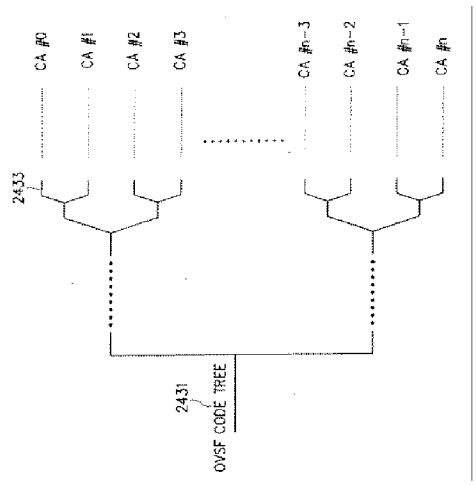
【図23】



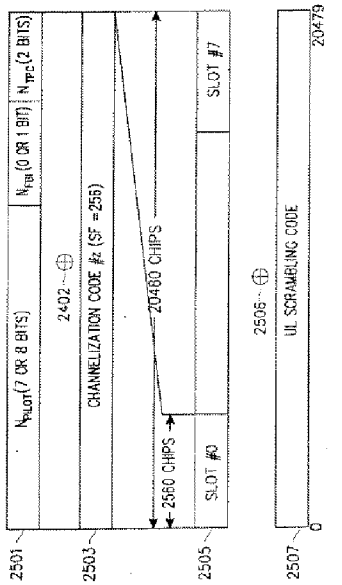
【図24A】



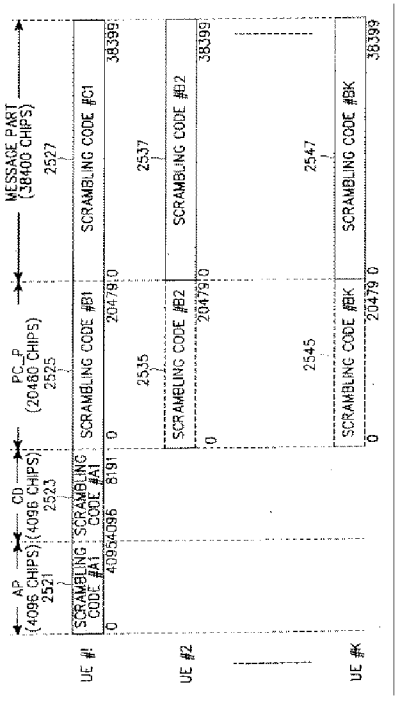
【図24B】



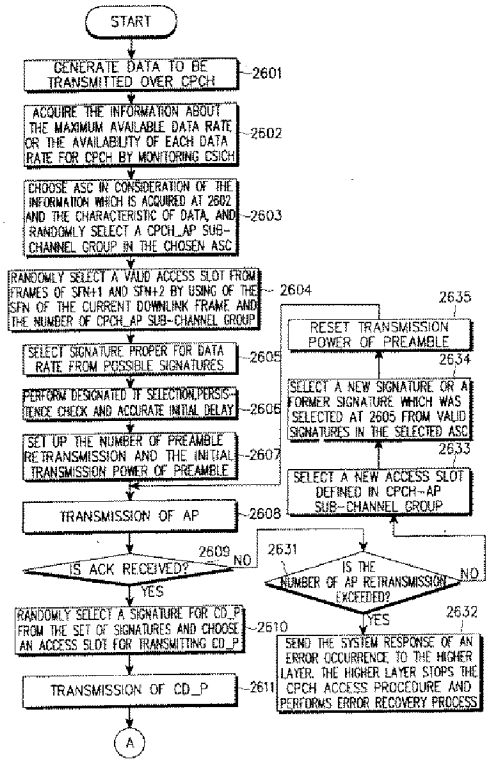
【図25A】



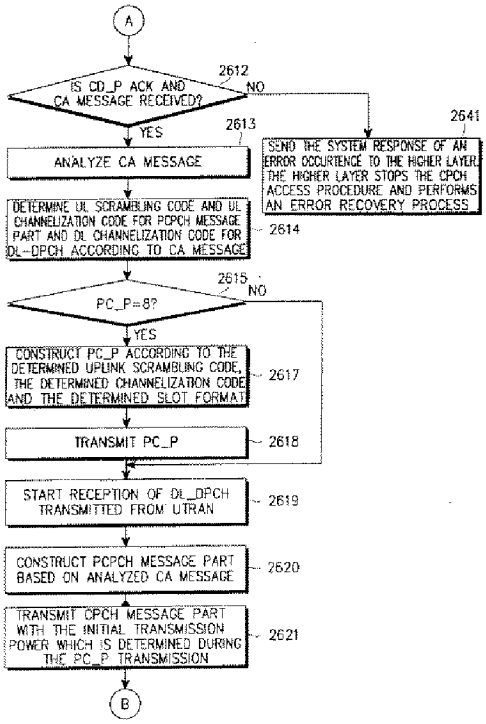
【図25B】



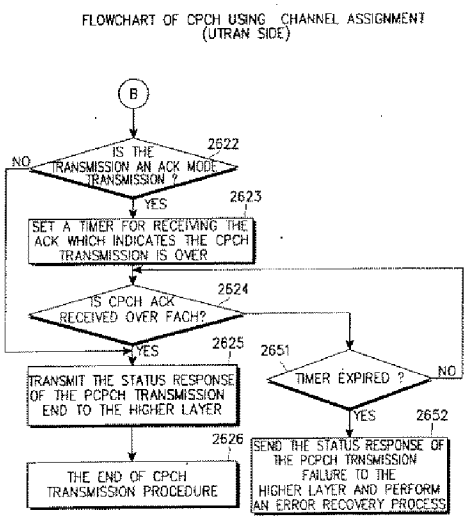
【図26A】



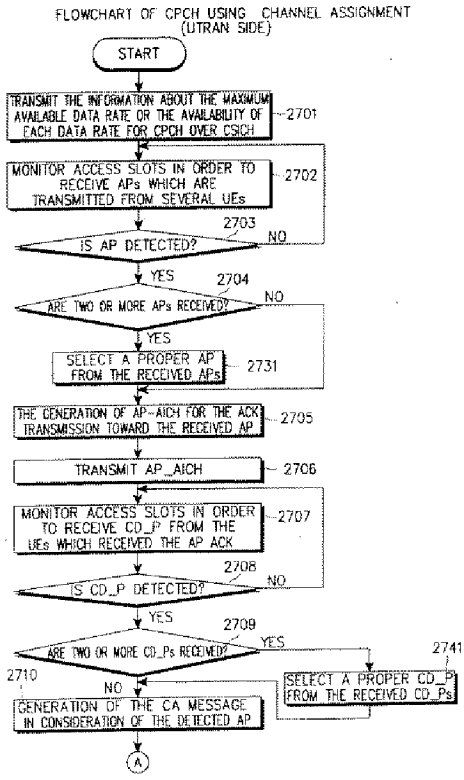
【図26B】



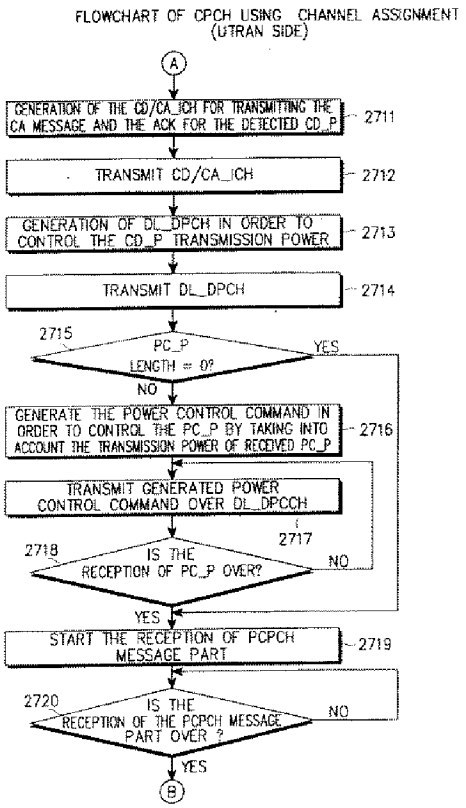
【図26C】



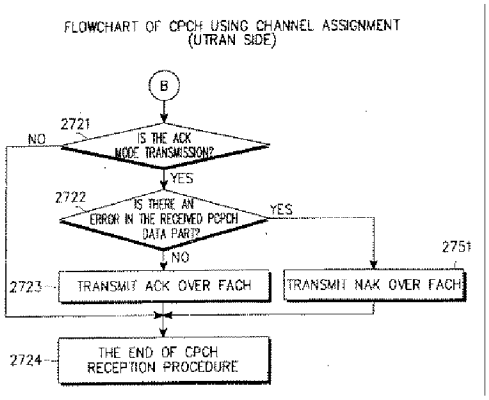
【図27A】



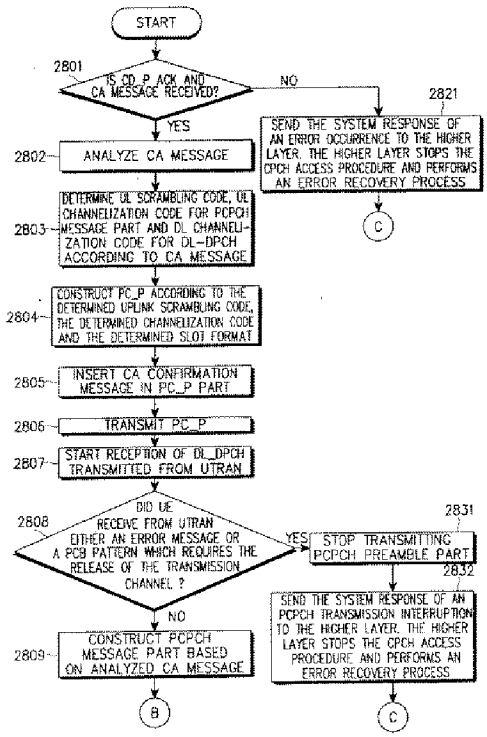
【図27B】



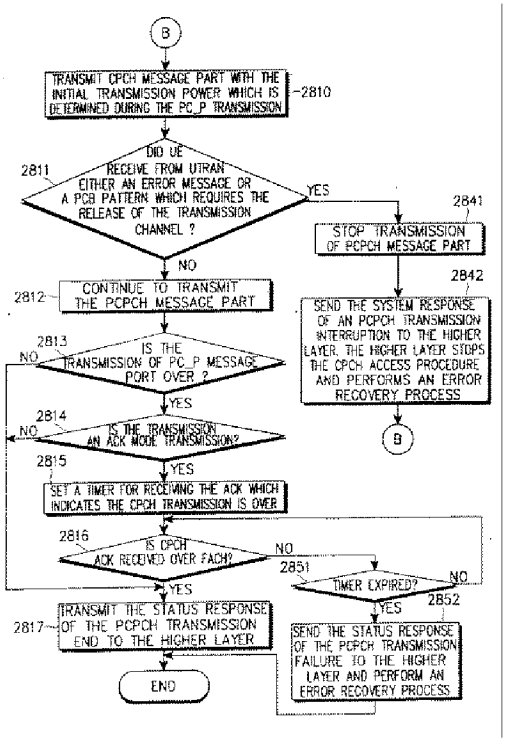
【図27C】



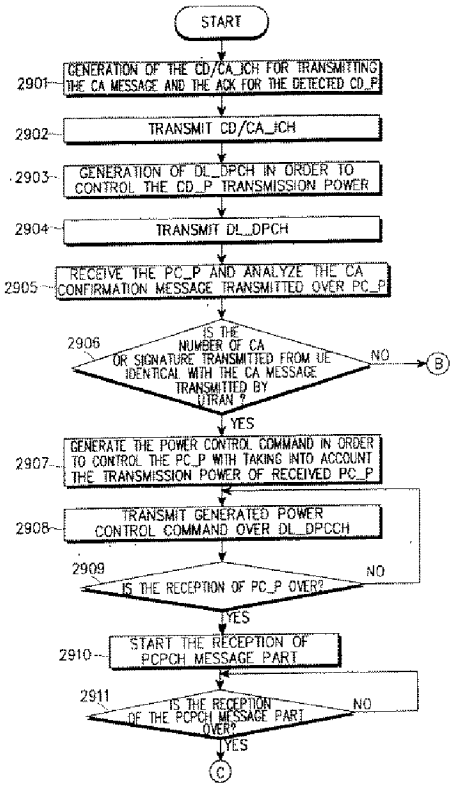
【図28A】



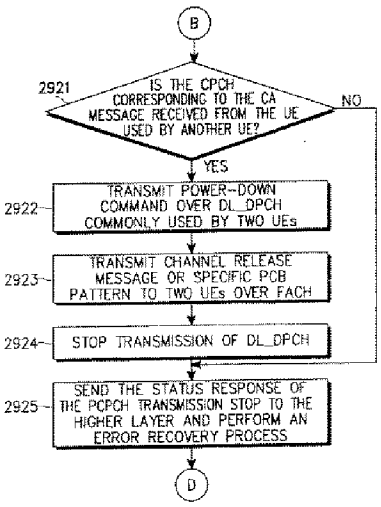
【図28B】



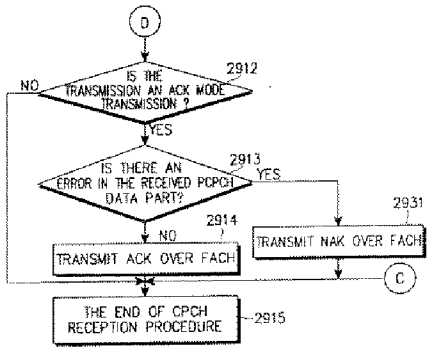
【図29A】



【図29B】



【図29C】



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5K067 AA11 BB04 CC08 CC10 DD23 DD24 GG08 JJ12

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DATA COMMUNICATION METHOD, AND CENTRAL STATION APPARATUS AND TERMINAL IN DATA COMMUNICATION SYSTEM

Publication date:	2005-08-11
Inventor(s):	INOUE HIDEKI; MAEDA TOSHIHIDE +
Applicant(s):	HITACHI LTD +
Classification:	- ***international:*** ***H04B7/24; H04B7/26; H04L12/28; H04L12/56; H04Q7/38;*** (IPC1-7): H04B7/26; H04L12/56; H04Q7/38 - **european:**
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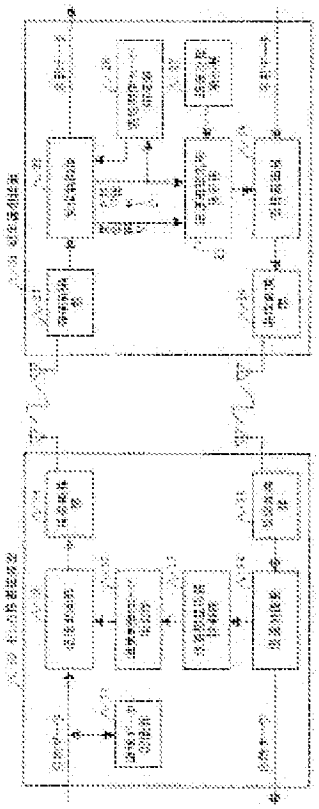
Also published as:	• JP 4189330 (B2) • KR 20050077782 (A) • CN 1649285 (A)

Abstract of JP 2005217743 (A)

PROBLEM TO BE SOLVED: To reliably and efficiently retransmit the data by preventing an acknowledgement from each terminal from causing congestion to the inbound lines of the central station in a data communication system wherein a central station transmits the same data to many terminals. ; SOLUTION: Each terminal 3 is provided with an acknowledgement determining section 23 to place a limit on the number of terminals for transmitting the acknowledgement to the central station 1, thereby preventing congestion from taking place in the inbound lines. Further, the central station 1 is provided with an acknowledgement evaluation section 17 for evaluating how many terminals have not received correct data yet on the basis of the acknowledgement transmitted from part of the terminals, and when the evaluation result shows that there are many terminals having not received the correct data yet, the central station 1 retransmit the data by broadcast communication, and when there are a few terminals having not received the correct data yet, the central station 1 retransmits the data by individual communication. ; COPYRIGHT: (C) 2005,JPO&NCIPI



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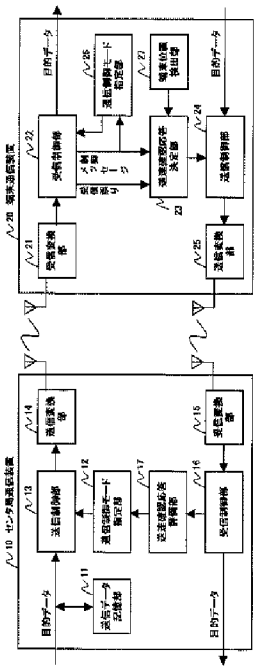
(54)【発明の名称】データ通信方法、並びに、データ通信システムのセンタ局装置及び端末装置

(57)【要約】
【課題】　センタ局から多数の端末装置に対し同一のデータを送信するデータ通信システムにおいて、端末装置からの送達確認応答がセンタ局のインバウンド回線を輻輳させることなく、データの再送を確実に効率よく行うことができるようにする。
【解決手段】　端末装置３に送達確認応答決定部２３を設け、センタ局１に送達確認応答を送信する端末数を制限し、インバウンド回線の輻輳を回避するようにした。また、一部の端末装置３からから送信される送達確認応答によってどの程度の端末装置が未だ正しいデータを受信していないかを評価する送達確認応答評価部１７を設け、その結果により、未だ正しいデータを受信していない端末装置３が多い場合には、同報通信でデータを再送し、少なくなった場合には、個別通信によってデータを再送するようにした。
【選択図】　図２



【特許請求の範囲】
【請求項1】
主として同報データを端末装置に送信するセンタ局装置と、主として同報データを受信する多数の端末装置とからなるデータ通信システムにおけるデータ通信方法であって、
前記センタ局装置が、
前記多数の端末装置に対して前記同報データを送信する同報データ送信ステップと、
前記同報データに対する送達確認応答を受信する送達確認応答受信ステップと、
前記送達確認応答受信ステップにおいて受信される前記多数の端末装置のうちの一部の端末装置から送信される送達確認応答に基づき、前記多数の端末装置全体の送達確認応答の状況を評価する送達確認応答評価ステップと、
前記送達確認応答評価ステップによる評価結果が所定の条件を満足していないときには、前記多数の端末装置に対して前記同報データを再送するデータ再送ステップと、
前記送達確認応答評価ステップによる評価結果が所定の条件を満足しているときには、前記センタ局装置と前記多数の端末装置との間の通信モードを個別通信モードへ移行させる通信モード移行ステップと
を備えることを特徴とするデータ通信方法。
【請求項2】
前記センタ局装置は、前記送達確認応答評価ステップによる評価結果が所定の条件を満足していないときには、前記多数の端末装置に対して前記同報データを再送する前に、前記端末装置との間で行う通信の通信制御モードを変更する旨のメッセージを前記端末装置に送信し、自装置の通信制御モードを当該通信制御モードに変更するセンタ局装置通信制御モード変更ステップ
をさらに備えることを特徴とする請求項１に記載のデータ通信方法。
【請求項3】
主として同報データを端末装置に送信するセンタ局装置と、主として同報データを受信する多数の端末装置からなるデータ通信システムにおけるデータ通信方法であって、
前記端末装置が、
前記センタ局装置から送信される前記同報データを受信する同報データ受信ステップと、
前記同報データ受信ステップにおいて受信された前記同報データに対して送達確認応答をするか否かを決定する送達確認応答決定ステップと、
前記送達確認応答決定ステップにおいて送達確認応答することが決定されたときに、前記センタ局装置に対し送達確認応答を送信する送達確認応答ステップと
を備えることを特徴とするデータ通信方法。
【請求項4】
前記端末装置は、前記送達確認応答決定ステップにおいて、前記センタ局装置から送信されるポーリングメッセージを受信したときには、前記ポーリングメッセージに含まれる情報に基づき送達確認応答するか否かを決定すること
を特徴とする請求項３に記載のデータ通信方法。
【請求項5】
前記端末装置は、前記センタ局装置から通信制御モードを変更する旨のメッセージを受信したときには、自装置の通信制御モードを前記メッセージにより指定される通信制御モードに変更する端末装置通信制御モード変更ステップ
をさらに備えることを特徴とする請求項３又は請求項４に記載のデータ通信方法。
【請求項6】
主として同報データを端末装置に送信するセンタ局装置と、主として同報データを受信する多数の端末装置からなるデータ通信システムのセンタ局装置であって、
前記センタ局装置が、
前記多数の端末装置に対して前記同報データを送信するデータ送信手段と、

前記同報データに対する送達確認応答を受信する送達確認応答受信手段と、
前記送達確認応答受信手段によって受信される前記多数の端末装置のうちの一部の端末装置から送信される送達確認応答に基づき、前記多数の端末装置全体の送達確認応答の状況を評価する送達確認応答評価手段とを備え、
前記送達確認応答評価手段による評価結果が所定の条件を満足していないときには、前記多数の端末装置に対して前記同報データを再送し、
前記送達確認応答評価手段による評価結果が所定の条件を満足しているときには、前記センタ局装置と前記多数の端末装置との間の通信モードを個別通信モードへ移行させる
ことを特徴とするデータ通信システムのセンタ局装置。
【請求項7】
前記送達確認応答評価手段による評価結果が所定の条件を満足していないときには、前記多数の端末装置に対して前記同報データを再送する前に、前記端末装置との間で行う通信の通信制御モードを変更する旨のメッセージを前記端末装置に送信し、自装置の通信制御モードを当該通信制御モードに変更するセンタ局装置通信制御モード変更手段
をさらに備えることを特徴とする請求項６に記載のデータ通信システムのセンタ局装置。
【請求項8】
主として同報データを端末装置に送信するセンタ局装置と、主として同報データを受信する多数の端末装置からなるデータ通信システムの端末装置であって、
前記センタ局装置から送信される前記同報データを受信する同報データ受信手段と、
前記同報データ受信手段により受信された同報データに対して送達確認応答をするか否かを決定する送達確認応答決定手段と、
前記送達確認応答決定手段により送達確認応答することが決定されたときに、センタ局装置に対し送達確認応答を送信する送達確認応答手段と
を備えることを特徴とするデータ通信システムの端末装置。
【請求項9】
前記送達確認応答決定手段は、前記センタ局装置から送信されるポーリングメッセージを受信したときに、前記ポーリングメッセージに含まれる情報に基づき送達確認応答するか否かを決定する送達確認応答決定手段であること
を特徴とする請求項１４に記載のデータ通信システムの端末装置。
【請求項10】
前記端末装置は、前記センタ局装置から通信制御モードを変更する旨のメッセージを受信したときには、自装置の通信制御モードを前記メッセージにより指定される通信制御モードに変更する端末装置通信制御モード変更手段
をさらに備えることを特徴とする請求項８又は請求９に記載のデータ通信システムの端末装置。
【発明の詳細な説明】
【技術分野】
【0001】
本発明は、同報データを端末装置に送信するセンタ局装置と、同報データを受信する多数の端末装置からなるデータ通信ネットワークにおいて送達確認応答を行うデータ通信方法、並びに、データ通信システムのセンタ局装置及び端末装置に関する。
【背景技術】
【0002】
一般に、データ通信ネットワークにおいてデータを送信する場合、その送信データが相手側に正しく受信されたか否かを確認する送達確認が行われている。もし、相手側から正しいデータを受信できなかった旨の送達確認応答が返送された場合には、送信側は同じデータを再送する。このような送達確認応答による再送を繰り返すことによって、ネットワークの回線が必ずしも高品質の回線でなくても、受信側は正しいデータを受信することができる。
【0003】

しかしながら、センタ局装置から多数の端末装置に対して同一のデータを同報的に送信する場合に、すべての端末装置と個別的な送達確認を行おうとすると、センタ局装置には多数の送達確認応答がほぼ同時に返送され、センタ局装置へのインバウンド（外から内側への）回線が輻輳することになる。そのため、センタ局装置は、送達確認処理に長時間を要することになったり、あるいは、タイムアウトによって実質的にはすべての端末装置からの送達確認応答を受け取ることができなかったりした。

【0004】

そこで、特許文献１に開示されているデータ通信システムにおいては、あらかじめ多数の端末装置をグループ化し、そのグループごとに代表端末装置を定め、最初はその代表端末装置のみがセンタ局装置へ送達確認応答を返送するようにしている。そして、非代表端末装置は、代表端末装置がセンタ局装置へ送信する送達確認応答をモニタしておき、非代表端末装置の送達確認応答が代表端末装置の送達確認応答と異なり、かつ、否定の送達確認応答であるときのみ、センタ局装置へ送達確認応答を返送するようにしている。このように特許文献１のデータ通信システムでは、端末装置が返送する送達確認応答の数を低減することによって、インバウンド回線の輻輳を回避している。

【特許文献1】特開平１１－１９６０４１号公報（段落００１８～００４２、図３～図８）

【発明の開示】

【発明が解決しようとする課題】

【0005】

近年、例えば、走行中の車両に搭載された端末装置に対し、同報的に交通情報等を提供するデータ通信システムが実用に供されてきている。このような情報提供のためのデータ通信システムでは、通信の信頼性を確保するために、センタ局装置と端末装置との間で送達の確認を行い、必要に応じて再送を行うことが、必須の要件となっている。しかしながら、このような場合においては、端末装置の数が数万から数１０万あるいはそれ以上に及ぶこともあるため、センタ局装置のインバウンド回線が輻輳する問題が当然生じることになる。しかも、端末装置は各々が移動し、また、センタ局装置と端末装置との間の通信は無線で行われるので、特許文献１のデータ通信システムのように代表端末装置を定めることも、他の端末装置の送達確認応答をモニタすることもできない。すなわち、このようなデータ通信システムにおいては、特許文献１に開示されているようなインバウンド回線輻輳回避の方法は適用できない。

【0006】

そこで、本発明においては、センタ局装置から多数の端末装置に対し同一のデータを送信するデータ通信システムにおいて、代表端末装置をあらかじめ決定しておかなくても、端末装置の送達確認応答によるセンタ局装置のインバウンド回線の輻輳を回避することができ、また、端末装置へのデータの再送を確実かつ効率よく行うことができる手段を提供することを、解決すべき課題とする。

【課題を解決するための手段】

【0007】

前記の課題を解決するために、本発明では、主として同報データを端末装置に送信するセンタ局装置と、主として同報データを受信する多数の端末装置とからなるデータ通信システムにおけるデータ通信方法が、（１）センタ局装置が、多数の端末装置に対して同報データを送信する同報データ送信ステップと、（２）端末装置が、センタ局装置から送信された同報データを受信する同報データ受信ステップと、（３）端末装置が、前記受信した同報データに対する送達確認応答をするか否かを決定する送達確認応答決定ステップと、（４）送達確認応答決定ステップにおいて応答することを決定された端末装置が、センタ局装置に対し送達確認応答を送信する送達確認応答ステップと、（５）センタ局装置が、多数の端末装置のうちの一部の端末装置から送信された送達確認応答に基づき、多数の端末装置全体から送信される送達確認応答の状況を評価する送達確認応答評価ステップと、（６）センタ局装置が、送達確認応答評価ステップの評価結果が所定の条件を満足して

いないと判断したときには、多数の端末装置に対して同報データを再送するデータ再送ステップと、（７）センタ局装置が、送達確認応答評価ステップの評価結果が所定の条件を満足していると判断したときには、センタ局装置と多数の端末装置との間の通信モードを個別通信モードへ移行する通信モード移行ステップとを備えるものとした。

【0008】

また、本発明では、センタ局装置に、多数の端末装置に対して同報データを送信するデータ送信手段と、多数の端末装置のうちの一部の端末装置から送信された送達確認応答に基づき、多数の端末装置全体から送信される送達確認応答の状況を評価する送達確認応答評価手段とを設け、また、端末装置に、センタ局装置から送信された同報データを受信する同報データ受信手段と、受信された同報データに対する送達確認応答をするか否かを決定する送達確認応答決定手段と、送達確認応答決定手段により応答することを決定されたときに、センタ局装置に対し送達確認応答を送信する送達確認応答手段とを設け、センタ局装置は、送達確認応答評価手段による評価結果が所定の条件を満足していないと判断したときには、前記多数の端末装置に対して前記同報データを再送し、所定の条件を満足していると判断したときには、多数の端末装置との間の通信モードを個別通信モードへ移行させるようにした。

【0009】

以上のように、本発明においては、端末装置が送達確認応答決定手段を備えたことにより、端末装置自身が送達確認応答をするか否かを決定し、送達確認応答をすることができる。そのため、あらかじめ代表端末を決定しておく必要がない。また、一部の端末装置のみが送達確認応答をするので、センタ局装置に送信する送達確認応答の数を削減させることができ、センタ局装置のインバウンド回線の輻輳を回避させることが可能となる。一方、センタ局装置では、送達確認応答評価手段によって一部の端末装置の送達確認応答の状況に基づき、多数の端末装置のうちどの程度の端末装置が未だ正しいデータを受信していないかを評価することができる。そして、その結果に基づき、未だ正しいデータを受信していない端末装置が多い場合には、同報通信でデータを再送し、少なくなった場合には、個別通信によってデータを再送する。

【発明の効果】

【0010】

本発明によれば、センタ局装置から多数の端末装置に対し同一のデータを送信するデータ通信システムにおいて、固定の代表端末を定めなくても、端末装置からの送達確認応答を削減することができ、センタ局装置のインバウンド回線の輻輳を回避することができる。また、端末装置へのデータの再送を効率よく確実に行うことができる。

【発明を実施するための最良の形態】

【0011】

以下、本発明の実施形態について、適宜図面を参照しながら詳細に説明する。

【0012】

図１は、本発明を適用した人工衛星を用いた通信システムの全体構成図の例である。

図１の通信システムは、センタ局１、人工衛星２、及び、多数の端末装置３からなる端末群３ａを主たる構成要素とする。ここで、センタ局１と各々の端末装置３とは、センタ局１から人工衛星２を経由して端末群３ａへ向かうアウトバウンド回線４と、端末群３ａから人工衛星２を経由してセンタ局１へ向かうインバウンド回線５とによって接続されている。また、端末装置３の一部は、直接又は無線ＬＡＮ（Local Area Network）７により地上のインタネット８を経由してセンタ局１と接続されていてもよい。さらに、端末装置３の他の一部は、携帯電話回線６、携帯電話基地局６ａ及びインタネット８又は専用回線９を経由してセンタ局１と接続されていてもよい。なお、この実施形態でいうセンタ局は、請求項でいうセンタ局装置を略称したものである。

【0013】

図１の通信システムにおいて、センタ局１は、人工衛星２を中継局としたアウトバウンド回線４を介して、多数の端末装置３からなる端末群３ａに対し各種の情報を同報データ

として送信する。例えば、端末装置３の多くが走行中の車両に搭載され、センタ局１は、その車上の端末装置３に、例えば道路の混雑状況等の情報を同報データとして提供する。また、この通信システムにおいては、一方向の衛星放送と異なり、端末装置３が受信誤りを起こした場合には、端末装置３は、インバウンド回線５を介してセンタ局１に、受信失敗を意味する送達確認応答のメッセージを送信することにより、データの再送を要求する。データを再送することによって、データ送受信の信頼性を高めることができる。

【0014】

図１の通信システムでは、アウトバウンド回線４の通信方式として、例えば、ＴＤＭ（Time Division Multiplexing）を用いる。ＴＤＭにおいては、通信動作のスケジューリングは、センタ局１又は人工衛星２によって全て制御可能である。従って、センタ局１は、データの再送制御や冗長化等の方式を任意に設定し、変更することができる。また、アウトバウンド回線４がＴＤＭ回線であれば、すべての端末装置３は、その送信データをすべて受信することができる。従って、ＴＤＭによって、センタ局１は、容易に多数の端末装置３に宛てて同報データを送信することができる。

【0015】

一方、インバウンド回線５、すなわち、端末装置３からセンタ局１へ向かう回線においては、個別に通信が行われるので、多数の端末装置３による競合アクセス方式とする必要がある。ここでは、インバウンド回線５の通信方式を、例えば、ＦＤＭＡ（Frequency Division Multiple Access）とする。ＦＤＭＡでは、キャリアの帯域によって同時アクセスの回線数が限られることになるので、多数の端末装置３が同時にセンタ局１にアクセスする場合には、インバウンド回線５が輻輳することになる。

【0016】

なお、図１の通信システムの構成において、端末装置３は、車両に搭載された移動端末だけでなく、パソコンなどによる固定端末であってもよく、また、ＰＤＡ（Personal Digital Assistant）等の移動端末であってもよい。また、センタ局１は、必ずしも地上局である必要はなく、人工衛星２の上に搭載されたものでもよい。さらに、端末装置３からセンタ局１へ向かうインバウンド回線５は、ＦＤＭＡ回線としたが、その一部又は全部が、携帯電話回線６やＰＨＳ（Personal Handy phone System）回線など地上系無線通信回線を用いても、無線ＬＡＮ（IEEE802.11b,a及びその後継規格、互換規格）、ｂｌｕｅｔｏｏｔｈ（IEEE802.15及びその後継規格、互換規格）、ＵＷＢ（Ultra Wide Band）などの地上系無線通信回線を介してもよい。また、固定の端末装置３の場合には、有線の通信回線を用いてもよい。これら地上の通信回線を介したインバウンド方向の送信データは、インタネット８を介してセンタ局１へ送信しても、専用回線９などを介して直接センタ局１へ送信してもよい。

【0017】

次に、本実施形態におけるセンタ局１及び端末装置３それぞれにおける通信装置の構成並びにその間で行われる通信動作について図２及び図３を参照しつつ説明する。ここで、図２は、センタ局１及び端末装置３それぞれにおける通信装置のブロック構成の例を示した図であり、図３は、センタ局１と端末群３ａとの間で行われる通信のシーケンスの例を示した図である。

【0018】

図２において、センタ局通信装置１０は、送信データ記憶部１１、通信制御モード指定部１２、送信制御部１３、送信変換部１４、受信変換部１５、受信制御部１６、送達確認応答評価部１７等を備える。また、端末通信装置２０は、受信変換部２１、受信制御部２２、送達確認応答決定部２３、送信制御部２４、送信変換部２５、通信制御モード指定部２６、端末位置検出部２７等を備える。

【0019】

また、図３に示すように、本発明の実施形態における通信シーケンスの特徴は、最初はセンタ局１が端末群３ａとの間で同報通信モードによってデータ通信を行い、センタ局１が端末群３ａから送信される否定の送達確認応答（ＮＡＫ）の数がある基準値以下になっ

たと判断したときは（Ｓ１４５：詳細後記）、データ通信モードを個別通信モードに切り換える点にある。また、同報通信モード時には、センタ局１から送信される同報データに対して、一部の端末装置３のみしか送達確認応答をセンタ局１へ送信しないようにし（Ｓ１２０ａ等：詳細後記）、個別通信モード時になって初めてすべての端末装置３が送達確認応答をセンタ局１へ送信するようにする。こうすることによって、センタ局１が送信する同報データに対して端末群３ａが送信する送達確認応答の数を制限することができ、送達確認応答に伴うインバウンド回線５の輻輳を回避することができる。なお、図３において、送達確認応答は、ＡＣＫ（Acknowledgement：肯定の送達確認応答）又はＮＡＫ（Negative Acknowledgement：否定の送達確認応答）と表記されており、本明細書においても必要に応じてＡＣＫ又はＮＡＫの表記を用いる。

【0020】

次に、図２に戻って、各ブロックの機能と動作を説明する。まず、センタ局１は、端末群３ａに向けて、目的データを同報データとして送信する。ここで、目的データとは、センタ局１が端末装置３へ転送しようとするデータの本体をいい、例えばファイルなど所定のデータ量を有するデータのかたまりをいう。目的データは、一般には複数個のパケットによって送受信されるが、以下の説明では、１つのパケットで送受信されるものとする。また、センタ局１と端末装置３との間で送受信されるデータには、目的データの他に、制御メッセージがある。制御メッセージは、センタ局１と端末装置３との通信の制御に用いられる送受信データをいい、前記の送達確認応答も制御メッセージに含まれる。

【0021】

センタ局通信装置１０に入力される目的データは、例えばコンピュータ等の上位層のシステムによって供給される。入力された目的データは、再送処理等に備えて、送信データ記憶部１１に記憶されるとともに、送信制御部１３においてデータフレームが再構成されたり、誤り検出・訂正のための符号化がされたりする。さらに、目的データは、送信制御部１３において所定の形式にパケット化され、モデム等からなる送信変換部１４においてアウトバウンド回線４の仕様に即した変調や周波数変換が加えられ、アンテナ等を介して端末群３ａへ向けて送信される。なお、センタ局１と端末装置３とが有線で接続されている場合は、アンテナではなく、例えば、ＬＡＮケーブルに接続するコネクタがそれに相当する。なお、送信制御部１３は、端末装置３に対する種々の制御メッセージを生成し、それらのメッセージを目的データと同様に、送信変換部１４を介して端末群３ａへ向けて送信することができる。

【0022】

端末通信装置２０は、センタ局１が送信した信号を、アンテナ又はコネクタを介して受信し、その受信した信号は、モデム等からなる受信変換部２１によって復調され、ディジタル信号に変換される。受信制御部２２は、ディジタル化された受信データのパケットを解体するとともに、所定の誤り検出・訂正処理を行い、目的データを復元する。その誤り検出・訂正処理において受信誤りがない目的データは、例えば端末装置３に含まれる表示制御装置（図示せず）等の上位層のシステムへ出力される。

【0023】

また、受信制御部２２は、所定の誤り検出・訂正処理の結果を送達確認応答決定部２３へ通知する。通知を受けた送達確認応答決定部２３は、所定の決定方法（詳細後記）に基づき、自己が送達確認応答をすべきか否かを決定する。その結果、送達確認応答をすべきことが決定された場合には、送達確認応答決定部２３は、送信制御部２４に対してセンタ局１へ受信の成否を示す送達確認応答（ＡＣＫ／ＮＡＫ）を送信するよう指示する。送信制御部２４は、その指示に従い、センタ局１へＡＣＫ／ＮＡＫを送信し、ＮＡＫ送信によって目的データの再送を要求する。ＡＣＫ／ＮＡＫメッセージは、送信に際しパケット化され、送信変換部２５においてインバウンド回線５の仕様に即して変調され、端末通信装置２０のアンテナ又はコネクタから送信される。なお、端末通信装置２０は、目的データを送信することができ、また、ＡＣＫ／ＮＡＫ以外の制御メッセージを送信することもできる。

【0024】
次に、センタ局通信装置１０は、アンテナ又はコネクタを介して端末通信装置２０から送信された信号を受信し、その受信信号は、モデム等からなる受信変換部１５において復調され、ディジタル信号に変換される。ディジタル化された受信信号は、受信制御部１６において、パケットが解体されるとともに、所定の誤り検出・訂正が行われ、目的データ又はＡＣＫ／ＮＡＫ等の制御メッセージが復元される。
【0025】
ここで、送達確認応答評価部１７は、端末群３ａから返送される送達確認応答（ＡＣＫ／ＮＡＫ）メッセージを監視し、端末群３ａの端末装置３のうちどの程度の数の端末装置３がセンタ局１から送信された目的データ（同報データ）を正しく受信しているか否かを推定し、評価する。その結果、正しい目的データを受信できていない端末装置３の数がある所定の数より大きい場合には、送達確認応答評価部１７は、送信制御部１３に対して目的データの再送を指示し、また、正しい目的データを受信できていない端末装置３の数がある所定の数より小さくなった場合には、送達確認応答評価部１７は、通信制御モード指定部１２にその旨を通知する。
【0026】
通信制御モード指定部１２は、その通知を受けて、送信制御部１３に対して個別通信モードへの移行指示メッセージの送信を指示する。送信制御部１３は、個別通信モードへの移行指示メッセージの送信のために、パケット化等の処理を行い、さらに、送信変換部１４は、それを変調等して、アンテナ又はコネクタから端末群３ａへ向けて送信する。その送信が終了すると、通信制御モード指定部１２は、送信制御部１３の通信モードを個別通信モードへ切り換える。
【0027】
また、端末通信装置２０においては、受信変換部２１を介して受信された個別通信モードへの移行指示メッセージが、受信制御部２２において制御メッセージと解釈されて、その旨が通信制御モード指定部２６に通知される。通信制御モード指定部２６は、その通知を受けて、受信制御部２２の通信モードを個別通信モードへ切り換える。
【0028】
次に、図３に基づき、また、適宜図２を参照しながらセンタ局１と端末群３ａとの間で行われる通信のシーケンスの例を説明する。なお、この通信のシーケンスの例は、説明のための動作の一例であるので、判断分岐ブロックにおけるシーケンスの流れは、その説明の状況に応じて１つの分岐方向に従って分岐している。また、図３では、端末群３ａの端末装置３の動作は、端末Ａ及び端末Ｂで代表させて説明している。
【0029】
まず、センタ局１は、目的データを同報データとして端末群３ａへ向けて送信する（Ｓ１１０）。端末Ａ及び端末Ｂは、送信された目的データを受信し（Ｓ１１０ａ、Ｓ１１０ｂ）、各々の受信制御部２２において受信誤りがなかったか否かを検査する。その結果、誤りがなければ、センタ局１に対して肯定の送達確認応答（ＡＣＫ）を送信し、誤りがあれば、否定の送達確認応答（ＮＡＫ）を送信する。つまり、ＡＣＫは、目的データの受信成功を、また、ＮＡＫは、目的データの受信失敗を意味する。ここでは、端末Ａ及び端末Ｂいずれにおいても受信誤りがあったものとして、ＮＡＫを送信している（１２０ａ、１２０ｂ）。なお、本実施形態においては、ルールとしてあらかじめ定めておけば、同報通信モードの間は、ＡＣＫ／ＮＡＫともに応答するようにしてもよく、ＡＣＫのみ又はＮＡＫのみ応答するようにしてもよい。
【0030】
次に、センタ局１は、端末群３ａから送信される送達確認応答（ＡＣＫ／ＮＡＫ）を受信する（Ｓ１２０）。このとき、端末群３ａのすべての端末装置３からＡＣＫ／ＮＡＫの送信がなされるとすれば、インバウンド回線５は、すぐに輻輳してしまう。そこで、本実施形態においては、端末通信装置２０に送達確認応答決定部２３が設けられ（図２参照）、自身の送達確認応答決定部２３により送達確認応答することを決定した端末装置３のみ

が、送達確認応答（ＡＣＫ／ＮＡＫ）をセンタ局１へ送信する。こうすることによって、ＡＣＫ／ＮＡＫの送信数を削減し、インバウンド回線５の輻輳を回避することができる。

【0031】

ここで、送達確認応答決定部２３が送達確認応答すべきか否かは、例えば、自己の機器番号や勝手に発生させた乱数に従って独自に決定することができる。ただし、送達確認応答する端末装置３のおよその数を確定するために、センタ局１は、あらかじめ端末装置３に返信率を指定する。返信率は、端末装置３が送達確認応答する確率である。例えば、返信率として１％が指定されている場合には、端末装置３は、例えば乱数を発生させ、その乱数の下２桁の数字が、例えば「２３」のとき送達確認応答するとすればよい。すると、端末装置３は、およそ１００台に１台の割合で送達確認応答を送信する。なお、「２３」のような基準となる数は、乱数で発生させてもよいし、機器番号の下２桁の数字としてもよい。また、返信率は、専用の制御メッセージのデータとして、又は、目的データのヘッダ部分の付加情報として、端末装置３へ送信することができる。

【0032】

センタ局１は、ポーリングすることによって送達確認応答すべき端末装置３を直接指定することができる。また、アウトバウンド回線４がＴＤＭの場合には、センタ局１は、複数の端末装置３を指定して又は同報送信データとして、ポーリングメッセージを送信することができる。この場合には、対象の端末装置３は、ポーリングメッセージに付属させたデータによって指定される。例えば、ポーリングメッセージに県名等の地理的位置情報を含ませておくと、そのポーリングメッセージを受信した端末装置３は、例えば、ＧＰＳ（Global Positioning System）等の端末位置検出部２７によって得られる位置情報をもとに送達確認応答すべきか否かを決定する。なお、端末装置３は、ポーリングメッセージを受信し、送達確認応答の対象とされたときに、送達確認応答を送信すればよい。

【0033】

図３において、端末Ａ及び端末Ｂは、その送達確認応答決定部２３により送達確認応答すべきものと決定された端末装置３の例である。ここでは、いずれもＮＡＫを送信（Ｓ１２０ａ、Ｓ１２０ｂ）としているが、もし、端末Ａ及び端末Ｂが送達確認応答すべきでないと決定された端末装置３である場合には、ステップＳ１２０ａ、Ｓ１２０ｂのＮＡＫの送信は行われない。

【0034】

次に、センタ局１は、端末群３ａから送信される送達確認応答（ＡＣＫ／ＮＡＫ）を受信する（Ｓ１２０）と、送達確認応答評価部１７においてＮＡＫの受信数が基準値以下になったか否かを判定する（Ｓ１２５）。この判定は、センタ局１から送信された目的データの受信に成功していない端末装置３が、どの程度の数残存しているかを推定し、その残存している端末装置３が送達確認応答（ＡＣＫ／ＮＡＫ）を送信したときにインバウンド回線５を輻輳させるか否かを判定しようとするものである。

【0035】

例えば、ここで、インバウンド回線５の輻輳が１０００以下の端末装置３との通信では生じないとし、端末装置３の総数が１０万台であるとすれば、最初の返信率は、１％とする必要がある。この場合、１０００台の端末装置３からＡＣＫ／ＮＡＫの応答を期待することができるので、ＮＡＫの受信数の基準値は１０となる。そこで、端末装置３の５％が受信に失敗し、実際のＮＡＫの受信数が５０であったとすれば、ステップＳ１２５の判定条件を満たさない。なお、受信の失敗率５％から推定すれば、正しいデータを受信できなかった端末装置３が、全体でまだ５０００台残存していることになる。

【0036】

そこで、センタ局１は、端末群３ａに対し目的データを再送する（Ｓ１３０）。端末Ａ及び端末Ｂは、先の目的データの受信に失敗したので、その再送された目的データを受信する（Ｓ１３０ａ、Ｓ１３０ｂ）。ここで、先の目的データの受信に成功した端末装置３は、再送される目的データを受信する必要がない。

次に、端末Ａ及び端末Ｂは、受信誤りの有無を検査する（Ｓ１３５ａ、Ｓ１３５ｂ）。

そして、送達確認応答決定部２３により送達確認応答することが決定された場合には、センタ局１へ送達確認応答を送信する。ここでは、端末Aは、受信誤りがあったので、センタ局１へＮＡＫを送信し（Ｓ１４０ａ）、また、端末Bは、受信誤りがなかったので、センタ局１へＡＣＫを送信して（Ｓ１４０ｂ）、受信動作を完了している。

【0037】

なお、前記の例に即すれば、正しいデータを受信できなかった端末装置３が５０００台残存し、インバウンド回線５の輻輳は１０００以下の端末装置３との通信までは生じないので、送達確認応答決定のおける返信率は２０％となる。この場合には、センタ局１は、前と同様に１０００台の端末装置３からＡＣＫ／ＮＡＫの応答を期待することができる。従って、通信の条件や環境に変化がないとすれば、ＮＡＫの受信数の基準値は２００とすることができる。

【0038】

次に、センタ局１は、端末群３ａから送信される送達確認応答（ＡＣＫ／ＮＡＫ）を、再度、受信する（Ｓ１４０）。端末装置３の受信失敗率が５％のままであれば、ＮＡＫの受信数は５０となる。従って、ＮＡＫの受信数が基準値以下となる（Ｓ１４５）。この時点で、目的データの受信に成功していない端末装置３の数は、２５０台と推定される。この数の端末装置３は、もはやインバウンド回線５を輻輳させることはない。

【0039】

そこで、センタ局１は、センタ局１と端末装置３との間の通信モードを同報通信モードから個別通信モードへ移行すべく、端末群３ａに対して個別通信モードへの移行指示メッセージを送信する（Ｓ１５０）。端末Aは、個別通信モードへの移行指示メッセージを受信して（Ｓ１５０ａ）、その通信モードを個別通信モードへ移行する（Ｓ１５５ａ）。ここで、端末群３ａの端末装置３のうち、未だ目的データの受信に成功していない端末装置３も、同様に、個別通信モードへの移行指示メッセージを受信して、その通信モードを個別通信モードへ移行する。なお、ＴＤＭ等の場合のように通信方式によっては、同報通信モードと個別通信モードとを区別する必要がない場合もある。その場合には、個別通信モードへの移行指示メッセージの送信（Ｓ１５０）は、不要である。

【0040】

一方、ステップＳ１４５において、ＮＡＫの受信数が基準値以下になっていない場合には、センタ局１及び端末Aは、ステップＳ１３０～ステップＳ１４５までの動作を、ＮＡＫの受信数が基準値以下になるまで繰り返し行う。すなわち、目的データの再送は、目的データの受信に成功していない端末装置３が個別通信をしてもインバウンド回線５を輻輳させることがない程度に少なくなるまで繰り返される。

【0041】

次に、通信モードが個別通信モードへ移行すると、端末Aを含め、未だに目的データの受信に成功していない端末装置３は、目的データの再送要求メッセージをセンタ局１に送信し（Ｓ１６０ａ）、センタ局１は、その目的データの再送要求メッセージを受信する（Ｓ１６０）。この段階になれば、目的データを正しく受信できていない端末装置３の数は十分少なくなっているので、この送信によってインバウンド回線５が輻輳することはない。なお、この目的データの再送要求メッセージは、送達確認応答としてのＮＡＫであってもよいが、ＮＡＫとは独立した制御メッセージとしてもよい。

【0042】

目的データの再送要求メッセージを受信したセンタ局１は、それを送信した端末装置３に対して個別に目的データを再送する（Ｓ１７０）。その再送を受けた端末装置３は、目的データを受信し（Ｓ１７０ａ）、受信誤りの有無を検査し（Ｓ１７０ｂ）、誤りがあった場合には、ＮＡＫをセンタ局１へ送信して、再度目的データの再送を求める（図示省略）。また、受信誤りの有無を検査し（Ｓ１７５ａ）、誤りがなかった場合には、ＡＣＫをセンタ局１へ送信して（Ｓ１８０ａ）、受信動作を完了する。一方、センタ局１は、端末装置３から送信されるＡＣＫを受信して（Ｓ１８０）、かつ、個別通信動作をした全端末装置からＡＣＫを受信したことを確認して（Ｓ１８５）、一連の送信動作を完了する。

【0043】
以上のように、本実施形態においては、端末装置３の端末通信装置２０に送達確認応答決定部２３を設けたことにより、センタ局１から送信される目的データに対して送達確認応答決定部２３が送達確認応答すると決定した端末装置３のみが、センタ局１へ送達確認応答（ＡＣＫ／ＮＡＫ）を送信することになる。従って、センタ局１と通信する端末装置３の数が、例えば数１０万の超える大きな数であっても、例えば返信率を０．１％程度に設定すれば、送達確認応答（ＡＣＫ／ＮＡＫ）の数を、数１００程度で済ませることができる。よって、端末装置３がセンタ局１へ送信する送達確認応答（ＡＣＫ／ＮＡＫ）のために、インバウンド回線５が輻輳することはない。
【0044】
また、センタ局通信装置１０に、送達確認応答評価部１７を設けたので、センタ局１は、端末装置３から送信される送達確認応答（ＡＣＫ／ＮＡＫ）の数を評価することができる。これにより、センタ局１は、目的データの受信に成功していない端末装置３の数を推定することができる。そこで、その推定値が所定の数以下になった場合、言い換えれば、ＮＡＫの受信数が所定の数以下になった場合には、センタ局１は、端末装置３との間の通信モードを個別通信モードに切り換えて、通信を行うようにする。こうすることによって、目的データを要求している端末装置３は、インバウンド回線５を輻輳させることなく確実に誤りのない目的データを受信することができる。
【0045】
以上、本発明の一実施形態について説明したが、図４～図７を用いて、この実施形態をさらに補足して説明する。ここで、図４は、センタ局１が送達確認応答すべき端末装置３をポーリングする場合に、センタ局１と端末群３ａとの間で行われる通信のシーケンスの例を示す図であり、図５は、センタ局１が端末群３ａに対して通信制御モード変更メッセージを送信する場合に、センタ局１と端末群３ａとの間で行われる通信のシーケンスの例を示すである。また、図６は、同報通信モード時のセンタ局通信装置１０の通信動作を示すフローチャートの例であり、図７は、同報通信モード時の端末通信装置２０の通信動作を示すフローチャートの例である。
【0046】
図４は、センタ局１が送達確認応答すべき端末装置３をポーリングする場合に、センタ局１と端末群３ａとの間で行われる通信のシーケンスの例を示す図であるが、これは、図３の一部を修正するための図である。そこで、図４においては、図３と対応する同一の動作を示すブロックには同一の符号を付している。また、図４においては、端末Ｂの図示を省略している。
【0047】
図４において、センタ局１は、まず、目的データを同報データとして端末群３ａへ向けて送信する（Ｓ１１０）。端末Ａは、その送信された目的データを受信し（Ｓ１１０ａ）、受信制御部２２において受信誤りがなかったか否かを検査する。次に、センタ局１は、端末装置３を例えば端末Ａと指定してポーリングメッセージを送信する（Ｓ１１７）。端末Ａは、ポーリングメッセージを受信して（Ｓ１１７ａ）、先に検査した受信誤りの結果に基づき、送達確認応答（ＡＣＫ／ＮＡＫ）をセンタ局１へ送信する。図４の例では、ＮＡＫを送信する（Ｓ１２０ａ）。なお、ポーリングメッセージを受信しなかった端末装置３、又は、ポーリングメッセージを受信しても対象とされていなかった端末装置３は、送達確認応答（ＡＣＫ／ＮＡＫ）をセンタ局１へ送信する必要はない。
【0048】
センタ局１は、以上のようにして送信された送達確認応答（ＡＣＫ／ＮＡＫ）を受信して（Ｓ１２０）、ＮＡＫの受信数が基準値以下になったか否かを評価する（Ｓ１２５）。その結果により、目的データを再送する（Ｓ１３０）か、個別通信モードへ移行するかになるが、それ以降の動作は、図３に示した通信のシーケンスと同じになる。
【0049】
センタ局１が送達確認応答する端末装置３をポーリングして選択する方法は、より確実

に目的データを送信したい場合などに有効である。

例えば、災害時に被災地域に対して確実に情報を届けたい場合、被災地域にある端末装置３を集中的にポーリング指定する。この場合には、端末装置３は、端末位置検出部２７により取得される位置情報を、センタ局１が指定したポーリング対象地域と比較することによって、自端末装置がポーリング対象であるか否かを判断する。

【0050】

また、例えば、目的データが地図の部分アップデートデータであった場合、アップデートされる地図の近隣に存在する端末装置３に比重を高めてポーリングしてもよい。

また、衛星回線においては、降雨等により受信電波が減衰することがあるので、降雨地域の端末装置３を集中的にポーリングしてもよい。逆に、降雨地域の端末装置３を除外してポーリングすることによって、端末群３ａ全体の受信誤り率の推定精度を向上させることができる。さらには、降雨地域の端末装置３を除外してポーリングした場合には、降雨解消後に再送信することによって、受信誤り率の高い降雨時の再送を繰り返す場合より、効率的に目的データの送信ができる。

【0051】

次に、図５は、センタ局１が端末群３ａに対して通信制御モード変更メッセージを送信する場合に、センタ局１と端末群３ａとの間で行われる通信のシーケンスの例を示すであるが、これは、図３の一部を修正するための図である。そこで、図５においては、図３と対応する同一の動作を示すブロックには同一の符号を付している。また、図５においては、端末Ｂの図示を省略している。

【0052】

図５において、センタ局１が目的データを送信し（Ｓ１１０）、端末Ａが、その目的データを受信し（Ｓ１１０ａ）、その受信誤りの有無を検査し（Ｓ１１５ａ）、受信誤りがあったので、送達確認応答としてＮＡＫをセンタ局１に送信する（Ｓ１２０ａ）。センタ局１は、端末Ａを含む端末群３ａから送信される送達確認応答（ＡＣＫ／ＮＡＫ）を受信し（Ｓ１２０）、その受信状況を評価し、ＮＡＫ受信数が所定の基準値以下か否かを判定する（Ｓ１２５）。ここまでは、図３に示した通信のシーケンスと同じである。

【0053】

次に、センタ局１は、ＮＡＫ受信数が所定の基準値以上にあり、目的データを再送しようとする場合、その再送に先立ち、端末群３ａに対して通信制御モード変更メッセージを送信する（Ｓ１２７）。ここで、通信制御モードの変更とは、センタ局１と端末装置３との間の通信プロトコルを変更することであり、例えば、目的データの誤り訂正コードをより強力なものに変更するとか、同一パケットの連送数を増やすとか、インタリーブの拡散の深さを大きくするとかが行われる。ここで、連送とは、フレームの生存率を高めるために同一のセッションで同一のフレームを複数回送信することをいい、同一データ送信のセッションを複数回繰り返す再送とは区別するものとする。

【0054】

このような通信制御モードの変更は、目的データの再送を効率よく行うために行うものである。例えば、降雨などのためにＮＡＫの受信数が異常に大きかった場合、つまり、目的データの受信に失敗した端末装置３が多かった場合には、再送時には、通信において誤りの生じにくい、又は、誤りが生じても訂正しやすい通信方式に変更する。そうすれば、目的データの受信に失敗する端末装置３の数は、通常に再送を繰り返すよりも早く減少する。

【0055】

また、逆に、ＮＡＫの受信数が少なく、目的データの受信に失敗した端末装置３が期待以上に少なかった場合には、端末装置３が送達確認応答をする確率、つまり、返信率を大きくする制御メッセージを送信してもよい。この処置は、端末装置３が送達確認応答としてＮＡＫのみを送信する場合にしか適用できないが、より多くの端末装置３からの送達確認応答を収集することができるので、目的データの受信に成功していない端末数の推定をより正確に行うことができる。

【0056】
図５において、センタ局１は、通信制御モード変更メッセージを送信すると（Ｓ１２７）、通信制御モード指定部１２における通信制御モードを変更する（Ｓ１２８）。また、端末装置３は、その通信制御モード変更メッセージを受信し（Ｓ１２７ａ）、通信制御モード指定部２６における通信制御モードを変更する（Ｓ１２８ａ）。こうして、変更された通信制御モードに従って、センタ局１は、目的データを送信し（Ｓ１３０）、端末装置３は、その目的データを受信する（Ｓ１３０ａ）。
【0057】
図６は、同報通信モード時のセンタ局通信装置１０の通信動作を示すフローチャートの例であり、図３～図５におけるセンタ局１の通信動作を統合したものとなっている。従って、図６の説明は、図３～図５の説明と多少重複するが、補足を含めて改めて説明する。なお、説明の便宜上、図６と図３～図５とでは、動作を示すブロックの符号は、同じ動作のブロックであっても異なる符号を付している。
【0058】
図６において、センタ局通信装置１０は、コンピュータ等の上位システムから供給される目的データを入力し（Ｓ２１０）、それを送信データ記憶部１１へ格納する（Ｓ２２０）とともに、端末群３ａへ向けて送信する（Ｓ２３０）。送達確認応答する端末装置３を指定するためにポーリングを使用する場合（Ｓ２４０でＹｅｓ）には、センタ局１は、端末群３ａへ向けて端末装置３を指定してポーリングメッセージを送信する（Ｓ２５０）。次に、センタ局１は、端末群３ａのうち所定の返信率で自発的に送達確認応答を決定した端末装置３又はポーリングにより指定された端末装置３から送信される送達確認応答（ＡＣＫ／ＮＡＫ）を受信し（Ｓ２７０）、そのＡＣＫ／ＮＡＫの受信状況を評価する（Ｓ２８０）。
【0059】
ここで、ＡＣＫ／ＮＡＫ受信状況の評価とは、一部の端末装置３から送信されるＡＣＫ／ＮＡＫの実際の受信数から、端末群３ａ全体の端末装置３のうち未だ正しい目的データを受信していない端末装置３の数やその割合を推定することをいう。その推定モデルの最も簡単なものは、図３の説明において例示したとおりである。そのモデルにおいては、端末装置３の総数、インバウンド回線５の輻輳を生じさせない端末装置３の最大数、返信率、ＮＡＫ受信数を利用したが、ＡＣＫ受信数や、ＮＡＫ受信数とＡＣＫ受信数との比等の情報も利用すると、モデルの精度が向上する。端末装置３の中には、非稼動のものや、通信不能領域（例えば、トンネルの中）等に存在するものがあるが、ＡＣＫ受信数及びＮＡＫ受信数により、端末装置３の総数を実際に稼動中の端末装置３の数として求めることができる。また、人工衛星２を介した回線においては、特に、天候によって回線の状態が大きく左右される。このような天候の情報等を返信率に反映するようにすることもできる。
【0060】
ここでは、図３の説明と同じモデルを想定する。そこで、センタ局１は、インバウンド回線５の輻輳を生じさせない端末装置３の最大数を求めておき、その最大数と端末装置３の総数と返信率とにより定められるＮＡＫの受信数の最大数を基準値とする。そして、実際に受信したＮＡＫの数をその基準値と比較する（Ｓ２９０）。その結果、ＮＡＫの受信数が基準値より大きかった場合には（Ｓ２９０でＮｏ）、センタ局１は、目的データを端末群３ａへ再送する（Ｓ３４０）。このようにして、端末群３ａへの目的データの再送を何度か繰り返せば、ＮＡＫの受信数は基準値以下になる。ＮＡＫの受信数が基準値以下になると（Ｓ２９０でＹｅｓ）、センタ局１は、個別通信モードへの移行指示メッセージを端末群３ａへ送信して（Ｓ３００）、未だに正しい目的のデータの受信に成功していない端末装置３とは個別に通信を行うようにする。
【0061】
なお、図６において、ステップＳ３１０及びＳ３２０は、目的データを再送するに当たり通信制御モードを変更する場合に行うオプションの動作である。例えば、衛星回線の場合には、降雨等により回線の状態が劣化するので、強力な誤り訂正方式を用いるようにし

て、再送時には、通信において誤りの生じにくい、又は、誤りが生じても訂正しやすい通信方式に変更する。そこで、センタ局１は、通信制御モードを変更する場合には（Ｓ３１０でＹｅｓ）、通信制御モード変更メッセージを端末群３ａへ送信し（Ｓ３２０）、通信制御モード指定部１２の通信制御モードを変更する（Ｓ３３０）。なお、これらの動作については、図５において詳しく説明している。

【0062】

図７は、同報通信モード時の端末通信装置２０の通信動作を示すフローチャートの例であり、図３～図５における端末装置３の通信動作を統合したものとなっている。従って、図７の説明は、図３～図５の説明と多少重複するが、補足を含めて改めて説明する。なお、説明の便宜上、図７と図３～図５とでは、動作を示すブロックの符号は、同じ動作のブロックであっても異なる符号を付している。

【0063】

図７において、端末装置３は、センタ局１から送信されるデータを受信（Ｓ４１０）、その受信したデータに誤りがないか検査する（Ｓ４２０）。その結果、訂正不可能な受信誤りがあり（Ｓ４２０でＹｅｓ）、送達確認応答の要があったときには（Ｓ４３０でＹｅｓ）、送達確認応答としてＮＡＫを送信する（Ｓ４４０）。また、訂正不可能な受信誤りもなく（Ｓ４２０でＮｏ）、送達確認応答の要があったときには（Ｓ４３０ａでＹｅｓ）、送達確認応答としてＡＣＫを送信する（Ｓ４４０ａ）。

【0064】

次に、受信したデータに受信誤りがなかった場合には（Ｓ４２０でＮｏ）、そのデータを分別する。受信データが目的データであった場合には（Ｓ４５０でＹｅｓ）、受信動作を完了する。受信データが個別通信モードへの移行指示メッセージであった場合には（Ｓ４６０でＹｅｓ）、端末通信装置２０の通信制御モード指定部２６を個別通信モードに変更して、個別通信モードに移行する。受信データがポーリングメッセージであった場合には（Ｓ４７０でＹｅｓ）、ポーリング応答のメッセージを送信する（Ｓ４８０）。ポーリング応答のメッセージは、ＡＣＫ／ＮＡＫで済ませてもよいし、特別なメッセージとしてもよい。また、受信データが通信制御モード変更メッセージであった場合には（Ｓ４９０でＹｅｓ）、通信制御モード指定部２６の通信制御モードを変更して（Ｓ５００）、その通信制御モードに従ってセンタ局１からの送信データを受信できるようにする。

【0065】

端末装置３は、データを受信すると、基本的には、ＡＣＫ／ＮＡＫのいずれかを応答として、センタ局１に送信する（Ｓ４４０、Ｓ４４０ａ）。ただし、前記したように同報通信モードにおいては、ＡＣＫ／ＮＡＫともに応答するようにしてもよく、ＡＣＫのみ又はＮＡＫのみ応答するようにしてもよい。応答する方法は、受信誤りの起こりやすさの程度を勘案してどれにするかをあらかじめ決定しておいてもよい。また、実際に受信されるＡＣＫ／ＮＡＫの数によって再送信動作を繰り返す途中であっても、その応答の方法を切り換えてもよい。さらに、端末装置３にとって目的データが不要の場合は、受信誤りの有無に関わらずＡＣＫを送信してもよい。この場合、センタ局１は、送信した目的データの需要の程度を把握できる利点がある。また、これにより、受信に成功していない端末装置３の数が早く基準値以下になるため、早期に個別通信モードへの移行が可能となる。さらに、ＡＣＫ（受信成功）、ＮＡＫ（受信失敗）に加え、明示的な受け取り不要を示す応答メッセージを用いてもよい。

【0066】

図７においては、制御メッセージについても目的データと同様に送達確認応答（ＡＣＫ／ＮＡＫ）を送信するとしているが、図３～図６においては、制御メッセージについてのＡＣＫ／ＮＡＫの送信動作及び制御メッセージについては記載を省略している。これは説明が煩雑になることを避けたためである。

また、制御メッセージには、端末装置３の通信制御モード等の状態をセンタ局１が指示する状態に設定する役割がある。従って、制御メッセージの送信は、より確実に行う必要がある。そこで、制御メッセージの送信は、ＡＣＫ／ＮＡＫの送達確認応答に関わりなく

、再送を複数回繰り返し行うようにしてもよい。制御メッセージは、目的データに比べデータ量が小さいので、通信効率への影響は小さい。

【0067】

以上の本発明の実施形態においては、端末装置３は、すべてが送達確認応答機能を有するとしているが、必ずしもすべての端末装置３が送達確認応答機能を有している必要はない。そこで、一部の端末装置３のみが送達確認応答機能を有し、他の端末装置３は送達確認応答機能を有さないとする構成にしてもよい。端末群３ａとしての端末装置３の数が多数である場合には、送達確認応答機能を有する一部の端末装置３からの送達確認応答から残りの端末装置３の受信誤りの状況を推定することができる。さらに、この場合には、送達確認応答機能を有する端末装置３のすべてが送達確認応答を送信するとしても、その一部が送達確認応答を送信するとしてもよい。このように、端末装置３の送達確認応答機能を削除、さらには送信機能そのものを削除することによって、端末装置３の製造コストや電力消費のコストを低減することができる。

【図面の簡単な説明】

【0068】

【図1】本発明を適用した人工衛星を用いた通信システムの全体構成図の例である。

【図2】本発明の実施形態におけるセンタ局及び端末装置それぞれにおける通信装置のブロック構成の例を示した図である。

【図3】本発明の実施形態におけるセンタ局と端末群との間で行われる通信のシーケンスの例を示した図である。

【図4】本発明の実施形態において、センタ局が送達確認応答すべき端末装置をポーリングする場合に、センタ局と端末群との間で行われる通信のシーケンスの例を示した図である。

【図5】本発明の実施形態において、センタ局が端末群に対して通信制御モード変更メッセージを送信する場合に、センタ局と端末群との間で行われる通信のシーケンスの例を示した図である。

【図6】本発明の実施形態において、同報通信モード時のセンタ局通信装置の通信動作を示すフローチャートの例である。

【図7】本発明の実施形態において、同報通信モード時の端末通信装置の通信動作を示すフローチャートの例である。

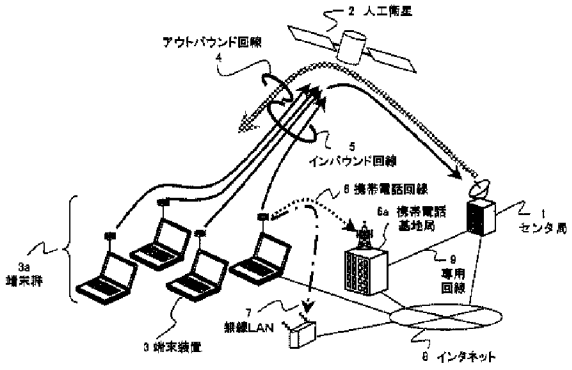
【符号の説明】

【0069】

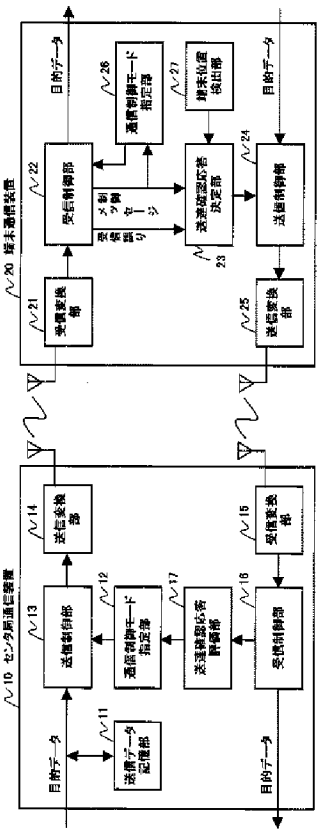
１　センタ局
３　端末装置
３ａ　端末群
４　アウトバウンド回線
５　インバウンド回線
１０　センタ局通信装置
１２　通信制御モード指定部
１３　送信制御部
１４　送信変換部
１５　受信変換部
１６　受信制御部
１７　送達確認応答評価部
２０　端末通信装置
２１　受信変換部
２２　受信制御部
２３　送達確認応答決定部
２４　送信制御部
２５　送信変換部

２６　通信制御モード指定部

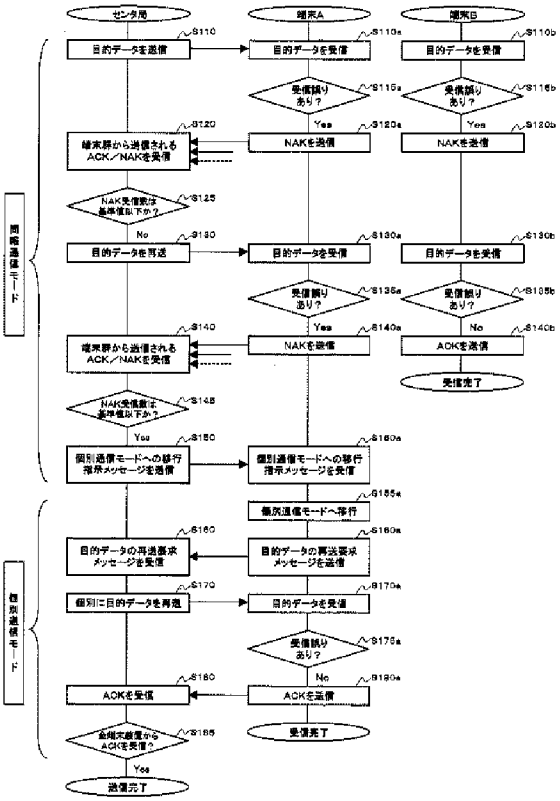
【図1】



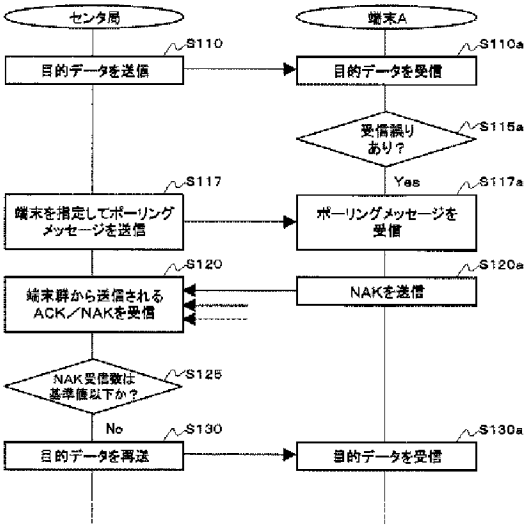
【図2】



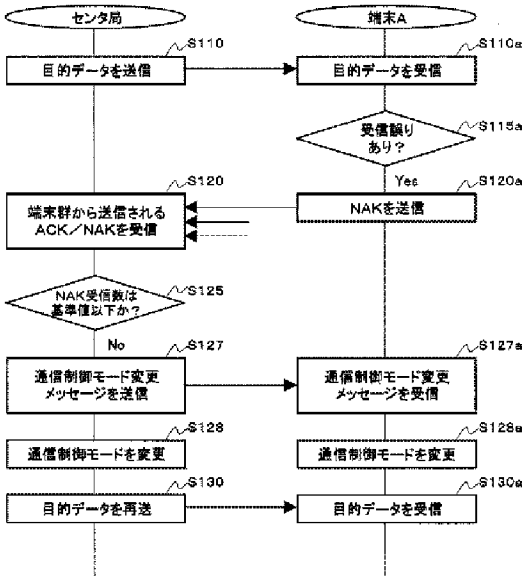
【図3】


センタ局
端末A
端末B
S110
目的データを送信
S110a
目的データを受信
S110b
目的データを受信
S115a
受信誤り あり？
S115b
受信誤り あり？
Yes
S120
端末群から送信される ACK／NAKを受信
S120a
NAKを送信
S120b
NAKを送信
S125
NAK受信数は 基準値以下か？
No
S130
目的データを再送
S130a
目的データを受信
S130b
目的データを受信
S135a
受信誤り あり？
S135b
受信誤り あり？
S140
端末群から送信される ACK／NAKを受信
S140a
NAKを送信
S140b
ACKを送信
受信完了
S145
NAK受信数は 基準値以下か？
Yes
S150
個別通信モードへの移行 指示メッセージを送信
S150a
個別通信モードへの移行 指示メッセージを受信
S155a
個別通信モードへ移行
S160
目的データの再送要求 メッセージを受信
S160a
目的データの再送要求 メッセージを送信
S170
個別に目的データを再送
S170a
目的データを受信
S175a
受信誤り あり？
No
S180
ACKを受信
S180a
ACKを送信
受信完了
S185
全端末数分のACKを受信？
Yes
送信完了
同報通信モード
個別通信モード

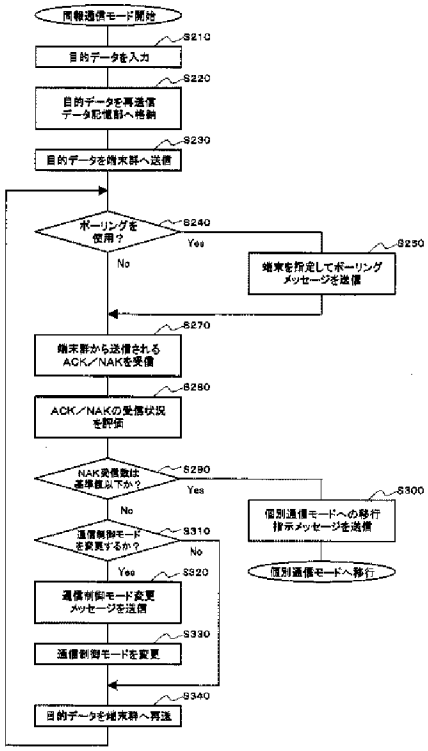
【図4】


センタ局
端末A
S110
目的データを送信
S110a
目的データを受信
S115a
受信誤り あり？
Yes
S117
端末を指定してポーリング メッセージを送信
S117a
ポーリングメッセージを 受信
S120
端末群から送信される ACK／NAKを受信
S120a
NAKを送信
S125
NAK受信数は 基準値以下か？
No
S130
目的データを再送
S130a
目的データを受信

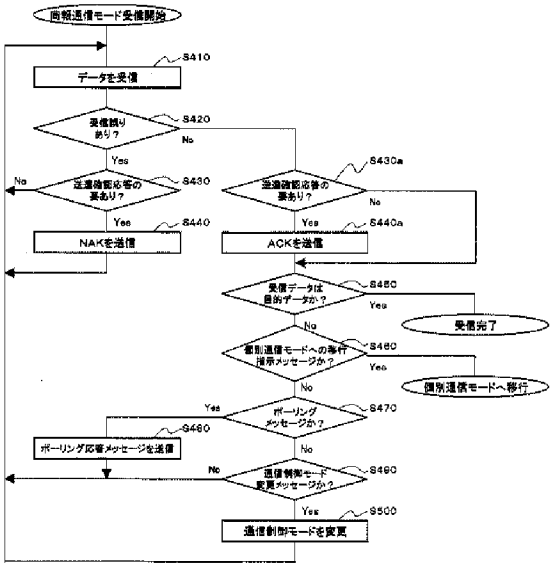
【図5】


センタ局
端末A
S110
目的データを送信
S110a
目的データを受信
S115a
受信誤り あり？
Yes
S120
端末群から送信される ACK／NAKを受信
S120a
NAKを送信
S125
NAK受信数は 基準値以下か？
No
S127
通信制御モード変更 メッセージを送信
S127a
通信制御モード変更 メッセージを受信
S128
通信制御モードを変更
S128a
通信制御モードを変更
S130
目的データを再送
S130a
目的データを受信

【図6】


同報通信モード開始
S210
目的データを入力
S220
目的データを再送信 データ記憶部へ格納
S230
目的データを端末群へ送信
S240
ポーリングを 使用？
Yes
S250
端末を指定してポーリング メッセージを送信
No
S270
端末群から送信される ACK／NAKを受信
S280
ACK／NAKの受信状況 を評価
S290
NAK受信数は 基準値以下か？
Yes
S300
個別通信モードへの移行 指示メッセージを送信
個別通信モードへ移行
No
S310
通信制御モード を変更するか？
No
Yes
S320
通信制御モード変更 メッセージを送信
S330
通信制御モードを変更
S340
目的データを端末群へ再送

【図7】


同報通信モード受信開始
S410
データを受信
S420
受信誤り
あり？
No
Yes
S430
誤通確認応答の
要あり？
No
Yes
S430a
誤通確認応答の
要あり？
No
Yes
S440
NAKを送信
S440a
ACKを送信
S450
受信データは
目的データか？
Yes
No
受信完了
S460
個別通信モードへの移行
指示メッセージか？
Yes
No
S470
ポーリング
メッセージか？
Yes
No
S480
ポーリング応答メッセージを送信
S490
通信制御モード
変更メッセージか？
No
Yes
S500
通信制御モードを変更

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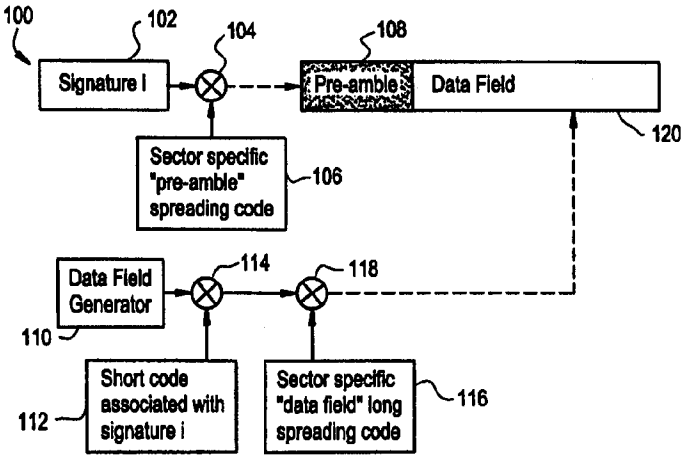

(57) Abstract

A method is disclosed that assigns each sector in a cell a unique preamble spreading code (106) and a unique long–code (116) which is concatenated with a signature–associated short code (112) to spread the data in the data field (120). The period selected for the long–code (116) can be relatively long in duration (e.g., up to hours or days in length). The widths of the transmission time slots are set equal to the length of the preambles (108). Consequently, the mobile station's random access requests (20, 22, 24) can be timed to start at the beginning of the slots, and detected during the preamble periods by the matched filter in the base station's random access receiver. The data field (120) of the mobile station's random access request (20, 22, 24) is transmitted in the slots following the preamble (108) and received by the rake receiver at the base station.

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RANDOM ACCESS IN A MOBILE TELECOMMUNICATIONS SYSTEM

RELATED APPLICATIONS

This application is related by subject matter to commonly-assigned U.S. Patent Application Serial No. 08/733,501, which was filed October 18, 1996.

BACKGROUND OF THE INVENTION

Technical Field of the Invention

The present invention relates generally to the field of mobile telecommunications and, in particular, to a method for processing multiple random access mobile-originated calls.

Description of Related Art

The next generation of mobile communications systems will be required to provide a broad selection of telecommunications services including digital voice, video and data in packet and channel circuit-switched modes. As a result, the number of calls being made is expected to increase significantly, which will result in much higher traffic density on random access channels (RACHs). Unfortunately, this higher traffic density will also result in increased collisions and access failures. Consequently, the new generation of mobile communications systems will have to use much faster and flexible random access procedures, in order to increase their access

success rates and reduce their access request processing times.

In most mobile communications systems, such as, for example, the European joint development referred to as the "Code Division Testbed" (CODIT), and systems operating in accordance with the IS-95 Standard (ANSI J-STD-008), a mobile station can gain access to a base station by first determining that the RACH is available for use. Then, the mobile station transmits a series of access request preambles (e.g., single 1023 chip symbols) with increasing power levels, until the base station detects the access request. In response, the base station starts the process of controlling the mobile station's transmitted power via a downlink channel. Once the initial "handshaking" between the mobile station and base station has been completed, the mobile user transmits a random access message.

In a Spread Spectrum Slot Reservation Multiple Access (SS-SRMA) System, a slotted ALOHA (S-ALOHA) random access scheme is used. At the beginning of a slot, a mobile station will send a random access packet to the base station and then await an acknowledgment from the base station that the packet was received. This S-ALOHA scheme dispenses with a number of steps that characterize the CODIT and IS-95 random access schemes (namely, power ramping and power control).

More specifically, in a CODIT-based Code Division Multiple Access (CDMA) system, a mobile station will attempt to access the base station receiver by using a "power ramping" process that increases the power level of each successive transmitted preamble symbol. As soon as

an access request preamble is detected, the base station activates a closed loop power control circuit, which functions to control the mobile station's transmitted power level in order to keep the received signal power from the mobile station at a desired level. The mobile station then transmits its specific access request data. The base station's receiver "despreads" the received (spread spectrum) signals using a matched filter, and diversity-combines the despread signals to take advantage of antenna diversity.

In an IS-95 CDMA system, a similar random access technique is used. However, the primary difference between the CODIT and IS-95 process is that the IS-95 mobile station transmits a complete random access packet instead of just the preamble. If the base station does not acknowledge the access request, the IS-95 mobile station re-transmits the access request packet at a higher power level. This process continues until the base station acknowledges the access request.

In a mobile communications system using an S-ALOHA random access scheme, such as the method disclosed in the above-described U.S. Patent Application Serial No. 08/733,501 (hereinafter, "the '501 Application"), a mobile station generates and transmits a random access packet. A diagram that illustrates a frame structure for such a random access packet is shown in FIGURE 1. The random access packet ("access request data frame") comprises a preamble and a data field portion. The preamble contains a unique signature (bit) pattern, which is "L" symbols long. The signature pattern is randomly selected from a set of patterns that are, but not necessarily, orthogonal

to each other. As such, the use of this unique signature pattern feature, as described and claimed in the '501 Application, provides a significantly higher throughput efficiency than prior random access schemes.

As described in the '501 Application, the data field of the random access packet includes certain random access information, including mobile (user) identity information, required service number (number of services to be provided), required air time (time needed to complete a message), short packet data message (to increase transmission efficiency), and an error detection redundancy field (cyclic redundancy code). For reasons elaborated in the '501 Application, the spreading ratio (spread spectrum modulation) of the preamble is selected to be longer than the spreading ratio of the data field portion. However, situations may be envisioned in which this is not necessarily so.

The random access packet (e.g., such as the packet shown in FIGURE 1) is transmitted by the mobile station at the beginning of the next available slot. A block diagram of an apparatus that can be used in a mobile station to generate and transmit the random access packet illustrated in FIGURE 1 is shown in FIGURE 2. Essentially, as illustrated by FIGURE 2, the preamble and data field of the random access packet are generated and spread separately (with respective spreading codes) and then multiplexed and transmitted by the mobile station.

Next, the random access packet transmitted by the mobile station is received and demodulated at the target base station with a matched filter-based receiver. FIGURE 3 is a block diagram of a detection section (for one

antenna) of a base station's random access receiver, which functions primarily to estimate the timing of the received signal rays. The matched filter, which is used only during the preamble period, is tuned to the preamble's spreading code. The matched filter is used to detect the presence of the random access request, and despread the preamble part of the random access packet and feed it to the accumulator unit. The accumulator (signatures 1-*I*) is a unique feature used for the '501 Application's random access method to sum the signals at the output of the matched filter during the preamble's (M) symbol periods, in order to increase the received signal-to-interference (S/I) power ratio. Since each received preamble comprises a unique signature pattern, the accumulation operation is carried out with a plurality of accumulators (1-*I*), with each accumulator tuned to one of the possible signature patterns to be received.

FIGURE 4 is a simple block diagram of an accumulator that can be used for the I channel (quadrature detection) in the random access detector section shown in FIGURE 3. A similar accumulator can be used for the Q channel. Referring to FIGUREs 3 and 4, the output of each accumulator (signature 1-*I*) is coupled to a peak detection unit. At the end of the preamble period, each peak detection unit searches the output of its respective matched filter for each signal peak that exceeds a predetermined detection threshold. Each peak detection unit then registers (detects and stores) the magnitude and relative phase of each of those peak signals, and thereby determines the number of significant signal rays available for demodulation in the receiver. As such, the timing of

each peak is estimated and used to set the receiver's "Rake" parameters (Rake receiver sections 1-*l*). FIGURE 5 is a block diagram of a random access demodulator that can be used to demodulate the data field portion of the random access packet. Essentially, the random access demodulator section decodes the data information in the received data field and checks for transmission errors.

Notably, although the random access apparatus and method described above with respect to FIGUREs 1-5 has numerous advantages over prior random access schemes, a number of problems still exist that remain to be solved. For example, a large number of packet collisions may occur if mobile stations in all of the cells use the same spreading codes during the preamble or data field processing stage. As a consequence, an excessive number of the random access requests will have to be retransmitted, which can lead to system instability. Moreover, using the random access apparatus and method described above, since the random access requests are transmitted at the beginning of the next time slot, the base station's matched filter receiver is not utilized as efficiently as it can be, because the matched filter receiver is idle for the complete period subsequent to the preamble reception stage. Additionally, since the length of the random access packet used with the above-described scheme is fixed, the size of the short data packets is restricted by the extent of use of the remainder of the packet. For all of these reasons, a more flexible random access request procedure is needed to resolve these problems.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to utilize random access channels more efficiently.

It is another object of the present invention to be capable of receiving a significantly higher number of random access requests per matched filter than received by conventional means.

It is yet another object of the present invention to reduce the probability of collisions between random access requests and also minimize their loss.

It is still another object of the present invention to be capable of selecting the length of a data field in a random access request packet to allow increased flexibility in selecting the length of a short packet field.

It is yet another object of the present invention to provide a random access packet that can be used to quickly establish long data or voice calls.

It is still another object of the present invention to maintain a low level of cross-correlation between random access attempts made from neighboring sectors/cells.

In accordance with the present invention, the foregoing and other objects are achieved by a method that assigns each sector in a cell a unique preamble spreading code and a unique long-code which is concatenated with a short spreading code associated with a randomly selected signature, and is used to spread the data part of a random access packet. The period selected for the long-code can be relatively long in duration (e.g., up to hours or days in length). Also, the widths of the transmission time slots are set equal to the length of the preambles.

Consequently, the mobile station's random access requests can be timed to start at the beginning of the slots, and detected during the preamble periods by the matched filter in the base station's random access receiver. The data field of the mobile station's random access request is transmitted in the slots following the preamble and received by the rake receiver at the base station. However, subsequent to the preamble period, the matched filter is still enabled to receive the preambles of other random access requests. Therefore, the matched filter can be utilized continuously and more efficiently, and a significantly larger number of random access requests can be processed in comparison with prior random access schemes. As such, the communications throughput and efficiency of a random access system using the present method are substantially higher than the throughput and efficiency of prior random access systems. Additionally, the length of the data field is not restricted. The method of concatenated spreading of the data field portion of the random access packet allows a user to generate a packet which is as long as desired. Moreover, the concatenated spreading removes the danger that the resulting packet will collide with other random access request packets, since the spreading pattern and/or its phase are unique.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the method and apparatus of the present invention may be had by reference to the following detailed description when taken in conjunction with the accompanying drawings wherein:

FIGURE 1 is a diagram that illustrates a frame structure for a random access packet;

FIGURE 2 is a block diagram of an apparatus that can be used in a mobile station to generate and transmit the random access packet illustrated in FIGURE 1;

FIGURE 3 is a block diagram of a detection section (for one antenna) of a base station's random access receiver, which functions primarily to estimate the timing of the received signal rays;

FIGURE 4 is a simple block diagram of an accumulator that can be used for the I channel (quadrature detection) in the random access detector section shown in FIGURE 3;

FIGURE 5 is a block diagram of a random access demodulator that can be used to demodulate the data field portion of a random access packet;

FIGURE 6 is a block diagram of a pertinent section of a cellular communications system, which can be used to implement the method of the present invention;

FIGURE 7 is a diagram that illustrates the structure and timing of a plurality of random access request packets that can be transmitted by different mobile stations, in accordance with the preferred embodiment of the present invention; and

FIGURE 8 is a simple block diagram of an apparatus that can be used to implement the method for use with a mobile station to generate and transmit a random access packet such as the random access packets shown in FIGURE 7, in accordance with the preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE DRAWINGS

The preferred embodiment of the present invention and its advantages are best understood by referring to FIGUREs 1-8 of the drawings, like numerals being used for like and corresponding parts of the various drawings.

Essentially, in accordance with the present invention, the method assigns each sector in a cell a unique preamble spreading code, and also a unique long-code which is concatenated with the data field's (signature-associated) short spreading code. The period selected for the long-code can be relatively long in duration (e.g., up to hours or days in length). Consequently, it can be said that the data field of the random access packet is transmitted in a dedicated channel, because no two messages can have the same spreading sequence and phase unless they have chosen the same signature and transmitted their preambles at the same time. This results in a collision of the packets, and renders these random access attempts unsuccessful. However, the probability of this happening is very small. Notably, this method of assigning sector/cell-unique spreading codes and long-codes provides a significantly low probability of collision between multiple access random attempts in neighboring sectors or cells.

Also in accordance with the present invention, the method sets the widths of the transmission time slots equal to the length of the preamble (minus, for practical purposes, a predefined guard time). Consequently, the mobile station's random access request can be timed to start at the beginning of the slot, and detected during the preamble period by the matched filter in the base station's random access receiver. The data field of the

mobile station's random access request is transmitted in the slots succeeding that of the preamble and received by the rake receiver at the base station. However, with the present method, subsequent to the preamble period, the matched filter is enabled to receive the preambles of other random access requests made by other mobile stations. Therefore, in accordance with the present invention, the matched filter can be utilized continuously and efficiently, and a significantly larger number of random access requests can be processed in comparison with prior random access schemes. As such, the communications throughput and efficiency of a random access system using the present method are significantly higher than the throughput and efficiency of prior random access systems.

Furthermore, in accordance with the present method, the length of the data field is not restricted. In other words, the method of concatenated spreading of the data field portion of the random access packet allows a user to generate a packet which is as long as desired. Moreover, in using this concatenated spreading approach, there is very little danger that the resulting packet will collide with other random access request packets.

Specifically, referring to FIGURE 6, a pertinent section of a cellular communications system 10 is shown, which can be used to implement the method of the present invention. System 10 includes a base station transmit/receive antenna 12 and transmitter/receiver section 14, and a plurality of mobile stations 16 and 18. Although only two mobile stations are shown, FIGURE 6 is for illustrative purposes only, and the present invention can be assumed to include more than two mobile stations.

Prior to generating and transmitting an access request frame, a mobile station (e.g., 16) acquires synchronization, or synchronizes, with a target base station receiver (14). The mobile station then determines the starting time for each slot from the base station's broadcast/pilot channel information. The mobile station also retrieves the number of the slot being processed from the broadcast/pilot channel information, which is to be used by the base station to tag its acknowledgment (ACK) message reply with the slot number to ensure that the correct mobile receives the acknowledgment. More details for synchronizing a mobile station to a base station in a random access environment can be found in the '501 Application.

The target base station also transfers to the requesting mobile station(s) (e.g., over the downlink broadcast channel) each unique random access spreading code and long-code associated with each of the sectors and/or cells defined by the base station transceiver. For example, these unique spreading codes and long-codes can be Gold codes or Kasami codes. The mobile station stores the spreading code and long-code information in a memory storage area (not explicitly shown), which is to be retrieved and used by the mobile station to spread the preamble and data field of the random access request packets generated. Finally, the base station also transfers to the requesting mobile station(s) (e.g., in an appropriate broadcast message) the signature patterns associated with the preambles, which can be used to help distinguish between different sectors and/or cells.

For example, as described in the '501 application, in order to enable the base station receiver to more effectively distinguish between multiple random access requests, a preamble bit or symbol pattern is used. Each requesting mobile station can transmit one of L different preamble bit or symbol patterns ("signatures"). The different signature patterns used are, but not necessarily, orthogonal to each other. At the base station receiver, each of L accumulators is tuned to detect a specific signature coupled from the output of the receiver's matched filter. This signature preamble in a received signal is used by the base station receiver to effectively distinguish between simultaneous, different multiple access attempts made by the mobile stations.

FIGURE 7 is a diagram that illustrates the structure and timing of a plurality of random access request packets that can be transmitted by different mobile stations, in accordance with the preferred embodiment of the present invention. Although only three random access request packets are shown for illustrative purposes, the invention is not intended to be so limited and can include the transmission and reception of more than three such packets. Essentially, for each of the random access request packets shown (20, 22 and 24), the S-ALOHA procedure used with the present method applies only to the preamble portion of the random access request process. The length of each preamble (20, 22 and 24) is set equal to the width of the time slots (n, n+1,..., n+i), minus (for design purposes) a predefined guard time to minimize potential interference between slots. For example, in practice, a one symbol guard time can be used. Also, as

shown, the lengths of the data field portions of the random access request packets (20, 22 and 24) can be varied according to the desired application, which provides mobiles with flexibility in transmitting different length data fields.

In order to avoid collisions between any two random access attempts made by mobile stations in two different sectors of a cell, or between two random access attempts made by mobile stations in adjacent cells, the following spreading method can be used. As described earlier, the mobile stations making the random access requests, each generate unique preambles using a cell-sector specific spreading code (e.g., retrieved from a respective internal memory area). In practice, these codes can be reused for other cells which are separated by a sufficient distance.

FIGURE 8 is a simple block diagram of an apparatus that can be used to implement the method for use with a mobile station to generate and transmit a random access packet such as the random access packets shown in FIGURE 7, in accordance with the preferred embodiment of the present invention. In one embodiment, the present method can be implemented under the control of a microprocessor (not explicitly shown) located in the mobile station. The random access packet generating apparatus 100 includes a signal mixer 104, which spreads a "signature *i*" 102 (e.g., retrieved from an internal memory area in the mobile station 18) with a specific preamble spreading code for the cell-sector involved (e.g., also retrieved from the internal memory area) to form the cell-sector specific preamble of the random access packet to be transmitted. The data field of the random access packet to be

transmitted is generated with a data field generator 110. A mixer 114 spreads the generated data field with a unique short spreading code (112) associated with the "signature *i*". The resulting data field of the random access packet is then spread with a concatenated code, which can be constructed, for example, by a modulo-2 addition (by mixer 118) of the signature-associated short code (112) with a sector-specific long spreading code 116 (e.g., retrieved from an internal memory area). The length of the resulting data field (120) of the random access packet to be transmitted can be flexibly selected at the mobile station (e.g., hours or days long). The length of the resulting data field (120) can be varied at the mobile station, which provides an effective and quick way to establish long data or voice calls.

Although a preferred embodiment of the method and apparatus of the present invention has been illustrated in the accompanying Drawings and described in the foregoing Detailed Description, it will be understood that the invention is not limited to the embodiment disclosed, but is capable of numerous rearrangements, modifications and substitutions without departing from the spirit of the invention as set forth and defined by the following claims.

WHAT IS CLAIMED IS:

1. A signal format for use in transmitting a random access request in a mobile communications system, comprising:

a preamble, said preamble including a signature code spread with a first spreading code, said first spreading code associated with a predetermined sector; and

a data field, said data field including information data spread with a short spreading code, said short spreading code associated with said signature code, said information data spread with a short spreading code further spread with a long spreading code, said long spreading code associated with said predetermined sector.

2. The signal format according to Claim 1, wherein a length of said preamble is set substantially equal to a width of a transmission slot.

3. The signal format according to Claim 1, wherein a length of said data field is selectively varied.

4. The signal format according to Claim 1, wherein a length of said data field is equal to at least one hour.

5. The signal format according to Claim 1, wherein said data field is spread by a concatenated code having at least one of a unique pattern and phase.

6. The signal format according to Claim 1, wherein said signature code comprises one of a plurality of signature patterns.

7. The signal format according to Claim 1, wherein said preamble and said data field comprise a random access packet.

8. A preamble format for use in transmitting a random access request in a mobile communications system, comprising:

a signature code; and

a spreading code, said spreading code associated with a predetermined sector.

9. A data field format for use in transmitting a random access request in a mobile communication system, comprising:

an information data field; and

a short spreading code, said information data spread with said short spreading code, said short spreading code associated with a signature code, said information data spread with a short spreading code further spread with a sector-associated long spreading code.

10. A method for use in creating a random access packet in a mobile communications system, comprising the steps of:

generating a preamble by combining a signature code with a spreading code, said spreading code associated with a predetermined sector;

generating a data field;

spreading said data field with a short code associated with said signature code; and

further spreading said spread data field with a long spreading code associated with said predetermined sector.

11. The method according to Claim 10, further comprising the step of transmitting said random access packet from a mobile station.

12. The method according to Claim 10, wherein said step of generating a preamble further comprises setting a length of said preamble to coincide substantially with a duration of a transmission slot.

13. The method according to Claim 10, wherein said further spreading step comprises the step of selecting a length of said data field.

14. The method according to Claim 10, further comprising the step of utilizing a matched filter in a target base station receiver during a period of time subsequent to transmitting said preamble.

15. The method according to Claim 10, wherein said further spreading step comprises the step of concatenating said spread data field with said long spreading code.

16. The method according to Claim 15, wherein said concatenating step comprises modulo-2 addition.

17. An apparatus for use in creating a random access packet in a mobile communications system, comprising:

first generating means for generating a preamble;

first spreading means for spreading a signature code with a spreading code associated with a predetermined sector;

second generating means for generating a data field;

second spreading means for spreading said data field with a short code associated with said signature code; and

third spreading means for spreading said spread data field with a long spreading code associated with said predetermined sector.

18. The apparatus according to Claim 17, further comprising a microprocessor located in a mobile station.

19. The apparatus according to Claim 17, wherein a length of said preamble corresponds substantially with a duration of a transmission slot.

FIG. 1

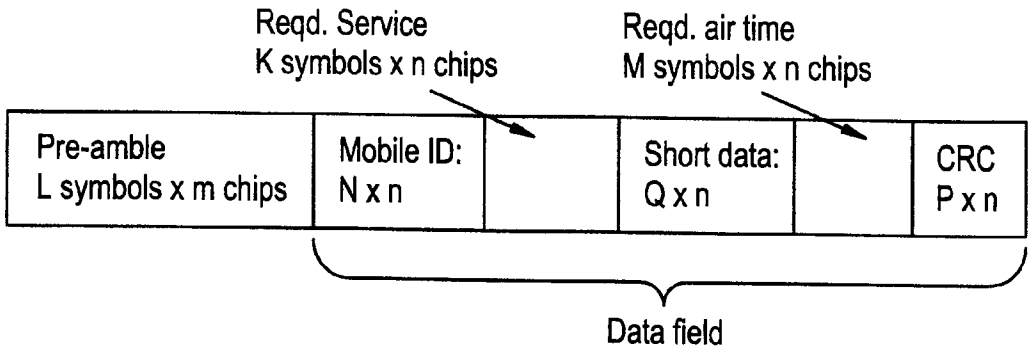


FIG. 2

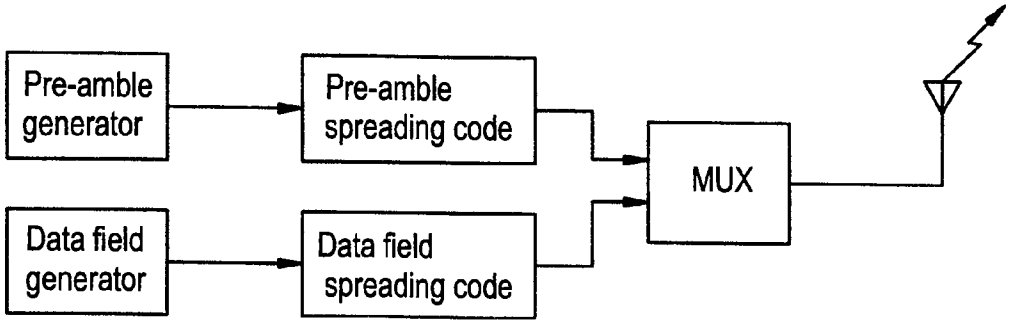


FIG. 3

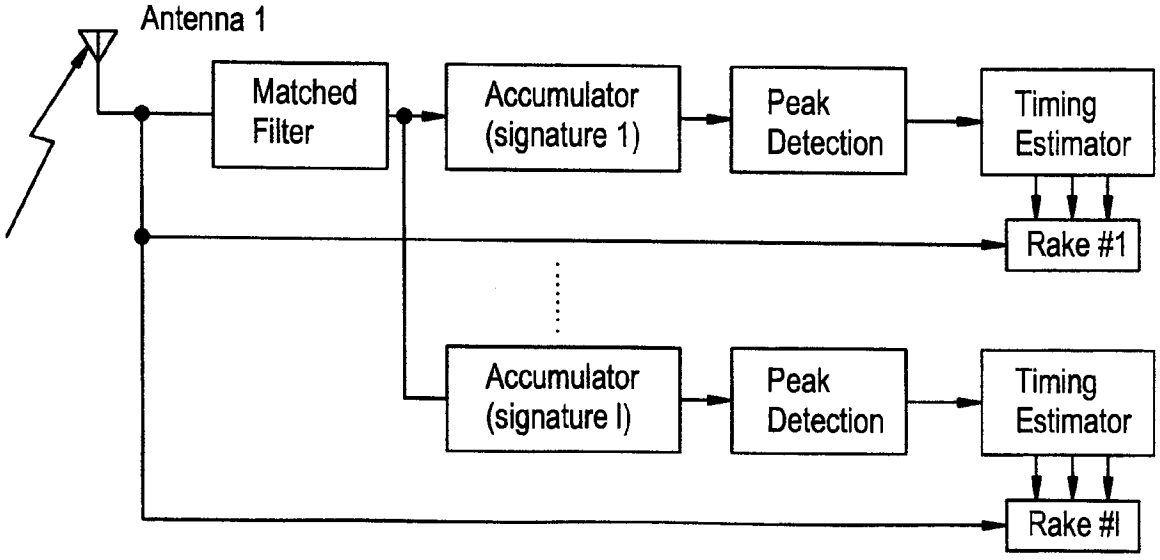


FIG. 4

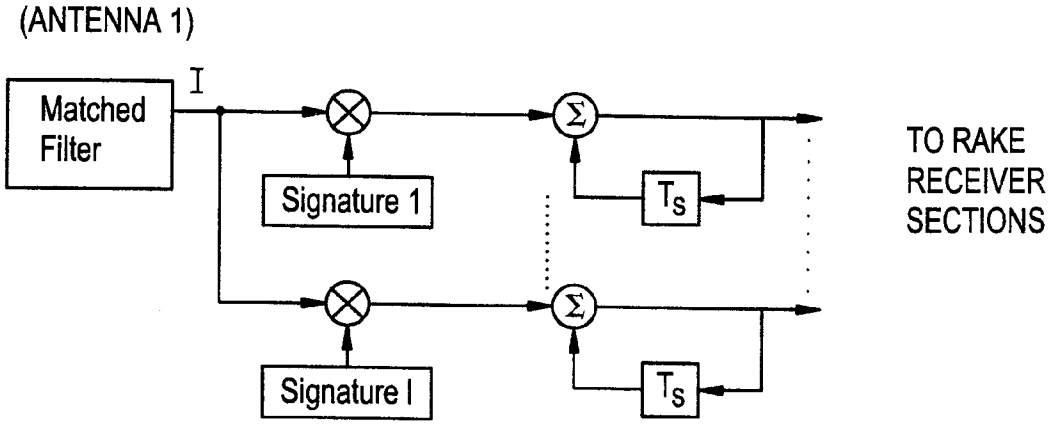


FIG. 5

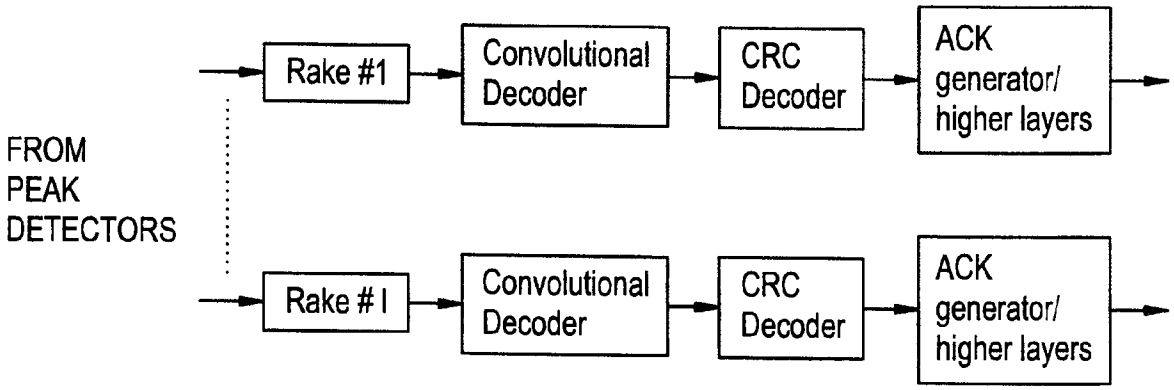


FIG. 6

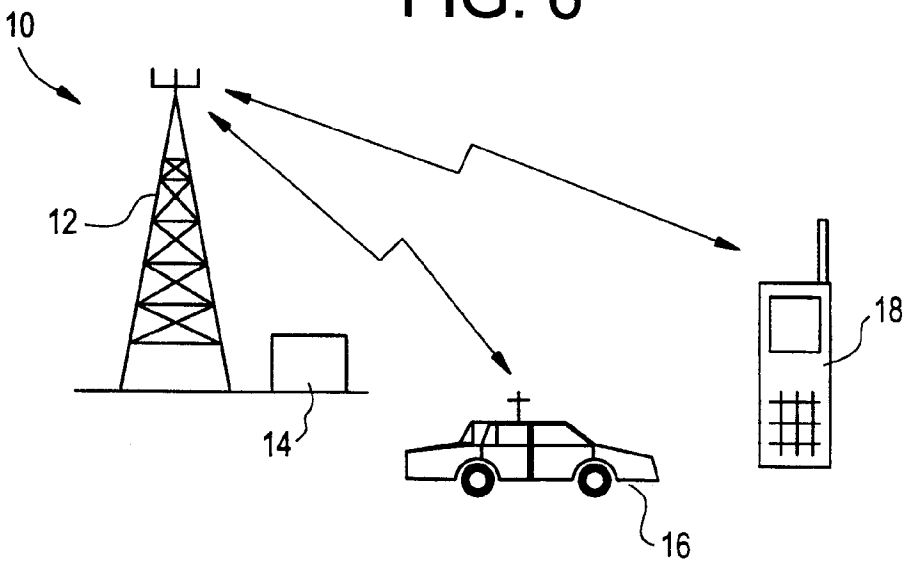


FIG. 7

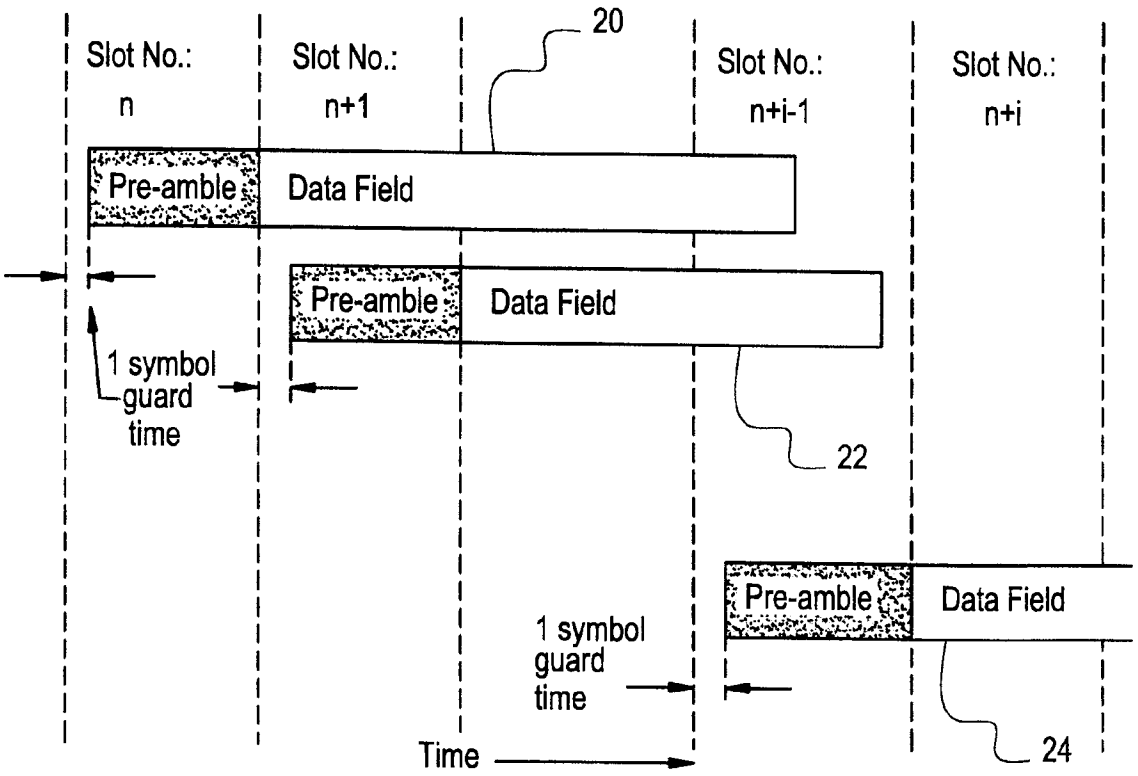
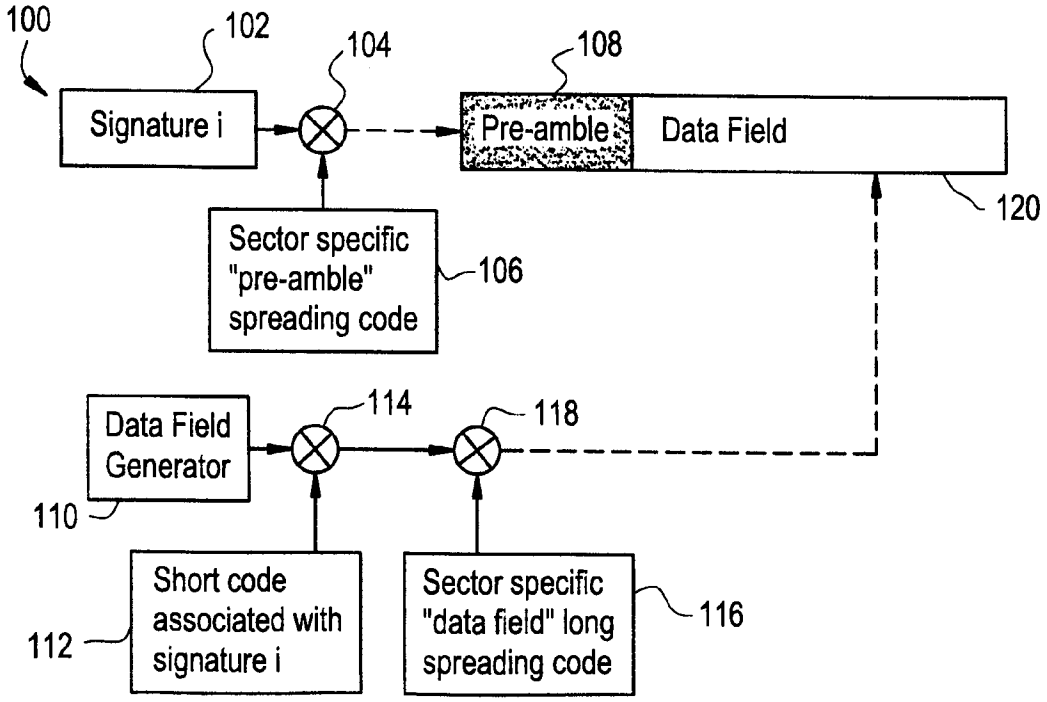

Slot No.:
n
Slot No.:
n+1
20
Slot No.:
n+i-1
Slot No.:
n+i
Pre-amble
Data Field
Pre-amble
Data Field
1 symbol
guard
time
22
Pre-amble
Data Field
1 symbol
guard
time
Time
24

FIG. 8


100
102
104
108
Signature i
Pre-amble
Data Field
120
Sector specific
"pre-amble"
spreading code
106
Data Field
Generator
110
114
118
Short code
associated with
signature i
112
Sector specific
"data field" long
spreading code
116

INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/SE 98/00751

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q7/38 H04B7/26

According to International Patent Classification(IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04Q H04L H04B

Documentation searched other than minimumdocumentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 621 752 A (ANTONIO ET AL.) 15 April 1997 see column 2, line 52 - column 4, line 61	1,8-10, 17
A	WO 97 11571 A (AIRNET COMMUNICATIONS CORP) 27 March 1997 see page 3, line 15 - page 4, line 19	1,8-10, 17
A	WO 95 22210 A (QUALCOMM INC) 17 August 1995 see column 4, line 27 - column 10, line 15	1,8-10, 17
A	WO 94 26074 A (AIRTOUCH COMMUNICATIONS) 10 November 1994 see page 6, line 34 - page 7, line 23	1,8-10, 17

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of theinternational search	Date of mailing of the international search report
14 August 1998	11/09/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	GASTALDI, G

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Int. ional Application No
PCT/SE 98/00751

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte onal Application No
PCT/SE 98/00751

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Published:
— *With international search report.*

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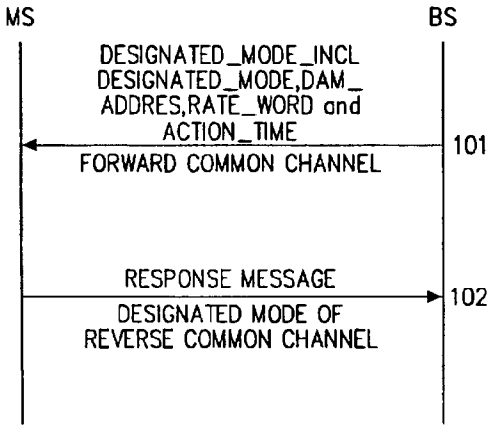
(54) Title: APPARATUS AND METHOD FOR DESIGNATING A REVERSE COMMON CHANNEL FOR DEDICATED COMMUNICATION IN A MOBILE COMMUNICATION SYSTEM



(57) Abstract: A method of designating a channel to be dedicated between a base station and a mobile station in a CDMA communication system. The base station generates designation information including a common channel designation indicator, the address of a common power control channel, transmission rate, and action time and transmits a message with the designation information to the mobile station. Then, the mobile station receives the message with the designation information and transmits a response message for the received message to the base station on a designated channel indicated by the designated channel indicator with transmission power set by the common power control channel at the data rate at the action time.

WO 01/05068 A1

APPARATUS AND METHOD FOR DESIGNATING A REVERSE COMMON CHANNEL FOR DEDICATED COMMUNICATION IN A MOBILE COMMUNICATION SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to a reverse common channel communication apparatus and method in a Code Division Multiple Access (CDMA) communication system, and in particular, to an apparatus and method for designating a reverse common channel for dedicated communication with a specific mobile station.

2. Description of the Related Art

Conventional CDMA mobile communication systems, which primarily provide voice service, have evolved into IMT-2000 standard systems. In addition to voice service, IMT-2000 systems can provide high quality voice service, moving picture service, and Internet browsing.

Data is communicated on dedicated channels and common channels in a mobile communication system. Dedicated channels and common channels are available on both the forward and reverse links. The common channels are so named because each common channel is commonly shared by a plurality of mobile stations (MSs). If more than one of the MSs attempt a call on a common channel at the same time, contention occurs, impeding reliable communications. The contention problem of common channels is more serious on the reverse link than on the forward link.

On the other hand, no channel contention occurs on a dedicated channel because the dedicated channel is literally dedicated to one-to-one communication between a base station (BS) and an individual mobile station. Therefore, the message transmission success rate is high on the dedicated channel.

Due to the low transmission success rate on common channels, an MS will attempt to access a BS repeatedly on a common channel. Consequently,

resources are misused and inter-channel interference increases.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide an apparatus and method for communicating between a BS and an MS on common channels with an increased transmission performance in a CDMA communication system.

It is also an object of the present invention to provide an apparatus and method for designating a common channel to be dedicated for one-to-one communication between a BS and a particular MS in a CDMA communication system.

It is another object of the present invention to provide an apparatus and method for designating a reverse common channel to be dedicated as a one-to-one communication link between a BS and an MS in a CDMA communication system, where the BS transmits a control message including spreading code information required for common channel designation and information about a common power control channel to the MS, and the MS spreads user data with the designated spreading code according to the control message.

It is a further object of the present invention to provide a method for constructing messages in a BS signaling layer and interfacing between BS layers in order to designate a reverse common channel to be dedicated for one-to-one communication between a BS and a particular MS in a CDMA communication system.

It is still another object of the present invention to provide a method for constructing a message in a BS signaling layer and interfacing between BS layers in order to release a reverse common channel from a dedicated mode in a CDMA communication system.

It is yet another object of the present invention to provide a method for constructing a message in a BS signaling layer and interfacing between BS layers in order to designate a reverse common channel to be dedicated for one-to-one communication between a BS and an MS and release the reverse common channel from the designated mode in a CDMA communication system.

It is another object of the present invention to provide a method for constructing a message in a BS LAC (Link Access Control) layer and interfacing between BS layers in order to designate a reverse common channel to be dedicated for one-to-one communication between a BS and an MS in a CDMA communication system.

It is another object of the present invention to provide a method for constructing a message in a BS LAC layer and interfacing between BS layers in order to release a reverse common channel from a dedicated mode in a CDMA communication system.

It is another object of the present invention to provide a method for constructing a message in a BS LAC layer and interfacing between BS layers in order to designate a reverse common channel to be dedicated for one-to-one communication between a BS and an MS and release the reverse common channel from the dedicated mode in a CDMA communication system.

It is another object of the present invention to provide a method for constructing a message in a BS MAC (Medium Access Control) layer and interfacing between BS layers in order to designate a reverse common channel to be dedicated for one-to-one communication between a BS and an MS in a CDMA communication system.

It is another object of the present invention to provide a method for constructing a message in a BS MAC layer and interfacing between BS layers in order to release a reverse common channel from a dedicated mode in a CDMA communication system.

It is another object of the present invention to provide a method for constructing a message in a BS MAC layer and interfacing between BS layers in order to designate a reverse common channel to be dedicated for one-to-one communication between a BS and an MS and release the reverse common channel from the dedicated mode in a CDMA communication system.

To achieve the above and other objects, there is provided a method of designating a reverse common channel to be dedicated in a base station of a CDMA communication system. The base station designates a reverse common channel on which to receive a response message to be dedicated when a message

requiring a response message is generated, generates designated channel indicating parameters including a reverse common channel designation indicator and an action time, transmits the generated message with the designated channel indicating parameters to a mobile station, and receives a response message from the mobile station on the designated reverse common channel at the action time.

According to another aspect of the present invention, there is also provided a method of releasing a reverse common channel from a designated mode in a base station of a CDMA communication system. The base station reserves a predetermined reverse common channel as a designated channel and sets a reservation time when a message is generated that requires a response message on the reverse common channel. Then, the base station generates designated channel indicating parameters including a reverse common channel designation indicator and an action time and transmits the generated message together with the designated channel indicating parameters to a mobile station. The base station checks whether a response message has been received on the designated reverse common channel within the reservation time and releases the reverse common channel from the designated mode if the response message has been received within the reservation time or the response message has not been received when the reservation time expires.

According to a further aspect of the present invention, there is provided a method of designating a reverse common channel to be dedicated in a mobile station of a CDMA communication system. The mobile station receives a message on a forward common channel. The mobile station analyses the received forward common channel message, sets the reverse common channel to a designated mode if the received message has designated channel indicating parameters that includes a reverse common channel designation indicator and an action time for designation, and generates a response message for the received message. Then, the mobile station designates the reverse common channel to be dedicated by assigning a designated channel spreading code to the reverse common channel and transmits the response message on the designated reverse common channel at the action time.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will become more apparent from the following detailed description

when taken in conjunction with the accompanying drawings in which:

FIG. 1 is a signal flow in a basic procedure of designating a reverse common channel to be dedicated according to an embodiment of the present invention;

FIG. 2 is a signal flow in a BS message transmission procedure for designation of a reverse common channel according to a first embodiment of the present invention;

FIG. 3 is a signal flow in a BS message reception procedure for releasing the reverse common channel from a designated mode according to a first embodiment of the present invention;

FIG. 4 is a flowchart illustrating a procedure from receipt of a message to transmission of a response message in an MS signaling layer to designate the reverse common channel to be dedicated according to a first embodiment of the present invention;

FIG. 5 is a flowchart illustrating the BS message transmission procedure shown in FIG. 2 according to a first embodiment of the present invention;

FIG. 6 is a flowchart illustrating the BS message reception procedure shown in FIG. 3 according to a first embodiment of the present invention;

FIG. 7 is a flowchart illustrating the response message generating procedure of the MS shown in FIG. 4 according to a first embodiment of the present invention;

FIG. 8A illustrates a BS message transmission procedure for reverse common channel designation in a BS LAC layer in case a BS signaling layer (L3) requests a channel element (CE) from a reserved state according to a second embodiment of the present invention;

FIG. 8B illustrates a BS message transmission procedure for reverse common channel designation in the BS LAC layer in case the BS LAC layer requests a channel element (CE) from a reserved state according to a second embodiment of the present invention;

FIG. 9A illustrates a BS message reception procedure for reverse common channel designation in the BS LAC layer in case the signaling layer (L3) requests release of the CE from a reserved state according to the second embodiment of a present invention;

FIG. 9B illustrates a BS message reception procedure for reverse common channel designation in the BS LAC layer in case the BS LAC layer requests release of the CE from a reserved state according to a second embodiment of the present invention;

FIG. 10 illustrates an MS message transmission and reception procedure

for reverse common channel designation according to a second embodiment of the present invention;

FIG. 11 illustrates a BS transmission procedure for reverse common channel designation in a BS MAC layer according to a third embodiment of the present invention;

FIG. 12 illustrates a BS reception procedure for reverse common channel designation in the BS MAC layer according to a third embodiment of the present invention; and

FIG. 13 illustrates a signal communication procedure on a designated reverse common channel in an MS MAC layer according to a third embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Preferred embodiments of the present invention will be described hereinbelow with reference to the accompanying drawings. In the following description, well-known functions or constructions are not described in detail since they would obscure the invention in unnecessary detail.

The present invention is intended to provide an apparatus and method for designating a reverse common channel to be dedicated for one-to-one communication between a BS and an MS in a CDMA communication system, covering the structure of a message generated from layer 3 of the BS, inter-layer interfacing, the structure of a message generated from the MS in response to a received message, and a communication method between the BS and the MS. Designation of a reverse common channel to be dedicated can be implemented in a LAC (Link Access Control) layer as well as in a signaling layer described in the preferred embodiments of the present invention. When message fields are formed not by the signaling layer but by the LAC layer, the layers may be interfaced in a different manner.

The preferred embodiments of the present invention provides an apparatus and method for designating a reverse common channel to be dedicated and an inter-protocol layer interfacing method. For this purpose, a BS transmits a control message on a forward common channel to an MS. This control message includes long code information representing the spreading code for common channel designation and common power control channel information. The MS responds to the control message with a response message. In this case, the reverse

common channel designation relieves the MS of the constraint of competing with other MSs for access to the common channel. In the preferred embodiments of the present invention, reverse common channels include a reverse access channel (R-ACH), a reverse common control channel (R-CCCH), and a reverse enhanced access channel (R-EACH).

The reverse common channel designation ensures a rapid response time in transmitting a message on a designated reverse common channel, increases the transmission success rate of the reverse common channel, and reduces inter-channel interference caused by message re-transmission. Further, it decreases the number of fields added by an MS LAC layer, thereby reducing errors that occur during message transmission.

Now, the preferred embodiments of the present invention will be described in detail with reference to the attached drawings.

FIG. 1 illustrates the signal flow between the BS and the MS in a common channel designating procedure for the case that the BS requests that the MS designate a common channel to be dedicated and the MS receives a message including parameters necessary for common channel designation from the BS, according to the preferred embodiments of the present invention. The parameters include designated channel indication including field (DESIGNATED_MODE_INCL), a designated channel indicator (DESIGNATED_MODE), the address of a common power control channel (DAM_ADDRESS: Designated Access Mode_Address), the data rate (RATE_WORD), and the action time (ACTION_ TIME). Here, the action time may be added to a message or preset in a system. When the action time is added to a message for transmission, the message may be a common channel designating message or an access parameter message.

Therefore, when the BS is to designate a common channel to be dedicated for one-to-one communication with a particular MS, it transmits a message with message fields including the above parameters constructed by a BS L3, LAC, or MAC layer to the MS on a forward common channel. Then, the MS analyses the message. If the MS confirms that the message includes the designated channel indicating parameters, it designates a reverse common channel to be dedicated according to the parameters and transmits a response message to the BS on the designated reverse common channel in step 102. The response message may be a

response to the received message or a user data traffic message. Since user traffic data is transmitted after common channel designation, the user data traffic message, if it is longer than a frame length supported by a physical layer, is segmented prior to transmission. For designation of the reverse common channel, the MS may use an ESN (Electronic Serial Number) mask, a private long code mask, or a specific R-CCCH long code mask assigned to a specific MS by a BS through prior scheduling. When the scheduled R-CCCH mask is used, the MS constructs the mask using the address of a common power control channel that is referred to for designation of a reverse common channel.

A description will be made of a reverse common channel designating method in signaling layer L3, LAC, or MAC of the BS.

Table 1 lists exemplary messages transmitted from the BS to the MS on a forward common channel. Upon receipt of these messages, the MS should transmit response messages for the messages to the BS on a reverse common channel. In the preferred embodiments of the present invention, the BS includes the designated channel indicating parameters in the messages shown in Table 1 and the MS transmits corresponding response messages to the BS after designating the reverse common channel based on the designated channel indicating parameters, by way of example.

(Table 1)

Message Title on f-csch
Status Request Message
TMSI Assignment Message
General Page Message
SSD Update Message
Authentication Challenge Message
Base Station Challenge Confirmation Order
Extended Release Message
Service Redirection Message
Data Burst Message
Service Release Message
Order Message

Referring to Table 1, if the BS transmits a status request message to the MS on a forward common signaling channel (f-csch), the MS transmits a status response message to the BS on a reverse common signaling channel (r-csch). When the MS transmits the exemplary messages of Table 1 on a reverse common channel in the conventional mobile communication system, the messages may not

reach the BS reliably and thus need to be retransmitted. The retransmission may incur interference with other MSs. However, transmission performance can be increased by designating the reverse common channel to be dedicated and transmitting the messages on the designated reverse common channel according to the preferred embodiment of the present invention.

To designate the reverse common channel, the BS's L3, LAC, or MAC layer adds designated channel indicating parameters shown in Table 2 to the forward channel messages of Table 1, according to the preferred embodiments of the present invention.

(Table 2)

Field	Length
DESIGNATED_MODE_INCL	1
DESIGNATED_MODE	1
DAM_ADDRESS	0 or 6
RATE_WORD	0 or 3

Though not shown in Table 2, the action time is added to the messages shown in Table 1 or preset in the system. If the action time is added to a message, a BS signaling layer or LAC layer adds it. On the other hand, if the system presets the action time, the system estimates time when a message is transmitted from an MS, considering the time required for transmission of a message on a common channel to an MS, that is, propagation time delay and message processing time. The action time may be added to a common channel designation request message or an access parameter message. If the action time is added to the access parameter message, the MS receives it when it access the system and stores it. When the MS receives a common channel designation command, it transmits a message to the BS based on the stored action time.

The designated channel indicating parameter fields include the four parameters (or action time in addition) shown in Table 2. In Table 2, DESIGNATED_MODE is a field that orders the MS to designate a common channel to be dedicated, the field DAM_ADDRESS represents the address of a common power control channel, i.e., the index of the common power control channel that is referred to for control of the transmission power of a message to be transmitted after common channel designation and the field RATE_WORD indicates the transmission rate of a designated reverse common channel. The

LAC layer adds a field Action_Time to notify the MS of the time to transmit a response message after the MS receives an exemplary message as shown in Table 1. The BS adds the two fields when it transmits a particular message or requests the MS to transmit a response message on the designated common channel.

For designation of the common channel to be dedicated, the corresponding MS should use a predetermined long code in spreading the reverse common channel and the BS should reserve a channel element to receive the reverse channel signal spread with the spreading code.

FIGs. 2 to 7 illustrate procedures of designating a reverse common channel in a BS L3 and an MS L3 according to a first embodiment of the present invention, FIGs. 8A to 10 illustrate procedures of designating a reverse common channel in a BS LAC layer and an MS LAC layer according to a second embodiment of the present invention, and FIGs. 11, 12, and 13 illustrate procedures of designating a reverse common channel in a BS MAC layer and an MS MAC layer according to a third embodiment of the present invention.

FIG. 2 is the signal flow in a procedure for adding information about the reverse common channel designation in the BS signaling layer, according to a first embodiment of the present invention.

Referring to FIG. 2, layer 3 (L3) of the BS requests reservation of a channel element before designation of the common channel in step 201, as stated above. That is, the BS L3 requests a designated mode to be set to designate the reverse common channel to be dedicated if the BS is to transmit a message that requires a response message from the MS. The designated mode can be set to designate the reverse common channel even when the BS is to transmit a message that acknowledges designation among response-requiring messages. Here, the f-csch messages listed in Table 1 require response messages from the MS. When a response message should be received on a designated reverse common channel, the BS L3 outputs a mode signal (Designated_Mode) requesting reservation of channel resources.

Upon receipt of the channel element reservation request from the BS L3, the resource controller (RC) of the BS transmits a channel element reservation request signal including reservation action time (CE_Reserve. Request with Action Time) to the physical layer (PHY) of the BS in step 202. The action time

may be added to a message directed to the MS or preset in the system.

Action Time is set to an appropriate value considering the time until the BS receives a response message from the MS after the MS receives a forward common channel message from the BS. Action Time is added in a LAC layer of the BS. The LAC layer adds one bit for USE_TIME and 6 bits for ACTION_TIME to set Action Time. The duration (T_designated) of the channel element reserved state is also set to prevent continuous occupation of the channel element and misuse of resources in case the BS fails to receive the response message within a predetermined time. The reservation duration can be set in consideration of time required for transmission of the forward common channel message, time required to process the forward common channel message in the MS, and time taken for other related operations.

The reservation duration, set in step 203 of FIG. 2, is necessary in case that the MS does not recognize the forward common channel message transmitted from the BS and thus cannot transmit a response message to the BS. Thus, the channel element starts to operate at the action time and the channel reserved state lasts for a time period set in a reservation timer (T_designated). Unless the BS fails to receive a required response message until the reservation timer expires, it automatically releases the channel element from the reserved state in order to prevent the dissipation of resources caused by the continuous reservation of the channel element. Thus, the timer should be set to an appropriate value.

In step 203, the PHY notifies the RC of information about channel element reservation. If it is not possible to reserve the channel element, the PHY generates a signal indicating "reservation unavailable" and the timer value is not set. If the channel element has been reserved, the PHY generates a reservation complete signal.

In step 204, the RC transmits a response received from the PHY to the L3. The BS transmits the thus-constituted message to the MS on the forward common channel in step 205. The DESIGNATED_MODE is set to 1 in the message as an indicator that orders the MS to spread the reverse common channel with a particular long code like the ESN of the MS.

If the L3 receives a signal indicating "reservation unavailable" in step 204, it sets DESIGNATED_MODE to 0 and omits the fields DAM_ADDRESS

and RATE_WORD. In this case, the LAC layer does not add USE_TIME and ACTION_TIME either. This implies that the corresponding reverse common channel assumes the same characteristics as a conventional reverse channel. On the other hand, if the L3 receives a reservation acknowledgment signal in step 204, the L3 sets DESIGNATED_MODE to 1, writes the address of a common power control channel for reference in the field DAM_ADDRESS, and writes information about the data rate of a designated channel in the field RATE_WORD. The LAC layer adds the field USE_TIME and ACTION_TIME.

FIG. 5 is a flowchart illustrating the reverse common channel designation procedure of FIG. 2 in the BS.

Referring to FIG. 5, if a forward common channel message is generated in step 500, the BS checks whether the message is used for reverse common channel designation in step 511. If the message is a designation request message, the BS request designation in step 513. And BS checks whether there is an available channel to be reserved in step 515. If channel reservation is possible, the BS reserves the channel and sets Action Time and T_designated in step 517. Action Time indicates a time point when the MS transmits the reverse common channel message and T_designated is a time period for which the BS awaits receipt of a response message from the MS on a reverse common control channel. Then, the BS generates the designated channel indicating parameters shown in Table 2 in steps 519 and 521. The parameters include DESIGNATED_MODE, DAM_ADDRESS, and RATE_WORD. To designate the reverse common channel, the BS sets DESIGNATED_MODE to 1 for designating the reverse common control channel at step 519, and the other parameters for setting the transmission power and transmission rate of the reverse common control channel to corresponding values in step 521. Then, the three parameters are added to one of the messages listed in Table 1 and transmitted at the designated action time on the forward common control channel.

If the generated message is not a designation request message in step 511 or there is no channel element to be reserved in step 515, the BS sets DESIGNATED_MODE to 0 in step 523, deletes the other parameter fields in step 525, and transmits the message on the forward common channel.

After transmitting the message (requiring a response from the MS) on the forward common channel, the BS awaits receipt of the response message from the

MS for the time T_designated.

FIG. 3 is the signal flow within the BS when the BS receives the response message for the transmitted forward common channel message including information about the reverse common channel from the MS on the designated reverse common channel, according a first embodiment of the present invention.

Referring to FIG. 3, the L3 of the BS receives the response message from the MS on the designated reverse common channel in step 301. If the reverse common channel has not been designated, the BS has, in effect, received the message on a conventional access channel.

In step 302, the L3 receives the response message from the MS and notifies the reception to the RC to release the dedicated reverse common channel in accordance with the response message (Designated_Mode_Release, Request).

In step 303, the RC notifies the PHY that the reverse common channel should be released from the designated mode. Then, the PHY demodulates the designated reverse common channel spread with a unique MS long code, (e.g., an ESN) and releases the reservation of the channel element

In step 304, the PHY notifies the RC that the reservation of the channel element has been released. Then, the RC notifies the L3 of the release of the channel element from the reserved state, thereby wholly releasing the reverse common channel from the designated mode, in step 305.

As described above, for a communication between a BS and a specific MS on a designated reverse common channel, a channel element is reserved and the reservation duration of the channel element is set. If the reserved channel element is available, the BS transmits designated channel indicating parameters to the MS on a forward common channel at a designated action time. The designated channel indicating parameters is added to one of the forward common channel messages shown in Table 1 that require response messages on a reverse common channel and includes the designated channel indicating parameters of DESIGNATED_MODE, DAM_ADDRESS, and RATE_WORD as shown in Table 2. DESIGNATED_MODE may be one bit. If this field is set, a spreading code that designates the reverse common channel is generated. Here, the BS and the MS control a preset dedicated long code to be generated for the reverse

common channel. The spreading code can be a long code generated using the ESN mask of the MS, a public long code mask, or a predetermined long code for common channel designation.

Table 3 shown below lists message fields added by a LAC layer of the MS when the MS transmits the response message on the designated reverse common channel, where message fields labeled with M are always included in a message and message fields labeled with O can be omitted when a reverse common channel is designated. The messages shown in Table 3 are LAC layer messages transmitted from the MS after reverse common channel designation.

(Table 3)

Field	Basic Mode	Designated Mode	Length [bit]
MSG_TYPE	M	M	8
ACK_SEQ	M	M	3
MSG_SEQ	M	M	3
ACK_REQ	M	M	1
VALID_ACK	M	M	1
ACK_TYPE	M	M	3
MSID_TYPE	M	O	3
MSID_LEN	M	O	4
MSID	M	O	8 × MSID_LEN

(M: Mandatory, O: Optional)

In Table 3, the LAC layer adds the fields listed under Basic Mode when the MS is to transmit the response message on the reverse common channel. Because the common channel is commonly shared by a plurality of MSs, the MS should transmit its address to the BS so that the BS can identify the MS. Therefore, MSID_TYPE, MSID_LEN, and MSID are of necessity added. However, if the reverse common channel is designated to be dedicated to the specific MS, the fields MSID_TYPE, MSID_LEN, and MSID that identify the MS are not necessary, as shown in the list under the Designated Mode column in Table 3. The resulting decrease in the number of fields added by the LAC layer reduces transmission errors.

MSG_TYPE provides transmission characteristics of the message. ACK_SEQ is the sequence number of the response. The BS confirms message receipt by checking the stored sequence of its transmitted message and the sequence of a received message. MSG_SEQ indicates the sequence of a transmitted message. ACK_REQ is a command requesting a response for the

current message. If this field is set to 1, the BS or the MS that receives the message should transmit a response message. VALID_ACK indicates the validity of an acknowledgment and ACK_TYPE indicates termination of the acknowledgment.

As noted from Table 3, designation of a reverse common channel increases a transmission success rate and reduces inter-channel interference. Furthermore, the length of an MS-initiated message is decreased, thereby reducing message transmission errors.

FIG. 4 is a signal flow in a response message transmission procedure in the MS after it designates a reverse common channel.

Referring to FIG. 4, the MS receives a message from the BS on the forward common channel in step 401. Upon receipt of the message including the designated channel indicating parameters on the forward common channel, a PHY of the MS transmits the received message to an L3 of the MS in step 401.

Then, the L3 recognizes the reverse common channel information included in an L3 service data unit (SDU), generates a response message for the received message, and transmits the response message to the LAC layer in step 402. Here, the L3 places a designated mode indicator requesting transmission of the response message on the designated reverse common channel in an message control status block (MCSB).

The LAC layer recognizes that the response message is to be transmitted on the designated reverse common channel from an analysis of the MSCB received together with the L3 SDU, does not add MS ID-related fields shown in Table 3, and transmits an LAC PDU (Protocol Data Unit) and PCSB (PDU Control Status Block) to a MAC (Medium Access Control) layer in step 403. The LAC PDU excludes the MS ID-related fields and the PCSB includes the designated mode indicator.

The MAC layer requests a designated_long_code response message to be spread with a unique long code to the PHY in step 404.

The PHY generates a spreading code using an ESN mask or a private long code mask for designation of the reverse common channel and transmits the

response message on the designated reverse common channel according to the command received from the MAC layer, in step and the MS refers to a common power control channel in transmitting the response message to the BS in step 405. The ID of the common power control channel can be detected from DAM_ADDRESS and the transmission rate of the reverse common channel is set according to RATE_WORD in the message received from the BS.

Consequently, the designated reverse common channel serves similarly as a dedicated channel.

FIG. 7 is a flowchart illustrating the reverse common control channel message transmitting procedure of FIG. 4 in the MS.

Upon receipt of the message on the forward common control channel in step 711, the MS checks whether the received message includes the designated channel indicating parameters in step 713. If it does, the MS constructs a response message for the received message in step 715 and deletes MS ID-related fields in step 717. The MS ID-related fields are MSID_TYPE, MSID_LEN, and MS ID in Table 3. The MS requests a designated long code mask and generates a spreading code for the reverse common control channel to be designated in step 719. The designated long code mask can be an ESN long code mask, a public long code mask, or a dedicated long code mask promised between the BS and the MS. The MS transmits the response message on the designated reverse common control channel at an action time in step 721 and 725. Unless the received message includes the designated channel indicating parameters in step 713, the MS generates a spreading code for the reverse common control channel using a contention-based common channel long code and transmits the response message on the reverse common channel.

After receiving the response message, the BS releases the reverse common control channel from the designated mode in the procedure shown in FIG. 3. FIG. 6 is a flowchart illustrating the procedure shown in FIG. 3

Referring to FIG. 6, upon receipt of the response message from the MS in step 611, the BS processes the received message in step 613. In step 615, the BS checks whether the message has been on the designated reverse common control channel. In the case of the designated reverse common control channel, the BS releases the reserved channel element in step 617 and cancels the timer

T_designated in steps 629 and 621.

If the BS fails to receive the response message from the MS within T_designated while the designated reverse common control channel is in use, the BS recovers resources by releasing the reserved channel element and stops the reservation time (T_designated) in order to assign the reverse designated common channel to another MS.

In accordance with the present invention, for designation of a reverse common channel, a BS transmits a control message including long code information indicating a spreading code, channel transmission rate, and information about a common power control channel to an MS. The MS spreads user data with a unique long code for the reverse common channel and transmits a response message for the control message on the designated reverse common channel. The designation of the reverse common channel to be dedicated ensures a rapid response time, increases a transmission success rate, and reduces interference between channels caused by message retransmission. Furthermore, an MS LAC layer adds a lesser number of fields, resulting in the decrease of transmission errors.

Now, procedures of designating a common channel in the BS and the MS will be described according to a second embodiment of the present invention.

FIG. 8A illustrates a procedure of adding reverse common channel designation information in a BS LAC layer, according to a second embodiment of the present invention.

Referring to FIG. 8A, the BS reserves a CE in step 801 prior to designation of a common channel in a BS LAC layer 2 (L2). When the BS allows dedicated transmission of user data traffic and the messages shown Table 1 (i.e., messages requiring a response from the MS), the L2 commands the CE to be reserved in step 801.

Upon receipt of a CE reservation request from the L2, the RC transmits a CE reservation request signal including reservation action time (CE_Reserve. Request with Action Time) to the PHY of the BS. The action time may be added to a message directed to the MS or preset in the system. The action time is set to an appropriate value considering the time until the BS receives a response message from the MS after the MS receives a forward common channel message

from the BS. including reservation action time (CE_Reserve. Request with Action Time) to the PHY of the BS. The action time is added by the BS LAC layer or signaling layer. The duration (T_designated) of the CE reserved state is also set to prevent continuous occupation of the channel element and misuse of resources in case the BS fails to receive the response message within a predetermined time. The reservation duration can be set considering the time required for transmission of the forward common channel message, the time required to process the forward common channel message in the MS, and the time taken for other related operations.

In step 803, the PHY notifies the RC of information about CE reservation. If it is not possible to reserve the channel element, the PHY generates a signal indicating "reservation unavailable" and the timer value is not set. If the channel element has been reserved, the PHY generates a reservation complete signal. In step 804, the RC transmits a response received from the PHY to the L3.

If the L3 receives a signal indicating "reservation unavailable", it transmits common channel designation request information to the L2 through a message control status block (MCSB) to receive a response message for a transmission message or user traffic data from the MS. Upon receipt of the MCSB with an L3 SDU from the L3, it recognizes the processing method of the current received message and adds the following fields to a message for designation of a common channel.

The L2 sets DESIGNATED_MODE to 1 and writes the address of a common power control channel for reference in the MS and the data rate of a designated channel in the fields DAM_ADDRESS and RATE_WORD, respectively. If the L2 adds the action time to the message, it sets USE_TIME and ACTION_TIME. The action time can be added by the L3.

If there is no common channel designation indication in the MCSB, the L2 sets DESIGNATED_MODE to 0 and omits the fields DAM_ADDRESS and RATE_WORD. Either the L2 or the L3 does not add USE_TIME and ACTION_TIME. This implies that the reverse common channel has the same characteristics as a conventional reverse common channel.

The thus-constituted message is transmitted to the MS on a forward common channel in step 805. Setting DESIGNATED_MODE to 1 in the

transmission message implies that the MS should spread the reverse common channel with a particular long code. The long code may be a code unique to the MS.

FIG. 8B illustrates a BS operation similar to that shown in FIG. 8A, except that the L2 reserves the CE. Referring to FIG. 8B, the L3 transmits an MCSB including a command requesting setting of ACK_REQ along with an SDU to the L2 in step 810. If the received MCSB includes the command requesting seeting of ACK_REQ, the L2 transmits Designated_Mode.Request to the RC, commanding reservation of the CE in step 811. In step 812, the RC checks the MAC state of the MS and transmits CE_Reserve.Request to the PHY. If the BS knows the ESN of the MS (e.g., in a suspended state), it designates an ESN-based long code mask. Otherwise, it designates a schedule R-CCCH long code mask. In addition, the BS sets an action time for synchronization to a message transmission time of the MS. The action time can be set using the previous action time value transmitted through a common channel designation request message or an (enhanced) access parameter message. In step 813, the PHY notifies the RC of information about CE reservation. In step 814, the RC transmits information about whether common channel designation is successful or not to the L2. In the case of successful common channel designation, the RC informs the LS of a designated long code mask type. The L2 sets common channel designated-related fields and adds them to a transmission message in step 806 and transmits the message on an F-CCCH I step 807.

If the L3 receives a signal indicating "reservation unavailable", it transmits common channel designation request information to the L2 through a message control status block (MCSB) to receive a response message for a transmission message or user traffic data from the MS. Upon receipt of the MCSB with an L3 SDU from the L3, the L2 recognizes the processing method of the current received message and adds the following fields to a message for designation of a common channel.

The L2 sets DESIGNATED_MODE to 1 and writes the address of a common power control channel for reference in the MS and the data rate of a designated channel in the fields DAM_ADDRESS and RATE_WORD, respectively. If the L2 adds the action time to the message, it sets USE_TIME and ACTION_TIME. The action can be added by the L3.

If there is no common channel designation indication in the MCSB, the L2 sets DESIGNATED_MODE to 0 and omits the fields DAM_ADDRESS and RATE_WORD. Either the L2 or the L3 does not add USE_TIME and ACTION_TIME. This implies that the reverse common channel has the same characteristics as a conventional reverse common channel.

The thus-constituted message is transmitted to the MS on a forward common channel in step 805. Setting DESIGNATED_MODE to 1 in the transmission message implies that the MS should spread the reverse common channel with a particular long code. The long code may be a code unique to the MS.

FIG. 9A illustrates a BS operation when the BS receives the response message for the transmitted forward common channel message or user data traffic from the MS on the designated reverse common channel according to a second embodiment of the present invention.

Referring to FIG. 9A, the BS receives the response message from the MS on the designated reverse common channel in step 901. If the reverse common channel has not been designated, the BS has, in effect, received the message on a conventional access channel.

In step 902, the L3 notifies the RC that the designated duration of the reverse common channel expires, when the L3 receives the user traffic data or the response message for the transmitted message that requires a response.

In step 903, the RC notifies the PHY that the reverse common channel should be released from the designated mode. Then, the PHY demodulates the designated reverse common channel spread with a unique MS long code, (e.g., an ESN) and releases the reservation of the channel element.

In step 904, the PHY notifies the RC that the reservation of the channel element has been released. Then, the RC notifies the L3 of the release of the channel element from the reserved state, thereby wholly releasing the reverse common channel from the designated mode, in step 905.

FIG. 9B illustrates a procedure of releasing the reverse common channel from a designated mode in the BS LAC layer, unlike the procedure shown in FIG.

9A. In step 910, a message is received on a designated R-CCCH. The L2 processes ACK_REQ of the received message, determines whether the message is a response for a message requiring DAM, and transmits a DAM release request to the RC if the message is the response message in step 911. The RC requests release of the CE in step 912. The PHY releases the CE from the reserved state and notifies the RC of the result in step 913. The RC notifies the L2 that DAM has been released in step 914.

FIG. 10 illustrates a procedure of processing a message including reverse common channel designation request information from the BS and transmitting a response message for the received message to the BS in the MS.

Referring to FIG. 10, the MS receives a message from the BS on the forward common channel in step 1001.

The L2 of the MS recognizes that the received message has a reverse common channel designation request field and places a designated mode indicator requesting transmission of the response message on the designated reverse common channel in a PCSB (PDU Control Status Block) along with an L3 SDU free of the LAC layer-related fields of the received message to the L3 in step 1002. The L3 transmits the L3 SDU and the MCSB including information requesting transmission of the response message on the designated reverse common channel to the L2 in step 1003.

The L2 recognizes that the current received message is to be transmitted on the designated reverse common channel from an analysis of the MCSB received with the L3 SDU, does not add MS ID-related fields as shown in Table 3, and transmits an L2 PDU and PCSB to the MAC layer of the MS in step 1004. Here, the MS ID-related fields are excluded in the L2 PDU and a designated mode indicator is placed in the PCSB. The MAC layer transmits a signal requesting the current transmission message to be spread with a unique long code to the PHY in step 1005.

The PHY spreads the reverse common channel using an ESN mask, a private long code mask, or a designated long code mask and transmits a response message or user traffic data on the designated reverse common channel in step 1006. Here, the MS refers to a common power control channel in transmitting the message to the BS. The ID of the common power control channel can be detected

from DAM_ADDRESS and the transmission rate of the reverse common channel is set according to RATE_WORD in the message received from the BS. If the message received from the BS designates an action time, the MS transmits the response message or the user traffic data to the BS at the designated action time. On the other hand, if the system sets the action time of the CE to a particular value, the MS does not know the action time and thus transmits the message at an arbitrary time.

Therefore, a reverse common channel signal is spread with an MS unique long code or a particular spreading code designated by the BS prior to transmission. Consequently, the designated reverse common channel serves similarly as a dedicated channel.

Designation of a common channel in the MS and BS will now be described according to a third embodiment of the present invention.

FIG. 11 illustrates a BS transmission procedure for designation of a common channel according to a third preferred embodiment of the present invention.

The L3 generates an L3 SDU and transmits the L3 SDU and an MCSB indicating that the generated message can request designation of a common channel to the L2 in step 1100. The L2 determines whether the received L3 SDU request designation of a common channel by processing the MCSB, generates an L2 PDU by adding L2-generated fields to the L3 SDU, and transmits the L2 SDU and a PCSB indicating that the message requests common channel designation to the MAC layer in step 1101. Here, the L2 sets the field ACK_REQ of the message to 1 to indicate this message requires a response from the MS.

If the MAC layer finds out that the current message is a common channel designation request message by interpreting the PCSB, it transmits Designated_mode.Request command to the RC to reserve a CE of the PHY in step 1102. The RC transmits CE_Reserve.Request with action time to the PHY in step 1103. The action time can be promised between the BS and the MS or set by the BS and then notified of to the MS through a message. A long code mask type is also transmitted to the MS for use in common channel designation. The PHY transmits information about the reserved state of the CE to the RC in step 1104.

The RC notifies the MAC layer whether the CE of the PHY has been successfully reserved and of a long code mask to be used during common channel designation in the MS in step 1105. After the MAC layer confirms that the CE has been successfully reserved, it constructs fields (i.e., DESIGNATED_MODE, DAM_ADDRESS, and RATE_WORD) necessary for common channel designation, and adds them to the L2 PDU in step 1106. In step 1107, the BS transmits the message including the common channel designation information to the MS on the F-CCCH.

FIG. 12 illustrates a BS reception procedure for common channel designation, according to a third embodiment of the present invention.

Referring to FIG. 12, the BS receives a response message for its transmitted message on a designated R-CCCH in step 1201. The MAC layer confirms that the current received message has been received on the designated common channel, constructs an L2 PDU and a PCSB, and transmits them to the L2 in step 1202. Also in step 1202, the MAC layer transmits Designated_Mode_Release.Request to the RC, requesting release of the common channel from a designated mode. The RC transmits CE_Release.Request to the PHY, requesting release of the CE from the reserved state, thereby releasing all the resources designated for designation of the common channel, in step 1205.

FIG. 13 illustrates a reverse common channel processing procedure for common channel designation in the MS, according to a third embodiment of the present invention.

The MAC layer of the MS receives a message from the BS and determines whether the received message is a common channel designation request message in step 1300.

After the MAC layer confirms that the received message is a common channel designation request message, it requests the PHY that it is changed to a long code mask to be used for common channel designation in step 1301. Also, the MAC layer transmits an L2 PDU and a PCSB including common channel designation request information to the L2. The L2 analyses the PCSB and transmits an L3 SDU and an MCSB with common channel designation indicating information to the L3 in step 1302. The L3 transmits the L3 SDU and the MCSB to the L2 in step 1303. The L2 transmits the L2 PDU and the PCSB to the MAC

layer in step 1304.

The MAC layer constructs a message converted from the L2 PDU and transmits the message to the PHY in step 1305. The PHY spreads the received message using the designated long code mask and transmits the spread message on the R-CCCH in steps 1306. Here, the MS starts the message transmission at an action time promised with the BS and controls the transmission power of the message using a common power control channel designated by the BS.

While the invention has been shown and described with reference to a certain preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

WHAT IS CLAIMED IS:

1. A method of designating a reverse common channel to be dedicated in a base station of a CDMA communication system, comprising the steps of:

designating a reverse common channel on which to receive a response message to be dedicated when a message requiring the response message is generated;

generating designated channel indicating parameters including a reverse common channel designation indicator and an action time;

transmitting the generated message together with the designated channel indicating parameters to a mobile station; and

receiving the response message from the mobile station on the designated reverse common channel at the action time.

2. The method of claim 1, wherein the designated channel indicating parameters further include the address of a common power control channel for use in controlling the transmission power of the reverse common channel and the data rate of the reverse common channel.

3. The method of claim 2, wherein the mobile station uses an ESN (Electronic Serial Number) mask of the mobile station to generate a spreading code for channel designation.

4. The method of claim 1, wherein the message transmitted on a forward common channel is one of the following messages requiring response messages: Status Request Message, TMSI Assignment Message, General Page Message, SSD Update Message, Authentication Challenge Message, Base Station Challenge Confirmation Order, Extended Release Message, Service Redirection Message, Data Burst Message, Service Release Message, and Order Message.

5. A method of releasing a reverse common channel from a designated mode in a base station of a CDMA communication system, comprising the steps of:

reserving a predetermined reverse common channel as a designated channel;

setting a reservation time when a message is generated that requires a

response message on the reverse common channel;

generating designated channel indicating parameters including a reverse common channel designation indicator and an action time;

transmitting the generated message together with the designated channel indicating parameters to a mobile station;

checking whether the response message has been received on the designated reverse common channel within the reservation time; and

releasing the reverse common channel from the designated mode if the response message has been received within the reservation time or the response message has not been received until the reservation time expires.

6. The method of claim 5, wherein the designated channel indicating parameters further include the address of a common power control channel for use in controlling the transmission power of the reverse common channel and the data rate of the reverse common channel.

7. The method of claim 6, wherein the mobile station uses an ESN (Electronic Serial Number) mask of the mobile station to generate a spreading code for channel designation.

8. A method of designating a reverse common channel to be dedicated in a mobile station of a CDMA communication system, comprising the steps of:

receiving a message on a forward common channel;

analyzing the received forward common channel message;

setting the reverse common channel to a designated mode if the received message has designated channel indicating parameters that includes a reverse common channel designation indicator and an action time for designation;

generating a response message for the received message;

designating the reverse common channel to be dedicated by assigning a designated channel spreading code to the reverse common channel; and

transmitting the response message on the designated reverse common channel at the action time.

9. The method of claim 8, wherein the designated channel indicating parameters further include an address of a common power control channel for use in controlling transmission power of the reverse common channel and data rate of the reverse common channel, a transmission rate of the response message is

controlled based on the common power control channel, and the response message is transmitted on the set data rate.

10. The method of claim 9, wherein the spreading code is generated using an ESN (Electronic Serial Number) mask of the mobile station.

11. A method of designating a channel to be dedicated between a base station and a mobile station in a CDMA communication system, comprising the steps of:

generating designated channel indicating parameters including a common channel designation indicator, an address of a common power control channel, transmission rate, and action time;

transmitting a message together with the designated channel indicating parameters to a mobile station by a base station; and

receiving the message with the designated channel indicating parameters and transmitting a response message for the received message to the base station on a designated channel indicated by the designated channel indicator with transmission power set by the common power control channel at the transmission rate at the action time by the mobile station.

12. An apparatus for designating a reverse common channel in a base station of a CDMA communication system, comprising:

a message generator for generating designated channel indicating parameters including a reverse common channel designation indicator and action time for designation and for generating a forward common channel message with the designated channel indicating parameters;

a forward common channel transmitter for transmitting the forward common channel message to a mobile station; and

a reverse common channel receiver to be reserved when the forward common channel message is transmitted and for receiving a response message for the forward common channel message on a reverse common channel that is designated to be dedicated for a reservation time through spreading with a designated channel spreading code.

13. An apparatus for designating a reverse common channel in a mobile station of a CDMA communication system, comprising:

a forward common channel receiver for receiving a message on a forward common channel;

a message analyzer for analyzing the received forward common channel message, for setting the reverse common channel to a designated mode if the received message has designated channel indicating parameters that includes a reverse common channel designation indicator and an action time for designation, and for generating a response message for the received message; and

a reverse common channel transmitter for designating the reverse common channel to be dedicated in the designated mode and for transmitting the response message on the designated reverse common channel at the action time.

14. A method of designating a reverse common channel in a base station, comprising the steps of:

reserving an available reverse common channel to be designated in a physical channel of the base station in response to a designated mode request from a signaling layer of the base station;

constructing, by the signaling layer, a message by including designated channel indicating parameters in transmission data, said designated channel indicating parameters being a designated channel indicator and an action time of designation; and

transmitting the constructed message on a forward common channel through the physical layer.

15. A method of designating a reverse common channel in a mobile station, comprising the steps of:

transmitting, by a physical layer of the mobile station, a message including dedicated channel indicating parameters to a signaling layer of the mobile station, said message being received on a forward common channel, said dedicated channel indicating parameters being a designated channel indicator and an action time of designation;

generating, by the signaling layer, a response message, said response message having designation indicating information;

requesting, by the signaling layer, the physical layer to designate a spreading code for common channel designation and an action time by the signaling layer;

spreading, by the physical layer, the response message with the designated spreading code at the designated action time; and

transmitting, by the physical layer, the response message on a designated reverse common channel.

16. A method of designating a reverse common channel in a base station, comprising the steps of:

reserving an available reverse common channel to be designated in a physical channel of the base station in response to a designated mode request from a signaling layer of the base station;

providing, by the signaling layer, transmission data and designated channel indicating parameters, said designated channel indicating parameters including a designated channel indicator and an action time of designation;

constructing , by a link access control layer of the base station, a message out of the transmission data and the designated channel indicating parameters; and

transmitting the constructed message on a forward common channel through the physical layer.

17. A method of designating a reverse common channel in a mobile station, comprising the steps of:

transmitting, by a physical layer of the mobile station, a message including dedicated channel indicating parameters to a link access control layer of the mobile station, said message being received on a forward common channel, said dedicated channel indicating parameters including a designated channel indicator and an action time of designation;

adding, by the link access control layer, designation indicating information to the received message;

transmitting, by the link access control layer, the received message with the added designation indicating information to a signaling layer of the mobile station;

generating, by the signaling layer, a response message;

adding, by the signaling layer, designation indicating information to the response message;

transmitting, by the signaling layer, the resulting response message to the link access control layer;

requesting, by the link access control layer, the physical layer to designate a spreading code for common channel designation and an action time;

spreading, by the physical layer, the response message with the designated spreading code at the designated action time; and

transmitting, by the physical layer, the spread response message on a designated reverse common channel.

18. A method of designating a reverse common channel in a base

station, comprising the steps of:

reserving an available reverse common channel to be designated in a physical channel of the base station in response to a designated mode request from a signaling layer of the base station;

providing, by the signaling layer, transmission data and designated channel indicating parameters, said designated channel indicating parameters including a designated channel indicator and an action time of designation;

constructing , by a Medicum Access Control (MSC) layer of the base station, a message out of the transmission data and the designated channel indicating parameters; and

transmitting the constructed message on a forward common channel through the physical layer.

19. A method of designating a reverse common channel in a mobile station, comprising the steps of:

transmitting, by a physical layer of the mobile station, a message including dedicated channel indicating parameters to a Medium Access Control (MSC) layer of the mobile station, said message being received on a forward common channel, said dedicated channel indicating parameters including a designated channel indicator and an action time of designation;

adding, by the MSC layer, designation indicating information to the received message;

transmitting, by the MSC layer, the received message with the added designation indicating information to a signaling layer of the mobile station;

generating, by the signaling layer, a response message;

adding, by the signaling layer, designation indicating information to the response message;

transmitting, by the signaling layer, the resulting response message to the link access control layer;

requesting, by the MSC layer, the physical layer to designate a spreading code for common channel designation and an action time;

spreading, by the physical layer, the response message with the designated spreading code at the designated action time; and

transmitting, by the physical layer, the spread response message on a designated reverse common channel.

FIG. 1

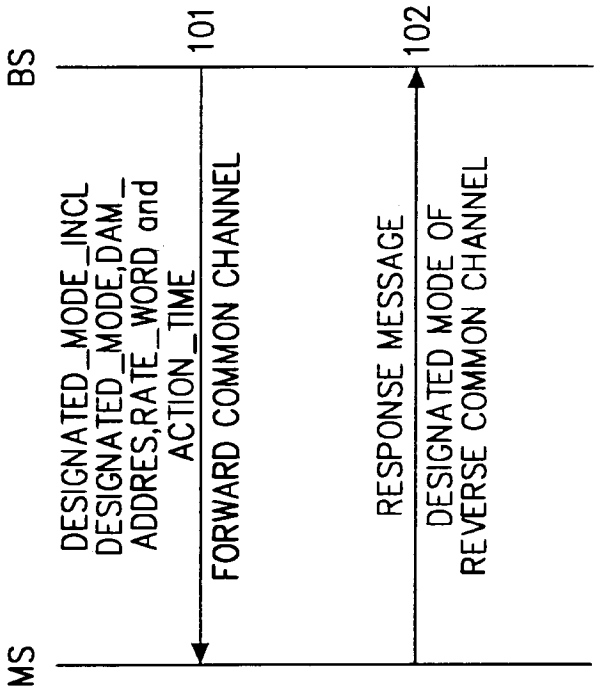

BS
MS
101
102
DESIGNATED_MODE_INCL
DESIGNATED_MODE,DAM_
ADDRES,RATE_WORD and
ACTION_TIME
FORWARD COMMON CHANNEL
RESPONSE MESSAGE
DESIGNATED MODE OF
REVERSE COMMON CHANNEL

FIG. 2

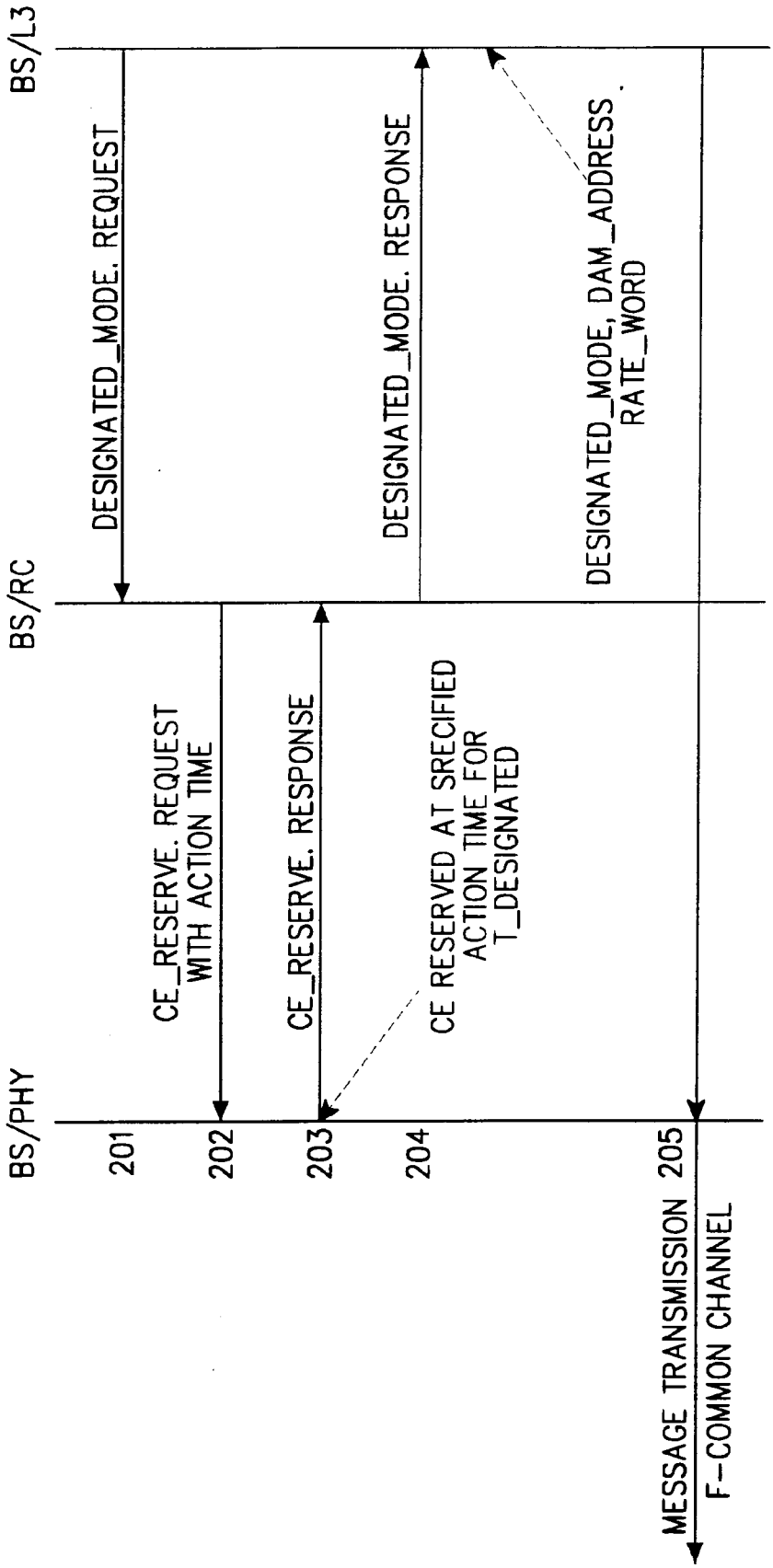

BS/L3
BS/RC
BS/PHY
DESIGNATED_MODE. REQUEST
DESIGNATED_MODE. RESPONSE
DESIGNATED_MODE, DAM_ADDRESS, RATE_WORD
CE_RESERVE. REQUEST WITH ACTION TIME
CE_RESERVE. RESPONSE
CE RESERVED AT SRECIFIED ACTION TIME FOR T_DESIGNATED
201
202
203
204
205
MESSAGE TRANSMISSION F-COMMON CHANNEL

FIG. 3

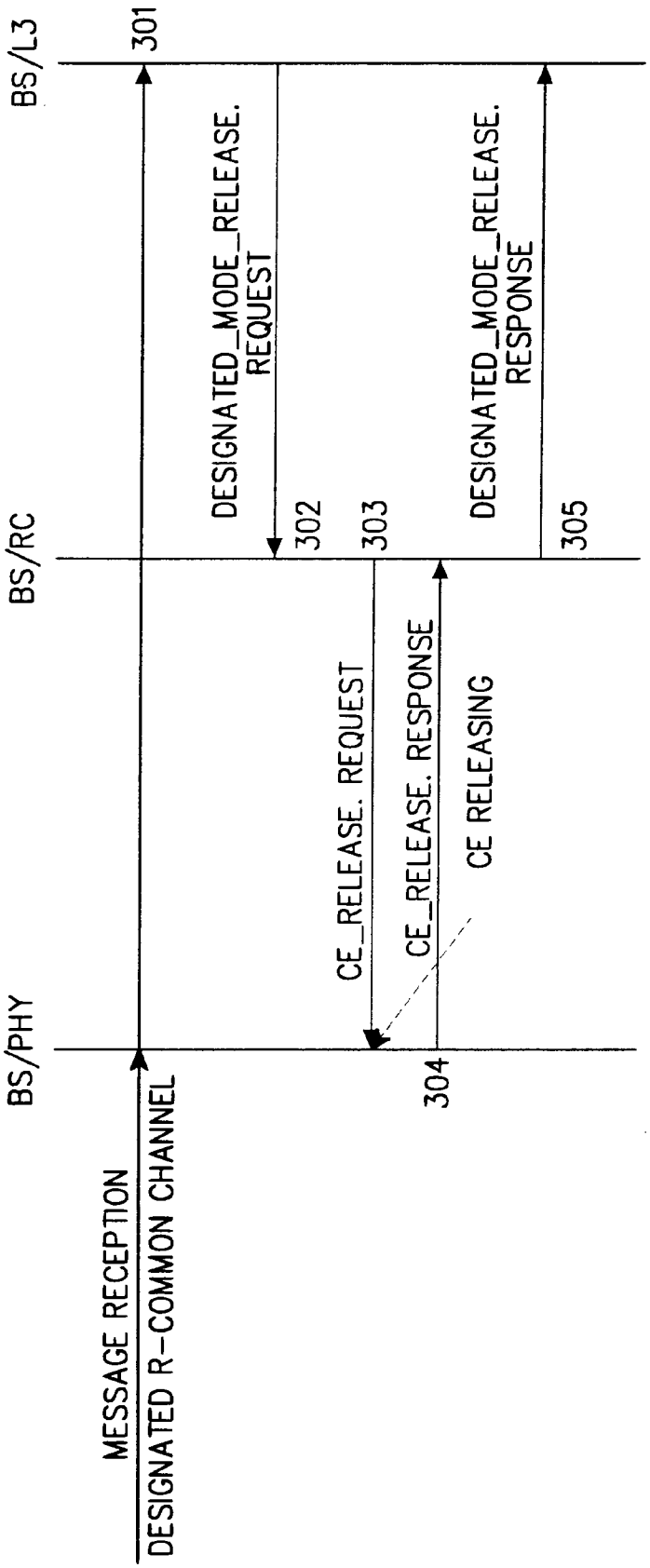
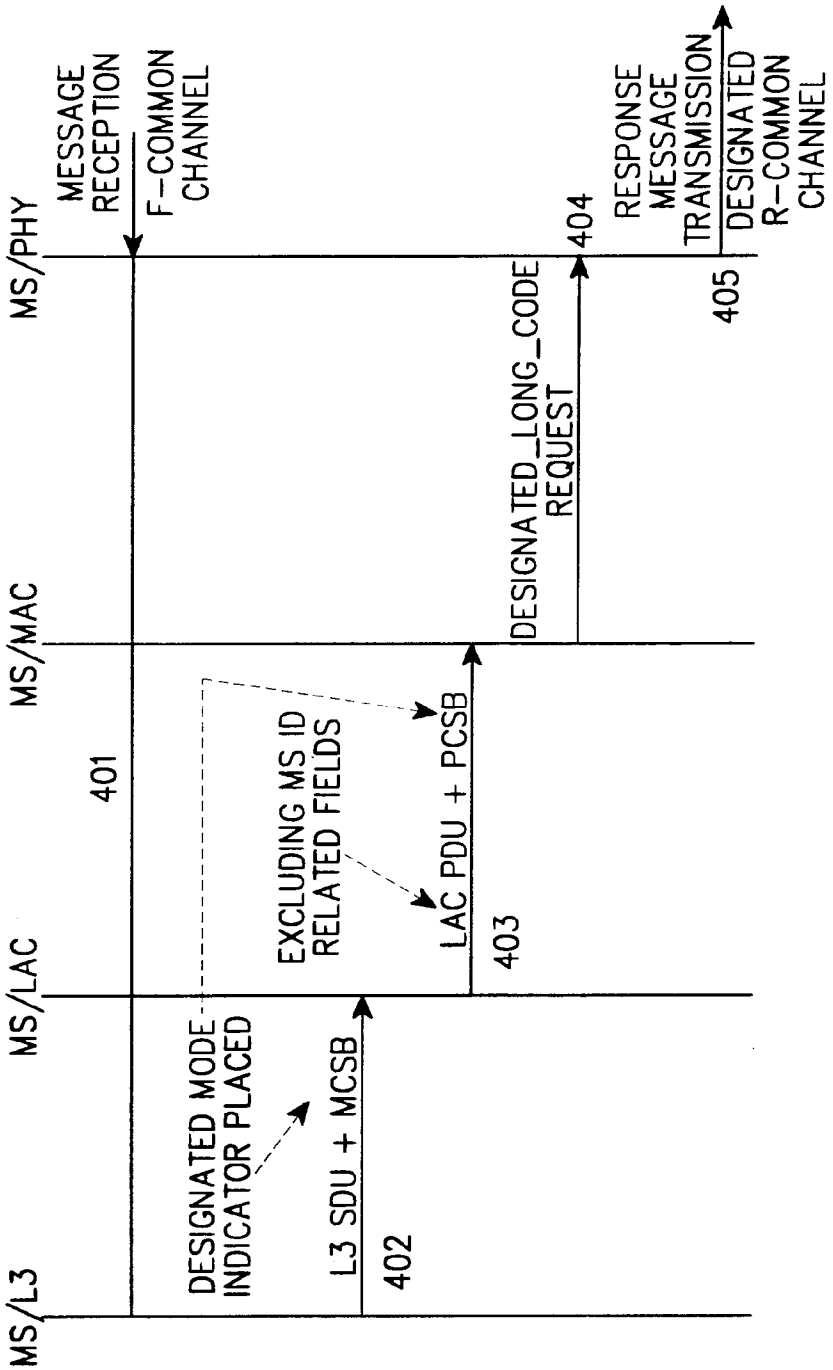

BS/L3
BS/RC
BS/PHY
301
DESIGNATED_MODE_RELEASE. REQUEST
302
303
DESIGNATED_MODE_RELEASE. RESPONSE
305
CE_RELEASE. REQUEST
CE_RELEASE. RESPONSE
CE RELEASING
304
MESSAGE RECEPTION
DESIGNATED R-COMMON CHANNEL

FIG. 4


MS/L3
MS/LAC
MS/MAC
MS/PHY
MESSAGE RECEPTION
F-COMMON CHANNEL
DESIGNATED MODE INDICATOR PLACED
L3 SDU + MCSB
402
401
EXCLUDING MS ID RELATED FIELDS
LAC PDU + PCSB
403
DESIGNATED_LONG_CODE REQUEST
404
RESPONSE MESSAGE TRANSMISSION
405
DESIGNATED R-COMMON CHANNEL

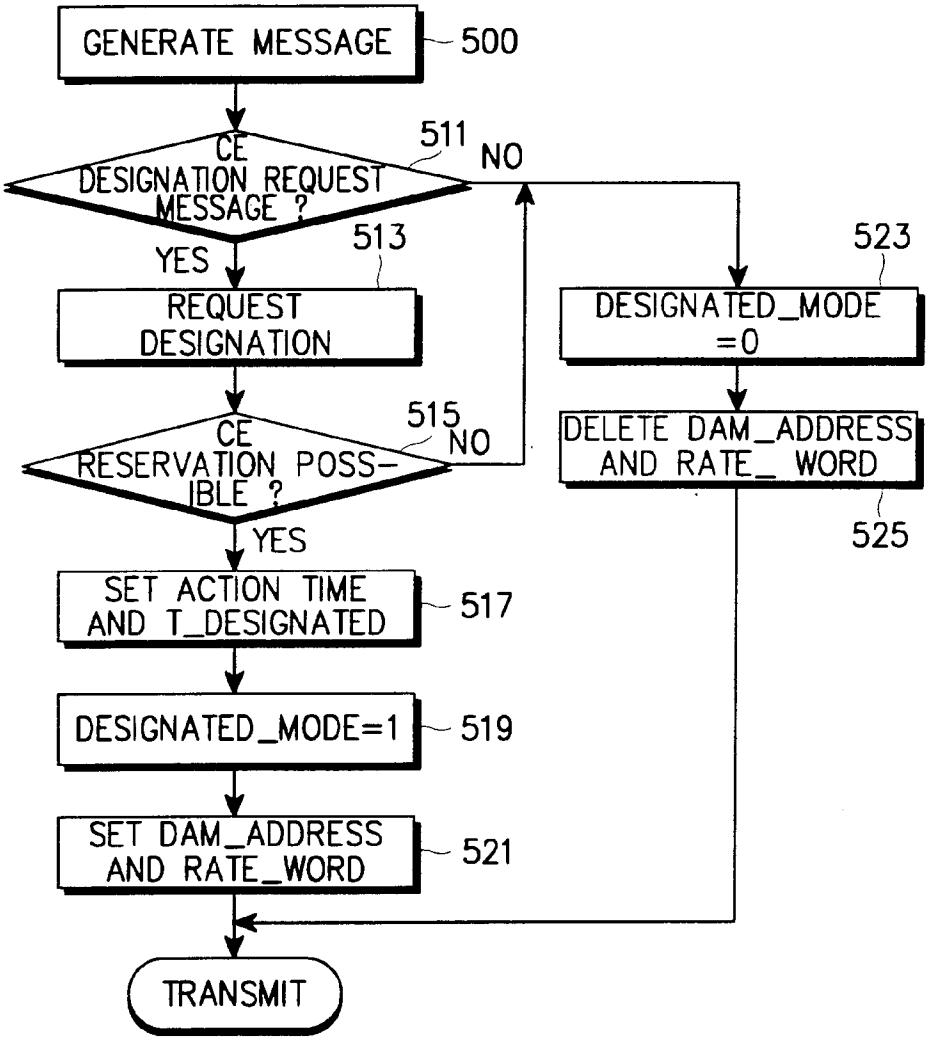

GENERATE MESSAGE
500
CE DESIGNATION REQUEST MESSAGE ?
511
NO
YES
513
REQUEST DESIGNATION
523
DESIGNATED_MODE =0
CE RESERVATION POSSIBLE ?
515
NO
YES
DELETE DAM_ADDRESS AND RATE_ WORD
525
SET ACTION TIME AND T_DESIGNATED
517
DESIGNATED_MODE=1
519
SET DAM_ADDRESS AND RATE_WORD
521
TRANSMIT

FIG. 5

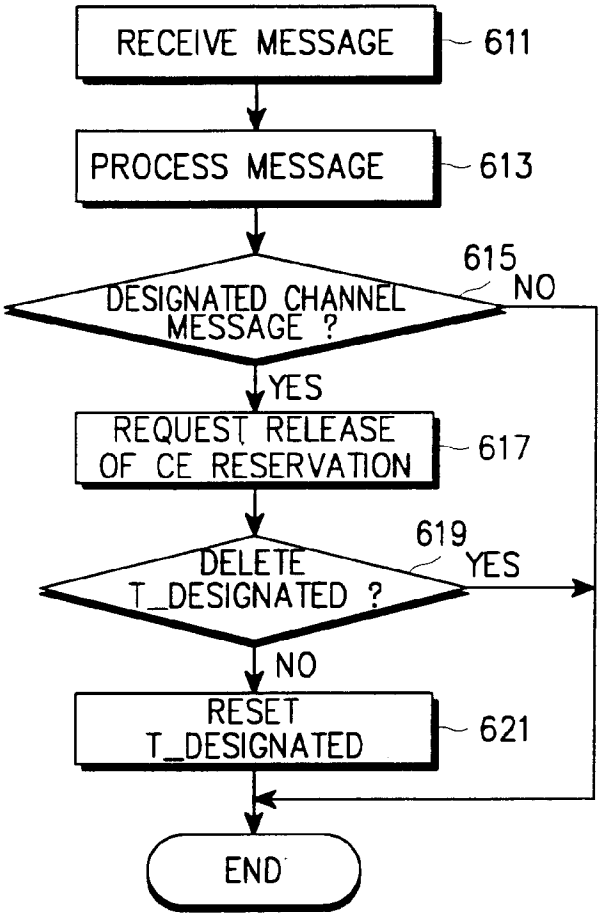

RECEIVE MESSAGE
611
PROCESS MESSAGE
613
615
DESIGNATED CHANNEL MESSAGE ?
NO
YES
REQUEST RELEASE OF CE RESERVATION
617
619
DELETE T_DESIGNATED ?
YES
NO
RESET T_DESIGNATED
621
END

FIG. 6

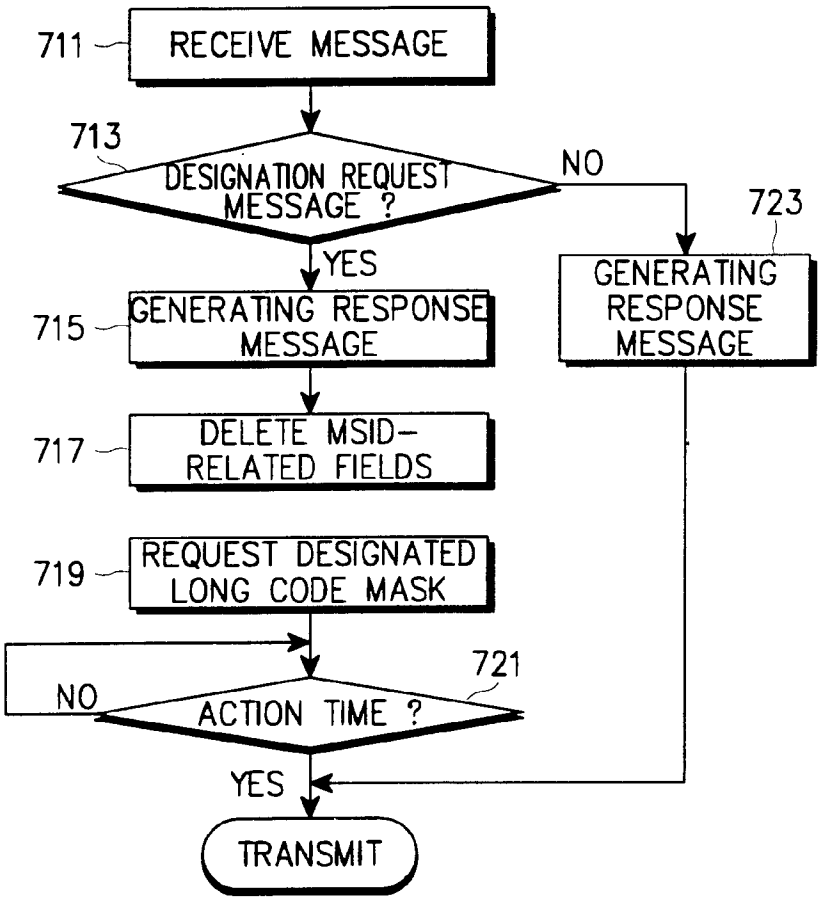

711
RECEIVE MESSAGE
713
DESIGNATION REQUEST MESSAGE ?
NO
723
GENERATING RESPONSE MESSAGE
YES
715
GENERATING RESPONSE MESSAGE
717
DELETE MSID-RELATED FIELDS
719
REQUEST DESIGNATED LONG CODE MASK
721
NO
ACTION TIME ?
YES
TRANSMIT

FIG. 7

FIG. 8A

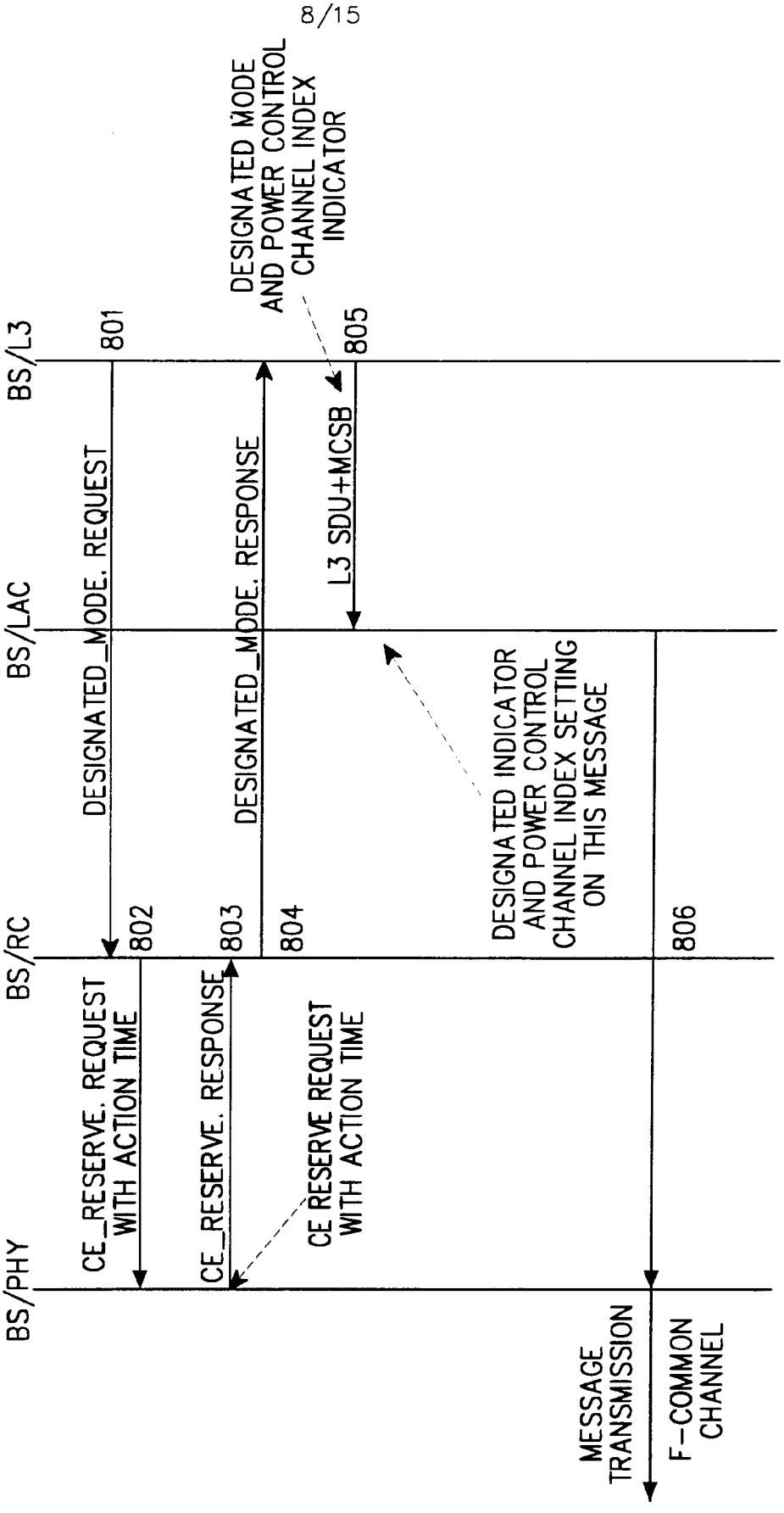

BS/L3
BS/LAC
BS/RC
BS/PHY
801
802
803
804
805
806
DESIGNATED_MODE. REQUEST
DESIGNATED_MODE. RESPONSE
L3 SDU+MCSB
DESIGNATED MODE AND POWER CONTROL CHANNEL INDEX INDICATOR
DESIGNATED INDICATOR AND POWER CONTROL CHANNEL INDEX SETTING ON THIS MESSAGE
CE_RESERVE. REQUEST WITH ACTION TIME
CE_RESERVE. RESPONSE
CE RESERVE REQUEST WITH ACTION TIME
MESSAGE TRANSMISSION
F-COMMON CHANNEL

FIG. 8B

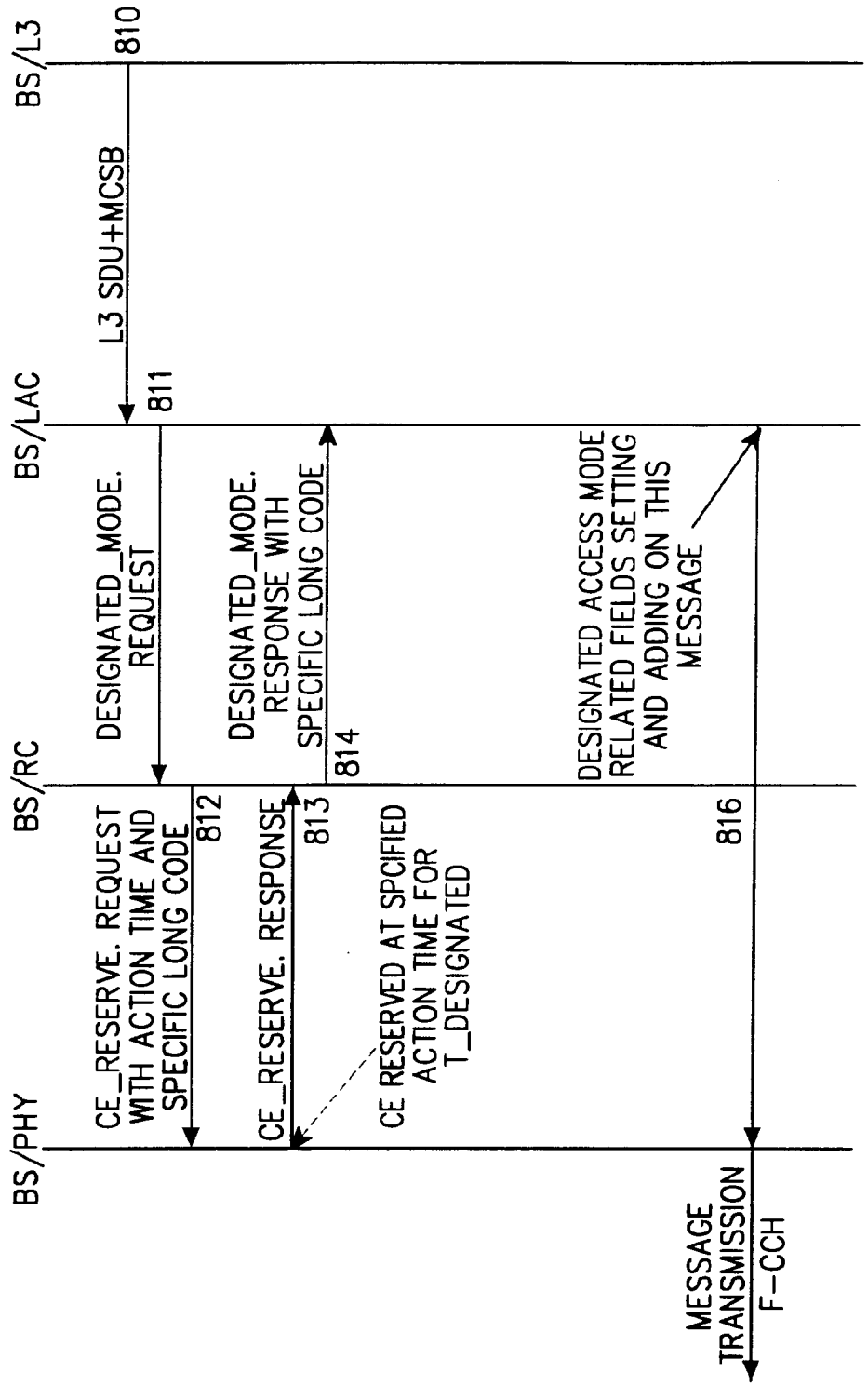

BS/L3
BS/LAC
BS/RC
BS/PHY
810
L3 SDU+MCSB
811
DESIGNATED_MODE. REQUEST
DESIGNATED_MODE. RESPONSE WITH SPECIFIC LONG CODE
814
DESIGNATED ACCESS MODE RELATED FIELDS SETTING AND ADDING ON THIS MESSAGE
CE_RESERVE. REQUEST WITH ACTION TIME AND SPECIFIC LONG CODE
812
CE_RESERVE. RESPONSE
813
CE RESERVED AT SPCIFIED ACTION TIME FOR T_DESIGNATED
816
MESSAGE TRANSMISSION F-CCH

FIG. 9A

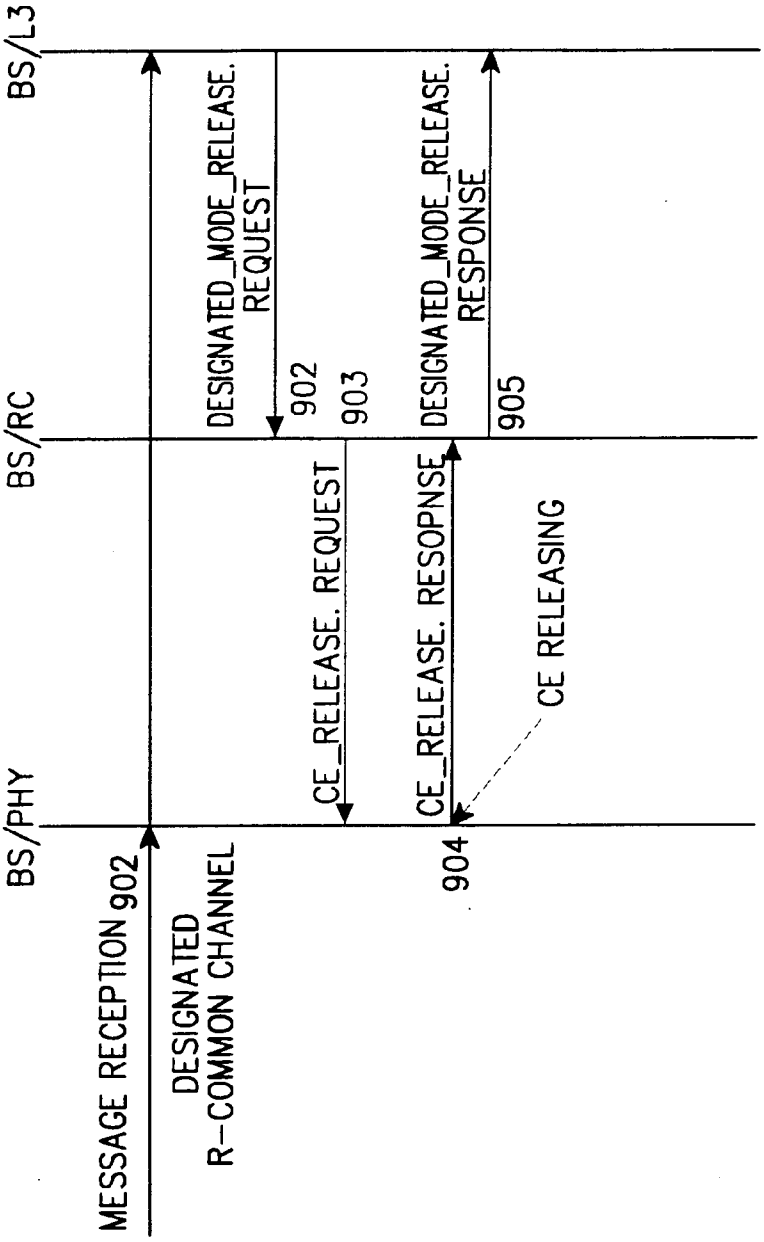

BS/L3
BS/RC
BS/PHY
DESIGNATED_MODE_RELEASE. REQUEST
902
903
DESIGNATED_MODE_RELEASE. RESPONSE
905
CE_RELEASE. REQUEST
CE_RELEASE. RESOPNSE
CE RELEASING
904
MESSAGE RECEPTION 902
DESIGNATED R-COMMON CHANNEL

FIG. 9B

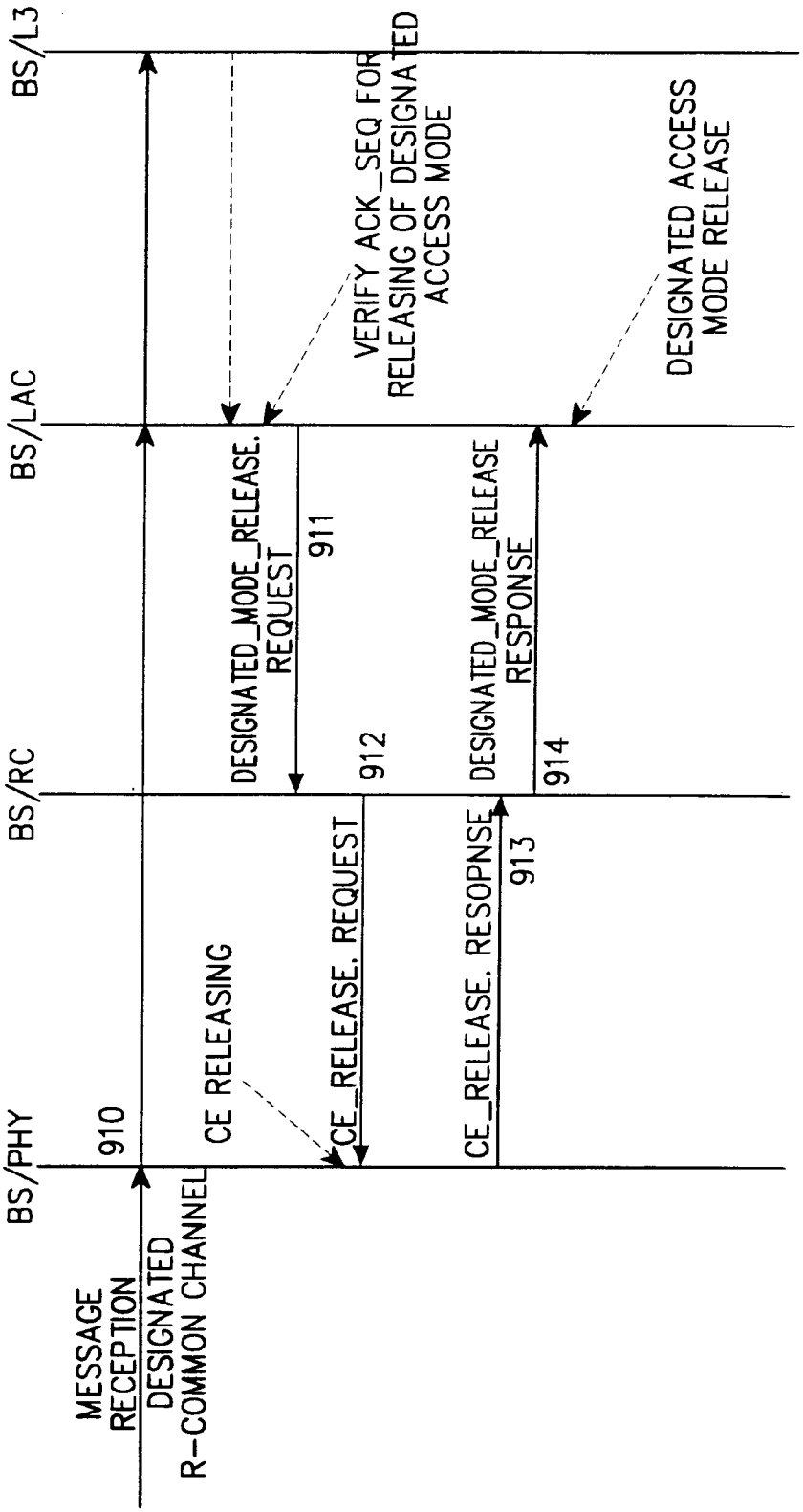

BS/L3
BS/LAC
BS/RC
BS/PHY
MESSAGE RECEPTION
DESIGNATED R-COMMON CHANNEL
910
CE RELEASING
VERIFY ACK_SEQ FOR RELEASING OF DESIGNATED ACCESS MODE
DESIGNATED ACCESS MODE RELEASE
DESIGNATED_MODE_RELEASE. REQUEST
911
CE_RELEASE. REQUEST
912
CE_RELEASE. RESOPNSE
913
DESIGNATED_MODE_RELEASE RESPONSE
914

FIG. 10

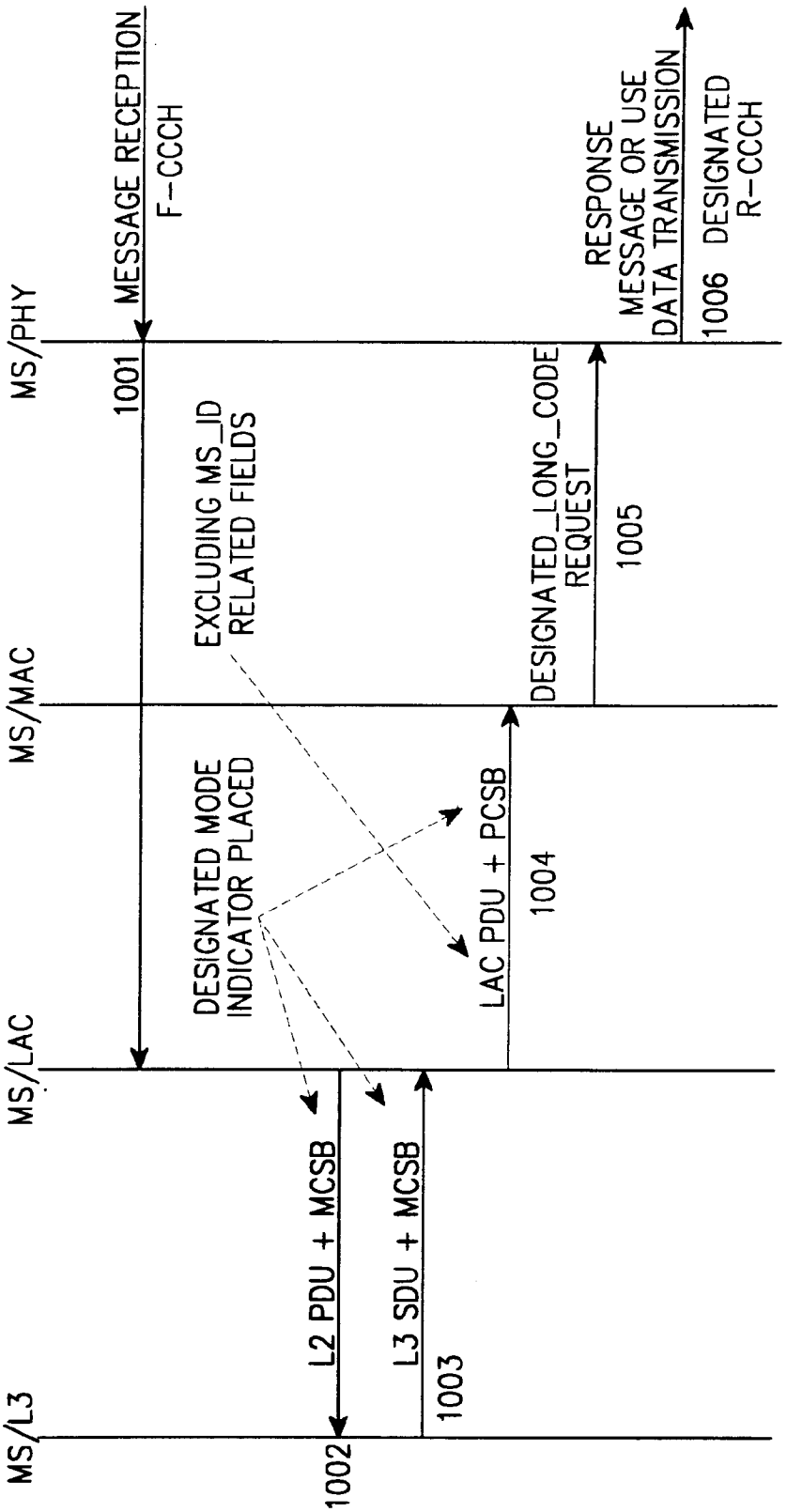

MS/PHY
MS/MAC
MS/LAC
MS/L3
MESSAGE RECEPTION
F-CCCH
1001
EXCLUDING MS_ID
RELATED FIELDS
DESIGNATED MODE
INDICATOR PLACED
L2 PDU + MCSB
1002
L3 SDU + MCSB
1003
LAC PDU + PCSB
1004
DESIGNATED_LONG_CODE
REQUEST
1005
RESPONSE
MESSAGE OR USE
DATA TRANSMISSION
1006 DESIGNATED
R-CCCH

FIG. 11

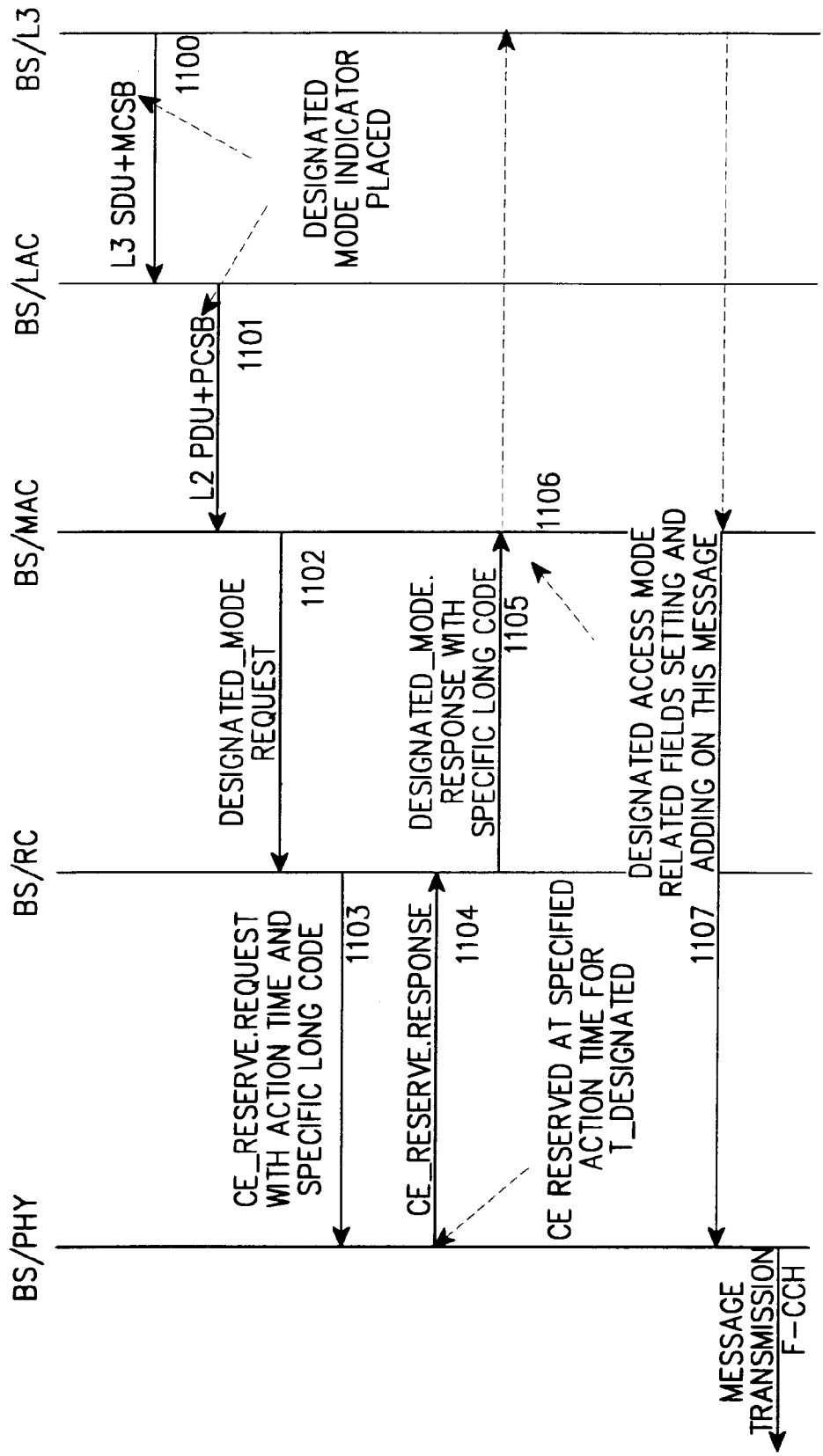

BS/L3
BS/LAC
BS/MAC
BS/RC
BS/PHY
L3 SDU+MCSB
1100
DESIGNATED MODE INDICATOR PLACED
L2 PDU+PCSB
1101
DESIGNATED_MODE REQUEST
1102
CE_RESERVE.REQUEST WITH ACTION TIME AND SPECIFIC LONG CODE
1103
CE_RESERVE.RESPONSE
1104
DESIGNATED_MODE. RESPONSE WITH SPECIFIC LONG CODE
1105
1106
CE RESERVED AT SPECIFIED ACTION TIME FOR T_DESIGNATED
DESIGNATED ACCESS MODE RELATED FIELDS SETTING AND ADDING ON THIS MESSAGE
1107
MESSAGE TRANSMISSION F-CCH

FIG. 12

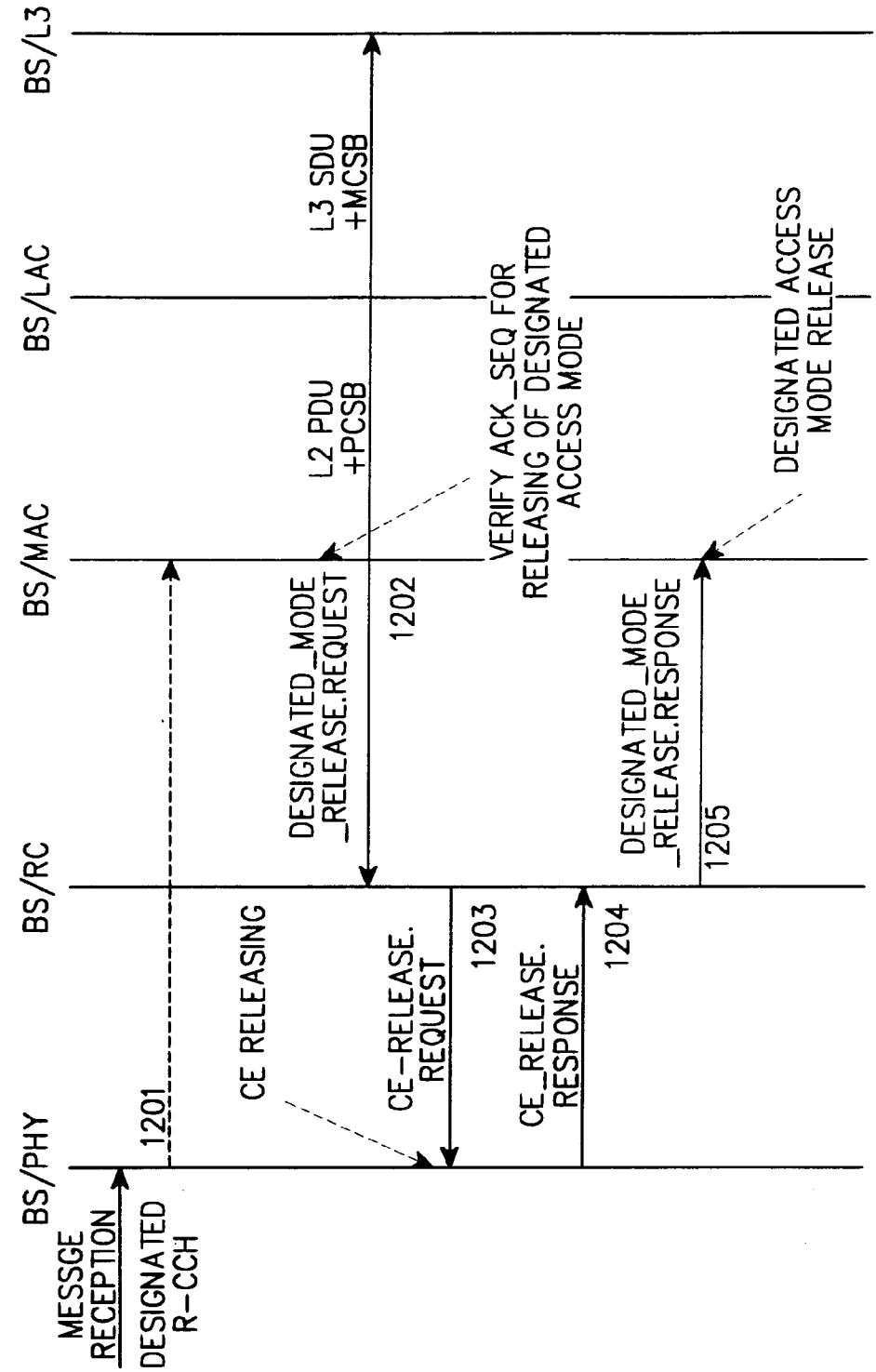
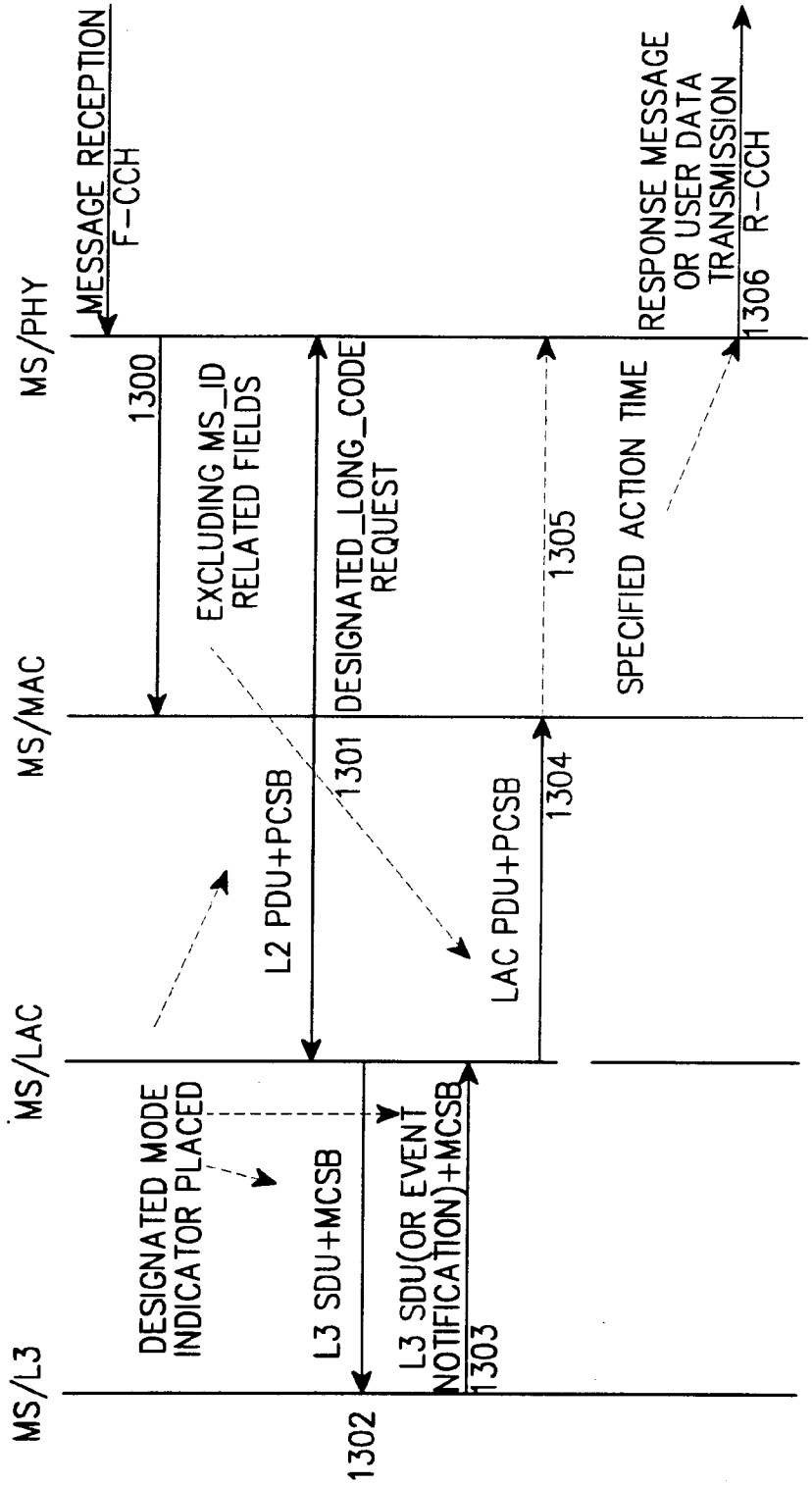

BS/L3
BS/LAC
BS/MAC
BS/RC
BS/PHY
MESSGE RECEPTION
DESIGNATED R-CCH
1201
CE RELEASING
CE-RELEASE. REQUEST
1203
CE_RELEASE. RESPONSE
1204
DESIGNATED_MODE _RELEASE.REQUEST
1202
L2 PDU +PCSB
L3 SDU +MCSB
VERIFY ACK_SEQ FOR RELEASING OF DESIGNATED ACCESS MODE
DESIGNATED_MODE _RELEASE.RESPONSE
1205
DESIGNATED ACCESS MODE RELEASE

FIG. 13


MS/PHY
MS/MAC
MS/LAC
MS/L3
MESSAGE RECEPTION F-CCH
1300
EXCLUDING MS_ID RELATED FIELDS
DESIGNATED_LONG_CODE REQUEST
1305
SPECIFIED ACTION TIME
RESPONSE MESSAGE OR USER DATA TRANSMISSION
1306 R-CCH
L2 PDU+PCSB
1301
LAC PDU+PCSB
1304
DESIGNATED MODE INDICATOR PLACED
L3 SDU+MCSB
L3 SDU(OR EVENT NOTIFICATION)+MCSB
1303
1302

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR00/00744

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 H04B 7/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimun documentation searched (classification system followed by classification symbols)

IPC7 H04B, H04J, H04Q

Documentation searched other than minimun documentation to the extent that such documents are included in the fileds searched

Korean Patents and applications for inventions since 1975
Korean Utility models and applications for Utility models since 1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search trerms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,A	KR 99-53170 A (ETRI) 15 July 1999 See the abstract & claims	1-19
P,A	KR 99-83643 A (Samsung CORP.) 25 November 1999 See the abstract & claims	1-19
A	US 5809421 A (Motorola INC.) 15 September 1998 See the abstract	1-19
A	US 5535259 A (Ericsson INC.) 09 July 1996 See the abstract	1-19

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevence
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevence; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevence; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 OCTOBER 2000 (24.10.2000)	25 OCTOBER 2000 (25.10.2000)

Name and mailing address of the ISA/KR	Authorized officer
Korean Industrial Property Office Government Complex-Taejon, Dunsan-dong, So-ku, Taejon Metropolitan City 302-701, Republic of Korea	YOON, Byoung Soo
Facsimile No. 82-42-472-7140	Telephone No. 82-42-481-5709

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR00/00744

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 99-53170 A	15. 07. 1999	-	-
KR 99-83643 A	25. 11. 1999	-	-
US 5809421 A	15. 09. 1998	-	-
US 5535259 A	09. 07. 1996	WO 9700589 A1	03. 01. 1997
		WO 9524106 A1	08. 09. 1995
		WO 9512957A1	11. 05. 1995
		US 5812955 A	22. 09. 1998
		US 5771453 A	23. 06. 1998
		US 5581597 A	03. 12. 1996
		US 5535259 A	09. 07. 1996
		US 5526402 A	11. 06. 1996
		US 5428668 A	27. 06. 1995
		JP 11513204 T2	09. 11. 1999
		JP 9504665 T2	06. 05. 1997
		EP 748573 B1	21. 04. 1999
		EP 727130 B1	22. 07. 1998
		CN 1193448 A	16. 09. 1998
		CN 1142307 A	05. 02. 1997
		CN 1134214 A	23. 10. 1996
		AU 702242 B2	18. 02.1999
		AU 686768 B2	12. 02. 1998

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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International Bureau

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PCT

(10) International Publication Number
WO 03/055142 A1

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(30) Priority Data:
10/029,711 19 December 2001 (19.12.2001) US

(71) Applicant: QUALCOMM, INCORPORATED [US/US]; 5775 Morehouse Drive, San Diego, CA 92121 (US).

(72) Inventor: LUNDBY, Stein, A.; 716 North Granados Ave, Solana Beach, CA 92075 (US).

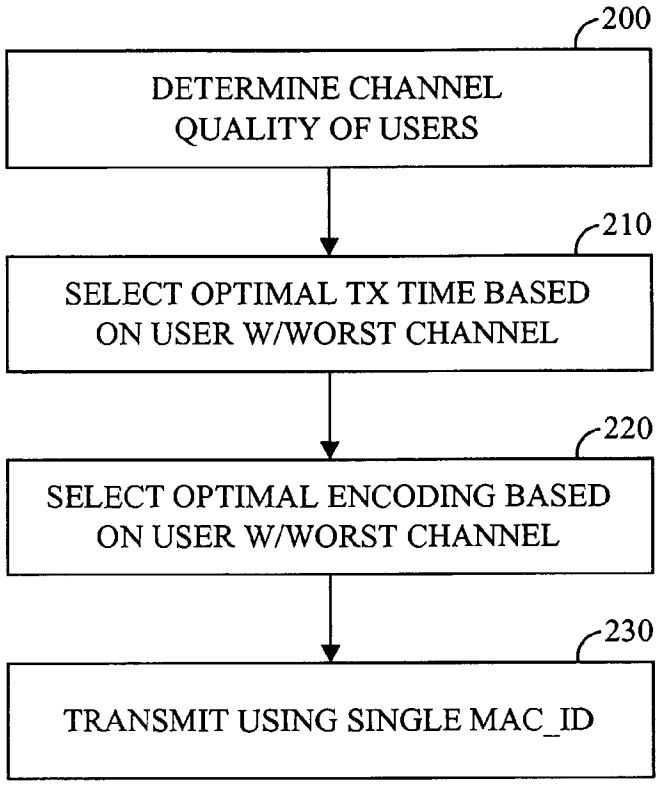
(74) Agents: WADSWORTH, Philip R. et al.; 5775 Morehouse Drive, San Diego, CA 92121 (US).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: EFFICIENT MULTICASTING FOR PACKET DATA SYSTEMS



(57) Abstract: Methods and apparatus are presented for efficient broadcasting in wireless packet data systems. A single MAC_ID is used for broadcasting to a group of subscribers. By using the channel quality information of the group of subscribers (200), a base station determines the identity of the subscriber with the worst channel conditions (210). The timing and the transmission format of the multi-cast are then tailored so that the subscriber with the worst channel conditions is capable of recovering the transmission (220). If the timing and the transmission format is chosen in relation to subscriber with the worst channel conditions, it is probable that other subscribers will be able to recover the transmission as well. Hence, only a single MAC_ID need to be used to make a single broadcast, rather than sending multiple transmissions to multiple subscribers.

WO 03/055142 A1

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

EFFICIENT MULTICASTING FOR PACKET DATA SYSTEMS

BACKGROUND

Field

[1001] The present invention relates generally to communications, and more specifically, to transmitting multi-cast broadcasts in wireless communication systems.

Background

[1002] The field of wireless communications has many applications including, e.g., cordless telephones, paging, wireless local loops, personal digital assistants (PDAs), Internet telephony, and satellite communication systems. A particularly important application is cellular telephone systems for mobile subscribers. As used herein, the term "cellular" system encompasses both cellular and personal communications services (PCS) frequencies. Various over-the-air interfaces have been developed for such cellular telephone systems including, e.g., frequency division multiple access (FDMA), time division multiple access (TDMA), and code division multiple access (CDMA). In connection therewith, various domestic and international standards have been established including, e.g., Advanced Mobile Phone Service (AMPS), Global System for Mobile (GSM), and Interim Standard 95 (IS-95). IS-95 and its derivatives, IS-95A, IS-95B, ANSI J-STD-008 (often referred to collectively herein as IS-95), and proposed high-data-rate systems are promulgated by the Telecommunication Industry Association (TIA) and other well known standards bodies.

[1003] Cellular telephone systems configured in accordance with the use of the IS-95 standard employ CDMA signal processing techniques to provide highly efficient and robust cellular telephone service. Exemplary cellular telephone systems configured substantially in accordance with the use of the IS-95 standard are described in U.S. Patent Nos. 5,103,459 and 4,901,307,

which are assigned to the assignee of the present invention and incorporated by reference herein. An exemplary system utilizing CDMA techniques is the cdma2000 ITU-R Radio Transmission Technology (RTT) Candidate Submission (referred to herein as cdma2000), issued by the TIA. The standard for cdma2000 is given in the draft versions of IS-2000 and has been approved by the TIA and 3GPP2. Another CDMA standard is the W-CDMA standard, as embodied in 3rd Generation Partnership Project "3GPP", Document Nos. 3G TS 25.211, 3G TS 25.212, 3G TS 25.213, and 3G TS 25.214.

[1004] The telecommunication standards cited above are examples of some of the various communications systems that can be implemented to transmit voice and/or data. Within these systems, multiple users must share limited system resources. One such limitation is the availability of channels to support multiple users. For example, in a CDMA-type system, each user within the range of a base station is assigned one or more channels to conduct communications with the base station. If there were not enough channels, then a new user that is entering the range of the base station would be blocked from accessing the services of that base station.

[1005] In certain situations, it is desirable to transmit the same data to several users. This is particularly desirable for applications that incur a large load on the wireless network, such as video streaming. However, cellular base stations are presently configured to transmit the data on separate channels to each user, regardless of the similarity of the data to each user. Hence, it could be said that the base station is wasting channel resources every time the base station makes multiple transmissions with the same data content. There is a present need in the art for a method and apparatus for transmitting identical or similar data to multiple users without using multiple channels.

SUMMARY

[1006] The methods and apparatus presented herein address the above needs. In one aspect, an apparatus is presented for multi-cast transmissions that minimize channel resources, the apparatus comprising: a memory element; and a processing element for executing a set of instructions stored in the memory element, the set of instructions for: generating an identifier for a group

of subscribers, wherein the identifier is for accessing a multi-cast service; using channel quality information for at least one subscriber to determine the timing of the multi-cast service to the group of subscribers; and transmitting the identifier and the multi-cast service on at least one channel, wherein the multi-cast service is transmitted in accordance with the timing determined by the channel quality information.

[1007] In another aspect, another apparatus is presented for generating an identifier for a group of subscribers, wherein the identifier is for accessing a multi-cast service; for using channel quality information for at least one subscriber to determine the transmission format of the multi-cast service to the group of subscribers; and for transmitting the identifier and the multi-cast service on at least one channel, wherein the multi-cast service is transmitted in accordance with the transmission format determined by the channel quality information.

[1008] In anther aspect, a method is presented for determining the channel quality information for a plurality of subscribers; for identifying the subscriber with the worst channel conditions; for scrambling a multi-cast service using a scrambling code known to the plurality of subscribers; and for transmitting the scrambled multi-cast service to the plurality of subscribers, wherein the scrambled multi-cast service is transmitted in accordance with a transmission format that is optimal for the subscriber with the worst channel conditions.

[1009] In another aspect, a method is presented for generating an identifier for a group of subscribers, wherein the identifier is for accessing a multi-cast service; for identifying the subscriber with the worst channel quality by analyzing a plurality of channel quality feedback indicators from a group of subscribers; for selecting a timing and a transmission format of the multi-cast service so that the multi-cast service will be received by the subscriber with the worst channel conditions; and for transmitting the identifier on a first channel and the multi-cast service on a second channel in accordance with the timing and the transmission format as determined by the subscriber with the worst channel quality.

BRIEF DESCRIPTION OF THE DRAWINGS

[1010] FIG. 1 is a diagram of a wireless communication network.

[1011] FIG. 2 is a flowchart of an embodiment for selecting the timing of a multi-cast transmission.

[1012] FIG. 3 is a flowchart of an embodiment for selecting the transmission format of a multi-cast transmission.

DETAILED DESCRIPTION

[1013] As illustrated in FIG. 1, a wireless communication network 10 generally includes a plurality of mobile stations (also called subscriber units or user equipment or remote stations) 12a-12d, a plurality of base stations (also called base station transceivers (BTSs) or Node B). 14a-14c, a base station controller (BSC) (also called radio network controller or packet control function 16), a mobile switching center (MSC) or switch 18, a packet data serving node (PDSN) or internetworking function (IWF) 20, a public switched telephone network (PSTN) 22 (typically a telephone company), and an Internet Protocol (IP) network 24 (typically the Internet). For purposes of simplicity, four mobile stations 12a-12d, three base stations 14a-14c, one BSC 16, one MSC 18, and one PDSN 20 are shown. It would be understood by those skilled in the art that there could be any number of mobile stations 12, base stations 14, BSCs 16, MSCs 18, and PDSNs 20.

[1014] In one embodiment the wireless communication network 10 is a packet data services network. The mobile stations 12a-12d may be any of a number of different types of wireless communication device such as a portable phone, a cellular telephone that is connected to a laptop computer running IP-based, Web-browser applications, a cellular telephone with associated hands-free car kits, a personal data assistant (PDA) running IP-based, Web-browser applications, a wireless communication module incorporated into a portable computer, or a fixed location communication module such as might be found in a wireless local loop or meter reading system. In the most general embodiment,

mobile stations may be any type of communication unit. The mobile stations 12a-12d may advantageously be configured to perform one or more wireless packet data protocols such as described in, for example, the EIA/TIA/IS-707 standard.

[1015] In one embodiment the IP network 24 is coupled to the PDSN 20, the PDSN 20 is coupled to the MSC 18, the MSC is coupled to the BSC 16 and the PSTN 22, and the BSC 16 is coupled to the base stations 14a-14c via wirelines configured for transmission of voice and/or data packets in accordance with any of several known protocols including, e.g., E1, T1, Asynchronous Transfer Mode (ATM), IP, PPP, Frame Relay, HDSL, ADSL, or xDSL. In an alternate embodiment, the BSC 16 is coupled directly to the PDSN 20, and the MSC 18 is not coupled to the PDSN 20.

[1016] During typical operation of the wireless communication network 10, the base stations 14a-14c receive and demodulate sets of reverse signals from various mobile stations 12a-12d engaged in telephone calls, Web browsing, or other data communications. Each reverse signal received by a given base station 14a-14c is processed within that base station 14a-14c. Each base station 14a-14c may communicate with a plurality of mobile stations 12a-12d by modulating and transmitting sets of forward signals to the mobile stations 12a-12d. For example, as shown in FIG. 1, the base station 14a communicates with first and second mobile stations 12a, 12b simultaneously, and the base station 14c communicates with third and fourth mobile stations 12c, 12d simultaneously.

[1017] BSC 16 provides call resource allocation and mobility management functionality including the orchestration of soft handoffs of a call for a particular mobile station 12a-12d from one base station 14a-14c to another base station 14a-14c. For example, a mobile station 12c is communicating with two base stations 14b, 14c simultaneously. Eventually, when the mobile station 12c moves far enough away from one of the base stations 14c, the call will be handed off to the other base station 14b.

[1018] If the transmission is a conventional telephone call, the BSC 16 will route the received data to the MSC 18, which provides additional routing services for interface with the PSTN 22. If the transmission is a packet-based

transmission such as a data call destined for the IP network 24, the MSC 18 will route the data packets to the PDSN 20, which will send the packets to the IP network 24. Alternatively, the BSC 16 will route the packets directly to the PDSN 20, which sends the packets to the IP network 24.

[1019] In some communication systems, packets carrying data traffic are divided into subpackets, which occupy slots of a transmission channel. For illustrative ease only, the nomenclature of a cdma2000 system is used herein. Such use is not intended to limit the implementation of the embodiments herein to cdma2000 systems. Embodiments can be implemented in other systems, such as, e.g., WCDMA, without affecting the scope of the embodiments described herein.

[1020] The forward link from the base station to a remote station operating within the range of the base station can comprise a plurality of channels. Some of the channels of the forward link can include, but are not limited to a pilot channel, synchronization channel, paging channel, quick paging channel, broadcast channel, power control channel, assignment channel, control channel, dedicated control channel, medium access control (MAC) channel, fundamental channel, supplemental channel, supplemental code channel, and packet data channel. The reverse link from a remote station to a base station also comprises a plurality of channels. Each channel carries different types of information to the target destination. Typically, voice traffic is carried on fundamental channels, and data traffic is carried on supplemental channels or packet data channels. Supplemental channels are usually dedicated channels, while packet data channels usually carry signals that are designated for different parties in a time and code-multiplexed manner. Alternatively, packet data channels are also described as shared supplemental channels. For the purposes of describing the embodiments herein, the supplemental channels and the packet data channels are generically referred to as data traffic channels.

[1021] Voice traffic and data traffic are typically encoded, modulated, and spread before transmission on either the forward or reverse links. The encoding, modulation, and spreading can be implemented in a variety of formats. In a CDMA system, the transmission format ultimately depends upon the type of channel over which the voice traffic and data traffic are being

transmitted and the condition of the channel, which can be described in terms of fading and interference.

[1022] Packet data systems traditionally transmit data to remote stations, from one to ten stations at a time. Data transmission occurs from a base station on a shared data traffic channel, which is accompanied by control information. The control information can comprise parameters of the data transmission, such as modulation, coding, and power, which are adjusted by the base station using channel quality feedback (CQF) information about the remote station. CQF information is used to maximize the system throughput, minimize channel usage, and maximize the likelihood that a data transmission will reach the remote station with a reasonable quality. The CQF can be explicit through a transmission from the remote station or the CQF can be derived by the base station through transmission power levels. The base station transmits the control information in order to aid the remote station in decoding the associated data transmission.

[1023] One piece of control information that is transmitted to the remote station is a medium access control identifier (MAC_ID). MAC_IDs are assigned to remote stations in accordance with a unique International Mobile Station Identify (IMSI) when the remote stations enter the communication system. Hence, the channel that is dedicated to the remote station can be identified by the MAC_ID that is assigned to the remote station.

[1024] Some packet data systems offer services such as multi-cast and broadcast. In a multi-cast, the same transmissions are sent to a group of remote stations. In a broadcast, the same transmissions are sent to all remote stations in the range of the base station. For example, a video broadcast would require the system to transmit the video stream to all users subscribed to the video streaming channel. However, as mentioned above, packet data systems are configured to transmit data to only one remote station at a time. Hence, multi-cast and broadcast in current packet data systems requires an independent transmission of the same data to each remote station. If *N* remote stations were present in the system and the system needed to broadcast the same message to all of the remote stations, then the system would transmit the

same information *N* times, each transmission tailored to the needs of each remote station.

[1025] The same information is sent independently to each remote station because a transmission to each remote station would propagate through different channel conditions. The condition of each channel will vary in accordance to distance to the base station, fading, and interference from other channels. In order to ensure delivery of the information within a desired quality level, such as a frame error rate (FER) of less than 1%, the various transmission parameters can be adjusted. As a simplistic example, if the channel conditions were bad, then the base station would transmit information to a remote station using a format where data symbols are repeated often in the packet. Hence, the receiving party could soft-combine any corrupted data symbols to attain the original information. However, if the channel conditions are good, then the base station could transmit information to a remote station using a format that does not repeat data symbols, since the receiving party is likely to receive the uncorrupted data symbols. Hence, although the same information is being carried to the remote stations, the transmission formats of the data packets to each remote station can be different.

[1026] An example of the different transmission parameters at different rates that can be used by a communication network is shown in Table 1.

Data Rate (kbps)	***Number of Slots***	***Bits per Packet***	***Code Rate***	***Modulation***
38.4	16	1024	1/5	QPSK
76.8	8	1024	1/5	QPSK
153.6	4	1024	1/5	QPSK
307.2	2	1024	1/5	QPSK
614.4	1	1024	1/3	QPSK
307.2	4	2048	1/3	QPSK
614.4	2	2048	1/3	QPSK
1228.8	1	2048	2/3	QPSK
921.6	2	3072	1/3	8-PSK
1843.2	1	3072	2/3	8-PSK

1228.8	2	4096	1/3	16-QAM
2457.6	1	4096	2/3	16-QAM

Table 1 Forward Link Modulation Parameters

[1027] It should be noted that Table 1 is merely an illustrative example of just some of the transmission parameters that can be different for a transmission to one subscriber versus a transmission to other subscribers. Other parameters, such as symbol repetition and transmission duration over multiple frames, are not shown.

[1028] The present embodiments are directed towards eliminating the waste of channel resources resulting from the multiplicity of identical broadcasts to multiple recipients. In one embodiment, the base station generates a special MAC_ID value that identifies a group of remote stations, rather than a single remote station. For each multi-cast service available, a corresponding special MAC_ID value is also generated. For example, MAC_ID 00203 could be reserved for the video streaming of a television channel. Remote stations wishing to receive the television channel via the communications system would subscribe to this service, and watch for MAC_ID 00203 in the control signaling information.

[1029] Since the MAC_ID identifies only one channel that will be demodulated and decoded by all the subscribing remote stations, embodiments for enabling each remote station in the subscription group to demodulate and decode the channel are also described herein. FIG. 2 is a flowchart for selecting the timing of a multi-cast to *M* subscribers. At step 200, a scheduling element in a base station determines the channel quality feedback indicators from *M* subscribers to a multi-cast service. The scheduling element can comprise a memory element and a processing element that is configured to execute the method steps described herein. In one embodiment, measurements of channel interference (C/I) of the forward link common pilot signal serves as channel quality feedback indicators. At step 210, the scheduling element selects an optimal time for transmitting the multi-cast on a channel marked by a special MAC_ID. The optimal time is selected by determining when the subscriber in the worst location has good channel conditions or the transmission delay of the data becomes too large. For

example, the channel conditions could be unfavorable for a subscriber who is traveling at extremely high speeds near the base station. The high speed could cause random, but short-lived, deep fades. Such short-lived, deep fades would be an unfavorable channel condition that would decrease the data throughput of the system. At step 220, the base station encodes the multi-cast data in a manner that would allow reception at an acceptable quality level by the subscriber with the worst channel conditions. The base station then scrambles the encoded multi-cast data as necessary with a scrambling code that is known by all subscribers, and transmits it at the selected time on the channel specified by the MAC_ID. At step 230, the base station transmits using the modulation scheme and power level that allow the subscriber with the worst channel conditions to receive the broadcast at an acceptable quality level. An additional refinement to the embodiment is the use of a scrambling code that is common for all subscribers, or common to a select group of subscribers who have paid for extra services.

[1030] In one alternative embodiment, rather than using the C/I as the channel quality feedback indicator, the scheduling element determines when the worst location subscriber has good channel conditions by transmitting test data packets to the worst location subscriber until acknowledgement signals arrive from the worst location subscriber. Once acknowledgement signals indicating the successful demodulation and decoding of the test data packet arrives, the scheduling element can commence the multi-cast.

[1031] In another alternative embodiment, the scheduling element transmits test data packets to all subscribers and waits for acknowledgement signals from a predetermined percentage of the subscribers. The percentage could be anywhere from a simple majority of the subscribers to 100% of the subscribers. The actual percentage value can be chosen by the serving system. In a system wherein acknowledgement signals are scheduled to arrive at predetermined times, this embodiment can be adjusted so that the multi-cast occurs when at least one designated subscriber has transmitted an acknowledgment signal. The at least one designated subscriber can be chosen so as to maximize the probable receipt of the multi-cast by the majority of the subscribers.

[1032] It should be noted that it is unlikely for a subscriber in a good location to not successfully receive the test data packets or the multi-cast. If a base station does not receive an acknowledgment signal from this subscriber, it is more probable that the base station lost the reverse link acknowledgment signal rather than an unsuccessful receipt of the forward link signal by the subscriber. Hence, it is more important to concentrate on acknowledgment signals from the subscribers with poor channels rather than subscribers with favorable channels.

[1033] FIG. 3 is a flowchart for selecting the transmission format of a multi-cast to *M* subscribers. At step 300, a scheduling element in a base station determines the channel quality feedback indicators from *M* subscribers to a multi-cast service. Based upon the channel quality feedback indicators, the scheduling element determines the time sensitivity of data and the transmission formats of the data. At step 310, the scheduling element selects a transmission format that will allow the subscriber with the worst channel conditions to recover the original data. At step 320, the base station transmits the multi-cast in the transmission format selected by the scheduling element, wherein the multi-cast is transmitted using a single MAC_ID. It should be noted that the other subscribers would not have difficulties decoding the multi-cast using the selected transmission format since all other subscribers had better channel conditions. As an alternative to using the single MAC_ID, the multi-cast is scrambled by a scrambling code known only to the subscribers.

[1034] In addition to the steps described above, the scheduling element could also send re-transmissions in the format designated by the subscriber with the worst channel conditions. Re-transmissions are redundant transmissions of the information, which have already been transmitted. Through the process of "soft-combining" at the receiver, symbols that have been corrupted during the transmission of one packet can be combined with symbols that have been corrupted during the transmission of another packet. Hence, the "good" symbol bits from the separate transmissions can be used together to recover the original data information.

[1035] As mentioned before, it is possible to have multiple special MAC_IDs for each possible multi-cast service. It is envisioned that the embodiments described above can allow a service provider to offer multiple multi-cast

services, such as news, weather, sports, stock quotes, etc., without sacrificing channel resources that could be otherwise used for voice traffic and dedicated data traffic.

[1036] Those of skill in the art would understand that information and signals may be represented using any of a variety of different technologies and techniques. For example, data, instructions, commands, information, signals, bits, symbols, and chips that may be referenced throughout the above description may be represented by voltages, currents, electromagnetic waves, magnetic fields or particles, optical fields or particles, or any combination thereof.

[1037] Those of skill would further appreciate that the various illustrative logical blocks, modules, circuits, and algorithm steps described in connection with the embodiments disclosed herein may be implemented as electronic hardware, computer software, or combinations of both. To clearly illustrate this interchangeability of hardware and software, various illustrative components, blocks, modules, circuits, and steps have been described above generally in terms of their functionality. Whether such functionality is implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. Skilled artisans may implement the described functionality in varying ways for each particular application, but such implementation decisions should not be interpreted as causing a departure from the scope of the present invention.

[1038] The various illustrative logical blocks, modules, and circuits described in connection with the embodiments disclosed herein may be implemented or performed with a general purpose processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array (FPGA) or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general purpose processor may be a microprocessor, but in the alternative, the processor may be any conventional processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing devices, e.g., a combination of a DSP and a microprocessor, a plurality of microprocessors, one or more

microprocessors in conjunction with a DSP core, or any other such configuration.

[1039] The steps of a method or algorithm described in connection with the embodiments disclosed herein may be embodied directly in hardware, in a software module executed by a processor, or in a combination of the two. A software module may reside in RAM memory, flash memory, ROM memory, EPROM memory, EEPROM memory, registers, hard disk, a removable disk, a CD-ROM, or any other form of storage medium known in the art. An exemplary storage medium is coupled to the processor such the processor can read information from, and write information to, the storage medium. In the alternative, the storage medium may be integral to the processor. The processor and the storage medium may reside in an ASIC. The ASIC may reside in a user terminal. In the alternative, the processor and the storage medium may reside as discrete components in a user terminal.

[1040] The previous description of the disclosed embodiments is provided to enable any person skilled in the art to make or use the present invention. Various modifications to these embodiments will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other embodiments without departing from the spirit or scope of the invention. Thus, the present invention is not intended to be limited to the embodiments shown herein but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

WHAT IS CLAIMED IS:

CLAIMS

1. An apparatus for multi-cast transmissions that minimize channel resources, comprising:

a memory element; and

a processing element for executing a set of instructions stored in the memory element, the set of instructions for:

generating an identifier for a group of subscribers, wherein the identifier is for accessing a multi-cast service;

using channel quality information for at least one subscriber to determine the timing of the multi-cast service to the group of subscribers; and

transmitting the identifier and the multi-cast service on at least one channel, wherein the multi-cast service is transmitted in accordance with the timing determined by the channel quality information.

2. The apparatus of Claim 1, wherein transmitting the identifier and the multi-cast service on at least one channel comprises:

transmitting the identifier on a first channel; and

transmitting the multi-cast on a second channel.

3. The apparatus of Claim 2, wherein the processing element is further for executing instructions for:

scrambling the multi-cast service before transmitting the multi-cast service on the second channel, wherein the scrambling is performed by using a code known only to the group of subscribers.

4. The apparatus of Claim 1, wherein using channel quality information for at least one subscriber to determine the timing of the multi-cast service comprises:

choosing channel quality information by selecting the channel quality information associated with the subscribers with the worst channel conditions; and

determining the timing of the multi-cast service in accordance with the subscribers with the worst channel conditions.

5. The apparatus of Claim 4, wherein the channel quality information is a measurement of the channel interference of the forward link common pilot signal.

6. The apparatus of Claim 4, wherein the channel quality information is derived from the transmission power levels of a base station.

7. The apparatus of Claim 4, wherein the channel quality information is a plurality of acknowledgment signals.

8. The apparatus of Claim 7, wherein choosing the channel quality information of the subscribers with the worst channel conditions comprises:

transmitting a plurality of test data packets to the group of subscribers;

waiting for a plurality of acknowledgment signals from the group of subscribers in response to the plurality of test data packets; and

transmitting the multi-cast service if the plurality of acknowledgment signals indicates a response from a predetermined percentage of the group of subscribers.

9. The apparatus of Claim 1, wherein using channel quality information for at least one subscriber to determine the timing of the multi-cast service comprises:

choosing the channel quality information of the subscriber with the worst channel conditions;

determining the timing of the multi-cast service in accordance with the subscriber with the worst channel condition.

10. The apparatus of Claim 9, wherein the channel quality information is an acknowledgment signal from the subscriber with the worst channel condition.

11. An apparatus for multi-cast transmissions that minimize channel resources, comprising:

a memory element; and

a processing element for executing a set of instructions stored in the memory element, the set of instructions for:

generating an identifier for a group of subscribers, wherein the identifier is for accessing a multi-cast service;

using channel quality information for at least one subscriber to determine the transmission format of the multi-cast service to the group of subscribers; and

transmitting the identifier and the multi-cast service on at least one channel, wherein the multi-cast service is transmitted in accordance with the transmission format determined by the channel quality information.

12. The apparatus of Claim 11, wherein transmitting the identifier and the multi-cast service on at least one channel comprises:

transmitting the identifier on a first channel; and

transmitting the multi-cast on a second channel.

13. The apparatus of Claim 12, wherein the processing element is further for executing instructions for:

scrambling the multi-cast service before transmitting the multi-cast service on the second channel, wherein the scrambling is performed by using a code known only to the group of subscribers.

14. The apparatus of Claim 11, wherein using channel quality information for at least one subscriber to determine the transmission format of the multi-cast service comprises:

choosing channel quality information by selecting the channel quality information associated with the subscribers with the worst channel conditions; and

determining the transmission format of the multi-cast service in accordance with the subscribers with the worst channel conditions.

15. The apparatus of Claim 14, wherein the channel quality information is a measurement of the channel interference of the forward link common pilot signal.

16. The apparatus of Claim 14, wherein the channel quality information is derived from the transmission power levels of a base station.

17. The apparatus of Claim 14, wherein the channel quality information is a plurality of acknowledgment signals.

18. The apparatus of Claim 17, wherein choosing the channel quality information of the subscribers with the worst channel conditions comprises:

transmitting a plurality of test data packets to the group of subscribers;

waiting for a plurality of acknowledgment signals from the group of subscribers in response to the plurality of test data packets; and

transmitting the multi-cast service if the plurality of acknowledgment signals indicates a response from a predetermined percentage of the group of subscribers.

19. The apparatus of Claim 11, wherein using channel quality information for at least one subscriber to determine the transmission format of the multi-cast service comprises:

choosing the channel quality information of the subscriber with the worst channel conditions;

determining the transmission format of the multi-cast service in accordance with the subscriber with the worst channel condition.

20. The apparatus of Claim 19, wherein the channel quality information is an acknowledgment signal from the subscriber with the worst channel condition.

21. An apparatus for multi-cast transmissions that minimize channel resources, comprising:

a memory element; and

a processing element for executing a set of instructions stored in the memory element, the set of instructions for:

determining the channel quality information for a plurality of subscribers;

identifying the subscriber with the worst channel conditions;

scrambling a multi-cast service using a scrambling code known to the plurality of subscribers; and

transmitting the scrambled multi-cast service to the plurality of subscribers, wherein the scrambled multi-cast service is transmitted in accordance with a transmission format that is optimal for the subscriber with the worst channel conditions.

22. A method for broadcasting to a group of subscribers in a cellular communication network, comprising:

determining the channel quality information for a plurality of subscribers;

identifying the subscriber with the worst channel conditions;

scrambling a multi-cast service using a scrambling code known to the plurality of subscribers; and

transmitting the scrambled multi-cast service to the plurality of subscribers, wherein the scrambled multi-cast service is transmitted in accordance with a transmission format that is optimal for the subscriber with the worst channel conditions.

23. A method for broadcasting to a group of subscribers in a cellular communication network, comprising:

generating an identifier for a group of subscribers, wherein the identifier is for accessing a multi-cast service;

using channel quality information for at least one subscriber to determine the timing of the multi-cast service to the group of subscribers; and

transmitting the identifier and the multi-cast service on at least one channel, wherein the multi-cast service is transmitted in accordance with the timing determined by the channel quality information.

24. A method for broadcasting to a group of subscribers in a cellular communication network, comprising:

generating an identifier for a group of subscribers, wherein the identifier is for accessing a multi-cast service;

using channel quality information for at least one subscriber to determine the transmission format of the multi-cast service to the group of subscribers; and

transmitting the identifier and the multi-cast service on at least one channel, wherein the multi-cast service is transmitted in accordance with the transmission format determined by the channel quality information.

25. A method for efficient multi-cast broadcasting, comprising:

generating an identifier for a group of subscribers, wherein the identifier is for accessing a multi-cast service;

identifying the subscriber with the worst channel quality by analyzing a plurality of channel quality feedback indicators from a group of subscribers;

selecting a timing and a transmission format of the multi-cast service so that the multi-cast service will be received by the subscriber with the worst channel conditions; and

transmitting the identifier on a first channel and the multi-cast service on a second channel in accordance with the timing and the transmission format as determined by the subscriber with the worst channel quality.

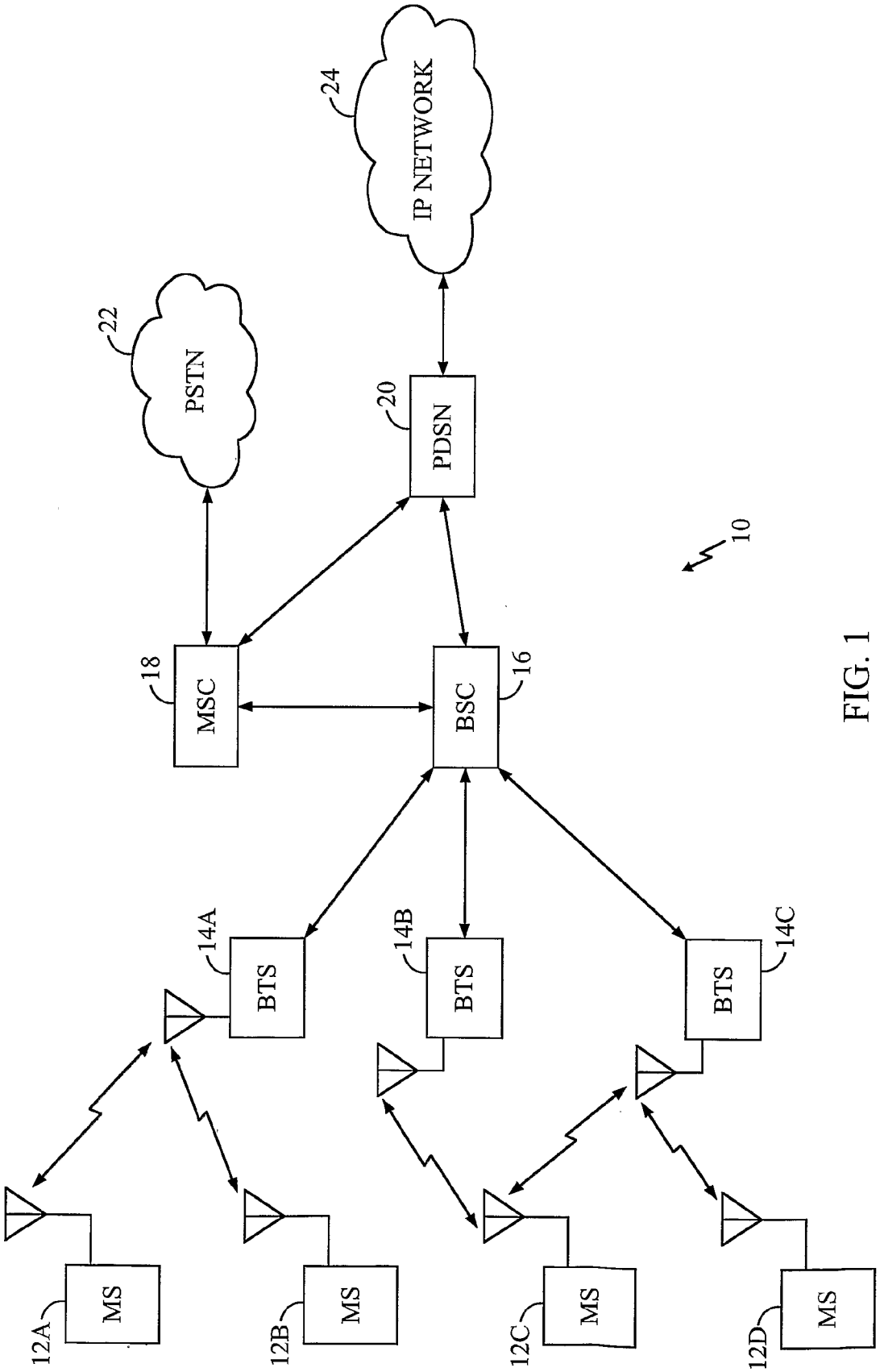

24
IP NETWORK
22
PSTN
20
PDSN
10
18
MSC
BSC
16
14A
BTS
14B
BTS
14C
BTS
12A
MS
12B
MS
12C
MS
12D
MS

FIG. 1

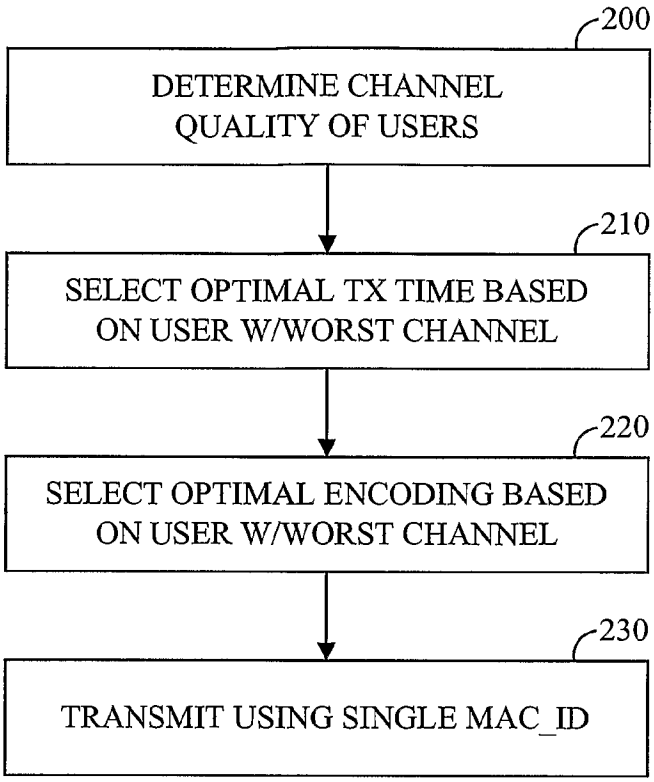

200
DETERMINE CHANNEL QUALITY OF USERS
210
SELECT OPTIMAL TX TIME BASED ON USER W/WORST CHANNEL
220
SELECT OPTIMAL ENCODING BASED ON USER W/WORST CHANNEL
230
TRANSMIT USING SINGLE MAC_ID

FIG. 2

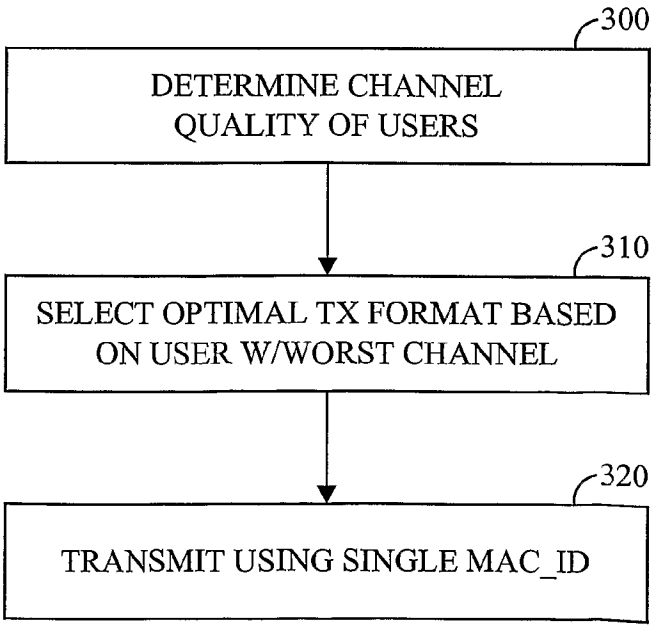

300
DETERMINE CHANNEL QUALITY OF USERS
310
SELECT OPTIMAL TX FORMAT BASED ON USER W/WORST CHANNEL
320
TRANSMIT USING SINGLE MAC_ID

FIG. 3

INTERNATIONAL SEARCH REPORT

Internati Application No
PCT/US 02/40419

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04L12/18 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04L H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	EP 0 999 656 A (NIPPON ELECTRIC CO) 10 May 2000 (2000-05-10) column 2, line 21-48 ---	11,14, 16,17, 19,20,24 1,4, 6-10,13, 18,21,22
X	EP 1 143 635 A (NTT DOCOMO INC) 10 October 2001 (2001-10-10) column 3, line 1 -column 4, line 14 ---	11,14, 16,17, 19,20,24
Y	US 5 920 701 A (CATES KENNETH ET AL) 6 July 1999 (1999-07-06) column 1, line 64 -column 2, line 10 --- -/--	1,4,6,7, 9,10

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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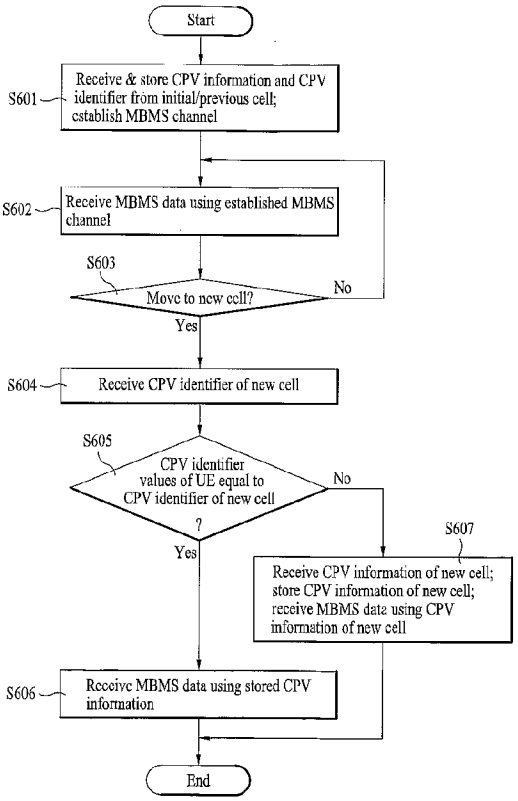
(54) Title: APPARATUS AND METHOD FOR SHARING RADIO PROTOCOL ENTITIES IN WIRELESS COMMUNICATION SYSTEM



(57) Abstract: A radio protocol entity sharing apparatus and method are provided for a multimedia broadcast/multicast service (MBMS) in a plurality of cells. Different cells share a second-layer protocol entity (MAC, RLC, PDCP) to use the same channel parameter values (CPV identifier) and the same protocol parameter values (CPV information), thereby reducing a delay resulting from re-establishing a radio bearer in the event of handover, minimizing data loss during handover, conserving network resources, and enhancing reception performance at the mobile station (UE) via soft combining. The method includes steps of receiving, in a mobile station (UE), a first parameter value and a first parameter indicator (S601); establishing a channel using the first parameter value and the first parameter value indicator and receive MBMS data (S602); receiving, in the mobile station (UE), a second parameter value indicator (S604); and maintaining the established channel if the first parameter value indicator is identical to the second parameter value indicator (S606). If said first and second parameter value indicators are different, the channel is re-established using a received second parameter value (S607).

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APPARATUS AND METHOD FOR SHARING RADIO PROTOCOL ENTITIES IN WIRELESS COMMUNICATION SYSTEM

Technical Field

The present invention relates to providing a user service in a wireless communication system, such as a universal mobile telecommunications system (UMTS), and more particularly, to providing a multimedia broadcast/multicast service (MBMS) in a plurality of cells by using one or more shared radio protocol entities.

Background Art

Referring to FIG. 1, illustrating a general UMTS network structure, the UMTS comprises a user equipment (UE) which is also referred to as a mobile terminal, a UMTS terrestrial radio access network (UTRAN), and a core network. The UTRAN comprises a plurality of radio network subsystems, each of which comprises one radio network controller (RNC) and at least one base station (or Node B) managed by the RNC. The Node B managed by the RNC receives uplink information transmitted from a physical layer of the UE and transmits downlink data to the UE, thereby serving as an access point for connecting the UE to the UTRAN. The RNC is responsible for allocation and management of radio resources and serves as an access point in connecting the Node B to the core network. An RNC managing radio resource for a specific UE is a serving RNC, and an RNC managing common resources for a plurality of UEs within one cell is controlling RNC. A drift RNC is any RNC, other than the serving RNC, through which a UE communicates.

An interface between RNC and core network is the Iu interface, an interface between serving RNC and drift RNC is the Iur interface, and an interface between RNC and Node B is the Iub interface. Each interface provides control information or data transfer service via a transport bearer. For instance, a bearer provided in the Iub interface is an Iub transport bearer, and the Iub transport bearer provides control information and data transmission between RNC and Node B.

FIG. 2 illustrates the architecture of a radio interface protocol between one UE and the UTRAN. Referring to FIG. 2, a radio interface protocol vertically comprises a physical layer (Layer 1 or L1), a data link layer (Layer 2 or L2), and a network layer (Layer 3 or L3). The radio interface protocol horizontally comprises a user plane for providing data information and a control plane for providing control signals (signaling). The user plane carries user traffic for voice or Internet protocol (IP) packet transfer and the like. The control plane carries control information for the maintenance and management of interface or call within the network and the like. The protocol layers include first (L1), second (L2), and third (L3) layers, which are the three lower layers of the open system interconnection reference model.

The L1 layer provides an information transfer service to a higher layer using various radio transport technologies. The L1 layer is linked to a medium access control (MAC) layer of the higher layer via transport channels. Data is delivered between the MAC and physical layers via the transport channels.

The MAC layer provides reallocation services of MAC parameters for allocation and reallocation of radio resources. The MAC layer is connected to a radio link control (RLC) layer as a higher layer via logical channels. The logical channels are

categorized, according to data type, as control channels or traffic channels. Generally, the control channels are used in transferring information of the control plane, and the traffic channels are used in transferring information of the user plane. The MAC layer comprises a MAC-b sublayer, a MAC-d sublayer, and a MAC-c/sh sublayer, categorized according to the type of transport channels being managed. The MAC-b sublayer manages a broadcast channel as a transport channel responsible for broadcasting system information. The MAC-c/sh layer manages common transport channels, which are shared with other UEs, such the forward access channel (FACH) and downlink shared channel (DSCH). The MAC-c/sh sublayer is located in the controlling RNC within UTRAN and manages the channels common with all the UEs within the cell. Hence, one MAC-c/sh sublayer exists in each cell, and one UE includes one MAC-c/sh sublayer. The MAC-d sublayer manages a dedicated channel (DCH) as a dedicated transport channel to a specific UE. Hence, the MAC-d layer of UTRAN is located in the serving RNC, and each UE also has one MAC-d sublayer.

To provide an MBMS service in accordance with the method of the present invention, an MBMS function is appended to the functions of the MAC-c/sh layer, thereby creating a MAC-c/sh/m layer. There is one MAC-c/sh/m layer per cell in the UTRAN and one MAC-c/sh/m layer per UE.

The radio link control (RLC) layer supports reliable data transfer and is operative in performing segmentation and concatenation of an RLC service data unit, which is delivered from a higher layer and adjusted in size to fit processing capacity in the RLC layer. A header is then appended to the adjusted RLC service data unit to be delivered to the MAC layer in the form of a protocol data unit. The RLC buffer exists in

the RLC layer to store the RLC service data units or RLC protocol data units delivered from the higher layer.

A broadcast/multicast control (BMC) layer is located above the RLC layer, and schedules a cell broadcast message delivered from the core network, and is operative in broadcasting to UEs in a specific cell or cells.

A packet data convergence protocol (PDCP) layer is located above the RLC layer and is operative in efficiently transferring data, which is transferred via such a network protocol as IPv4 and IPv6, over a radio interface having a relatively small bandwidth. Thus, through a process known as header compression, the PDCP layer eliminates unnecessary control information utilized in a wire network, such that only information essential to the header is included for transfer, thereby enhancing the transmission efficiency of a radio section.

A radio resource control (RRC) layer, which is part of the L3 layer, is defined on the control plane only. Concerning the establishment, reconfiguration, and release of radio bearers, the RRC layer controls the transport and physical channels. A radio bearer is a service, provided by the second layer, for the data transfer between UE and UTRAN securing a certain QoS (quality of service). Radio bearer establishment, in general, defines the regulating characteristics of the protocol layers and channels needed to provide a specific service and respectively configures the respective parameters and operation methods. A UE is said to be in an RRC-connected mode when the RRC layers of the UE and the UTRAN are in communication with each other, to enable a communication of RRC messages, and is in the RRC-idle mode when there is no such communication.

An MBMS service provides a streaming or background service to a plurality of UEs using a downlink only MBMS radio bearer. In the UTRAN or a network, an MBMS service may utilize point-to-multipoint or point-to-point radio bearer services. The point-to-multipoint service generally represents transmitting data from a network to a plurality of UEs. The point-to-point service generally represents transmitting data from a network to a designated UE.

In the MBMS broadcast mode, multimedia data is transmitted to all UEs within a broadcast area, i.e., the domain where the broadcast service is available. In the MBMS multicast mode, multimedia data for a specific UE group is transmitted within a multicast area, i.e., the domain where the multicast service is available. MBMS service requires the support of two logical channels: an MBMS control channel (MCCH), which is a point-to-multi point downlink channel for transmitting MBMS control information to UEs, and an MBMS traffic channel (MTCH), which is a point-to-multi point downlink channel for transmitting MBMS data to UEs. One MCCH channel exists in each cell, and one MTCH channel exists for each specific MBMS within a specific cell. Both logical channels are mapped to a transport channel (FACH) and a secondary common control physical channel (S-CCPCH).

FIG. 3 illustrates MTCH protocol architecture according to a related art, in which an example RNC configuration has two Node Bs, with one managing three cells and another managing one cell. Each cell has separately configured radio bearer parameters for every PHY, RLC, and PDCP entity per MTCH channel per MBMS service in the UTRAN side. The same protocol entities are similarly established in the UE side (not shown).

In the related art, however, the network independently configures (and reconfigures) separate protocol entities for each cell. Hence, despite providing the same service, the protocol entities may be differently configured, whereby entity-associated parameter values are independently and separately set by the different protocol entities existing in the different cells, and the protocol entities providing the same service are independently managed and controlled. As a result, the UE needs to reconfigure new protocol parameters whenever it moves to another cell. Thus, there is an undesirable delay before a new radio bearer is established, during which time the UE has no radio bearer and thus receives no MBMS data. Therefore, data loss occurs when moving to a new cell. Moreover, the UE is unable to achieve soft combining gain, in which values from various cells are combined during a soft handover.

Disclosure of Invention

Accordingly, the present invention is directed to a radio protocol entity sharing apparatus and method that substantially obviates one or more problems due to limitations and disadvantages of the related art.

An object of the present invention is to provide a radio protocol entity sharing method for MBMS services. At least one protocol entity shared by a plurality of cells and common associated parameter values are used for a specific MBMS service and establishment of a bearer is facilitated when a UE moves to another cell. Data loss occurring during handover is minimized, soft combining gain can be achieved between cells and a waste of network resources is prevented using a single protocol entity and single associated parameter values for a specific MBMS service.

Additional advantages, objects, and features of the invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention may be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, a method is provided for a point-to-multipoint service in a cellular system. The method includes establishing a radio protocol entity in a radio access network for the point-to-multipoint service for a group of cells, each cell capable of servicing at least one mobile terminal with uplink and downlink communication capabilities, and providing data for the point-to-multipoint service through the same radio protocol entity to the group of cells. Preferably, the group of cells belongs to a radio network system and the radio access network includes at least one radio network system. The radio protocol entity includes at least a medium access control entity (MAC), a radio link control entity (RLC) or packet data convergence protocol entity (PDCP).

According to one aspect of the invention, the method further includes transmitting to the group of cells a parameter indicator and a radio protocol parameter associated with the parameter indicator necessary for at least one mobile terminal in one of the group of cells to receive the point-to-multipoint service, wherein the parameter indicator is identical for the group of cells.

According to another aspect of the invention, the radio protocol entity provides the point-to-multipoint service through a common traffic channel. Also, the parameter indicator is transmitted through a common control channel, and the common control channel is a broadcast control channel (BCCH). Preferably, the common control channel is a multimedia broadcast multicast service control channel (MCCH).

According to another embodiment of the invention, a method is provided for receiving a point-to-multipoint service. The method includes receiving a first parameter indicator and a first radio protocol parameter associated with the first parameter indicator, establishing a radio protocol entity for receiving the point-to-multipoint service in a mobile terminal according to the received first radio protocol parameter, receiving a second parameter indicator necessary to receive the point-to-multipoint service, continuing to receive the point-to-multipoint service without receiving a second radio protocol parameter associated with the second parameter indicator if the first and second parameter indicators are identical, receiving the second radio protocol parameter if the first and second parameter indicators are not identical, and reestablishing the radio protocol entity according to the received second radio protocol parameter for receiving the point-to-multipoint service.

According to one aspect of the invention, the first parameter indicator and the second parameter indicator are received in the same cell. Alternatively, the first parameter indicator is received in a first cell and the second parameter indicator is received in a second cell.

According to another aspect of the invention, each one of the first and second parameter indicators identifies a group of cells sharing the radio protocol entity.

Preferably, the radio protocol entity includes at least a medium access control module (MAC), a radio link control module (RLC) or a packet data convergence protocol entity (PDCP).

According to another embodiment of the invention, a wireless communication system for providing a point-to-multipoint service in a cellular system includes a radio access network, such as RAN or UTRAN, for establishing a radio protocol entity for the point-to-multipoint service for a group of cells. Each cell is capable of servicing at least one mobile terminal with uplink and downlink communication capabilities, with the radio access network providing data for the point-to-multipoint service through the same radio protocol entity to the group of cells. Preferably, the radio protocol entity includes at least a medium access control entity (MAC), a radio link control entity (RLC) or a packet data convergence protocol entity (PDCP). The radio protocol entity transmits to the group of cells a parameter indicator and a radio protocol parameter associated with the parameter indicator necessary for at least one mobile terminal in one of the group of cells to receive the point-to-multipoint service. The parameter indicator is identical for the group of cells.

According to another embodiment of the invention, a mobile terminal for receiving a point-to-multipoint service includes a means for receiving a first parameter indicator and a first radio protocol parameter associated with the first parameter indicator, a means for establishing a radio protocol entity for receiving the point-to-multipoint service in a mobile terminal according to the received first radio protocol parameter, a means for receiving a second parameter indicator necessary to receive the point-to-multipoint service and a means for continuing to receive the point-to-multipoint service

without receiving a second radio protocol parameter associated with the second parameter indicator if the first and second parameter indicators are identical. The mobile terminal further includes a means for receiving the second radio protocol parameter if the first and second parameter indicators are not identical and a means for reestablishing the radio protocol entity according to the received second radio protocol parameter for receiving the point-to-multipoint service.

It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

Brief Description of Drawings

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings:

FIG. 1 is a structural diagram of a wireless communication network.

FIG. 2 is a diagram of radio interface protocol architecture between the UE and UTRAN of FIG. 1.

FIG. 3 is a block diagram of a protocol entity of the UTRAN, providing a specific MBMS service according to a related art.

FIG. 4A is a block diagram of protocol entities of the UTRAN, providing a specific MBMS service by sharing layer 2 protocol entity according to another embodiment of the present invention.

FIG. 4B is a block diagram of protocol entities of the UTRAN, providing a specific MBMS service by sharing layer 2 protocol entity according to alternative embodiment of the present invention.

FIG. 5 is a block diagram of a protocol entity of the UTRAN, providing a specific MBMS service by sharing the Iub transport bearer according to the present invention.

FIG. 6 is a flowchart for receiving a specific MBMS service in a UE (mobile terminal) according to a preferred embodiment of the present invention.

FIG. 7 illustrates a mobile communication device for receiving a service from a network according to one embodiment of the present invention.

Best Mode for Carrying out the Invention

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

At least one protocol entity for transferring data of a specific MBMS service in a specific RNC is shared by a plurality of cells or Node Bs managed by the specific RNC. The at least one protocol entity is preferably radio protocol entity of a second layer and includes PDCP, RLC, and MAC sublayers. Preferably, each cell includes separate physical layers for the specific MBMS service, and for the physical layers to operate identically, the RNC preferably delivers the same parameter values to the physical layers via the Iub interface. Furthermore, after having received the specific MBMS service data

from the core network, the RNC preferably delivers the MBMS data to the at least one protocol entity. Preferably, the at least one protocol entity delivers the received MBMS data to respective lower layer protocol entities, and if the lower layer is a physical layer (L1), the RNC preferably delivers the MBMS data via the Iub interface to the respective physical layers in each cell.

FIGS. 4A and 4B illustrate protocol entities of the UTRAN, providing a specific MBMS service by sharing at least one of layer 2 protocol entities according to one embodiment of the present invention. In this example, an MTCH channel is being used as a logical channel for the RNC to provide three different MBMS services. In other words, the data is transmitted via three channels.

As shown in the RNC of FIG. 4A, second-layer protocol entities, which include the PDCP, RLC, and MAC sublayers, are configured to provide a specific MBMS service to a plurality of cells managed by the RNC. Referring to FIG. 4A, in the UTRAN side, the PDCP and RLC entities are separately provided for each service, where a plurality of cells (or Node Bs) each share the use of one PDCP entity and one RLC entity. Hence, in this case, the three different PDCP entities and three different RLC entities provide three different MBMS services, respectively, and are shared by the lower physical layers. And it is also possible only PDCP entity is shared by a plurality of cells for a specific MBMS service. FIG. 4B illustrates a network configuration in which both PDCP and RLC protocol entities are shared to provide a specific MBMS service to mobile terminals. Preferably, one PDCP entity and one RLC entity exist for one specific MBMS per radio access network (RAN). Alternatively, in lieu of sharing both PDCP and RLC, either PDCP or RLC may only need to be shared for the specific MBMS service.

One MAC entity in the UTRAN side is shared by the various MBMS services to also be used by a plurality of cells (Node Bs). Preferably, there is one MAC entity – more specifically, one MAC-c/sh/m sublayer – per RNC. The one MAC entity provides the three different MBMS services and is shared by the lower physical layers.

Two UEs, shown in FIGS. 4A and 4B as terminal A and terminal B, each receiving a specific MBMS service from at least two different cells or Node Bs, share one of the layer 2 radio protocol entity (e.g., the MAC sublayer in FIG. 4A, and the PDCP and the RLC sublayers in FIG. 4B) and the same associated parameter value for the specific MBMS service. In other words, despite being located in different cells, UEs receiving the same MBMS service share the same protocol entity and the same associated parameter value.

A plurality of cells share a protocol entity for the data transfer of a specific MBMS service. Hence, a logical channel provided by the protocol entity is also shared by the plurality of cells. Moreover, the cells share parameter values of logical, transport, and physical channels set up for the data transfer of the MBMS service. That is, the plurality of cells have the same parameter values of the logical, transport and physical channels and share the protocol parameter values of the protocol entity as well. Thus, the cells all possess the same channel parameter values and the same protocol parameter values. Furthermore, since the cells involved share the same protocol entity and protocol parameter values, the terminal B can, obtaining soft combining gain, simultaneously receive a specific MBMS service from two or more different cells.

FIG. 5 illustrates the protocol entity of a UTRAN providing a specific MBMS service when an Iub transport bearer is shared according to the present invention.

Referring to FIG. 5, in which a plurality of cells of one Node B commonly use one Iub transport bearer, one protocol entity is shared and one Iub data frame is transmitted once to various cells during one transmission time interval (TTI). The various cells share one MAC protocol data unit included in the Iub data frame. Node B receives the data frame via one shared Iub transport bearer and copies the MAC protocol data unit included in the received data frame, to deliver the data frame to a plurality of cells governed by the Node B.

According to the preferred embodiment of the present invention, a UE intending to receive a specific MBMS service sets up, for example, a channel and protocol entity for receiving the data of the specific MBMS service using the channel and protocol parameter values shared by the plurality of cells. These parameter values are referred to herein as common parameter values, or CPV information. The channel parameter values include parameter values of the logical channel MTCH, transport channel FACH, physical channel S-CCPCH used in transferring the data of the specific MBMS service. The protocol parameter values include parameter values of the PDCP, RLC, MAC, and physical layers used in transferring the data of the specific MBMS service. The UE uses the CPV information to set up channels and protocol entities for receiving the MBMS data. A UE moving to any one of a plurality of cells sharing the CPV information can, without reconfiguration of the logical and transport channels and the protocol entity, quickly receive the data in the new cell.

The UTRAN transmits to UEs, that are to receive a specific MBMS service, the above CPV information and a CPV identifier for identifying the CPV information per cell. Preferably, the CPV identifier uniquely identifies MBMS cell groups. As cells having the

same CPV identifier use the same CPV information, if the CPV identifier of a new cell is identical to that of a previous cell, the UE having moved to the new cell can, using the CPV information of the previous cell, set up the channels and protocol entity for the new cell. Moreover, as cells having the same CPV identifier use the same CPV information, the UE can achieve soft combining gain when receiving MBMS data during handover.

FIG. 6 illustrates a process of receiving a specific MBMS service in a UE adopting the method of the present invention. The UE operates using the CPV information and CPV identifier.

In step S601, a UE receives from an initial cell CPV information and a CPV identifier, stores the same, and establishes an MBMS channel for transferring data of a specific MBMS service using that information, and in step S602, the UE receives the MBMS data via the established MBMS channel while located in the initial (or previous) cell, that is, until moving to a new cell as determined according to step S603. In step S604, after the UE has moved to a new cell, the UE receives the CPV identifier transmitted from the new cell and compares the received value to the stored value, i.e., the CPV identifier of the previous cell, in step S605.

If the value of newly received CPV identifier (new cell) is the same as that of the stored CPV identifier (previous cell), the UE receives the MBMS data using the stored CPV information in step S606. Alternatively, the UE receives CPV information of the new cell and stores the new CPV information in place of that of the previous cell for use in receiving the MBMS data in the new cell via the MBMS channel using the newly stored CPV information in step S607. Once enabled to receive MBMS channels of the

previous and new cells simultaneously, the UE performs soft combining on the MBMS channels from the two cells in a manner similar to that of a soft handover.

The method of the present invention can be implemented by a computer-readable program stored in a record media.

Accordingly, the present invention enables different cells to share a second-layer protocol entity to use the same channel parameter values and the same protocol parameter values, thereby reducing a delay resulting from reestablishing a radio bearer in the event of a handover, minimizing data loss during handover, conserving network resources, and enhancing reception performance via soft combining.

Referring to FIG. 7, a block diagram of a mobile communication device 800 of the present invention is illustrated, for example a mobile phone for performing the methods of the present invention. The mobile communication device 800 includes a processing unit 810 such as a microprocessor or digital signal processor, an RF module 835, a power management module 805, an antenna 840, a battery 855, a display 815, a keypad 820, a storage unit 830 such as flash memory, ROM or SRAM, a speaker 845 and a microphone 850.

A user enters instructional information, such as a telephone number, for example, by pushing the buttons of the keypad 820 or by voice activation using the microphone 850. The processing unit 810 receives and processes the instructional information to perform the appropriate function, such as to dial the telephone number. Operational data may be retrieved from the storage unit 830 to perform the function. Furthermore, the processing unit 810 may display the instructional and operational information on the display 815 for the user's reference and convenience.

The processing unit 810 issues instructional information to the RF section 835, to initiate communication, for example, by transmitting radio signals comprising voice communication data. The RF module 835 includes a receiver and a transmitter to receive and transmit radio signals. The antenna 840 facilitates the transmission and reception of radio signals. Upon receiving radio signals, the RF module 835 may forward and convert the signals to baseband frequency for processing by the processing unit 810. The processed signals may be transformed into audible or readable information output, for example, via the speaker 845.

It will be apparent to one skilled in the art that the mobile communication device 800 may be readily implemented using, for example, the processing unit 810 or other data or digital processing device, either alone or in combination with external support logic.

Although the present invention is described in the context of mobile communication, the present invention may also be used in any wireless communication systems using mobile devices, such as PDAs and laptop computers equipped with wireless communication capabilities. Moreover, the use of certain terms to describe the present invention should not limit the scope of the present invention to certain type of wireless communication system, such as UMTS. The present invention is also applicable to other wireless communication systems using different air interfaces and/or physical layers, for example, TDMA, CDMA, FDMA, WCDMA, etc.

The preferred embodiments may be implemented as a method, apparatus or article of manufacture using standard programming and/or engineering techniques to produce software, firmware, hardware, or any combination thereof. The term "article of

manufacture" as used herein refers to code or logic implemented in hardware logic (e.g., an integrated circuit chip, Field Programmable Gate Array (FPGA), Application Specific Integrated Circuit (ASIC), etc.) or a computer readable medium (e.g., magnetic storage medium (e.g., hard disk drives, floppy disks, tape, etc.), optical storage (CD-ROMs, optical disks, etc.), volatile and non-volatile memory devices (e.g., EEPROMs, ROMs, PROMs, RAMs, DRAMs, SRAMs, firmware, programmable logic, etc.).

Code in the computer readable medium is accessed and executed by a processor. The code in which preferred embodiments are implemented may further be accessible through a transmission media or from a file server over a network. In such cases, the article of manufacture in which the code is implemented may comprise a transmission media, such as a network transmission line, wireless transmission media, signals propagating through space, radio waves, infrared signals, etc. Of course, those skilled in the art will recognize that many modifications may be made to this configuration without departing from the scope of the present invention, and that the article of manufacture may comprise any information bearing medium known in the art.

The logic implementation shown in the figures described specific operations as occurring in a particular order. In alternative implementations, certain of the logic operations may be performed in a different order, modified or removed and still implement preferred embodiments of the present invention. Moreover, steps may be added to the above described logic and still conform to implementations of the invention.

It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention. Thus, it is intended that the present

invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

Industrial Applicability

The present invention can be applicable to a mobile communications system for providing MBMS services.

What is claimed is:

1. A method of providing a point-to-multipoint service in a cellular system, the method comprising:

establishing a radio protocol entity in a radio access network for the point-to-multipoint service for a group of cells, each cell capable of servicing at least one mobile terminal with uplink and downlink communication capabilities; and

providing data for the point-to-multipoint service through the same radio protocol entity to the group of cells.

2. The method of claim 1, wherein the group of cells belongs to a radio network system.

3. The method of claim 2, wherein the radio access network comprises at least one radio network system.

4. The method of claim 1, wherein the radio protocol entity comprises at least one of medium access control entity (MAC), radio link control entity (RLC) and packet data convergence protocol entity (PDCP).

5. The method of claim 1, further comprising: transmitting to the group of cells a parameter indicator and a radio protocol parameter associated with the parameter indicator necessary for at least one mobile terminal in one of the group of cells to receive the point-to-multipoint service, wherein the parameter indicator is identical for the group of cells.

6. The method of claim 1, further comprising: transmitting to the group of cells a parameter indicator necessary for at least one mobile terminal in one of the group of cells to receive the point-to-multipoint service, wherein the parameter indicator is identical for the group of cells.

7. The method of claim 1, the radio protocol entity provides the point-to-multipoint service through a common traffic channel.

8. The method of claim 5, wherein the parameter indicator is transmitted through a common control channel.

9. The method of claim 8, wherein the common control channel is a broadcast control channel (BCCH).

10. The method of claim 8, wherein the common control channel is a multimedia broadcast multicast service control channel (MCCH).

11. A method of receiving a point-to-multipoint service, the method comprising:

receiving a first parameter indicator and a first radio protocol parameter associated with the first parameter indicator;

establishing a radio protocol in a mobile terminal according to the received first radio protocol parameter for receiving the point-to-multipoint service;

receiving a second parameter indicator necessary to receive the point-to-multipoint service; and

continue receiving the point-to-multipoint service without receiving a second radio protocol parameter associated with the second parameter indicator if the first and second parameter indicators are identical.

12. The method of claim 11, further comprising

receiving the second radio protocol parameter if the first and second parameter indicators are not identical;

reestablishing the radio protocol entity according to the received second radio protocol parameter for receiving the point-to-multipoint service.

13. The method of claim 11, wherein the first parameter indicator and the second parameter indicator are received in the same cell.

14. The method of claim 11, wherein the first parameter indicator is received in a first cell and the second parameter indicator is received in a second cell.

15. The method of claim 11, wherein each one of the first and second parameter indicators identifies a group of cells sharing the radio protocol entity.

16. The method of claim 11, the radio protocol entity receives the point-to-multipoint service through a common traffic channel.

17. The method of claim 11, wherein the radio protocol entity comprise at least one of medium access control module (MAC), radio link control module (RLC) and packet data convergence protocol entity (PDCP).

18. The method of claim 11, wherein each one of the first and second parameter indicators is received through a common control channel.

19. The method of claim 18, wherein the common control channel is a broadcast control channel (BCCH).

20. The method of claim 18, wherein the common control channel is a multimedia broadcast multicast service control channel (MCCH).

21. A wireless communication system for providing a point-to-multipoint service in a cellular system, the wireless communication system comprising:

a radio access network for establishing a radio protocol entity for the point-to-multipoint service for a group of cells, each cell capable of servicing at least one mobile terminal with uplink and downlink communication capabilities, wherein the radio access

network providing data for the point-to-multipoint service through the same radio protocol entity to the group of cells.

22. The wireless communication system of claim 21, wherein the group of cells belongs to a radio network system.

23. The wireless communication system of claim 22, wherein the radio access network comprises at least one radio network system.

24. The wireless communication system of claim 21, wherein the radio protocol entity comprise at least one of medium access control entity (MAC), radio link control entity (RLC) and packet data convergence protocol entity (PDCP).

25. The wireless communication system of claim 21, wherein the radio access network transmitting to the group of cells a parameter indicator and a radio protocol parameter associated with the parameter indicator necessary for at least one mobile terminal in one of the group of cells to receive the point-to-multipoint service, wherein the parameter indicator is identical for the group of cells.

26. The wireless communication system of claim 1, the radio access network transmitting to the group of cells a parameter indicator necessary for at least one mobile terminal in one of the group of cells to receive the point-to-multipoint service, wherein the parameter indicator is identical for the group of cells.

27. The wireless communication system of claim 21, the radio protocol entity provides the point-to-multipoint service through a common traffic channel.

28. The wireless communication system of claim 25, wherein the parameter indicator is transmitted through a common control channel.

29. The wireless communication system of claim 28, wherein the common control channel is a broadcast control channel (BCCH).

30. The wireless communication system of claim 28, wherein the common control channel is a multimedia broadcast multicast service control channel (MCCH).

31. A mobile terminal for receiving a point-to-multipoint service, the mobile terminal comprising:

means for receiving a first parameter indicator and a first radio protocol parameter associated with the first parameter indicator;

means for establishing a radio protocol entity in a mobile terminal according to the received first radio protocol parameter for receiving the point-to-multipoint service;

means for receiving a second parameter indicator necessary to receive the point-to-multipoint service; and

means for continue receiving the point-to-multipoint service without receiving a second radio protocol parameter associated with the second parameter indicator if the first and second parameter indicators are identical.

32. The mobile terminal of claim 31, further comprising

means for receiving the second radio protocol parameter if the first and second parameter indicators are not identical; and

means for reestablishing the radio protocol entity according to the received second radio protocol parameter for receiving the point-to-multipoint service.

33. The mobile terminal of claim 31, wherein the first parameter indicator and the second parameter indicator are received in the same cell.

34. The mobile terminal of claim 31, wherein the first parameter indicator is received in a first cell and the second parameter indicator is received in a second cell.

35. The mobile terminal of claim 31, wherein each one of the first and second parameter indicators identifies a group of cells sharing the radio protocol entity.

36. The mobile terminal of claim 31, the radio protocol entity receives the point-to-multipoint service through a common traffic channel.

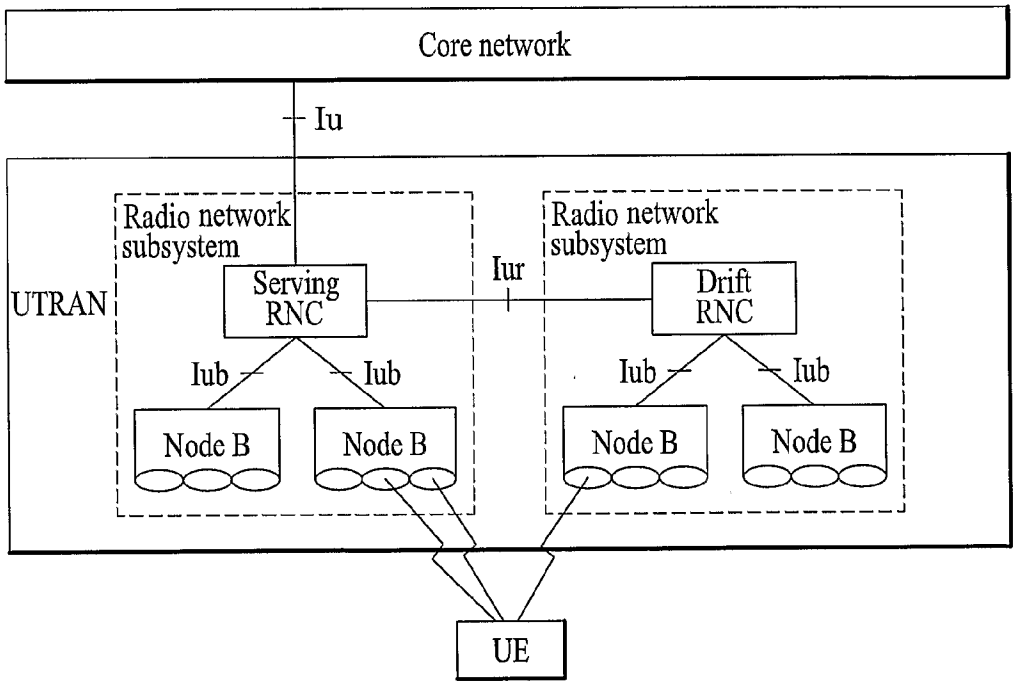
37. The mobile terminal of claim 31, wherein the radio protocol entity comprise at least one of medium access control module (MAC), radio link control module (RLC) and packet data convergence protocol entity (PDCP).

38. The mobile terminal of claim 31, wherein each one of the first and second parameter indicators is received through a common control channel.

39. The mobile terminal of claim 38, wherein the common control channel is a broadcast control channel (BCCH).

40. The mobile terminal of claim 38, wherein the common control channel is a multimedia broadcast multicast service control channel (MCCH).

FIG. 1
Related Art



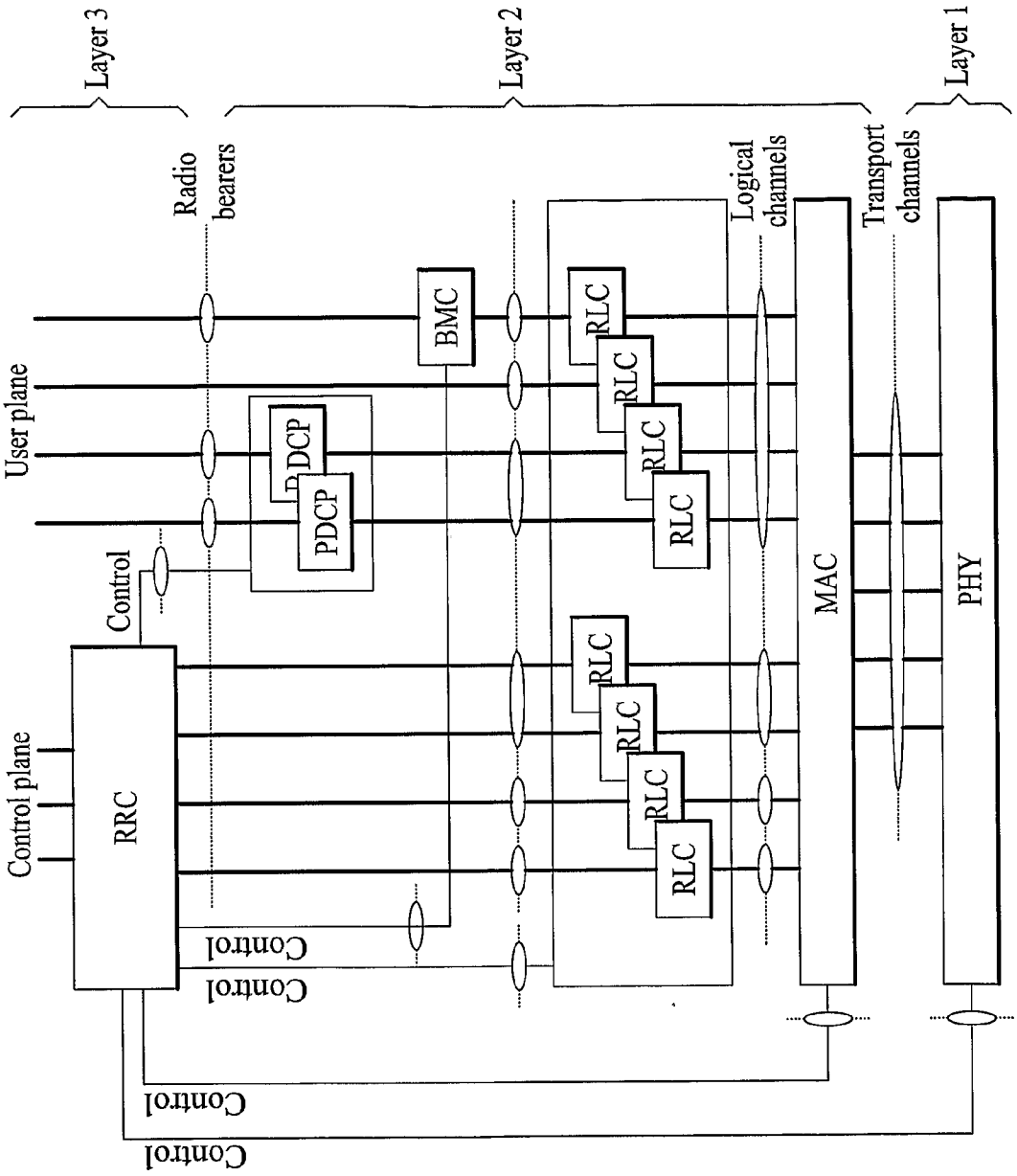


FIG. 2
Related Art

FIG. 3
Related Art

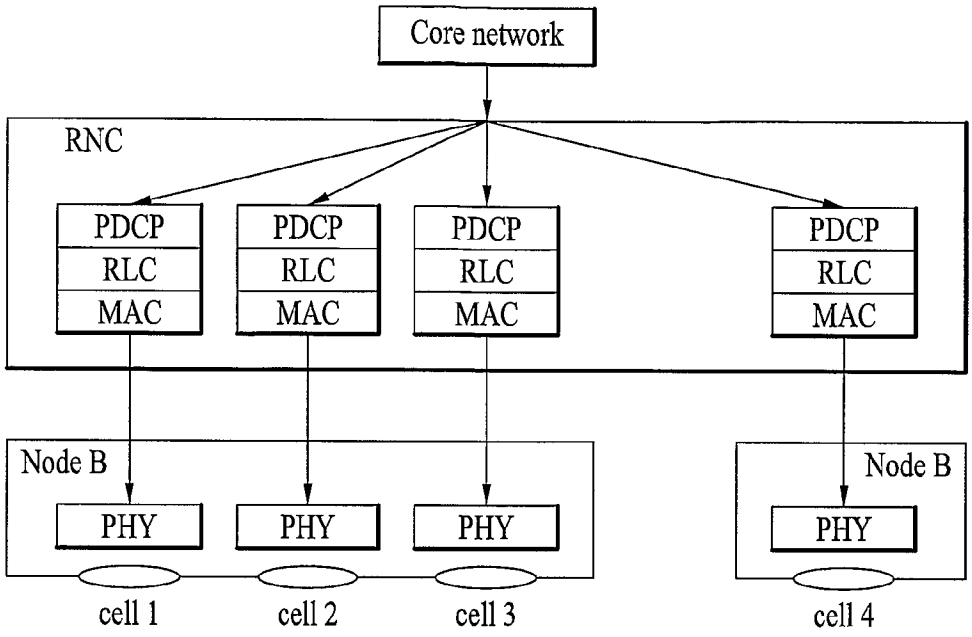


FIG. 4A

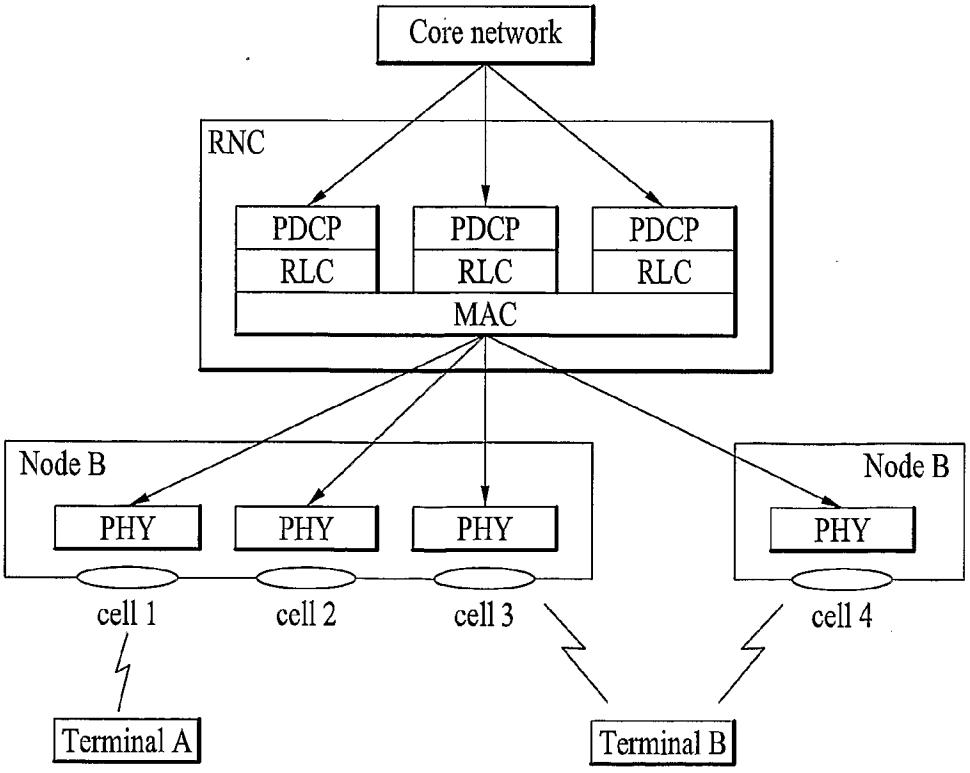


FIG. 4B

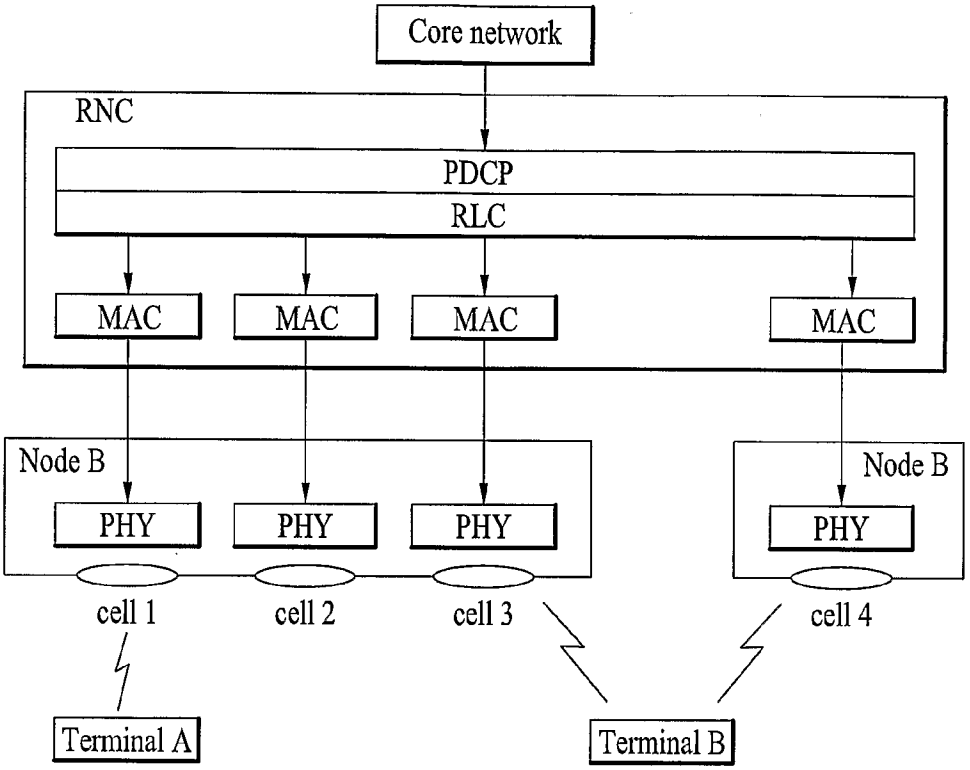

Core network
RNC
PDCP
RLC
MAC
MAC
MAC
MAC
Node B
Node B
PHY
PHY
PHY
PHY
cell 1
cell 2
cell 3
cell 4
Terminal A
Terminal B

FIG. 5

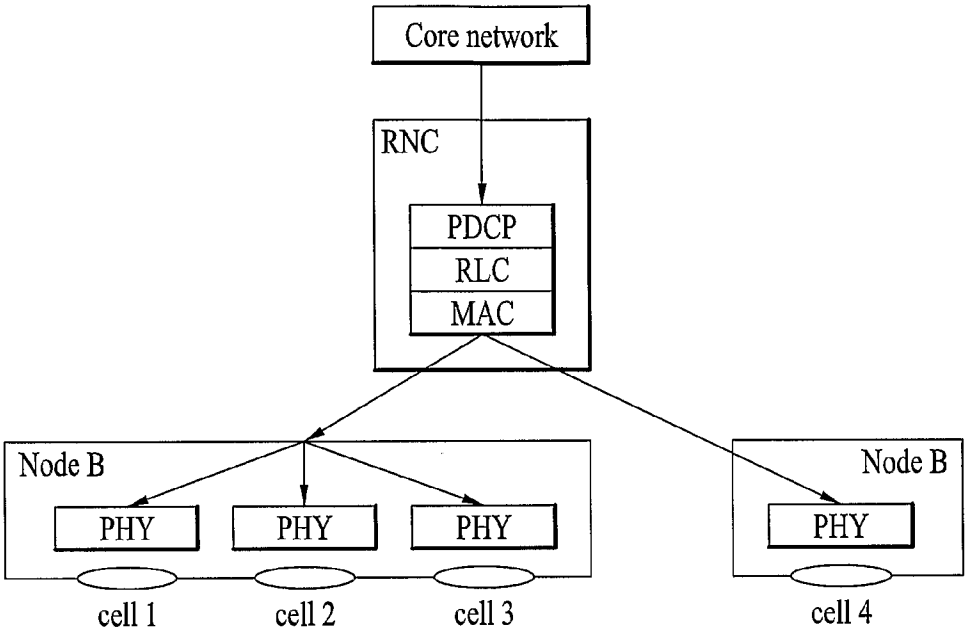

Core network
RNC
PDCP
RLC
MAC
Node B
PHY
PHY
PHY
Node B
PHY
cell 1
cell 2
cell 3
cell 4

FIG. 6

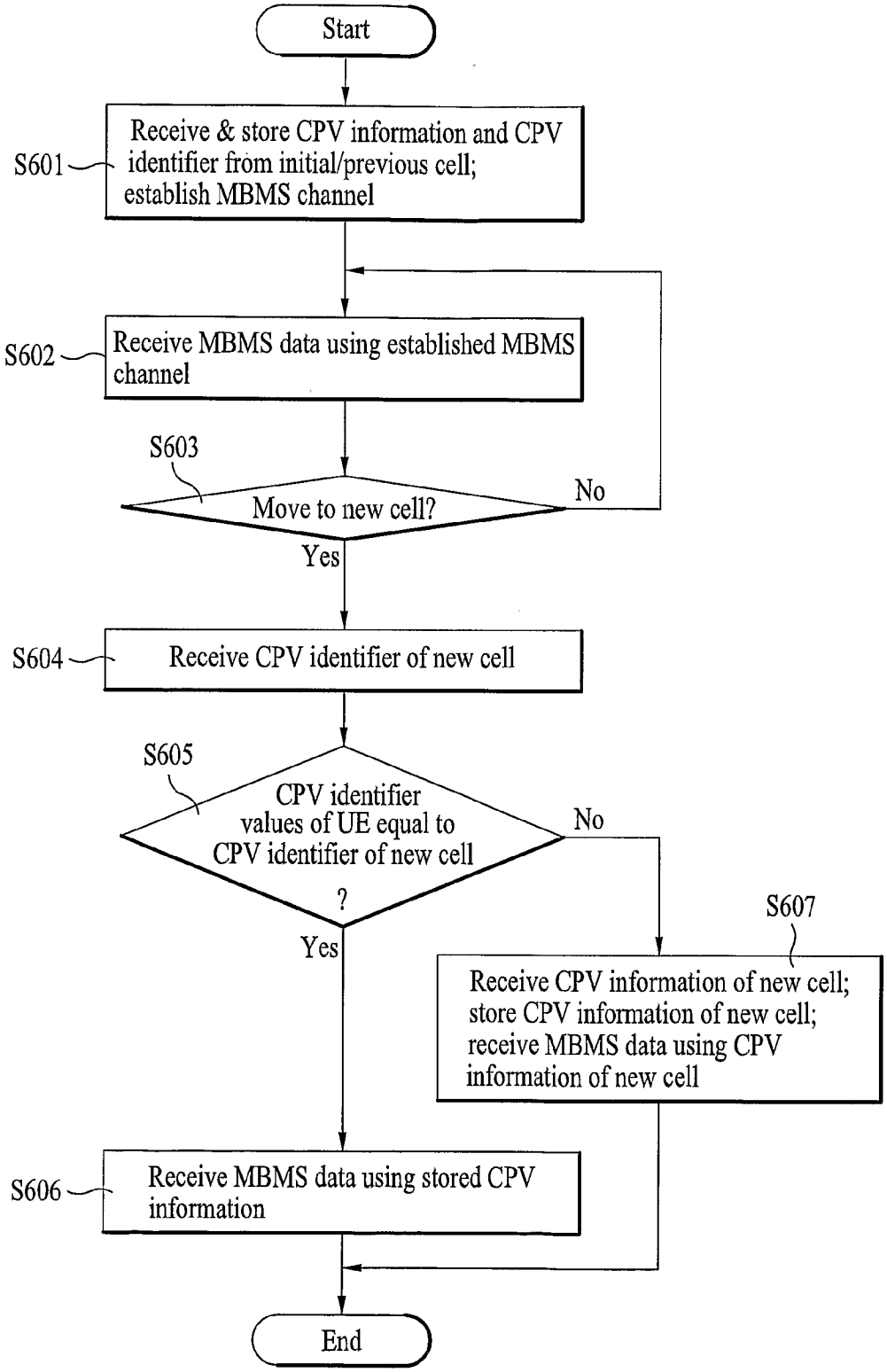
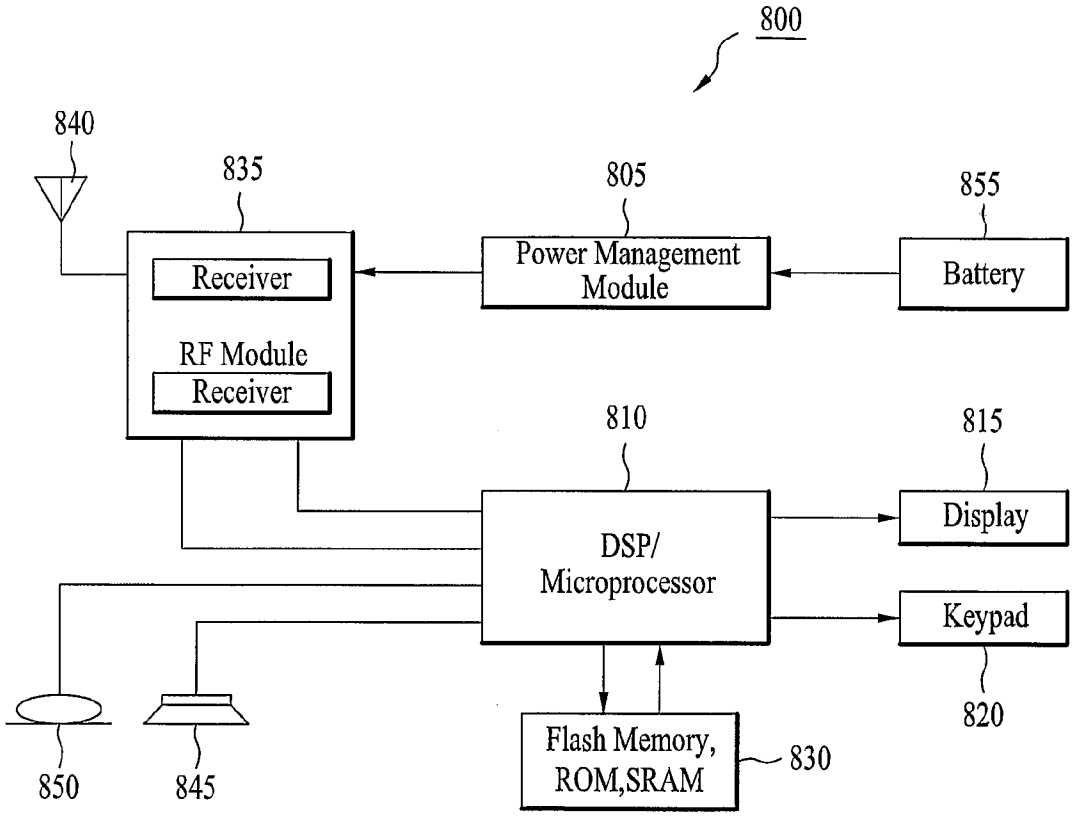

Start
S601
Receive & store CPV information and CPV identifier from initial/previous cell; establish MBMS channel
S602
Receive MBMS data using established MBMS channel
S603
Move to new cell?
No
Yes
S604
Receive CPV identifier of new cell
S605
CPV identifier values of UE equal to CPV identifier of new cell ?
No
Yes
S607
Receive CPV information of new cell; store CPV information of new cell; receive MBMS data using CPV information of new cell
S606
Receive MBMS data using stored CPV information
End

FIG. 7


800
840
835
805
855
Receiver
Power Management Module
Battery
RF Module
Receiver
810
815
DSP/ Microprocessor
Display
Keypad
820
850
845
Flash Memory, ROM,SRAM
830

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR 2004/002071

A. CLASSIFICATION OF SUBJECT MATTER
IPC[7]: H04Q 7/38, H04Q 7/22, H04L 29/06
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC[7]: H04Q, H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
---

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPI, EPODOC, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	US 2003/0174678 A1 (CHANG, J.-W. et al.) 18 September 2003 (18.09.2003) *abstract, figures 15, 16, paragraphs [0045], [0072], [0077]-[0086].* —	1-4, 7-10, 21-24, 27-30
P,X	EP 1 387 591 A1 (SAMSUNG ELECTRONICS CO. LTD.) 4 February 2004 (04.02.2004) *abstract, figures 1-8, paragraphs [0011]-[0013], [0033]-[0047], [0051], [0072]-[0082].* —	1-10, 21-30

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 December 2004 (17.12.2004)	7 January 2005 (07.01.2005)

Name and mailing address of the ISA/ AT	Authorized officer
Austrian Patent Office Dresdner Straße 87, A-1200 Vienna	LOIBNER K.
Facsimile No. +43 / 1 / 534 24 / 535	Telephone No. +43 / 1 / 534 24 / 323

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	3GPP: "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Introduction of the Multimedia Broadcast Multicast Service (MBMS) in the Radio Access Network (Stage-2); (Release 6)" 3GPP TS 25.346 V2.0.0, [online] June 2003 (2003-06) [retrieved on 3 December 2004 (03.12.2004)]. Retrieved from the Internet: <URL: http://www.3gpp.org/ftp/Specs/Archive/25_series/25.346/25346-200.zip> *page 7, paragraph 5.1.1 - page 19, paragraph 9.1.* ---	1-40

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR 2004/002071

Patent document cited in search report			Publication date	Patent family member(s)			Publication date
	A					none	
EP	A	1387591	2004-02-04	JP	A	2004135283	2004-04-30
				US	A	2004022218	2004-02-05
US	A	20030174678				none	

Continuation of first sheet

Continuation No. III:

Observations where unity of invention is lacking

(Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Group I: Claims 1-7 and claims 21-30 directed to a method of providing a point-to-multipoint service in a cellular system and to a corresponding wireless communication system for providing a point-to-multipoint service in a cellular system wherein a common radio protocol entity in a radio access network for the point-to-multipoint service for a group of cells is established and data for the point-to-multipoint service is provided through the said common radio protocol entity to the group of cells.

Group II: Claims 11-20 and claims 31-40 directed to a method of receiving a point-to-multipoint service and to a corresponding mobile terminal for receiving a point-to-multipoint service wherein a first parameter indicator and a first radio protocol parameter associated with the first parameter indicator are received and a radio protocol in a mobile terminal is established according to the said first radio protocol parameter for receiving the point-to-multipoint service. Due to mobility of the mobile terminal a second parameter indicator is received and if the said first and second parameter indicators are different a second radio protocol parameter is received and a radio protocol is re-established according to the said second radio protocol parameter for receiving the point-to-multipoint service.

The special technical features common to Group 1 invention is the concept of introducing a common radio protocol entity in a radio access network for providing a point-to-multipoint service in a cellular system wherein data for the point-to-multipoint service is provided through said common radio protocol entity to the group of cells.

The special technical features common to Group 2 invention is the concept of receiving a point-to-multipoint service whereby a first parameter indicator coresponding to a first radio protocol parameter is received and the radio protocol for receiving the point-to-multipoint service is established according to the said first radio protocol parameter and a second parameter indicator necessary to receive the point-to-multipoint service is received and the point-to-multipoint service is continued without re-establishing the radio protocol if said first and second parameter indicators are identical.

All inventions are directed to methods and systems for providing a point-to-multipoint service in a cellular system. However, the special technical features common to Group 1 invention are not present in the features common to Group 2 invention and the special technical features common to Group 2 invention are not present in the features common to Group 1 invention. Consequently, the group of inventions are not so linked as to form a single general inventive concept and the requirement of unity of invention is therefore not met.

2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

Continuation No. IV:

Text of the abstract

(Continuation of item 5 of the first sheet)

A radio protocol entity sharing apparatus and method are provided for a multimedia broadcast/multicast service (MBMS) in a plurality of cells. Different cells share a second-layer protocol entity (MAC, RLC, PDCP) to use the same channel parameter values (CPV identifier) and the same protocol parameter values (CPV information), thereby reducing a delay resulting from re-establishing a radio bearer in the event of handover, minimizing data loss during handover, conserving network resources, and enhancing reception performance at the mobile station (UE) via soft combining.
The method includes the steps of receiving, in a mobile station (UE), a first parameter value and a first parameter indicator (S601); establishing a channel using the first parameter value and the first parameter value indicator and receive MBMS data (S602); receiving, in the mobile station (UE), a second parameter value indicator (S604); and maintaining the established channel if the first parameter value indicator is identical to the second parameter value indicator (S606). If said first and second parameter value indicators are different, the channel is re-established using a received second parameter value (S607).

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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
21 April 2005 (21.04.2005)

PCT

(10) International Publication Number
WO 2005/036917 A1

(51) International Patent Classification[7]: H04Q 7/38

(21) International Application Number:
PCT/US2004/033302

(22) International Filing Date: 7 October 2004 (07.10.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/509,804 8 October 2003 (08.10.2003) US
60/562,736 16 April 2004 (16.04.2004) US

(71) Applicant *(for all designated States except US)*: **QUALCOMM INCORPORATED** [US/US]; 5775 Morehouse Drive, San Diego, California 92121 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **CASACCIA, Lorenzo** [IT/US]; 1501-8 Reed Avenue, San Diego, California 92109 (US). **GRILLI, Francesco** [IT/US]; 5350 Toscana Way, #402, San Diego, California 92122 (US).

(74) Agent: **NGUYEN, Thien T.?**; 5775 Morehouse Drive, San Diego, California 92121 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

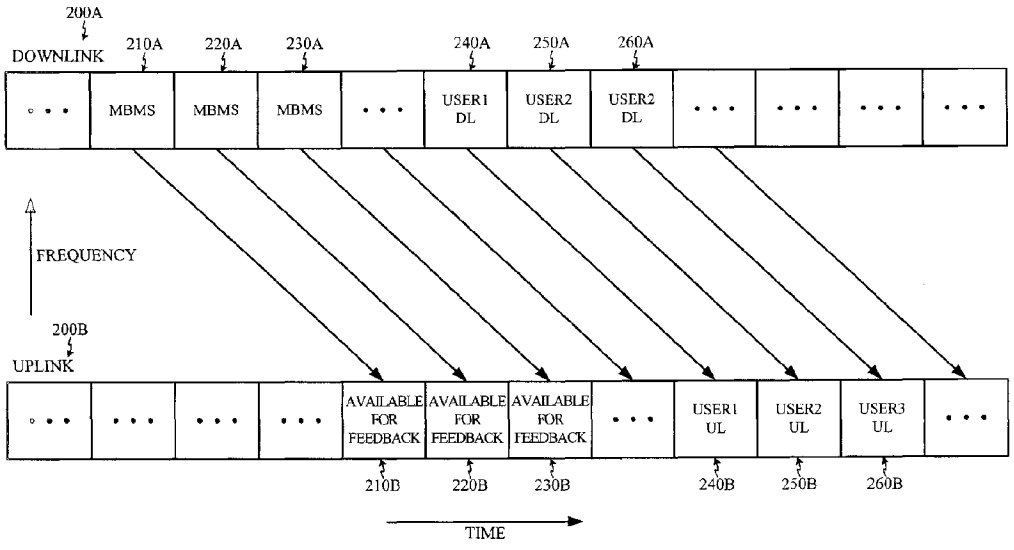
(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA,*

[Continued on next page]

(54) Title: METHOD AND APPARATUS FOR FEEDBACK REPORTING IN A WIRELESS COMMUNICATIONS SYSTEM



(57) Abstract: Feedback from user stations to the base station for a multicast/broadcast transmission is performed by decoding multicast/broadcast data received from a transmitter on a downlink resource, forming a feedback message corresponding to the reception of the multicast/broadcast data, and queuing the feedback message for transmission to the transmitter on an uplink resource. The uplink resource used corresponds to the downlink resource used for the multicast/broadcast transmission. For unicast transmissions the uplink resource is dedicated to an uplink transmission corresponding to a downlink transmission on the downlink resource.

WO 2005/036917 A1

MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for all designations*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for all designations*

Published:

— *with international search report*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

METHOD AND APPARATUS FOR FEEDBACK REPORTING IN A WIRELESS COMMUNICATIONS SYSTEM

Claim of Priority under 35 U.S.C. §119

[0001] The present Application for Patent claims priority to Provisional Application No. 60/509,804 entitled "Method, Apparatus, and System for Statistical Reporting" filed October 8, 2003, and to Provisional Application No. 60/562,736 entitled "Method and Apparatus for Statistical Reporting in a Wireless Communication System" filed April 16, 2004, both applications assigned to the assignee hereof and hereby expressly incorporated by reference herein.

BACKGROUND

Field

[0002] The present invention relates generally to wireless communications and more specifically to feedback reporting in wireless communications systems.

Background

[0003] In recent years, communication systems' performance and capabilities have continued to improve rapidly in light of several technological advances and improvements with respect to telecommunication network architecture, signal processing, and protocols. In the area of wireless communications, various multiple access standards and protocols have been developed to increase system capacity and accommodate fast-growing user demand. These various multiple access schemes and standards include Time Division Multiple Access (TDMA), Frequency Division Multiple Access (FDMA), Code Division Multiple Access (CDMA), and Orthogonal Frequency Division Multiple Access (OFDMA), etc. Generally, in a system which employs TDMA technique, each user is allowed to transmit information in his assigned or allocated time slots whereas an FDMA system allows each user to transmit information on a particular frequency that is assigned to that particular user. A CDMA system, in contrast, is a spread spectrum system which allows different users to transmit information at the same frequency and at the same time by assigning a unique code to

each user. In an OFDMA system, a high-rate data stream is split or divided into a number of lower rate data streams which are transmitted simultaneously in parallel over a number of subcarriers (also called subcarrier frequencies herein). Each user in an OFDMA system is provided with a subset of the available subcarriers for transmission of information.

[0004] In connection therewith, various domestic and international standards have been established including Advanced Mobile Phone Service (AMPS), Global System for Mobile (GSM), and cdmaOne.

[0005] Code division multiple access (CDMA) technology was introduced in cellular systems in the early 1990s with the development of the IS-95 standard. The IS-95 system has significantly evolved and matured in the last decade resulting in the enhanced revisions IS-95 A and B in 1994 and 1998, respectively. The IS-95-A/B and several related standards form the basis of the second generation cellular technology which is also known as cdmaOne.

[0006] The 3G evolution of cdmaOne consists of a family of standards, known as cdma2000, which first appeared with the publication of the IS-2000 Release 0 in 1999. Release A version of IS-2000 was published in mid 2000 with the inclusion of additional signaling support for features such as new common channels, Quality-of-Service (QoS) negotiation, enhanced authentication, encryption and concurrent services. The cdma2000 system was designed to be backward compatible with existing cdmaOne networks and voice terminals.

[0007] Several CDMA-based standards and their relation to the harmonized third generation (3G) mobile communication systems have been developed and endorsed by the International Telecommunications Union (ITU) and known as IMT-2000. Both Time Division Duplex (TDD) and Frequency Division Duplex (FDD) modes are supported by IMT-2000. The more common FDD mode uses different frequency bands for the uplink and downlink carriers separated by a fixed frequency, while TDD systems use the same frequency band for both uplink and downlink. The downlink is the communications link from the base station to the user terminal. The uplink is the communications link from the user terminal to base station.

[0008] The 3rd Generation Partnership Project (3GPP) is a collaboration agreement that was established in December 1998. Initially, the scope of 3GPP was to produce globally applicable Technical Specifications and Technical Reports for a 3rd Generation Mobile System. The scope was subsequently amended to include the maintenance and

development of the Global System for Mobile communication (GSM) Technical Specifications and Technical Reports including evolved radio access technologies (e.g. General Packet Radio Service (GPRS) and Enhanced Data rates for GSM Evolution (EDGE)), WCDMA, etc.

[0009] Various types of services have been developed and implemented in various systems which operate based on the various standards mentioned above. For example, Mutimedia Broadcast/Multicast Service (MBMS) is a service that is (1) one base station to many user terminals and (2) unbalanced towards the downlink in that there is a higher data rate transmission on the downlink as compared to on the uplink. As such, in general the MBMS users do not provide any sort of feedback including feedback information or feedback messages to the network. However, if a feedback (even low data rate) were possible, this would be surely beneficial for the system. The advantages of the feedback include the ability for the system to retransmit lost data packets as well to adapt the data transmission to the operating conditions. There is therefore a need for user terminals (also called mobile stations or MS herein) to signal multicast/broadcast service quality and provide feedback on a statistical basis or on a per-event basis.

SUMMARY

[0010] Feedback from user stations to the base station for a multicast/broadcast transmission is performed by decoding multicast/broadcast data received from a transmitter on a downlink resource, forming a feedback message corresponding to the reception of the multicast/broadcast data, and queuing the feedback message for transmission to the transmitter on an uplink resource. The uplink resource used corresponds to the downlink resource used for the multicast/broadcast transmission. For unicast transmissions the uplink resource is dedicated to an uplink transmission corresponding to a downlink transmission on the downlink resource.

[0011] An apparatus which send feedback messages for multicast/broadcast may have a decoder to decode multicast/broadcast data received from a transmitter on a downlink resource, a first processing unit to form a feedback message corresponding to the reception of the multicast/broadcast data, and a second processing unit to queue the feedback message for transmission to the transmitter on an uplink resource that corresponds to the downlink resource, wherein for unicast transmissions the uplink

resource is dedicated to an uplink transmission corresponding to a downlink transmission on the downlink resource.

[0012] An apparatus which sends the feedback message for multicast/broadcast may have means for decoding multicast/broadcast data received from a transmitter on a downlink resource, means for forming a feedback message corresponding to the reception of the multicast/broadcast data, and means for queuing the feedback message for transmission to the transmitter on an uplink resource that corresponds to the downlink resource, wherein for unicast transmissions the uplink resource is dedicated to an uplink transmission corresponding to a downlink transmission on the downlink resource.

[0013] An apparatus which sends the feedback message for multicast/broadcast may have a memory unit and a processor unit configured to execute instructions from the memory unit in order to decode multicast/broadcast data received from a transmitter on a downlink resource, form a feedback message corresponding to the reception of the multicast/broadcast data, and queue the feedback message for transmission to the transmitter on an uplink resource that corresponds to the downlink resource, wherein for unicast transmissions the uplink resource is dedicated to an uplink transmission corresponding to a downlink transmission on the downlink resource.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. 1 is a block diagram of a communication system in which the teachings of the present invention are implemented;

[0015] FIG 2 is an example of a TDMA system in which an uplink resource is dedicated for a downlink resource.

[0016] FIG. 3 is a flow diagram illustrating a process in accordance with one embodiment of the present invention; and

[0017] FIG. 4 is a flow diagram illustrating a process in accordance with one embodiment of the present invention.

[0018] FIG. 5 is a block diagram of a portion of a receiver apparatus in accordance with one embodiment of the present invention.

DETAILED DESCRIPTION

[0019] The word "exemplary" is used herein to mean "serving as an example, instance, or illustration." Any embodiment described herein as "exemplary" is not necessarily to be construed as preferred or advantageous over other embodiments.

[0020] It should be noted that while the teachings of the present disclosure as described herein are focused on MBMS systems for WCDMA and GSM, they should not be limited to WCDMA and GSM and should be applicable to other systems as well. The MBMS service is included in the WCDMA standard under specification 3GPP TS 25.346 V6.1.0 (2004-06), and in the GSM standard under specification 3GPP TS 43.246 v0.14.1 (2004-06). In general, the embodiments of the present disclosure apply to multicast/broadcast in a communication system in which for a unicast transmission an uplink resource would be dedicated to an uplink transmission corresponding to a downlink transmission on a downlink resource. Here the term resource designates any of the means to apportion multiple access in a communications system including but not limited to a channel, a time slot, a frequency band, a code, a subcarrier, or any combination of these means.

[0021] Unicast transmission is the usual transmission mode in a wireless communications system. The base station sends one transmission to one user terminal. A typical unicast transmission would be for a voice telephone call. Here the base station sends data including portions of the voice call on the downlink resource and the user terminal sends data on the uplink resource that corresponds to the downlink resource. For many communications systems, including those based on the GSM standard, the downlink resource is dedicated and corresponds to the uplink resource when the communication link is established. In a multicast/broadcast transmission the base station sends one transmission to multiple users. Furthermore, the communication is unbalanced in that there is more data being sent on the downlink than on the uplink. If there is an uplink resource dedicated for every downlink resource, and more of the downlink resources are being used because of the unbalanced transmission, then some of the uplink resources are not being used. These unused uplink resources can be used to send feedback messages from the user terminals to the base station.

[0022] FIG. 1 is a block diagram of a communication system in which the teachings of the present invention are implemented. As shown in FIG. 1, the system 100 includes various user terminals (UT) 110 and base stations (BS) 120. User terminals 110 are also

referred to as user terminals, remote stations, subscriber stations. The user terminals 110 can be mobile (in which case they may also be referred to as mobile stations) or stationary. In one embodiment, each base station 120 can communicate with one or more user terminals 110 on a communication link called the forward link or downlink (DL). Each user terminal 110 can communicate with one or more base stations 120 on a communication link called the reverse link or uplink (UL). As shown in FIG. 1, system 100 further includes a base station controller (BSC) 130 to coordinate and control data communication between the user terminals 110 and the base stations 120. As also shown in FIG. 1, the base station controller 130 may be connected to a circuit-switched network (e.g., PSTN) 190 through a mobile switching center (MSC) 170 and/or a packet-switched network (e.g., IP network) 150 via a packet data service node 140 (also referred to as packet network interface herein). As described herein, in one embodiment, each base station 120 may include a scheduler (not shown) to coordinate and schedule data transmissions from the respective base station 120 to the various user terminals 110 that are served by their respective base station 120. In another embodiment, the scheduler may be implemented within the BSC 130 to coordinate and schedule data transmissions for all base stations 120 that are connected to the BSC 130. In other words, the location of the scheduler may be chosen depending upon whether a centralized or distributed scheduling processing is desired.

[0023] As mentioned above, multicast/broadcast is an unbalanced service (most of the traffic happens in the downlink). MSBS is an example of a multicast/broadcast service, but the embodiments in the present disclosure can also be used for any multicast/broadcast service, or for any service which is unbalanced in the sense described above. The GSM air interface is based on a TDMA structure which is well suited for paired services (e.g., voice). In this structure, when a given time slot is used in the downlink (DL), the corresponding uplink (UL) time slot is also used. Obviously this does not apply to MBMS. Since MBMS happens in one or more downlink time slots, all the corresponding uplink time slots are unused, and unusable to carry on voice conversations. Therefore, they constitute a bandwidth that can be exploited to signal MBMS service quality using feedback messages, as explained in more detail below. The feedback message can be sent autonomously by the mobile station, or in response to a prompt send by the base station.

[0024] FIG 2 is an example of a TDMA system in which an uplink resource is dedicated for a downlink resource. FIG. 2 shows an example of a TDMA downlink

200A and uplink 200B similar to the one in the GSM air interface. Time slots 210A through 260A are on the downlink 200A. Time slots 210B through 260B are on the uplink 200B. Every time slot on the downlink has a corresponding time slot. For example, time slot 210A on the downlink has corresponding slot 210B on the uplink. Slots 210A, 220A, and 230A are used for an MBMS transmission. Therefore, the corresponding time slots on the uplink, 210B, 220B, and 230B are unused for uplink traffic and are available for feedback message transmissions. Time slots 240A, 250A, and 260A are assigned to downlink transmissions for user 1, user 2, and user 3, respectively. Time slots 240B, 250B, and 260B are assigned to the uplink transmissions for user 1, user 2, and user 3, respectively. The time delay between a downlink time slot and its corresponding uplink time slot, e.g. time slot 210A and time slot 210B is not necessarily shown to scale. Also note that uplink 200A and downlink 200B are on different frequency bands and hence this is a FDD system. The various disclosed embodiments apply equally to TDD systems.

[0025] The use of statistical reporting to decide to retransmit erroneous frames is described in U.S. Patent Application Serial No. 09/898,347 entitled "System and Method for Frame Re-Transmission in a Broadcast Communication System", filed July 2, 2001, and assigned to the assignee hereof.

[0026] In a broadcast data delivery system, not all of the protocol data units (PDUs) that are received in error can be retransmitted. In particular, if there were a single user experiencing a very high block error rate, most PDUs would have to be retransmitted in order for this particular user to receive most of his packets. Such a situation is likely in a wireless communications system when a particular user is on the edge of a base station coverage area, when the user is in a deep fade, or any other condition under which the user experiences low signal quality. Most of the other users, however, may not require the retransmission of the packets because they received them without error. To retransmit all the other packets simply for a single user or for a few users would burden the resources of the MBMS system. To avoid this, the network may decide to retransmit a PDU only when the number of user terminals that have requested its retransmission crosses a threshold. This threshold could be a predetermined threshold or it could be dynamically set to a fraction of the total number of users in the area, or through other means to adaptively determine the threshold. This technique is described in details in the U.S. Patent Application mentioned above.

[0027] In general, a broadcast system has to configure its transmission parameters in order to optimize the Quality of Service (QoS) perceived by each receiver. This task is complicated because the MBMS transmission is point-to-multipoint (PtM), or from a single point (a single base station) to multipoint (multiple user terminals). A PtM link is distinguished from a point-to-point (PtP) link which is from a single point (a single base station) to a single point (a single user terminal). Note that in either the case of the PtM link or the PtP link multiple base stations may be used in place of a single base station during handoff or in order to foster more robust communications. What is clear is that the operating conditions for PtM communications link vary among the paths to the multiple user terminals. Different user terminals may be varying distances away from the base station or be experiencing varying shadowing and fading conditions. Therefore, the base station requires a means to adapt and tailor the transmission to account for the varying conditions over the multiple links that comprise the PtM link.

[0028] For example, in a GSM or a CDMA system the optimal settings can vary in time due to changes in the interference. The system or network can use open loop schemes to determine the best settings (e.g., it could decide the optimal transmit or Tx power on a PtM radio link based on the power of similar rate PtP radio link in the same cell). This may not produce good results at all times, especially if the transmission scheme utilized for point-to-point (PtP) and point-to-multipoint (PtM) are different. For example, if soft handover is used in PtP, but it is not used in PtM, it will be very difficult or challenging to estimate the correct power to allocate to the PtM link in each case. Soft handoff is a method by which a link is established between a user terminal and a new base station while the link between the user terminal and the old base station still exists. The soft handoff results in more robust communications because links are not dropped when a user terminal transitions from one base station to another.

[0029] Closed loop schemes use feedback from the receiver back to the transmitter to indicate the quality of the communications link. The transmitter can then use this feedback to better adapt the communications to the operating environment, either by retransmitting data missing at the receiver, or by adapting the communications method itself. For example, the transmitter could adapt the transmit power, data rate, or modulation scheme in response to feedback from the transmitter. Closed loop schemes are typically more accurate at achieving or guaranteeing the required QoS. A possible implementation could use feedback provided by all the terminals that are receiving the broadcast transmission. The system or network would use this information to determine

how to optimize the settings of the PtM radio link. For example, if the majority of the terminals receive a bad signal quality, the network could increase the power or change other parameters, such as the amount of redundancy, the amount of CDMA codes, the rate matching attributes, etc. These parameters could be modified until the required QoS is achieved. As the interference condition varies, the value of the parameters can be adapted to allow for the most efficient transmission configuration of the PtM radio link.

[0030] If all the terminals provide feedback to the network, the amount of uplink capacity utilized may be prohibitive, as the number of terminals receiving the broadcast transmission in the same cells increases. The number of users receiving the PtM transmission may be relatively high when a multicast/broadcast service is in place. The feedback from every user terminal receiving a multicast/broadcast service would likely overburden the system resources.

[0031] Instead of receiving feedback from all the terminals, the network could select a statistical sample of terminals in each cell and instruct them to report feedback information.

[0032] In various embodiments, the number of terminals that report feedback information should be large enough compared to a threshold or criteria to have statistical significance and provide useful information to the base station, but not be large enough to overburden the uplink resources. For example, if the network operator wants to guarantee that at least 90% of the terminals in the cell can receive the PtM transmission with good quality, the selection criteria is used to decide on the necessary number terminal of terminals to allow such a guarantee. Further selection criteria may also apply. For example, the statistical sample may be such that it includes user terminals at the edge of the coverage area or user terminals at certain distance ranges from the base station. For a differentiated service such as one in which different users terminals have varying QoS requirements, the selection criteria may ensure that user terminals with the highest QoS requirements are included. Operators may use varying selection criteria and algorithms to determine the number of reporting user terminals in such statistically sampled feedback schemes. In addition, varying selection criteria and algorithms may be used to determine the specific user terminals included in the sample.

[0033] Since MBMS is an unbalanced service, most of the traffic happens in the downlink. The GSM air interface is based on a TDMA structure, which was conceived

and is well suited for balanced services (e.g., voice). Balanced services, or paired services, have similar traffic on both downlink and uplink.

[0034] During a voice call, in a system such as one that is based on the GSM TDMA structure, when a given time slot is used in the downlink, the corresponding uplink time slot is also used. Obviously, the same does not apply to MBMS. Since an MBMS transmission takes place in one or more downlink time slots, all the corresponding uplink time slots cannot be used to deliver voice calls. In principle, these uplink time slots would be wasted. Therefore, they constitute a bandwidth that can be exploited for statistical reporting, as explained below.

[0035] Various mechanisms could be used to take advantage of this uplink resource as detailed below:

[0036] In one embodiment, the terminals could use a random access message containing the information relevant to the statistical reporting. The random access channel would be made up of the unused uplink resources corresponding to the time slots allocated for the MBMS downlink transmission.

[0037] In another embodiment, the terminals would request the establishment of a short-lived data connection in the uplink (for example, a Single Slot Temporary Block Flow or TBF). This request would involve sending a random access message, and receiving a TBF assignment separately from the current MBMS transmission (for example, on another time slot). This solution reuses existing procedures in the GSM standard but the setup procedure results in the expense of some additional delay in the reporting.

[0038] Different strategies or processes are then possible for the use of the statistical feedback information at the transmitter. One possibility is to use the feedback information to adjust the transmit power such that the majority or a required portion of the user terminals have adequate received signal power.

[0039] Statistical reporting also can be used by strategies or processes dealing with Layer 2 (L2) or link layer retransmissions. A Layer 2 retransmission resends a packet when the packet is not received or decoded properly at the user terminal. In a MBMS system, the base station needs to decide when to resend a packet when some but not all the user terminals have not received the packet. In various embodiments of statistical reporting with feedback the following strategies or processes may be utilized:

(1) The receiver sends cumulative negative acknowledgements (NAKs) of packets that have been missing for a time greater than a specific interval. This interval may be based on a play-out buffer such that NAKs are not sent for packets that are not longer of use to the user terminal because the application no longer needs them. In other words, the receiver performs a preemptive timer discard based on the playback delay. The discard is preemptive because it takes place before the formation of the NAK message. Such a discard is useful in applications such as streaming media applications because packets not received correctly may not be useful after as certain elapsed time because the stream has played past the point of the missing packets. Cumulative NAKs send information on multiple packets missing at the receiver in the same message. The use of cumulative NAK that have been missing for a time greater than a specific interval that are still needed by the application results in a smaller burden on the uplink resources. Alternatively, for certain critical packets an acknowledgment message may be sent specifying that a particular packet or packets have been received.

(2) The transmitter combines the information of the NAKs and ranks the receivers into different categories of reception, e.g. good, medium, or bad. This ranking of the receivers can then be used when performing retransmissions. For example, the network may decide to retransmit a PDU only when x user terminals in a good reception situation, or y user terminals in a bad reception situation (with y>x) have requested it. This policy would be motivated by the fact that it may not be worth to put more effort in the transmission towards terminals whose reception is particularly bad. For example, a few users may be at the edge of the coverage area or in a deep fade or shadow and the tailor the retransmission to

such users would overburden the downlink with retransmissions. Because the downlink would have to send would have to send more retransmission packets and fewer original packets, the MBMS service of the bulk of the users would be impaired. This impairment is avoided by ranking the receivers according to their reception quality. The ranking essentially assigns a relative weight to the receivers. The relative weight can be assigned on the basis of many parameters, e.g. location, signal strength, QoS requirements, etc. Similarly, the user stations may be assigned to various categories based on the many parameters included those stated above.

(3) The transmitter combines the information of the NAKs and ranks the NAKed packets. This ranking can be based on the number of times every packet has been NAKed. This sum could also be weighted according to the importance of every packet. For example, there are more and less important packets in an MPEG streams (some packets provide only a marginal improvement). In video coding such as MPEG there are both intra-frame coded frames and inter-frame coded frames. The intra-frame coded frames are more critical for decoding. Hence, the transmitter would put more weight on retransmitting packets from intra-frame coded frames. The feedback message can contain other information regarding the video transmission quality. In another example, in the case of combined audio and video, audio packets could be considered more important. Here, the feedback message may specifically provide information on audio transmission quality.

(4) A combination of (2) and (3), where the transmitter decides which packets to retransmit using a 2-dimension ranking, where one dimension is based on the ranking of the receivers (good/medium/bad reception quality), and the other dimension is based on the ranking of the packets (more/less important).

[0040] FIG. 3 is a flow diagram illustrating a process in accordance with one embodiment of the present invention. FIG. 3 illustrates a flow diagram of process 300 performed on the transmitter side. At step 310, the transmitter transmits the broadcast/multicast packets. At step 320, the transmitter receives feedback from several receivers. At step 330, the transmitter decides on the retransmission strategy. At step 340, the transmitter performs the retransmissions. At step 350, the transmitter decides if the broadcast/multicast transmission has ended and either transmits more broadcast/multicast packets or exits the broadcast/multicast mode.

[0041] FIG. 4 is a flow diagram illustrating a process in accordance with one embodiment of the present invention. FIG. 4 illustrates a flow diagram of process 400 performed on the receiver side. At step 410, the receiver receives broadcast/multicast packets. At step 420, the receiver decides what to send in the feedback message as explained above in the various embodiments. The receiver has just presently received or has previously received instructions from the base station to send a feedback message. The receiver may also alternately have a default mode to send feedback messages. At step 430, the receiver sends the feedback message. At step 440, the receiver determines is the transmission has ended and either receives more broadcast/multicast packets or exits the multicast/broadcast mode.

[0042] The embodiments disclosed herein may be implemented in dedicated hardware or using software on a processor with memory. Further, the embodiments may be implemented using any combination or subcombination of software, one or more processors, one or more memory units, and one or more dedicated hardware. FIG. 5 shows portion 500 of a receiver apparatus in accordance with one embodiment. Processor 510 is coupled to memory unit 520. Processor 510 includes control unit 530, data sink 540, receiver RX decoder 550, data source 570, and transmitter TX encoder 580. Processor 510 may be split into multiple processor units on multiple hardware or constitute a portion of hardware with more functions than what is shown in FIG. 5. Furthermore, the processor and memory may be combined into the same hardware. RX

analog/RF 560 and TX analog/RF 590 may be combined with the processor or be implemented in separate hardware.

[0043] RF analog/RF 560 receives the signal from the antenna on the downlink and converts it to digital baseband. Decoder 550 converts the channel symbols to bits. Error detection and correction may be performed at decoder 550, as well as by other portions of processor 510. Data sink 540 is any portion of the receiver which operates on or uses the decoded bits. Data source 570 generates the bits to transmit from the receiver apparatus on the uplink. Transmit TX encoder 580 encodes the bits into channel symbols. TX analog/RX 590 converts the digital baseband symbols into an RF signal to be transmitted via the antenna on the uplink.

[0044] Control unit 530 manages the feedback message generation process. From RX decoder 550 or data sink 540 or from other hardware, control unit 530 determines that a feedback message should be sent and what that message should constitute. Control unit 530 can then instruct data source 570 to construct the feedback message. In addition control unit 530 can control the encoding of the feedback message at TX encoder 580, or even directly manipulate symbols to form a feedback message or a portion of the feedback message. Control unit 530 also ensures that the feedback message is queued for transmission on an uplink resource that corresponds to the downlink resource used for the broadcast/multicast transmission on the downlink.

[0045] The feedback message can provide other specific information regarding the quality of the communications link. For example, the feedback message can include a bit error rate, a frame error rate, or the error rate from a higher layer application such as an audio or video codec. The feedback message could also contain explicit power control information such as the received power at the user terminal, or an up/down power command.

[0046] The feedback message can also provide information about the quality of the communication link by sending feedback on a specific number of packets received with error, or a specific number received without error.

[0047] Even if the communications link is good, the user terminal may not be able to use all of the packets due to processing or capacity limitations of the hardware or software. A feedback message may include the amount of packets that were not able to be processed or used so that the transmitter can decide either to resend these packets, or perhaps even decrease the data rate to that which can be processed by the user terminal hardware.

[0048] In another embodiment for MBMS, the UMTS Terrestrial Radio Access Network (UTRAN) may select a statistical sample of User Equipments (UEs) that are receiving a Point-to-Multipoint (PtM) transmission in a given cell or group of cells. The discussion of feedback reporting in a UMTS system below is similar to the GSM/GPRS embodiments discussed above. The UTRAN would instruct some UEs to send measurement reports that describe the quality of the one or more channels such as the MBMS Point-to-Multipoint Traffic Channel (MTCH). UTRAN may use such quality measurement reports to optimize the transmission parameters channels in the cell. For example, the UTRAN may optimize the transmission parameters for the Secondary-Common Control Physical Channel (S-CCPCH)/MTCH in the cell.

[0049] A UMTS broadcast system may configure its transmission parameters in order to optimize the Quality of Service (QoS) perceived by each receiver. In a CDMA based system such as UMTS the optimal settings may vary in time due to the changes in the interference or other changes in the wireless operating environment. The network can use open loop schemes to determine the best settings, e.g. it may decide the optimal transmit power on a PtM radio link based on the power of similar rate Point-to-Point (PtP) radio link in the same cell. This approach may not produce good results at all times, especially if the transmission scheme utilized for PtP and PtM are different. For example, if soft handover is used in PtP, but it is not used in PtM, it will be quite challenging to estimate the correct power to allocate to the PtM link in each case.

[0050] Closed loop scheme are typically more accurate at guaranteeing the required QoS. Theoretically, the UTRAN could use feedback provided by all the terminals that are receiving the MBMS transmission in order to optimize the settings of the PtM channel. If the majority of the UEs receive a bad signal quality, UTRAN may increase the power or change other parameters, such as the amount of redundancy, the spreading factor, the rate matching attributes, the bit rate, the Layer 2 parameters, etc. These parameters may be modified until the required QoS is achieved. As the interference or operating conditions vary, the value of the parameters may be adapted to allow for the most efficient transmission configuration of the PtM radio link.

[0051] If all the terminals provide feedback to the network, the amount of uplink capacity utilized may be prohibitive as the number of terminals receiving the broadcast transmission in the same cells increases. It has to be assumed that the number of users receiving the PtM transmission will be relatively high. In fact, if a high number of

terminals are listening to the same MBMS transmission the network would more likely use a PtM channel, instead of a PtP channel.

[0052] Rather than receiving feedback from all the terminals, the network could select a statistical sample of terminals in each cell and instruct them to report feedback information.

[0053] The number of terminals that report feedback information should be large enough to have statistical significance, but the number should not be too large such as to affect the Uplink (UL capacity) more than necessary. The particular algorithm for determining the number of reporting terminals in each cell or in each group of cells can be flexible and adapted by the operator for a particular wireless communications system.

[0054] The network may select the statistical sample in a variety of ways. In one embodiment, the UTRAN may partition the total population of UEs that receive MBMS service in several classes similar to the embodiments described above for the GSM/GPRS embodiments. Each class could be determined by various factors, such as the UE capability (e.g. capability to perform selection combining of MBMS signals from more than one cell at the same time), the subscription profile (e.g. all the UE that subscribe to streaming services, or all the UEs that subscribe to download and play services), the release version of the UE (e.g. all the UE that belong to Rel-6, or all the UEs that belong to Rel-7), the level of QoS for the individual QoS for a differentiated QoS service, etc.

[0055] Then the network could randomly select UEs from each class so that the number of UEs selected for each class statistically represents that class. Or the network could randomly select a representative sample from all of the UEs as a whole. This procedure is akin to treating all UEs as if they are from one class.

[0056] The UTRAN may use more sophisticated techniques to determine the classes of the UEs. For example, received power level signals and power control commands on the Uplink or Downlink may be used to select a representative sample of UEs with varying channel conditions.

[0057] In a WCDMA system, the reporting terminals may be kept in a Radio Resource Control (RRC) connected state. This is the assumption in order to allow the counting and recounting of the terminals in each cell. More in general we can assume that if the reported feedback is sporadic, a common transport channel (RACH) could be used. If

the feedback is continuous in nature, a dedicated transport channel could be assigned by the network.

[0058] The existing quality measurements defined in the WCDMA standard are applicable to dedicated transport channels, which could be used for PtP transmission of MBMS content. In order to allow for the statistical reporting, which is mainly applicable to PtM transmission, the currently defined quality measurements would have to be extended to the common transport channels, introducing quality measurements on the MTCH. The particular method by which Radio Network Controller (RNC) selects the UEs that have to send the quality reports and the RRC state of the UEs involved in the measurements may vary depending on the implementation.

[0059] Several new measurement scenarios for MTCH are possible depending on the implementation. In addition to the existing event type for quality measurements (a predefined number of bad cyclical redundancy checks or CRCs is exceeded), other types of events may be introduced. For example, an event could be that the UE enters the CELL_DCH or cell dedicated channel mode. In this case the measurement would be reported only if the UE enters CELL_DCH and all the accumulated quality measurements may be transmitted in CELL_DCH. If the UE does not enter CELL_DCH but enters idle mode, all the accumulated quality measurements may be deleted. Moreover, a periodic quality reporting may also be considered, so that the frequency of the measurement report messages can be selected by UTRAN. As for the existing measurements, there would be no quality measurements when the UE is in idle mode, therefore, UTRAN would have to keep the UEs involved in these quality measurements in connected mode. In order to force the UE to enter connected mode, the same counting mechanism that is already defined to determine if enough UEs are interested to the PtM transmission could be used. When enough UEs are in RRC connected mode, i.e. when the sample of UEs is statistically significant, UTRAN can reset the counting flag for a particular MBMS service.

[0060] The UE may be required to report the identifier of the cell from which the MTCH is sent, and, in case either selection combining or soft combining or both are used, the UE may be required to list the identifiers of all cells from which the MTCH combining is performed during a specific measurement period. The quality measurements do not necessarily have to be BLER or block error rate measurements. Power measurements and any other quality metric could be considered, such as: maximum number of consecutive PDUs in error; maximum number of consecutive

PDUs without errors; total number of PDUs that could not be decoded due to limitations in the UE capability; etc.

[0061] The RNC collects all the quality measurement reports and act on them so that the target QoS is met. In the absence of these reports, the RNC would have to dimension the resources dedicated to the MTCH assuming the worst case. UTRAN could modify some transmission parameters of the S-CCPCH/MTCH in near real time (e.g. the power allocated to the S-CCPCH), or it could change some parameters at the beginning of the next MBMS session (e.g. amount of redundancy, the spreading factor, the rate matching attributes, the bit rate, the Layer 2 parameters, etc).

[0062] An algorithm similar to the one used for the open loop power control could be used in this case. The main difference is that the open loop power control currently defined in IS-95/cdma2000 and in WCDMA takes into account the quality measurements from a single mobile terminal. In this case, the reporting of a statistical sample of mobile terminals would be used, enabling efficient control for a broadcast or multicast service.

[0063] The network would change the setting of the one or more parameters based on a quality target and on the received quality measurement reports. For example, if the network wants that 99% of the PDUs are received without errors, and the quality reports reveal that on average 80% of the PDUs are received without errors, the network would increase the transmit power of the common channel, so that the percentage of PDUs received without errors increases. If, after an interval of time (with length selected by the network so that enough new quality measurements are received) the quality reports reveal that on average 99.9% of the PDUs are received without errors, the network would decrease the transmit power of the common channel. This process could continue indefinitely or until the network is satisfied with the achieved QoS.

[0064] The quality measurements on common channels (such a the MTCH) may be disabled most of the time, and enabled only when the network wants to fine tune the use of the resources in a particular cell or group of cells.

[0065] A measurement similar to periodic quality reporting could be defined for the MTCH. UTRAN could use such reports to fine tune the transmission parameters of the S-CCPCH/MTCH that are used to transmit the MBMS content.

[0066] The optimization of the MTCH transmission can benefit from a closed loop scheme that relies on the feedback from the UEs. Since it would not be possible to collect the feedback from all the UEs receiving the MTCH, a statistical sample of UEs

which the UTRAN selects reports MTCH quality measurements. Such selection would be based on statistical considerations by the UTRAN.

[0067] The technique of statistical reporting can be extended to other common transport channels so that the same mechanism could be exploited to fine tune the resources allocated to these common transport channels.

[0068] Those of skill in the art would understand that information and signals may be represented using any of a variety of different technologies and techniques. For example, data, instructions, commands, information, signals, bits, symbols, and chips that may be referenced throughout the above description may be represented by voltages, currents, electromagnetic waves, magnetic fields or particles, optical fields or particles, or any combination thereof.

[0069] Those of skill would further appreciate that the various illustrative logical blocks, modules, circuits, and algorithm steps described in connection with the embodiments disclosed herein may be implemented as electronic hardware, computer software, or combinations of both. To clearly illustrate this interchangeability of hardware and software, various illustrative components, blocks, modules, circuits, and steps have been described above generally in terms of their functionality. Whether such functionality is implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. Skilled artisans may implement the described functionality in varying ways for each particular application, but such implementation decisions should not be interpreted as causing a departure from the scope of the present invention.

[0070] The various illustrative logical blocks, modules, and circuits described in connection with the embodiments disclosed herein may be implemented or performed with a general purpose processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array (FPGA) or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general purpose processor may be a microprocessor, but in the alternative, the processor may be any conventional processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing devices, e.g., a combination of a DSP and a microprocessor, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration.

[0071] The steps of a method or algorithm described in connection with the embodiments disclosed herein may be embodied directly in hardware, in a software module executed by a processor, or in a combination of the two. A software module may reside in RAM memory, flash memory, ROM memory, EPROM memory, EEPROM memory, registers, hard disk, a removable disk, a CD-ROM, or any other form of storage medium known in the art. An exemplary storage medium is coupled to the processor such the processor can read information from, and write information to, the storage medium. In the alternative, the storage medium may be integral to the processor. The processor and the storage medium may reside in an ASIC. The ASIC may reside in a user terminal. In the alternative, the processor and the storage medium may reside as discrete components in a user terminal.

[0072] The previous description of the disclosed embodiments is provided to enable any person skilled in the art to make or use the present invention. Various modifications to these embodiments will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other embodiments without departing from the spirit or scope of the invention. Thus, the present invention is not intended to be limited to the embodiments shown herein but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

WHAT IS CLAIMED IS:

CLAIMS

1. A method for sending feedback for a multicast/broadcast transmission comprising:

decoding multicast/broadcast data received from a transmitter on a downlink resource;

forming a feedback message corresponding to the reception of the multicast/broadcast data;

queuing the feedback message for transmission to the transmitter on an uplink resource that corresponds to the downlink resource, wherein for unicast transmissions the uplink resource is dedicated to an uplink transmission corresponding to a downlink transmission on the downlink resource.

2. The method of claim 1, wherein the uplink resource and the downlink resource are time slots in a time division multiple access communications system.

3. The method of claim 2, wherein the communications system is frequency division duplex.

4. The method of claim 2, wherein the communications system is time division duplex.

5. The method of claim 1, wherein the feedback message comprises at least in part an acknowledgement message.

6. The method of claim 1, wherein the feedback message comprises at least in part a negative acknowledgement message.

7. The method of claim 1, wherein the feedback message at least in part provides Quality-of-Service information.

8. The method of claim 1, wherein the feedback message at least in part provides an indication of audio transmission quality.

9. The method of claim 1, wherein the feedback message at least in part provides an indication of bit error rate.

10. The method of claim 1, wherein the feedback message at least in part provides an indication of frame error rate.

11. The method of claim 1, wherein the feedback message at least in part provides power control information.

12. The method of claim 1, wherein the feedback message at least in part provides an indication of video transmission quality.

13. The method of claim 12, wherein the feedback message provides information on the quality of reception of both intra-frame coded frames and inter-frame coded frames.

14. The method of claim 1, wherein the feedback message is formed in response to a prompt sent from the transmitter.

15. The method of claim 1, wherein the feedback message is part of a statistically sampled feedback scheme, wherein a subset of the total number of receivers in communication with the transmitter is sampled.

16. The method of claim 1, wherein the feedback message is used to decide to retransmit a protocol data unit by the transmitter.

17. The method of claim 16, wherein a decision to retransmit a protocol data unit is based at least in part on whether a number of receivers requiring retransmission exceeds a threshold.

18. The method of claim 1, wherein the feedback message sent as a random access message.

19. The method of claim 1, further comprising requesting an establishment of a short-lived uplink data connection using the uplink resource.

20. The method of claim 19, further comprising receiving an assignment message from the transmitter allowing the use of uplink resource.

21. The method of claim 6, wherein the negative acknowledgment message is cumulative for more than one protocol data unit.

22. The method of claim 21, further comprising discarding protocol data units from the negative acknowledgment message in response to the expiration of a timer.

23. The method of claim 16, wherein a decision to retransmit the protocol data unit is based in part on a numbers of receivers in a particular category sending a negative acknowledgement message.

24. The method of claim 16, wherein a decision to retransmit the protocol data unit is based in part on a number of negative acknowledgment messages for the protocol data unit.

25. The method of claim 16, wherein a decision to retransmit the protocol data unit is based in part on the relative importance of the protocol data unit among other protocol data units.

26. The method of claim 25, wherein the decision is further based in part on relative weights of receivers requiring retransmission, wherein a relative weight is assigned to every receiver in communication with the transmitter.

27. The method of claim 15, wherein the sampled receivers belong to more than one category and the statistically sampled feedback scheme is based in part on the more than one category.

28. The method of claim 1, wherein the feedback message at least in part includes the number of protocol data units received with error.

29. The method of claim 1, wherein the feedback message at least in part includes the number of protocol data units received without error.

30. The method of claim 1, wherein the feedback message at least in part includes the number of protocol data units that could not be decoded due to processing limitations.

31. An apparatus comprising:

a decoder to decode multicast/broadcast data received from a transmitter on a downlink resource;

a first processing unit to form a feedback message corresponding to the reception of the multicast/broadcast data;

a second processing unit to queue the feedback message for transmission to the transmitter on an uplink resource that corresponds to the downlink resource, wherein for unicast transmissions the uplink resource is dedicated to an uplink transmission corresponding to a downlink transmission on the downlink resource.

32. The apparatus of claim 31, wherein the uplink resource and the downlink resource are time slots in a time division multiple access communications system.

33. The apparatus of claim 31, wherein the feedback message is part of a statistically sampled feedback scheme, wherein a subset of the total number of receivers in communication with the transmitter is sampled.

34. The apparatus of claim 31, wherein the feedback message is used to decide to retransmit a protocol data unit by the transmitter.

35. An apparatus comprising:

means for decoding multicast/broadcast data received from a transmitter on a downlink resource;

means for forming a feedback message corresponding to the reception of the multicast/broadcast data;

means for queuing the feedback message for transmission to the transmitter on an uplink resource that corresponds to the downlink resource, wherein for unicast transmissions the uplink resource is dedicated to an uplink transmission corresponding to a downlink transmission on the downlink resource.

36. The apparatus of claim 35, wherein the uplink resource and the downlink resource are time slots in a time division multiple access communications system.

37. The apparatus of claim 35, wherein the feedback message is part of a statistically sampled feedback scheme, wherein a subset of the total number of receivers in communication with the transmitter is sampled.

38. The apparatus of claim 35, wherein the feedback message is used to decide to retransmit a protocol data unit by the transmitter.

39. An apparatus comprising:

a memory unit; and

a processor unit configured to execute instructions from the memory unit in order to:

decode multicast/broadcast data received from a transmitter on a downlink resource;

form a feedback message corresponding to the reception of the multicast/broadcast data; and

queue the feedback message for transmission to the transmitter on an uplink resource that corresponds to the downlink resource, wherein for unicast transmissions the uplink resource is dedicated to an uplink transmission corresponding to a downlink transmission on the downlink resource.

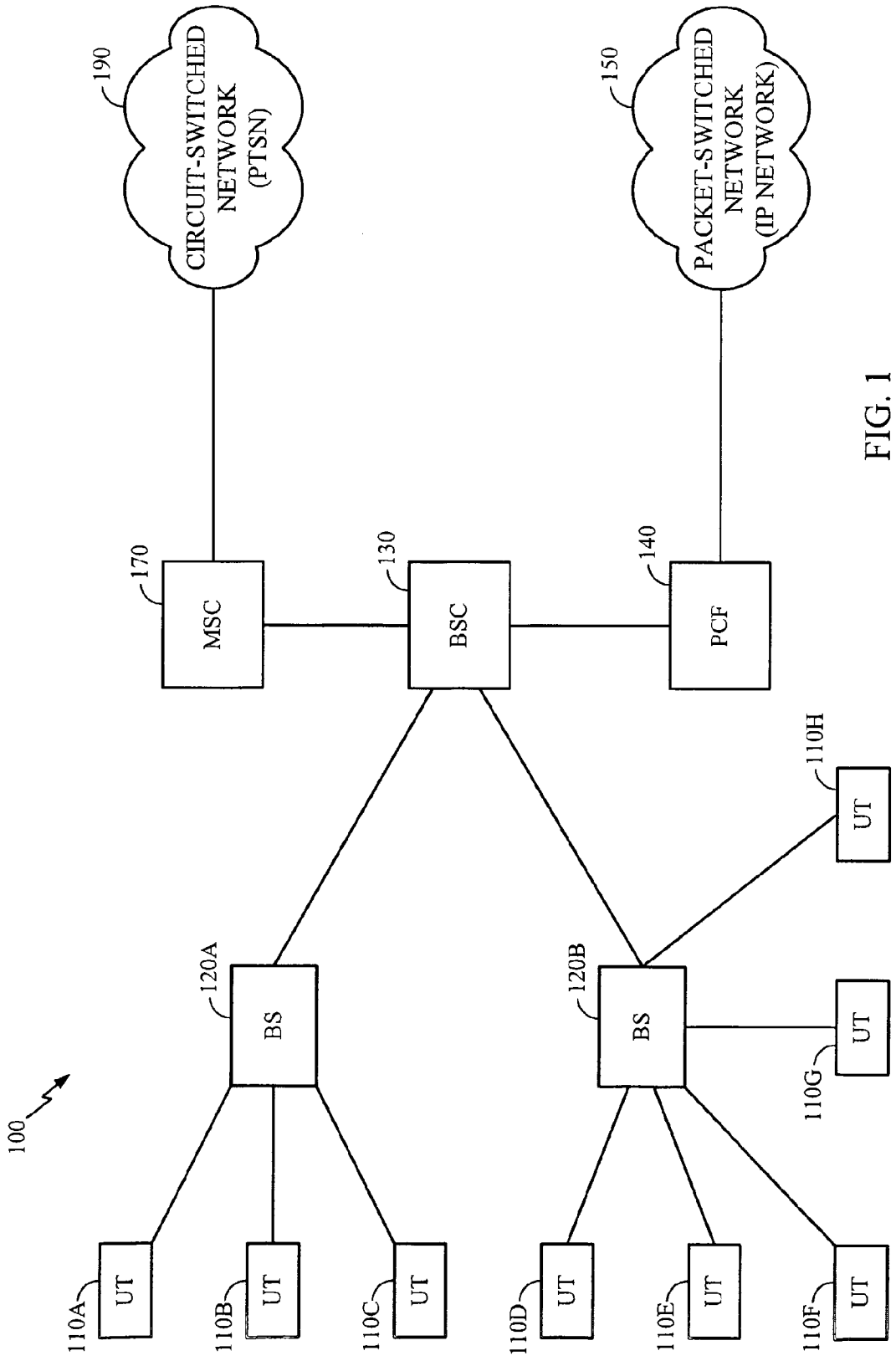

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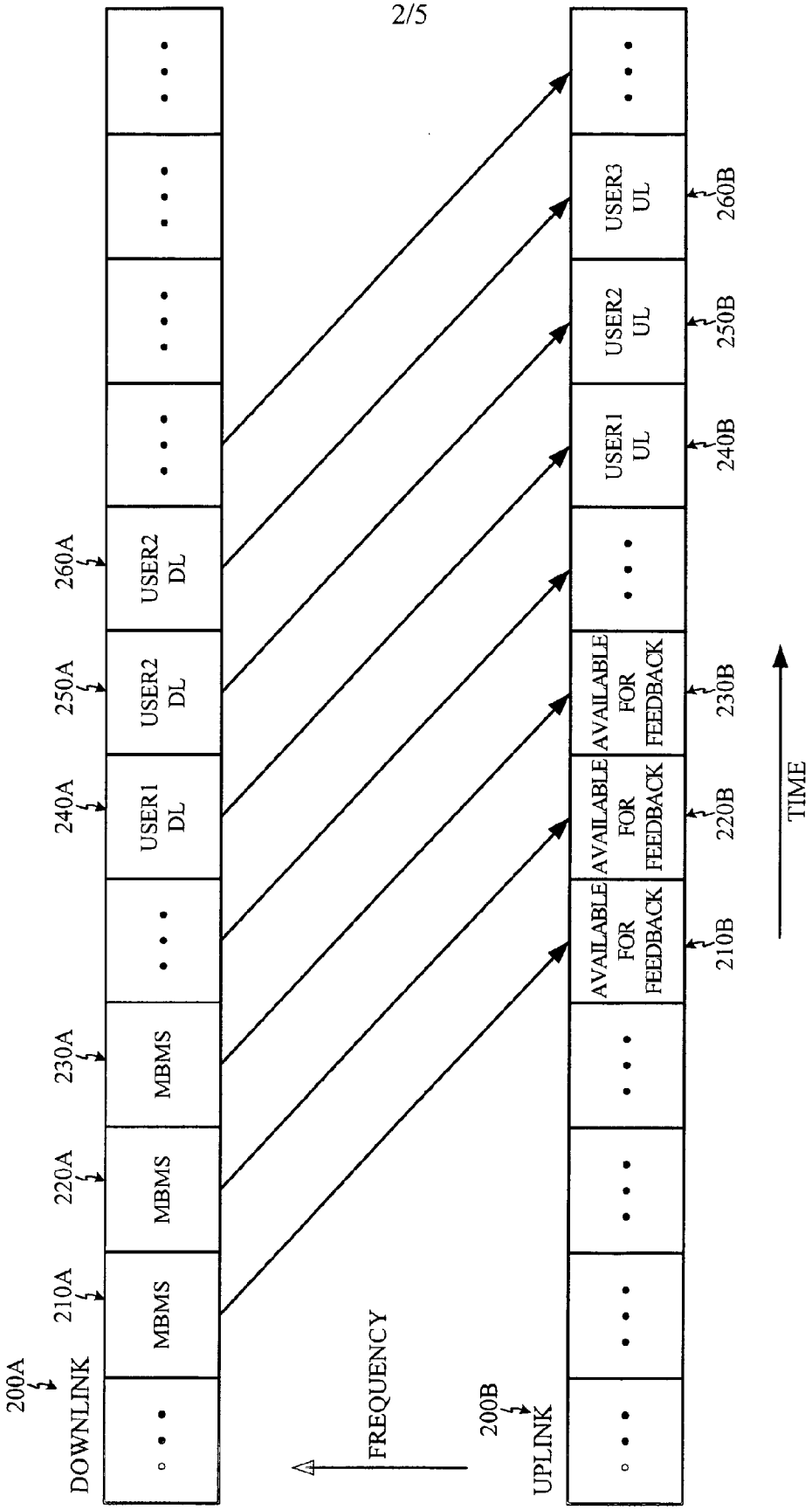
FIG. 1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200B
UPLINK
AVAILABLE FOR FEEDBACK
210B
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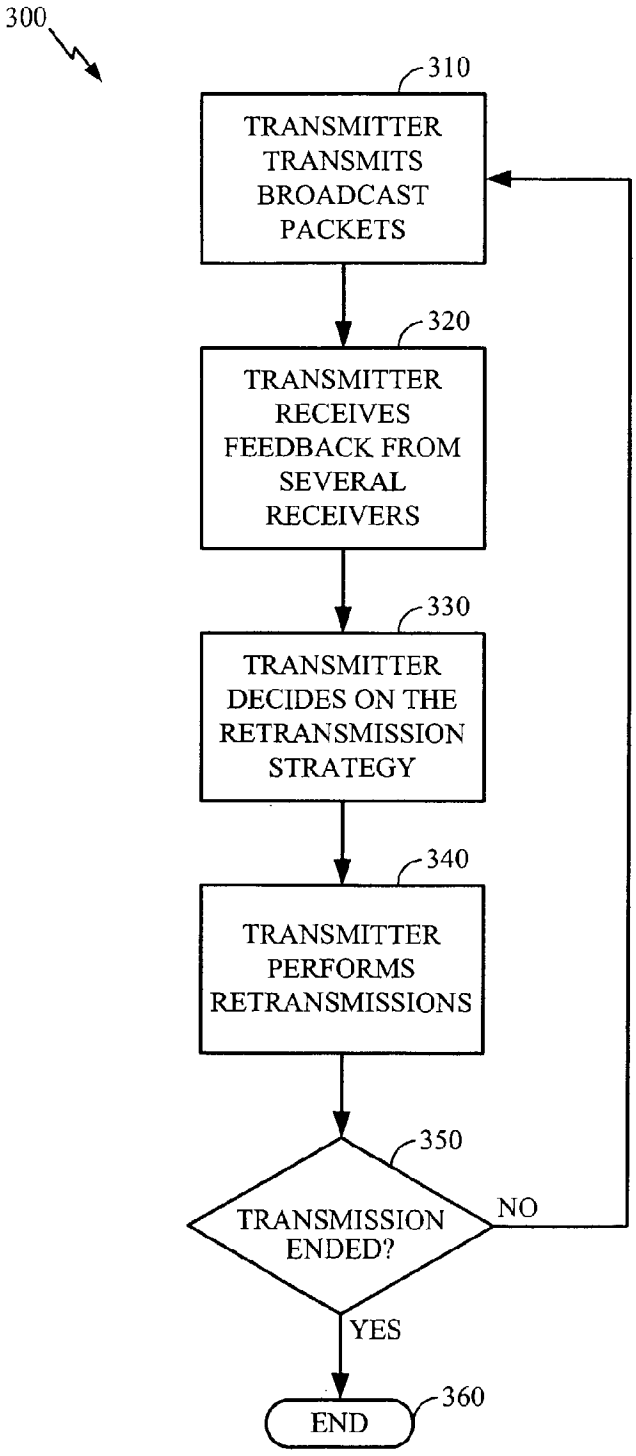
260B
USER3 UL
TIME

FIG. 2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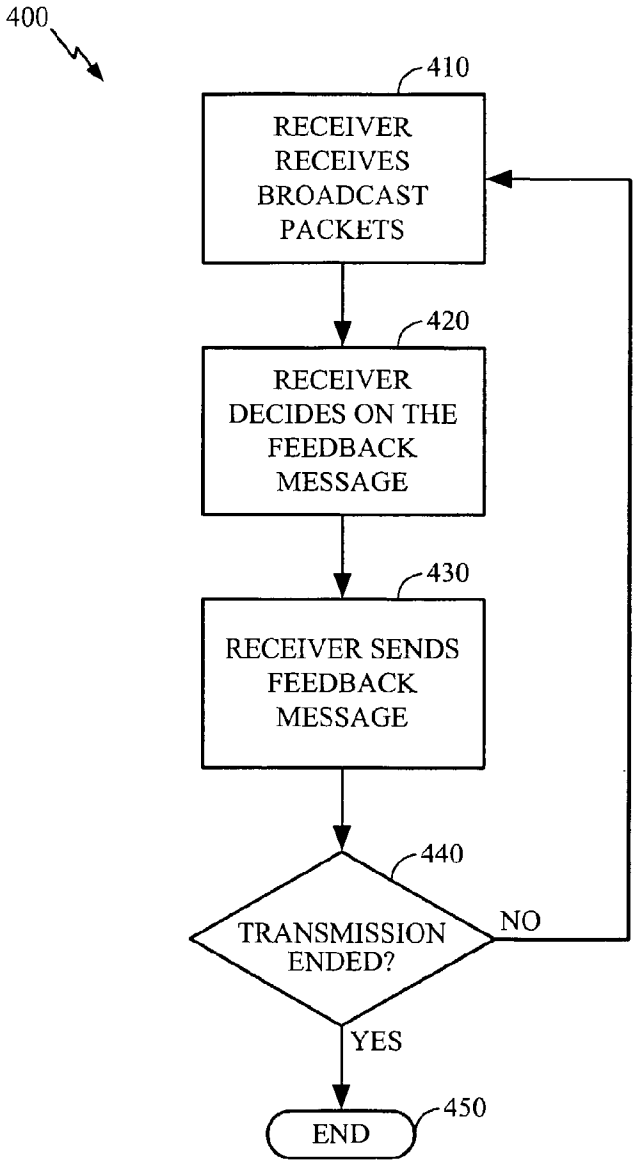
310
TRANSMITTER TRANSMITS BROADCAST PACKETS
320
TRANSMITTER RECEIVES FEEDBACK FROM SEVERAL RECEIVERS
330
TRANSMITTER DECIDES ON THE RETRANSMISSION STRATEGY
340
TRANSMITTER PERFORMS RETRANSMISSIONS
350
TRANSMISSION ENDED?
NO
YES
360
END

FIG. 3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RECEIVER RECEIVES BROADCAST PACKETS
420
RECEIVER DECIDES ON THE FEEDBACK MESSAGE
430
RECEIVER SENDS FEEDBACK MESSAGE
440
TRANSMISSION ENDED?
NO
YES
450
END

FIG. 4

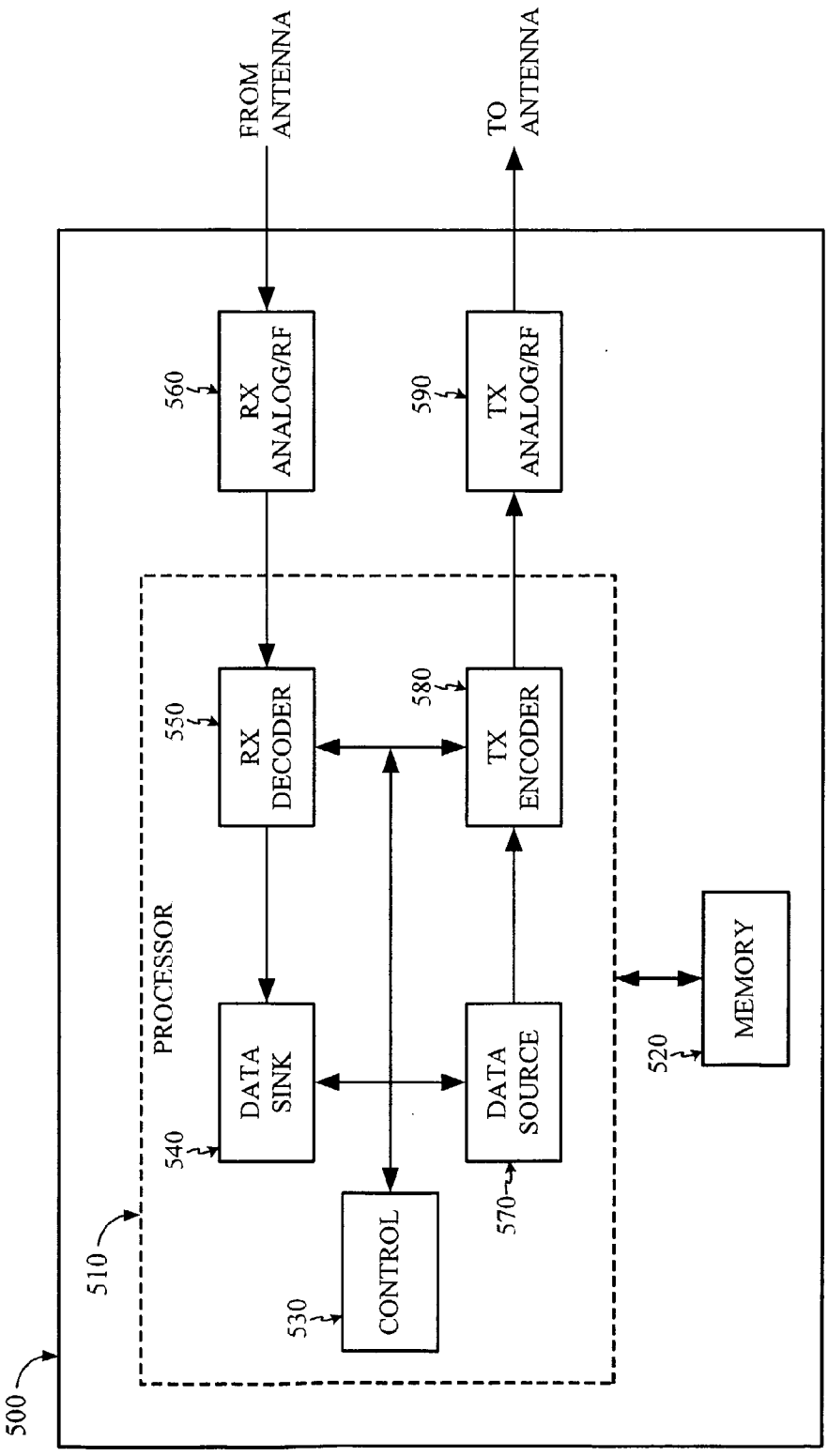
FROM ANTENNA
TO ANTENNA
560
RX ANALOG/RF
590
TX ANALOG/RF
PROCESSOR
550
RX DECODER
580
TX ENCODER
DATA SINK
540
DATA SOURCE
570
MEMORY
520
CONTROL
530
510
500

FIG. 5

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2004/033302

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2003/119452 A1 (KIM SUNG-HOON ET AL) 26 June 2003 (2003-06-26) abstract paragraph '0011! paragraph '0012! paragraph '0137! paragraph '0138! paragraph '0171! paragraph '0188! -----	1-39
X	WO 03/005603 A (SIEMENS AKTIENGESELLSCHAFT; BECKMANN, MARK; BAER, SIEGFRIED; CHOI, HYU) 16 January 2003 (2003-01-16) abstract page 13, line 32 - page 14, line 4 claims 1-4 ----- -/--	1-39

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 February 2005	25/02/2005

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Harrysson, A

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2004/033302

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Categcry °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2003/005382 A1 (CHEN TAO ET AL) 2 January 2003 (2003-01-02) cited in the application abstract paragraph '0007! paragraph '0016! - paragraph '0023! claims 1-3 -----	1-39

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US2004/033302

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		DE 10248988 A1	26-06-2003
		FI 20021863 A	20-04-2003
		FR 2831357 A1	25-04-2003
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		JP 2003188818 A	04-07-2003
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		WO 03005603 A1	16-01-2003
		EP 1405438 A1	07-04-2004
US 2003005382 A1	02-01-2003	EP 1413081 A1	28-04-2004
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		WO 03005631 A1	16-01-2003

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(74) Agent: **GRÜNECKER, KINKELDEY, STOCKMAIR & SCHWANHÄUSSER**; Maximilianstrasse 58, 80538 München (DE).

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(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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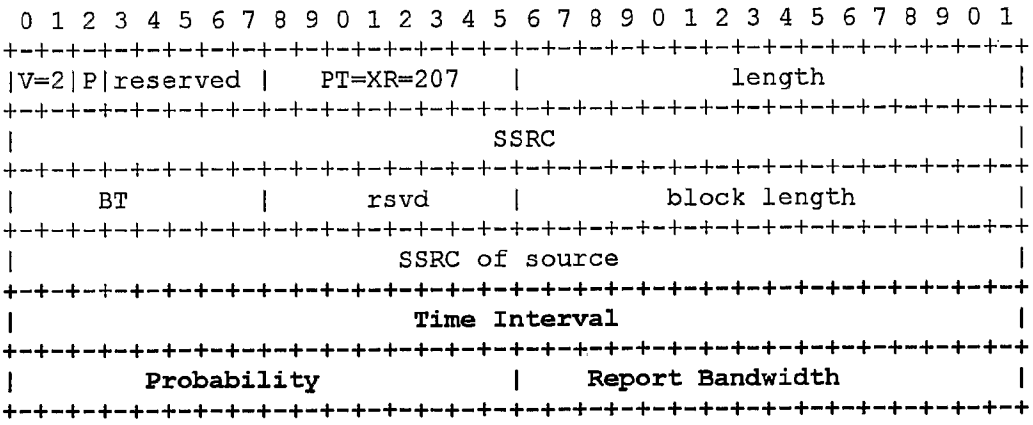
(54) **Title:** FEEDBACK CONTROL FOR MULTICAST OR BROADCAST SERVICES



(57) **Abstract:** The invention relates to a method for controlling the transmission of feedback of mobile terminals receiving via an air interface of a mobile communication system a multicast or broadcast service transmitted or forwarded by a feedback control entity and to a mobile terminal, the feedback control entity using this method. Further, a communication system comprising a feedback control entity and a mobile terminal receiving a multicast or broadcast service is provided. To enable configurable and adaptive feedback for multicast or broadcast services provided via an air interface maintaining the end-to-end session concept the invention suggests selecting a subset of the mobile terminals of the mobile communication system and which receive the multicast or broadcast service for providing feedback to a feedback control entity. In one embodiment of the invention the terminals may decide whether to provide feedback based on a probabilistic experiment performed based on parameters determined and provided by the feedback control entity.

WO 2006/012946 A2

FEEDBACK CONTROL FOR MULTICAST OR BROADCAST SERVICES

FIELD OF THE INVENTION

The invention relates to a method for controlling the transmission of feedback of mobile terminals receiving via an air interface of a mobile communication system a multicast or broadcast service transmitted or forwarded by a feedback control entity and to a mobile terminal and the feedback control entity using this method. Further, a communication system comprising a feedback control entity and a mobile terminal receiving a multicast or broadcast service is provided.

TECHNICAL BACKGROUND

The Real-time Transport Protocol (RTP) (see Schulzrinne et al., "RTP: A Transport Protocol for Real-Time Applications", RFC 3550, available at http://www.ietf.org) provides end-to-end network transport functions suitable for applications transmitting real-time data, such as audio, video or simulation data, over multicast or unicast network services. RTP does not address resource reservation and does not guarantee quality-of-service for real-time services.

The data transport is augmented by a control protocol (RTCP) to allow monitoring of the data delivery in a manner scalable to large multicast networks, and to provide minimal control and identification functionality. RTP and RTCP are designed to be independent of the underlying transport and network layers.

For the multicast or broadcast data transport of streaming services in 3G networks RTP may be used. As mentioned above, the Real-Time Control Protocol (RTCP) provides means for monitoring and transporting control information on a delivered RTP stream.

Standard RTP/RTCP

RTP (and its companion protocol RTCP) have been originally designed for both unicast as well as multicast data transport (RTP reporting). Consequently, scalable algorithms for preventing feedback implosion and the corresponding mechanisms have been

proposed. In the rest of this document it is referred to the latter as "the standard RTCP algorithm and mechanisms", respectively.

The RTCP standard algorithm and mechanisms have been designed with the assumption of an underlying Any-Source Multicast (ASM) model, where every end system is allowed to send and receive data over the bi-directional transport channel.

Consequently, each participating end system receives the RTP data, as well as the RTCP sender reports (SR) and receiver reports (RR) of all participants. The reception of all RR allows each end system to estimate the number of participants of a session independently, and use this value to calculate the report time interval according to the RTCP standard algorithm. Furthermore, it provides a means for the end hosts to gather information about all participants, which might be useful for some applications like small group conferencing.

RTCP RR for unidirectional multicast channels

The Source-Specific Multicast (SSM) model as described S. Bhattacharyya, Ed. "An Overview of Source-Specific Multicast (SSM)" (see RFC 3569, available at http//www.ietf.org) may be particularly suitable for use in conjunction with the 3GPP MBMS architecture as specified in 3GPP TR 23.846: "Multimedia Broadcast/Multicast (MBMS); Architecture and functional description (Release 6)", V6.1.0, December 2003, available at http://www.3gpp.org.

The SSM multicast model introduces less complexity compared to ASM and allows for subscription-based access control. In SSM, each single end system is allowed to transmit data using a unidirectional multicast transport channel. Only those participants subscribed to this channel will receive the messages.

Unlike in ASM, RTCP receiver reports cannot be transmitted over this multicast channel. This limitation for the SSM may however be overcome by each receiver sending feedback over individual unicast transport channels to the sender and the sender reflecting these messages over the multicast channel, according to the specified Receiver and Sender Report bandwidth values.

SDP bandwidth modifiers for RTCP

The standard RTCP mechanisms scale the overall control traffic bandwidth to 5% of the RTP Session Bandwidth. For the target application scenario with a single sender, the fraction *S* of the RTP Bandwidth assigned for sender reports (SR) is 1.25%, while the fraction *R* equally shared by the end systems for receiver reports (RR) is assigned a value of 3.75%. In order to support assignment of differing allocations, the signaling of RTCP bandwidth modifiers within the Session Description Protocol (SDP) has been proposed by Casner, "Session Description Protocol (SDP) Bandwidth Modifiers for RTP Control Protocol (RTCP) Bandwidth" (see RFC 3556, available at http://www.ietf.org).

The SDP instance for the particular session may be extended with two additional parameters, where b=RS:<bandwidth-value> and b=RR:<bandwidth-value> specifies the overall sender and receiver report rate, respectively. The per-host allocation and report time interval is determined according to the standard RTCP algorithm.

Multicast feedback regulation

The bulk of existing work as considered within the IETF RMT Working Group addresses the problem of suppressing redundant feedback, e.g. negative acknowledgements of lost data packets for reliable multicast transmission. Other multicast applications demand for feedback of the end system with an extreme value according to a particular metric.

The goal of these schemes is to find the receiver with the limiting capabilities (bandwidth) in a multicast session, so that the sender adjusts the transmission rate with respect to this receiver's feedback. End-to-end solutions to both problems usually use different variants of feedback timers or polling mechanisms.

Hardly any existing work deals with feedback regulation for collecting state information of participating receivers in a multicast. One prominent mechanism for video streaming applications based on collecting receiver state information is presented in Bolet et al., "Scalable Feedback Control for Multicast Video Distribution in the Internet" (Proceedings of ACM/SIGCOMM 1994, Vol. 24, No. 4, Oct. 1994). The primary goal of the proposed mechanism is to adjust the sending rate of packets according to the reported state information.

Hence, the set of states a receiver is allowed to report is limited to only three different states. Consequently, this approach is not applicable for regulating feedback of statistics in 3GPP MBMS sessions due to the following problems:

The number of participating end systems has to be discovered by each receiver by means of RTCP RR. This requires each participating mobile terminal (MT, UE) to establish a point-to-point feedback channel to the sender.

The sender would then have to reflect all RRs or summarize them and forward this information on the unidirectional multicast channel. The shortcomings of this solution in the context of a cellular and mobile environment are obviously:

- the cost for the establishment and maintenance of the feedback channels (one per MT/UE),
- the overhead on the multicast channel generated by the reflected reports, and
- the power consumption overhead on the end devices which have to maintain and update state information dynamically.

Unicast feedback channels might require a significant amount of resources within a cell, e.g. if every user is to have a dedicated uplink channel having for example an individual spreading code. This situation may lead to an increased call blocking and handoff dropping probability in the corresponding cells.

The per-receiver bandwidth b_{RR} is calculated with the standard algorithm as follows:

$$b_{RR} = \min\left(\frac{\text{avg}(P_{RTCP})}{T_{min}}, \frac{B_{RR}}{n}\right)$$

with the minimum time interval T_{min} (e.g. 5s), the RTCP packet size P_{RTCP}, the overall receiver report bandwidth B_{RR} (3.75% of the RTP bandwidth), and the number of receivers n. The resulting per-receiver bandwidth b_{RR} as a function of the group size is depicted in Fig. 1.

Per-receiver bandwidth as calculated with the standard RTCP algorithm

Due to group dynamics – receivers may join and leave during an ongoing session – the effective per-receiver bandwidth is not known a priori and may vary significantly. In order to avoid frequent re-establishment of feedback channels in order to adapt to the current group size, receiver feedback channels would have to be established with resources reserved to the upper bound, i.e. in the worst case the maximum RR bandwidth. As a

consequence, reserved resources for the feedback channels might be used very inefficiently.

The RTCP RR time interval T is calculated by the standard RTP algorithm as follows:

$$T = \max(T_{min}, T_{calc})$$

where

$$T_{calc} = n \times \frac{\text{avg}(P_{RTCP})}{B_{RR}}$$

with the minimum time interval T_{min}, the number of receivers n, the RTCP packet size P_{RTCP}, and the overall receiver report bandwidth B_{RR}.

Fig. 2 shows the RR time interval T (calculated according to the equations above) versus the number of receivers n participating in the RTP session. The time interval increases linearly with the number of participating receivers.

To illustrate the quantitative effect, the following example of streaming audio-visual content with a data rate of 64 kbps may be considered. For an average RTCP RR packet size of 120 Bytes and n = 100 the report time interval will be calculated to T_{100} = 40s, i.e.; for n = 9,000 it already reaches $T_{9,000}$ = 3,600s = 1h.

Following the standard algorithm, receivers schedule their report packets probabilistically within the interval [0.5T, 1.5T] following a uniform distribution. I.e., in the above example the first report packet is expected to be sending after 20s and 0.5h, respectively. Obviously this resulting RR time interval T is unacceptable for practical purposes.

As mentioned above, the standard RTCP approach addresses the characteristics of the ASM model, where every end system may send and receive data over a single bi-directional channel and further provides the possibility of loss reporting. However, for 3GPP MBMS services the interval would easily exceed the duration of a session, making reporting useless.

Further it is to be noted that also for broadcast data delivery it may be considered to provide feedback from the receivers of a broadcast service, especially as content based charging may be used also for broadcast data delivery, where the quality of the received content may be crucial for charging. In contrast to subscription based charging where only the fact that a certain service is received is of importance.

The above mentioned RTP and MBMS specific problems may be generalized to multicast or broadcast services received at mobile terminals via an air interface using protocols enabling the provision of feedback from the receiving terminals to the sending source, e.g. a multicast or broadcast server.

In WO 2004/040928 A1 method for reporting for multi-user services in wireless networks is known. The concept of this document is to generate aggregated feedback reports based on the RNC knowledge of the air interface resources in an intermediate network part. RTCP feedback from the terminals can be disabled for the multi-user service, i.e. for all receivers of the multi-user service. In a variation all receivers of the multi-user service may be configured by the RNC to provide event driven feedback. This information from the receivers may also be used in the RNC to form the aggregated feedback.

The method and system proposed in WO 2004/040928 A1 uses the RNC's knowledge on the radio resources of the mobile communication system to generate aggregated feedback reports transmitted to the source of the multi-user service, the server. Thereby the end-to-end concept multi-user service provision is sacrificed as the method proposed in this document requires interactions and data exchange among different layers, for example as the session layer and radio resource control as well as proprietary extensions between radio resource management in the RNC and the intermediate network part to communicate data. These extensions are not feasible if the architecture for providing a multicast or broadcast service should be widely settled.

SUMMARY OF THE INVENTION

The object of the present invention is to enable configurable and adaptive feedback for multicast or broadcast services provided via an air interface maintaining the end-to-end session concept. Another object may be to provide configurable and adaptive feedback for MBMS services provided using the RTP protocol.

The object is solved by the subject matter of the independent claims. Advantageous embodiments of the present invention are subject matters to the dependent claims.

One of the main ideas of the invention is to allow only a subset of terminals receiving a multicast or broadcast service from a feedback control entity within the mobile communication network to provide feedback to the sending source, i.e. the feedback

control entity. Thereby it is possible to keep the end-to-end concept and to not break the layered architecture of the utilized protocols. Another idea of the invention is the use of statistical user sampling based on which the subset of terminals providing feedback is determined.

According to an embodiment of the invention a method for controlling the transmission of feedback of mobile terminals receiving via an air interface of a mobile communication system a multicast or broadcast service transmitted or forwarded by a feedback control entity is provided. According to this method a mobile terminal may receive the multicast or broadcast service via a unidirectional downlink channel and using an unreliable transport protocol and a session protocol, wherein the session protocol configures feedback provision of terminals receiving the multicast or broadcast service. Further, the mobile terminal may receive parameters based on which it may decide whether to provide feedback to the feedback control entity or not.

In a decision step the mobile terminal may decide whether to provide session protocol configured feedback for the multicast service or broadcast to the feedback control entity based on the received parameters, and in case it is decided to provide session protocol configured feedback, a bearer for providing feedback to the session protocol configured feedback control entity may be established.

Upon having established the bearer, the mobile terminal may transmit session protocol configured feedback indicating reception statistics of the multicast or broadcast service to the feedback control entity via the established bearer.

This embodiment has the advantage that the mobile terminals may decide based on a set of signaled parameters (or a single parameter) whether to provide session protocol configured feedback. As mentioned above, a bearer for providing session protocol configured feedback is established in case the mobile terminal decide to provide session protocol configured feedback, such that resources e.g. in the radio access network of the mobile communication system are only allocated to the mobile terminal in this case.

In a further embodiment of the invention, the parameters received at the mobile terminal indicate a probability value for a probabilistic experiment based on which the mobile terminal decides whether to provide session protocol configured feedback. Hence, the decision on whether to provide session protocol configured feedback may be based on the result of a probabilistic experiment performed by the mobile terminal, wherein the received probability value is used to perform this experiment.

By using probability metric signaled to the mobile terminals receiving the multicast or broadcast service, the size of the of data (parameters) received from a feedback control entity of the mobile communication system may be reduced but allow each mobile terminal receiving the probability metric to autonomously determine whether to provide session protocol configured feedback. Details on the use of a probabilistic experiment for deciding on whether to provide feedback or not will be provided below.

According to another embodiment of the invention, the probabilistic experiment is a Bernoulli experiment. This may have the advantage that approximations simplifying the calculations when performing the experiment may be used to reduce computational complexity at the mobile terminals.

In a further embodiment of the invention the parameters are received via a multicast or broadcast data channel providing the multicast or broadcast service. In this case the data may be delivered to the terminal using an unreliable transport protocol, for example UDP, as outlined above.

The method according to another embodiment of the invention foresees to receive the parameters via an announcement channel on which the multicast or broadcast service is announced to potential receivers. In a variation of this embodiment a reliable communication protocol is used for data transport on the announcement channel.

This embodiment considers that it may be desirable that each of the terminals receives at least once the signaled parameters in a reliable manner. In case the parameters are provided by means of an unreliable communication protocol it may not be assured that each receiving terminal may have the necessary parameters for deciding whether to provide session protocol configured feedback present.

Another embodiment of the present invention foresees that the parameters received at the mobile terminal further indicate the point in time until which the parameter(s) is/are valid. In a variation of the embodiment, the mobile terminal may release an established bearer for providing session protocol configured feedback in case the point in time indicated by the parameters is reached.

Thereby, it may be assured that mobile terminals use outdated parameter sets to determine whether session protocol configured feedback should be provided from the respective terminal or not. For example, this may be applicable to situations in which the parameters received from the feedback control entity are (e.g. periodically) updated and

provided using an unreliable transport mechanism. In this case it may not be assured that each terminal successfully receives an update of the parameter set such that it may be feasible to foresee the above outlined mechanism of indicating a validity period of the parameters.

As already indicated above, another embodiment of the invention facilitates the reconfiguration or update of parameters. The mobile terminal may receive reconfiguration parameters wherein the reconfiguration parameters update the parameters previously received from the feedback control entity.

In a variation of the embodiment, the reconfiguration parameters may comprise a flag indicating whether to update a validity period for the parameters previously received, i.e. indicating whether the parameters should be valid for a so-to-say "additional" time period. In this case, the mobile terminal may update the validity period of the previously received parameters based on this flag.

In a further embodiment, only those mobile terminals having established a bearer for providing session protocol configured feedback may update of the validity period.

Moreover, according to a further embodiment of the invention the received reconfiguration parameters may comprise an (additional) flag indicating whether a new decision on providing session protocol configured feedback is to be performed by the mobile terminal. Thus, depending on the flag the mobile terminal may be controlled to determine whether a new decision on providing session protocol configured feedback.

If the flag indicates to do so, the mobile terminal may decide whether to provide session protocol configured feedback for the multicast or broadcast service to the feedback control entity based on the received reconfiguration parameters. As outlined previously, in case it is decided to provide session protocol configured feedback, a bearer for providing session protocol configured feedback to the feedback control entity may be established and the mobile terminal may transmit session protocol configured feedback indicating reception statistics of the multicast or broadcast service to the feedback control entity via the established bearer.

Next, further embodiments relating to the operation of the feedback control entity will be outlined in the following. It should be noticed that the feedback control entity may be embodied in an individual network element or may be embodied in a network element of the mobile communication network together with the service source, i.e. the multicast or

broadcast service provider. One of the various embodiments of the present invention provides a method for controlling by a feedback control entity the transmission of feedback of a plurality of mobile terminals receiving via an air interface of a mobile communication system a multicast or broadcast service transmitted or forwarded by a feedback control entity. According to this method the feedback control entity may transmit or forward the multicast or broadcast service via a unidirectional downlink channel and using an unreliable transport protocol and a session protocol, wherein the session protocol configures feedback provision of terminals receiving the multicast or broadcast service.

Further, the feedback control entity may determine parameters allowing a mobile terminal deciding whether to provide session protocol configured feedback to the feedback control entity, and may transmitting those parameters to at least a subset of the plurality of mobile terminals receiving the multicast or broadcast service. Accordingly, the feedback control entity may receive feedback from a subset of the plurality of mobile terminals having received the parameters.

In another embodiment of the invention, the feedback control entity determines the parameters based on state information of the multicast and broadcast service maintained by the feedback control entity or received from a network entity of the mobile communication system.

In a further embodiment of the invention, the parameters determined by the feedback control entity may indicate a probability value for a probabilistic experiment based on which the mobile terminal decides whether to provide session protocol configured feedback. Thus, according to this embodiment, the feedback control entity may determine the probability metric to be used by the mobile terminals for the probabilistic experiment and may signal this metric to the at least a subset of the plurality of mobile terminals.

As already outlined above, one embodiment of the present invention foresees that the parameter(s) is/are transmitted via an announcement channel on which the multicast or broadcast service is announced to potential receivers. Further, a reliable communication protocol may be used for data transport on the announcement channel.

According to a further embodiment, the feedback control entity may determine the probability value based on the number of participants of the multicast or broadcast

service. The number of participants of the multicast or broadcast service may for example be obtained from multicast or broadcast service related state information.

In another embodiment of the invention, the multicast or broadcast service related state information is comprised within the MBMS UE Context or the MBMS Bearer Context maintained at the feedback control entity. Alternatively, the state information may be received by the feedback control entity from a network entity of the mobile communication network maintaining MBMS UE Contexts or an MBMS Bearer Context.

In a further embodiment of the invention, the feedback control entity may receive the data of the multicast or broadcast service from a multicast or broadcast service provider.

In a variation of this embodiment, the feedback control entity may forward session protocol configured feedback received from the mobile terminals to the multicast or broadcast service provider.

In a further variation the data of the multicast service may be transported to the feedback control entity using a transport protocol and a session protocol. The feedback control entity may translate at least one of the transport protocol and a session protocol to another transport protocol or session protocol, respectively, before transmitting or forwarding the data of the multicast or broadcast service to the mobile terminals.

Further, it may be possible that the feedback for the multicast service is transported to the feedback control entity using a transport protocol and a session protocol. In this case the feedback control entity may further translate at least one of the transport protocol and a session protocol to another transport protocol or session protocol, respectively, before forwarding the feedback to the multicast or broadcast service provider.

In another variation of this embodiment the feedback control entity form an aggregate of the session protocol configured feedback received from the mobile terminals and may transmit the aggregate of the feedback received as feedback information to the multicast or broadcast service provider.

A further embodiment of the invention considers the service provision using RTP. In this embodiment, the multicast or broadcast service is provided using the RTP protocol and feedback is provided using the RTCP protocol, wherein a fraction of the available bandwidth for a session providing the multicast or broadcast service is allocated to the RTCP protocol messages.

Further, in an alternative, the session protocol configured feedback may be provided in from of receiver reports of the RTCP protocol. It should be noticed that according to an embodiment of the invention the reception statistics mentioned above may correspond to the information signaled within a receiver report according to the RTCP protocol.

According to another embodiment of the present invention the parameters transmitted by the feedback control entity and received by the mobile terminal may further indicate the report time interval and the available bandwidth for providing feedback using the RTCP protocol.

The parameters signaled from the feedback control entity may be comprised within a sender report message of the RTCP protocol transmitted by the feedback control entity.

A further embodiment relates to a mobile terminal receiving via an air interface of a mobile communication system a multicast or broadcast service transmitted or forwarded by a feedback control entity. The mobile terminal may comprise a receiver for receiving the multicast or broadcast service via a unidirectional downlink channel and using an unreliable transport protocol. Further, the terminal may receive parameters based on which the mobile terminal decides whether to provide session protocol configured feedback to the feedback control entity, a processor for deciding whether to provide session protocol configured feedback for the multicast or broadcast service to the feedback control entity based on the received parameters and for establishing a bearer for providing session protocol configured feedback to the feedback control entity, in case it is decided to provide session protocol configured feedback and a transmitter for transmitting session protocol configured feedback indicating reception statistics of the multicast or broadcast service to the feedback control entity via the established bearer.

In another embodiment of the invention, the mobile terminal may further comprise means adapted to execute the steps performed by the mobile terminal in one of the various embodiments of the feedback control method outlined above.

Another embodiment of the invention provides feedback control entity for controlling the transmission of feedback of a plurality of mobile terminals receiving a multicast or broadcast service transmitted or forwarded by the feedback control entity via an air interface of a mobile communication system. According to this embodiment the feedback control entity may comprise a transmitter for transmitting or forwarding the multicast or broadcast service via a unidirectional downlink channel and using an unreliable transport protocol and a session protocol, wherein the session protocol configures feedback

provision of terminals receiving the multicast or broadcast service. Further, the feedback control entity may further comprise a processor for determining parameters allowing a mobile terminal deciding whether to provide session protocol configured feedback to the feedback control entity, wherein the transmitter is adapted to transmit the parameters to at least a subset of the plurality of mobile terminals receiving the multicast or broadcast service, and a receiver for receiving session protocol configured feedback from a subset of the plurality of mobile terminals having received the parameters.

In another embodiment of the invention, the feedback control entity may further comprise means adapted to execute the steps performed by the feedback control entity in one of the various embodiments of the feedback control method outlined above.

Further, one embodiment of the invention relates to a mobile communication system comprising a feedback control entity as defined above and at least one mobile terminal as defined above for receiving a multicast or broadcast service from feedback control entity via an air interface.

A further embodiment of the invention relates to a computer-readable medium for storing instructions that, when executed by a processor of a mobile terminal, cause the processor to control the transmission of feedback of mobile terminals receiving via an air interface of a mobile communication system a multicast or broadcast service transmitted or forwarded by a feedback control entity by receiving at the mobile terminal the multicast or broadcast service via a unidirectional downlink channel and using an unreliable transport protocol and a session protocol, wherein the session protocol configuring feedback provision of terminals receiving the multicast or broadcast service, receiving at the mobile terminal parameters based on which the mobile terminal decides whether to provide session protocol configured feedback to the feedback control entity, deciding by the mobile terminal whether to provide session protocol configured feedback for the multicast service or broadcast to the feedback control entity based on the received parameters, in case it is decided to provide session protocol configured feedback, establishing by the mobile terminal a bearer for providing session protocol configured feedback to the feedback control entity, and transmitting session protocol configured feedback indicating reception statistics of the multicast or broadcast service from the mobile terminal to the feedback control entity via the established bearer.

In another embodiment the computer-readable medium may further store instructions that, when executed by the processor of the mobile terminal, cause the processor to

perform the steps performed by the mobile terminal in one of the various embodiments of the feedback control method outlined above.

Moreover, another embodiment of the invention provides a computer-readable medium for storing instructions that, when executed by a processor of a feedback control entity, cause the processor to control the transmission of feedback of mobile terminals receiving via an air interface of a mobile communication system a multicast or broadcast service transmitted or forwarded from a feedback control entity by forwarding the multicast or broadcast service from the feedback control entity via a unidirectional downlink channel and using an unreliable transport protocol to at least one mobile terminal and a session protocol, wherein the session protocol configuring feedback provision of terminals receiving the multicast or broadcast service, determining at the feedback control entity parameters allowing a mobile terminal deciding whether to provide session protocol configured feedback to the feedback control entity, transmitting the parameters from the feedback control entity to at least a subset of the plurality of mobile terminals receiving the multicast or broadcast service, and receiving at the feedback control entity feedback from a subset of the plurality of mobile terminals having received the parameters.

In a further embodiment, the computer-readable medium may further store instructions that, when executed by the processor of the feedback control entity, cause the processor perform the steps performed by the feedback control entity in one of the various embodiments of the feedback control method outlined above.

BRIEF DESCRIPTION OF THE FIGURES

In the following the present invention is described in more detail in reference to the attached figures and drawings. Similar or corresponding details in the figures are marked with the same reference numerals.

Fig. 1 shows the per-receiver report bandwidth as a function of the number of receivers n receiving which have subscribed to an RTP session,

Fig. 2 shows the receiver report (RR) time interval T as a function of the shows the number of receivers n receiving which have subscribed to an RTP session,

Fig. 3 shows an RTCP application-defined packet,

Fig. 4 shows the format of application-defined parameters transported in a RTCP application-defined packet according to an embodiment of the invention,

Fig. 5 shows the format of an extended RTCP receiver report block according to an embodiment of the invention,

Fig. 6 shows the format of for transporting parameters in an RTCP application-defined packet of Fig. 3 or an extended RTCP receiver report block as shown in Fig. 5 according to an embodiment of the invention,

Fig. 7, 8 & 9 show different scenarios for providing an multicast and broadcast service to users and for controlling the feedback of the receiving terminals according to different embodiments of the invention, and

Fig. 10 & 11 show a mobile terminal and a feedback control entity, respectively, according to different embodiments of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The following paragraphs will describe various embodiments of the invention. For exemplary purposes only, most of the embodiments are outlined in relation to a UMTS communication system and the terminology used in the subsequent sections mainly relates to the UMTS terminology. However, the used terminology and the description of the embodiments with respect to a UMTS architecture is not intended to limit the principles and ideas of the present invention to such systems.

Also the detailed explanations given in the Technical Background section above are merely intended to better understand the mostly UMTS specific exemplary embodiments described in the following and should not be understood as limiting the present invention to the described specific implementations of processes and functions in the mobile communication network.

The ideas and principles that will be outlined in the subsequent sections may be applicable to multicast or broadcast services received at mobile terminals via an air interface using a unidirectional downlink as well as an unreliable transport protocol for data delivery. Further, protocols enabling the provision of feedback from the receiving

terminals to the sending source, e.g. a feedback control entity, are used. It is noted that in the scenario described above, the feedback may not be provided via the channel through which the service data is received since same is unidirectional.

The key aspect of one embodiment of the invention is to allow only a subset of terminals receiving a multicast or broadcast service from a feedback control entity to provide feedback to the feedback control entity in the mobile communication network which may control service and feedback provision within the communication network, as outlined previously. In an embodiment of the invention, this may for example be achieved by letting the mobile terminal receiving a multicast or broadcast service decide - e.g. based on a probabilistic experiment - whether they provide feedback or not. By signaling parameters, e.g. a probability value to be used in the experiment, the feedback control entity may control feedback by varying the signaled parameters such that - statistically - the desired number of mobile terminals receiving a service provides feedback.

In this respect it is important to note that the basis for a multicast or broadcast service is an end-to-end concept, which means that the exchanged information between the end points is transparent to optional intermediate nodes. This is also reflected by the utilized protocols that follow a layered architecture, which capsulate the conveyed information within a certain layer. Information at one layer is initially not visible to other layers. Only adjacent layers can exchange information over well-defined services and service access points. As the transmitted information of the multicast or broadcast service is only visible to the sending source, i.e. the feedback control entity and the receivers, the intermediated nodes only support protocols of lower layers than the used transmission protocol.

The idea of selecting a subset of terminals receiving the multicast or broadcast service to provide feedback keeps this end-to-end concept and does not break the layered architecture of the utilized protocols.

In contrast, generating feedback in an intermediated node of the UTRAN or CN would break these concepts and would require changing the protocols in an incompatible way and extending the intermediate nodes to perform improper functionality. Either one of these assumptions is not feasible if the architecture for providing a multicast or broadcast service is widely settled.

Another embodiment of the present invention is based on the idea to provide a configurable and adaptive feedback solution for MBMS Services. In the following this embodiment will be explained in more detail.

MBMS Services typically use the RTP protocol for streaming media. The companion RTCP protocol may be used for collecting RTP session feedback and to provide a loose control of the session. RTCP feedback may be used to collect statistics about ongoing RTP multicast session. As the underlying unreliable transport protocol UDP may be assumed.

Instead of the standard RTP algorithms, i.e. using RTCP RR to estimate the number of participating mobile terminals (MT), the scheme proposed by this embodiment of the invention uses MBMS signaling and/or MBMS state information to determine the exact number of MT/UE in a session. This approach avoids the necessity of having a feedback channel for every receiver, the fact that every participant receives all messages from the rest of participants and eliminates the multicast/broadcast as well as computation overhead.

Generally, it should be noted that in the MBMS specifications, there are two types of state information: a MBMS Bearer Context describing a particular MBMS bearer service and a MBMS UE Context, which comprises UE-specific information related to a specific MBMS bearer service. Both contexts may be created in the RAN, SGSN, GGSN and BM-SC. A UE context may be created for each UE receiving the service. At present, the Bearer Context in the GGSN contains the number of UEs receiving the service.

However, it may of course also possible that other RAN or CN nodes store state information of the service within a context, that allow either to determine the number of service participating UEs e.g. by counting the number of contexts created (i.e. each UE has its own UE context in the network node) or by a field within a context indicating the total number of service participants.

In case when employing a MBMS architecture for service provision, e.g. the number of participants the UE contexts of the BM-SC can be counted or the GGSN can provide the total number of participants signaling the respective field value of the Bearer Context to the BM-SC.

The usage of statistical user sampling for the collection of session statistics may be used to only allow a subset of mobile terminals (MT) to provide feedback. I.e., only a set of

receivers is configured to send reports to the feedback control entity. This is in contrast to standard RTP multicast where every participant is sending RTCP feedback and which is typically forwarded to all others.

According to this embodiment of the invention, the set of reporting receivers is selected in a probabilistic manner. One parameter necessary to perform statistical user sampling may be the report probability. Further parameters that may be used/signaled are the report time interval and feedback bandwidth to reserve. The sending feedback control entity, e.g. the BM-SC, may set these parameters according to the overall amount of allowed feedback, as different services might have different reporting needs.

By employing this scheme the number of feedback channels may be controlled and each feedback channel is used more efficiently.

The parameters for the configuration of the scheme mentioned above may be transported to the multicast/broadcast group participants. This may be accomplished by using the multicast/broadcast data channel or an announcement channel, for example.

A variant of this embodiment provides a feedback control entity (e.g. BM-SC) with the possibility to reconfigure the reporting receiver set and to (re)set the report time interval during an ongoing session to a constant value independent of the group size. This may tackle the problem of allowing to set the report time interval for the RR to reasonable values.

In order to avoid terminals operating with different reporting interval and probabilities after reconfiguration, a timer value may be included in these messages. Thereby, the signaling and overhead on the multicast channel may be kept to a minimum, as well as the computational overhead emerging by the calculation of the parameters on each end device.

The standard RTP/RTCP algorithms and mechanisms follow a generic design in order to support a broad class of applications with single and multiple data sources and receivers.

The goal of the activities in the context of 3GPP MBMS are more specific than the provisions of RTP/RTCP and are focused on providing unidirectional data delivery services from a single server to a set of mobile terminals, i.e. streaming or download services.

Hence, as indicated above, one embodiment of the invention relates to an optimization for the latter environment while utilizing RTP and RTCP. In particular the goal of this embodiment may be to support feedback of statistics regarding a RTP data delivery session while solving some of the problems described in the introduction section above.

One part of the 3GPP MBMS Architecture is the MBMS Bearer Context. In this Bearer Context the necessary information to establish the link across the 3G network is gathered. The MBMS Bearer Context is typically stored at every node in the path via which the MBMS service data are provided to the terminal, i.e. in the BM-SC, the RAN, GGSN and SGSN.

The number of hosted UEs is also stored in the MBMS Bearer Context in the GGSN. Thus, the GGSN may provide the number of hosted UEs to the BM-SC, such that the BM-SC may have knowledge about the exact number of participating UEs in a MBMS session avoiding the delay and overhead inherent to using RTCP feedback to determine the number of users participating in an RTP session. Thus, instead of determining the number of UEs by collecting feedback reports from every participant, state information stored in the Bearer Context may be used.

Since the number of session participants may be determined based on MBMS state information and without using feedback from the participating users, it is not necessary to maintain a feedback channel for each participant. Thus, significant savings in available resources in the RAN and Core Network of the mobile communication system may be achieved. As outlined above, an embodiment of the invention foresees that state information related to the service and that may be stored within one or more of the network nodes in the RAN and/or CN may be used to determine the number of terminals receiving a particular service. If necessary state information may be exchanged between the network nodes.

As indicated previously, in order to reduce the necessary resources allocated for feedback purposes, only *M* receivers, being a subset of the receivers, may be chosen to establish *M* uplink channels for feedback to the server. The MBMS server may determine the value for the overall feedback bandwidth B_{RR} as well as the number of available feedback channels *M*.

Since the feedback control entity may know the structure and average size of the report packets P_{RTCP}, it may calculate the report interval for each feedback message *T*, according to the following equation:

$$T = M \times \frac{\text{avg}(P_{\text{RTCP}})}{B_{\text{RR}}}$$

According to an embodiment of the invention, a probabilistic approach may be taken for the selection of the reporting receiver set *M*. Each receiver may perform a probabilistic experiment, for example a Bernoulli experiment with a success probability *p*. For the calculation of this value the probability density function may be characterized as follows.

Assuming that *n* users perform the Bernoulli experiment with probability *p*, and assuming that each experiment is independent from the others, a binomial distribution may be obtained and the probability density function may be expressed as:

$$f_X(x) = P(X = x) = \binom{n}{x} p^x (1-p)^{n-x}$$

Furthermore, the probability distribution function is given by:

$$F_X(x) = P(X \le x) = \sum_{k \le x} \binom{n}{k} p^k (1-p)^{n-k}$$

The binomial distribution can, under certain conditions, be approximated with a Gauß distribution. The requirements are that:

$$np > 4$$
$$n(1-p) = nq > 4$$

This approximation may also be used for simplification when considering MBMS services, since in general it may be assumed that multicast services are sent to a large number of users.

Given this simplification the equation is more tractable. The probability density function of the simplified binomial distribution would be a Gauß distribution with the following mean and variance:

$$f_X(x) = P(X = x) = \frac{1}{\sqrt{2\pi npq}} e^{\frac{-1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$$

with

$\mu = np$ and $\sigma^2 = npq$.

The total number of currently participating receivers in the multicast session *n* may be determined according to the MBMS Bearer Context, as mentioned above. In this manner, the server may have all the information stored for calculating the success probability *p*.

Thus, it is reasonable to let the feedback control entity perform the above calculation, and subsequently announce all the necessary parameters (time interval *T*, probability *p*, per-receiver report bandwidth, B_{RR} /M=b_{RR}) to the group over the multicast/broadcast channel.

From the above probability distribution functions, we can obtain a value of *p* that results in a total number of reporting receivers *M,* which should be in the interval (M_{Min}, M_{Max}) as the value of *p* that fulfils:

$$P(M_{Min} \le x \le M_{Max}) = F_X(M_{Max}) - F_X(M_{Min})$$

This equation may be solved using the approximation outlined above or other methods, which are not more closely specified in this document (see for example Bronstein et al., "Taschenbuch der Mathematik", 1999, chapter 16.2.3.1: "Binomialverteilung").

Once the value of *p* as above is received by a UE, it may perform a Bernoulli experiment. Only if the result of the experiment is positive, the receiver may establish a feedback channel with the provided per-participant receiver report bandwidth b_{RR}. It is noted that a UE may have the chance to specify the required bandwidth for the bearer depending on the system in which the principles outlined in this document are used. The UE may then send a RTCP RR after the specified time interval *T*.

According to one embodiment of the invention, the parameters used for receiver configuration, i.e. for allowing an UE to determine whether to provide feedback or not, may be transported to the receivers utilizing RTCP sender report blocks. For this purpose several options may be available.

A first possibility may be to use application-defined packets (APP packets) conforming the RTCP specification as shown in Fig. 3. Generally, the APP packet is intended for experimental use as new applications and new features are developed, without requiring packet type value registration.

In Fig. 3, the fields V, P, subtype, PT, length and SSRC are defined in RFC 3500, section 6.7. The name field may for example be set to "MBMS" but any other name consisting of up to 4 octets may be used instead. Further, the application-dependent data may be appended to the fields mentioned before.

In the exemplary embodiment of the invention shown in Fig. 4 the application-specific part of the APP packet may comprise consists at least of the following fields: a time interval indicating the (RTCP) report time interval in milliseconds, a probability value in a fixed-point representation of the success probability for the probabilistic experiment and the report bandwidth specifying bandwidth (e.g. in bits per second) a receiver has to allocate for the report channel, given the probabilistic experiment is successful.

With the fixed-point representation of the probability value, the maximum probability p=1 may for example be coded as a sequence of 16 bits ("1111111111111111"). Hence, the resolution for p equals $1/(2^{16}-1)$).

A further embodiment of the invention foresees to transmit the necessary parameters by means of a newly defined extended receiver report block (XR report block) as shown in Fig. 5. In "RTP Control Protocol Extended Reports (RTCP XR)", Friedman et al. (see RFC 3611, available at http://www.ietf.org) specify a framework for defining ad-hoc RTCP report blocks with extended capabilities. According to this embodiment, such a block may be defined to convey the reporting information as specified above (e.g. reporting interval, reporting probability, etc.).

In the XR report block shown in Fig. 5, the fields V, P, reserved, PT, length, SSRC are defined as in RFC 3611, section 2. Similarly the fields BT, rsvd (for type-specific info) and block length are defined in section 3 of RFC 3611. The field BT (block type) takes an unused value in the range (8, 255). Values 0-7 are already used.

This option has the advantage that it includes the possibility to implement the logic directly in the RTP protocol instead of at the application layer when using an APP report block as outlined above. The solution proposed by this embodiment of the invention has the further advantage that receivers may use or provide extended reporting possibilities available as per RFC 3611 or defined within this document.

In a further embodiment of the invention it is suggested to use methods such as profile specific extensions in the RTP header, an ad-hoc report block or a profile-specific

extension for RTCP for conveying the parameters for allowing the mobile terminals to determine whether to provide feedback to same.

In the following, several variants on how to transport the reporting information (using partially different transport protocols) according to several embodiment of the invention are outlined in following sections.

Due to its probabilistic nature and in case RTP running over the unreliable transport protocol such as UDP, the embodiments outlined above may not guarantee the establishment of exactly the preferred number of feedback channels.

One reason for this may be that not enough number of participants receives the parameters from the feedback control entity, so that the targeted minimum of reports may not reached. As mentioned above, packets in the downstream might get lost due to use of an unreliable transport mechanism.

Another reason may be that the experiment resulted in too few users actually sending feedback messages due to the probabilistic nature of the experiment. This should be a rare case, as the equation

$$P(M_{Min} \le x \le M_{Max}) = F_X(M_{Max}) - F_X(M_{Min})$$ (see also above)

may be solved so that the probability for too few users sending feedback is minimal.

Also, various other reasons such as an increase in reporting bandwidth may make it reasonable to allow a receiver reconfiguration.

In the following, an embodiment of the invention outlines how the reconfiguration of parameters for deciding whether to provide feedback or not at a mobile terminal may be reconfigured. In addition to the information signaled according the embodiments above (see Fig. 4 and Fig. 5), two flags indicating a reconfiguration and some timer information may be included to the packets conveying the parameters to the mobile terminals. The timer may for example avoid that different participants use different settings and thereby exhaust the uplink bandwidth.

A packet structure according to this embodiment is shown in Fig. 6. As in the embodiments outlined with respect to Fig. 4 and Fig. 5 above, the packet comprises a probability field. Assuming that the field is 14 bits long and using a fixed-point representation of the success probability for the Bernoulli experiment the resolution for p

equals $1/(2^{14}-1)$. A probability of *p=1* may be indicated by a sequence of 14 predetermined bits (e.g. "11111111111111").

Besides the probability field, the report bandwidth field and the time interval field, the packet structure may comprise a reconfiguration flag (R), a delta flag (D) and a timer value field (e.g. 32 bits) indicating the time interval (e.g. in milliseconds) for which this parameters are valid.

When the timer expires and this receiver has not received a new value the receiver (mobile terminal) may stop using these values and may tear down an established feedback channel. This may be feasible in order to avoid that terminals operate with different settings because successive reporting settings (parameters) were not received by the same set of participants. Receivers with established feedback channels may listen for reporting settings and may update their timer values accordingly.

The reconfiguration flag (R) may indicate to the receivers whether there a reconfiguration is to be performed. If the reconfiguration flag is not set (e.g. R=0) the message is used to refresh the timer values of the receivers with an already established feedback channel. This is used to keep the existing reporting receivers and no reconfiguration is performed. With the reconfiguration flag set (e.g. R=1) the receivers have to perform the probabilistic experiment according to state of the delta flag (D).

The delta flag (D) may define the scope of the reconfiguration if the reconfiguration flag is set (e.g. R=1). If the delta flag is not set (e.g. D=0) the reconfiguration applies to all receivers. In this case all receivers may perform the probabilistic experiment according to the specified probability value. This may be used to initially select reporting receivers or to completely reconfigure an established reporting scenario, e.g. to stop all reporting receivers.

In case the delta flag is not set (e.g. D=0) a mobile terminal which has already decided to perform feedback and thus already established a feedback channel previously, may keep that channel instead of performing a teardown and reestablishment. The latter may hold true only under the assumption that the established uplink provides the same bandwidth as announced in the new message. If the bandwidth has changed, the receiver may need to teardown the old channel and to reestablish a new feedback channel (bearer).

If the delta flag is set (e.g. D=1) the reconfiguration may apply only to those receivers, which do not already maintain a feedback channel. Only those receivers may perform the

probabilistic experiment according to the specified probability value. This may be useful in case that a certain preferred threshold M_{min} of reporting receivers is not met and additional receivers should establish feedback channels.

The following table summarizes the different reconfiguration options:

R	D	Description
1	0	Global reconfiguration message; all receivers perform the probabilistic experiment
1	1	Additive reconfiguration message; only receivers without a feedback channel perform the probabilistic experiment
0	?	Refresh message; No reconfiguration is performed, only receivers with an established feedback channel to refresh their timer value

As seen in the sections above, in case an unreliable transport mechanism is used to convey the reporting parameters, same may get lost during transport. This may be in particular true in case RTP packets are transferred over the unreliable UDP protocol. UDP is a transport protocol that provides an unreliable datagram service. It is typically used to unicast/multicast streaming media (like MPEG4) in RTP packets. The corresponding RTCP packets are also transported over UDP.

The BM-SC (acting as a feedback control entity in this embodiment) may also decide to send this information in a more reliable way. It is noted that in the embodiments above the BM-SC has been considered as the source of parameters transmitted to the mobile terminals. However, it is also possible that the feedback control entity providing the content of a multicast or broadcast service (session) may determine and propagate these parameters to the mobile terminals receiving the service.

In the MBMS framework, there are methods to transmit the information in a more reliable way. Terminals may retrieve the session description information (e.g. as SDP description) of an MBMS service using a point-to-point connection to, e.g., a HTTP server or they may receive an SMS comprising this information before joining an MBMS session.

Another possibility may be the use of the FLUTE protocol (see Paila et al., "FLUTE - File Delivery over Unidirectional Transport", draft-ietf-rmt-flute-07.txt, June 2004, available at http://www.ietf.org). The FLUTE protocol may be used for reliable data transfer in the

MBMS architecture. Service announcement information, comprising inter alia the parameters for allowing the mobile terminals to decide whether to provide feedback, may be transmitted using FLUTE and a session description protocol for describing the offered services, e.g. SDP (Session Description Protocol).

Therefore, where reliable transmission of session description as above is available, the reporting information (at least the reporting probability, and possibly additionally the reporting interval and the reporting bandwidth if needed) may be included in that description according to another embodiment of the invention.

Next, some possible scenarios for providing a multicast or broadcast service to users and capable of employing the invention outlined in the various embodiments above are outlined for exemplary purposes with respect to Fig. 7, 8 and 9.

In Fig. 7 a content server 701 provides a multicast or broadcast session via a feedback control entity, for example the BM-SC 704, to users for example over an IP-based network. Some of the users receiving the service data may be located in a mobile communication network such as an UMTS network 702, which is considered in the following for exemplary purposes.

According to one embodiment of the invention, the BM-SC 704 located within the UMTS network 702 may control the provision of feedback of service-receiving terminals 712, 713 as outlined above. The BM-SC 704 receives the service data from the content server 701 and may transmit same within an MBMS session to the terminal 712, 713 for example via an GGSN (GPRS Gateway Support Node) 705 and an SGSN (Serving GPRS Support Node) 706 of the CN (core network) 703, at least one RNC 709 and at least one Node B 710, 711. Please note that the BM-SC 704 may also be responsible for announcing the service availability via an announcement channel in the UMTS network 702 and be involved in service admission, i.e. in UEs joining and leaving the service. As outlined previously in reference to one embodiment of the invention, the service announcements may comprise the parameters for feedback control.

Turning now to Fig. 8, an exemplary embodiment of the invention in which the content server 801 is located within the mobile communication system is illustrated. Essentially, the same considerations made for the embodiments of the invention outlined with reference to Fig. 7 above apply here as well, except that employing an IP-based network as shown in Fig. 7 for data provision may not be necessary.

In Fig. 9 an exemplary embodiment of the invention wherein the content server 901 is the source of the data of the multicast or broadcast service is illustrated. In this embodiment of the invention the content server 901 is providing the service related data stream(s) directly to the GGSN 705. According to this embodiment, the GGSN 705 may thus be the network entity which controls feedback provision of the downstream terminals receiving the service. In case the GGSN 705 may directly determine the number of service participants based on the respective information stored in service related context information, such as the MBMS Bearer Context.

In a further embodiment of the invention, the feedback control entity, e.g. the BM-SC may receive the data of the multicast or broadcast service from a multicast or broadcast service provider (content provider 701, 801) as shown in Fig. 7 and 8.

The feedback control entity may be operated in a non-transparent mode for a multicast or broadcast service provider. This mode will be explained in the following with reference to Fig. 7.

In case, the BM-SC 704 (i.e. the feedback control entity in the exemplary embodiment shown in Fig 7) acts as a client receiving the multicast or broadcast service from the viewpoint of the content provider 701 (i.e. the multicast or broadcast service provider in the exemplary embodiment shown in Fig 7). From the terminals' 712, 713 viewpoint, the multicast or broadcast service, the BM-SC 704 acts as a multicast or broadcast server providing the service.

Hence, there may be no end-to-end service session from content server 701 to the mobile terminals 712, 713 but the service provision is split into two end-to-end sessions: one between the terminals 712, 713 and the BM-SC 704 and one between the BM-SC 704 and the content provider 701.

For both sessions different protocols e.g. on the transport and the session layer may be used. For example, the session between BM-SC 704 and the terminals 712, 713 may be using an RTP/UDP/IP (and RTCP feedback) while the session between content provider 701 and BM-SC 704 may use the same protocols or different ones. Hence, the BM-SC 704 may operate in a gateway-like fashion providing protocol translation mechanisms.

Considering now the session between content server 701 and BM-SC 704, the latter may therefore provide feedback to the content provider 701. In order to reflect the reception statistics e.g. the QoS achieved for the different service-receiving terminal 712, 713, the

packet loss rate to the individual terminal 712, 713 or the like which are reflected by the feedback received from the terminal 712, 713, the BM-SC 704 may analyze the feedback received and may form an aggregated or cumulative values thereof reflecting the reception statistics of the service within the mobile communication system. This aggregate or the cumulative values may be provided as feedback to the content provider 701 in any form. For example, the BM-SC 704 may generate "standard" RTCP Receiver Reports reflecting the aggregated or cumulative values or a special form of feedback provision may be defined between content provider 701 and BM-SC 704.

A second possibility may be that the BM-SC 704 forwards the received feedback of the individual UEs 712, 713 to the content provider 701. Also in this case the BM-SC 704 may perform some conversion of the feedback data because there is a separate connection/session between the BM-SC 704 and the content provider 701 where even another protocol may be used.

In any case the feedback provision from BM-SC 704 to content provider 701 may be especially feasible for example in case the users get charged for a received service based on the QoS achieved.

Another embodiment of the present invention relates to the implementation of the above described various embodiments using hardware and software. It is recognized that the various above mentioned methods as well as the various logical blocks, modules, circuits described above may be implemented or performed using computing devices (processors), as for example general purpose processors, digital signal processors (DSP), application specific integrated circuits (ASIC), field programmable gate arrays (FPGA) or other programmable logic devices, etc. The various embodiments of the present invention may also be performed or embodied by a combination of these devices.

Further, the various embodiments of the present invention may also be implemented by means of software modules which are executed by a processor or directly in hardware. Also a combination of software modules and a hardware implementation may be possible. The software modules may be stored on any kind of computer readable storage media, for example RAM, EPROM, EEPROM, flash memory, registers, hard disks, CD-ROM, DVD, etc.

In this respect, Fig. 10 and Fig. 11 show a mobile terminal and a feedback control entity, respectively, according to exemplary embodiments of the invention.

The mobile terminal may inter alia comprise a display 1001 for displaying the data delivered from the feedback control entity as well as at least one communication interface 1004 enabling the reception of the multicast or broadcast session and the transmission of feedback. Further, the mobile terminal may comprise a processor 1002 (computing device), which may be inter alia used to execute instructions stored on the computer-readable storage medium 1003. Further, the processor 1002 may control communications via the communication interface(s) 1004 and may perform the probabilistic experiment to determine at the terminal whether to provide feedback or not, etc.

The feedback control entity shown in Fig. 11 may comprise a processor 1101 a computer readable-storage medium 1102 and at least one communication interface 1104.

The feedback control entity may be the BM-SC of the UMTS network providing or forwarding a multicast or broadcast service. The feedback control entity may further comprise a service database 1103 storing or buffering the service data (e.g. streams) provided by the multicast or broadcast service to the users. Further, the computer-readable medium 1102 may store instructions executable by the processor 1101 and further data.

For example, the data stored in the computer-readable medium 1102 may comprise the context information of the respective service based on which the feedback control entity determine the number of service participants. The instructions stored on the computer-readable medium 1102 may further enable the feedback control entity to control feedback provision from the service participants as outlined in the various embodiments above.

CLAIMS

1. A method for controlling the transmission of feedback of mobile terminals receiving via an air interface of a mobile communication system a multicast or broadcast service transmitted or forwarded by a feedback control entity of the mobile communication system, the method comprising the following steps performed by a mobile terminal:

receiving the multicast or broadcast service via a unidirectional downlink channel and using an unreliable transport protocol and a session protocol, wherein the session protocol configures feedback provision of terminals receiving the multicast or broadcast service,

receiving parameters based on which the mobile terminal decides whether to provide session protocol configured feedback to the feedback control entity,

deciding whether to provide session protocol configured feedback for the multicast service or broadcast to the feedback control entity based on the received parameters,

in case it is decided to provide session protocol configured feedback, establishing a bearer for providing feedback to the feedback control entity, and

transmitting session protocol configured feedback indicating reception statistics of said multicast or broadcast service to the feedback control entity via said established bearer.

2. The method according to claim 1, wherein the parameters received at the mobile terminal indicate a probability value for a probabilistic experiment based on which the mobile terminal decides whether to provide session protocol configured feedback.

3. The method according to claim 2, wherein the decision on whether to provide feedback comprises performing at the mobile terminal a probabilistic experiment using said received probability value and deciding whether to provide session protocol configured feedback based on the result of the experiment.

4. The method according to claim 2 or 3, wherein the probabilistic experiment is a Bernoulli experiment.

5. The method according to one of claims 1 to 4, wherein the parameters are received via a multicast or broadcast data channel providing said multicast or broadcast service.

6. The method according to one of claims 1 to 4, wherein the parameters are received via an announcement channel on which the multicast or broadcast service is announced to potential receivers.

7. The method according to claim 6, wherein a reliable communication protocol is used for data transport on the announcement channel.

8. The method according to one of claims 1 to 7, wherein the parameters received at the mobile terminal further indicate the point in time until which the parameters are valid.

9. The method according to claim 8, further comprising the step of the mobile terminal releasing the established bearer for providing session protocol configured feedback in case the point in time indicated by the parameters is reached.

10. The method according to one of claims 1 to 9, further comprising the step of receiving reconfiguration parameters wherein the reconfiguration parameters update the parameters previously received from the feedback control entity.

11. The method according to claim 10, wherein the reconfiguration parameters comprise a flag indicating whether to update a validity period for the parameters previously received and the method further comprising the step of updating the validity period of the previously received parameters based on this flag.

12. The method according to claim 11, wherein the update of the validity period is only performed if the mobile terminal has established a bearer for providing session protocol configured feedback.

13. The method according to one of claims 10 to 12, wherein the received reconfiguration parameters comprise a flag indicating whether a new decision on providing session protocol configured feedback is to be performed by the mobile terminal and further comprising the step of determining based on this flag whether a new decision on providing session protocol configured feedback or not is to be performed by the mobile terminal, and

if so, deciding whether to provide session protocol configured feedback for the multicast or broadcast service to the feedback control entity based on the received reconfiguration parameters,

in case it is decided to provide session protocol configured feedback, establishing a bearer for providing session protocol configured feedback to the feedback control entity, and

transmitting feedback indicating reception statistics of said multicast or broadcast service to the feedback control entity via said established bearer.

14. A method for controlling by a feedback control entity the transmission of feedback of a plurality of mobile terminals receiving a multicast or broadcast service via an air interface of a mobile communication system, the method comprising the following steps performed by the feedback control entity:

transmitting or forwarding data of the multicast or broadcast service via a unidirectional downlink channel and using an unreliable transport protocol to at least one mobile terminal and a session protocol, wherein the session protocol configures feedback provision of terminals receiving the multicast or broadcast service,

determining parameters allowing a mobile terminal deciding whether to provide session protocol configured feedback to the feedback control entity,

transmitting said parameters to at least a subset of said plurality of mobile terminals receiving the multicast or broadcast service, and

receiving session protocol configured feedback from a subset of said plurality of mobile terminals having received said parameters.

15. The method according to claim 14, wherein the parameters are determined based on state information of the multicast and broadcast service maintained by the feedback control entity or received from a network entity of the mobile communication system.

16. The method according to claim 14 or 15, wherein the parameters determined by the feedback control entity indicate a probability value for a probabilistic experiment based on which the mobile terminal decides whether to provide feedback.

17. The method according to claim 15 or 16, wherein the parameters are transmitted via an announcement channel on which the multicast or broadcast service is announced to potential receivers.

18. The method according to claim 17, wherein a reliable communication protocol is used for data transport on the announcement channel.

19. The method according to one of claims 14 to 18, wherein the parameters further indicate the point in time until which the parameters are valid.

20. The method according to one of claims 15 to 19, further comprising the step of determining the probability value based on the number of participants of the multicast or broadcast service.

21. The method according to claim 20, further comprising the step of obtaining the number of participants of the multicast or broadcast service from the state information maintained or received by the feedback control entity.

22. The method according to claim 21, wherein the state information of the multicast or broadcast service is comprised within the MBMS UE Context or the MBMS Bearer Context maintained at the feedback control entity.

23. The method according to claim 21, further comprising the step of receiving the state information of the multicast or broadcast service from a network entity of the mobile communication network maintaining an MBMS UE Context or an MBMS Bearer Context.

24. The method according to one of claims 14 to 23, further comprising the step of receiving the data of the multicast or broadcast service from a multicast or broadcast service provider.

25. The method according to claim 24, further comprising the step of forwarding session protocol configured feedback received at the feedback entity to the multicast or broadcast service provider.

26. The method according to claim 24 or 25, wherein the data of the multicast service is transported to the feedback control entity using a transport protocol and a session protocol, and the method further comprising the step of translating at least one of the transport protocol and a session protocol to another transport protocol or session protocol, respectively, before transmitting or forwarding the data of the multicast or broadcast service to the mobile terminals.

27. The method according to claim 25 or 26, wherein the feedback for the multicast service is transported to the feedback control entity using a transport protocol and a session protocol, and the method further comprising the step of translating at least one of the transport protocol and a session protocol to another transport protocol or session protocol, respectively, before forwarding the feedback to the multicast or broadcast service provider.

28. The method according to claim 24, further comprising the steps of forming an aggregate of the session protocol configured feedback received at the feedback control entity and

transmitting said aggregate of the session protocol configured feedback to the multicast or broadcast service provider.

29. The method according to one of claims 1 to 28, wherein the multicast or broadcast service is provided using the RTP protocol and feedback is provided using the RTCP protocol, wherein a fraction of the available bandwidth for a session providing the multicast or broadcast service is allocated to the RTCP protocol messages.

30. The method according to claim 29, wherein the session protocol configured feedback is provided in form of receiver reports of the RTCP protocol.

31. The method according to claim 29 or 30, wherein the parameters further indicate the report time interval and the available bandwidth for providing session protocol configured feedback using the RTCP protocol.

32. The method according to one of claims 1 to 31, wherein the parameters are comprised within a sender report message of the RTCP protocol transmitted by the feedback control entity.

33. A mobile terminal receiving via an air interface of a mobile communication system a multicast or broadcast service transmitted or forwarded by a feedback control entity, the mobile terminal comprising:

a receiver for receiving the multicast or broadcast service via a unidirectional downlink channel and using an unreliable transport protocol and a session protocol, wherein the session protocol configures feedback provision of terminals receiving the multicast or broadcast service,

wherein the receiver is adapted to further receive parameters based on which the mobile terminal decides whether to provide session protocol configured feedback to the feedback control entity,

a processor for deciding whether to provide session protocol configured feedback for the multicast or broadcast service to the feedback control entity based on the received parameters and for establishing a bearer for providing session protocol configured feedback to the feedback control entity, in case it is decided to provide session protocol configured feedback and

a transmitter for transmitting session protocol configured feedback indicating reception statistics of said multicast or broadcast service to the feedback control entity via said established bearer.

34. The mobile terminal according to claim 33, further comprising means adapted to execute the steps of the method according to one of claims 1 to 13 or claims 29 to 32.

35. A feedback control entity for controlling the transmission of feedback of a plurality of mobile terminals receiving a multicast or broadcast service transmitted or forwarded by a feedback control entity via an air interface of a mobile communication system, the feedback control entity comprising:

a transmitter for transmitting or forwarding data of the multicast or broadcast service to at least one mobile terminal via a unidirectional downlink channel and using an unreliable transport protocol and a session protocol, wherein the session protocol configures feedback provision of terminals receiving the multicast or broadcast service,

a processor for determining parameters allowing a mobile terminal deciding whether to provide session protocol configured feedback to the feedback control entity,

wherein the transmitter is adapted to transmit said parameters to at least a subset of said plurality of mobile terminals receiving the multicast or broadcast service, and

a receiver for receiving session protocol configured feedback from a subset of said plurality of mobile terminals having received said parameters.

36. The feedback control entity according to claim 35, further comprising means adapted to execute the steps of the method according to one of claims 14 to 32.

37. A mobile communication system comprising a feedback entity according to claim 35 or 36 and at least one mobile terminal according to claim 33 or 34 for receiving a multicast or broadcast service from a feedback control entity via an air interface using a unidirectional downlink channel and an unreliable transport protocol.

38. A computer-readable medium for storing instructions that, when executed by a processor of a mobile terminal, cause the processor to control the transmission of feedback of said mobile terminal receiving via an air interface of a mobile communication system a multicast or broadcast service transmitted or forwarded by a feedback control entity by:

receiving at the mobile terminal the multicast or broadcast service via a unidirectional downlink channel using an unreliable transport protocol and a session protocol, wherein the session protocol configures feedback provision of terminals receiving the multicast or broadcast service,

receiving at the mobile terminal parameters based on which the mobile terminal decides whether to provide session protocol configured feedback to the feedback control entity,

deciding by the mobile terminal whether to provide session protocol configured feedback for the multicast service or broadcast to the feedback control entity based on the received parameters,

in case it is decided to provide session protocol configured feedback, establishing by the mobile terminal a bearer for providing session protocol configured feedback to the feedback control entity, and

transmitting feedback indicating reception statistics of said multicast or broadcast service from the mobile terminal to the feedback control entity via said established bearer.

39. The computer-readable medium according to claim 38, further storing instructions that, when executed by the processor of the mobile terminal cause the processor to perform the steps of the method according to one of claims 1 to 13 or claims 29 to 32.

40. A computer-readable medium for storing instructions that, when executed by a processor of a feedback control entity, cause the processor to control the transmission of feedback of mobile terminals receiving via an air interface of a mobile communication system a multicast or broadcast service transmitted or forwarded by the feedback control entity by:

transmitting or forwarding data of the multicast or broadcast service from the feedback control entity to at least one mobile terminal via a unidirectional downlink channel and using an unreliable transport protocol and a session protocol, wherein the session protocol configures feedback provision of terminals receiving the multicast or broadcast service,

determining at the feedback control entity parameters allowing a mobile terminal deciding whether to provide session protocol configured feedback to the feedback control entity,

transmitting said parameters from the feedback control entity to at least a subset of said plurality of mobile terminals receiving the multicast or broadcast service, and

receiving at feedback control entity session protocol configured feedback from a subset of said plurality of mobile terminals having received said parameters.

41. The computer-readable medium according to claim 40, further storing instructions that, when executed by the processor of the feedback control entity cause the processor perform the steps of the method according to one of claims 14 to 32.

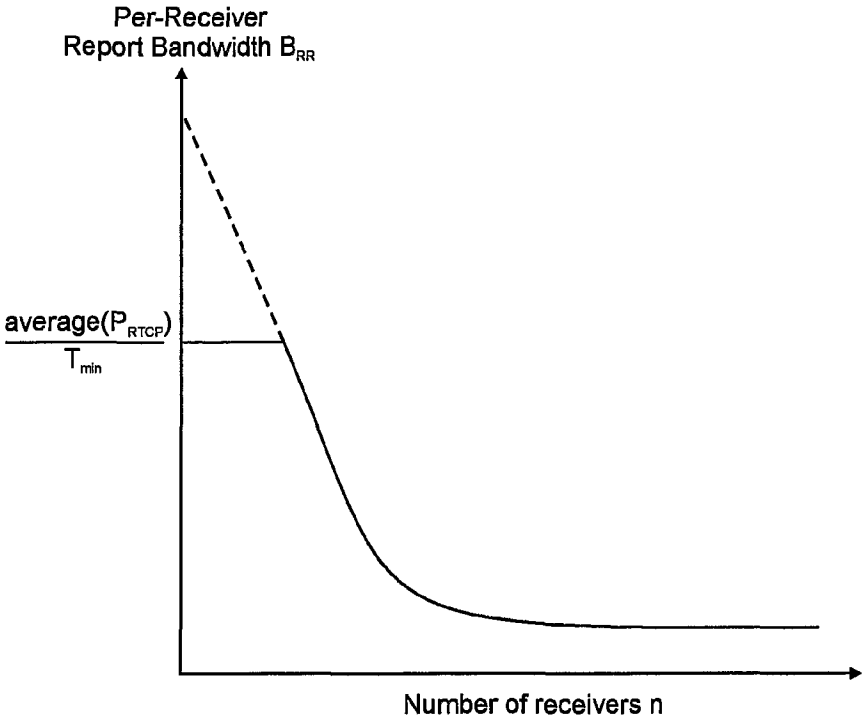

Per-Receiver
Report Bandwidth B_{RR}
average(P_{RTCP})
T_{min}
Number of receivers n

Fig. 1

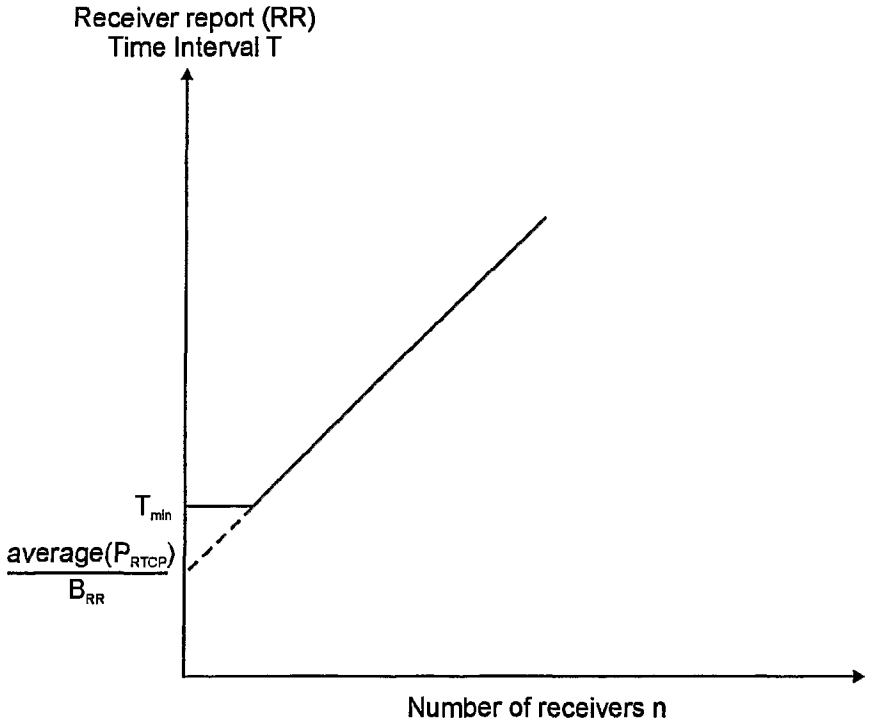

Receiver report (RR)
Time Interval T
T_{min}
average(P_{RTCP})
B_{RR}
Number of receivers n

Fig. 2

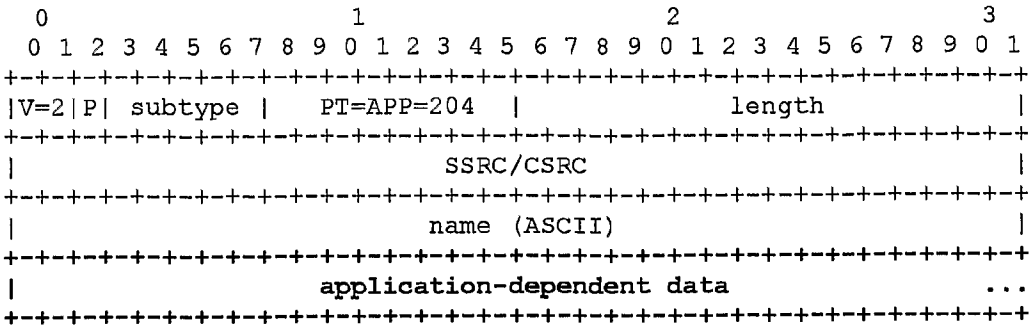


Fig. 3

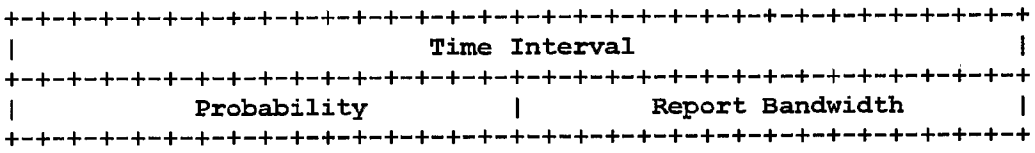


Fig. 4

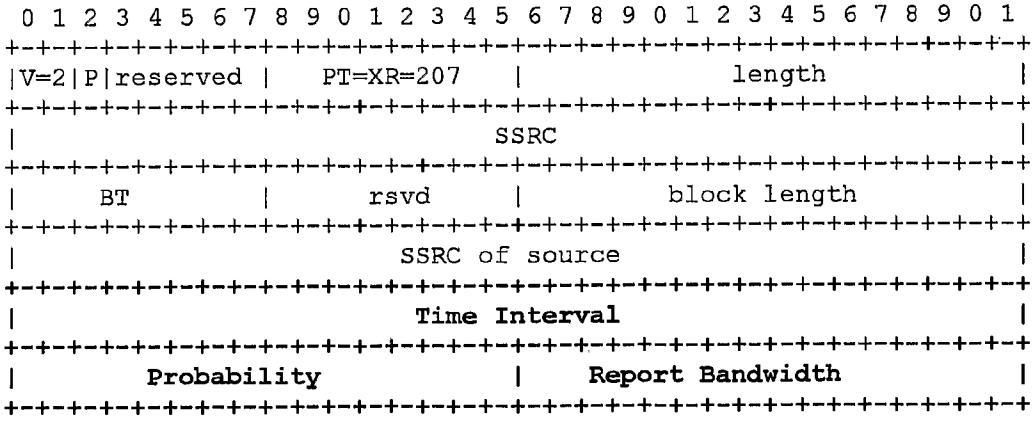
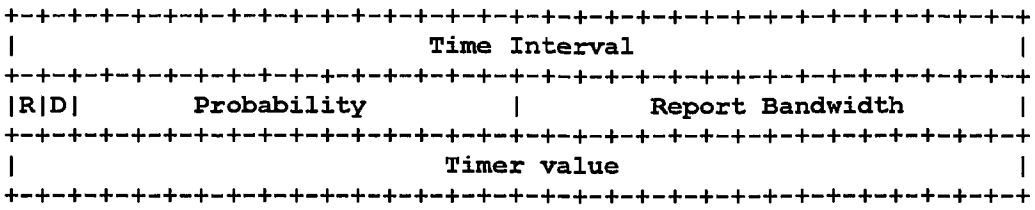


Fig. 5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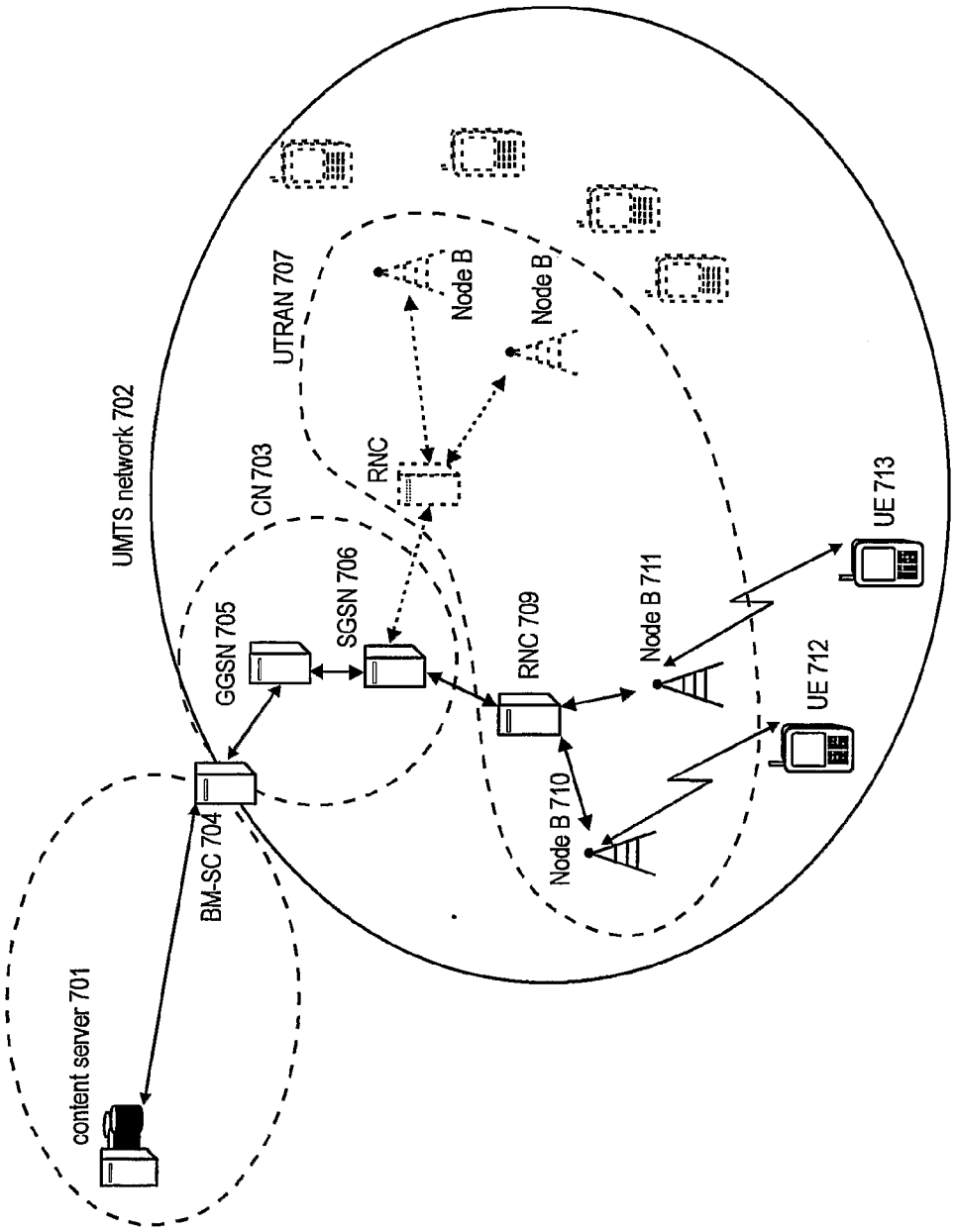
Probability
Report Bandwidth
Timer value

Fig. 6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BM-SC 704
content server 701

Fig. 7

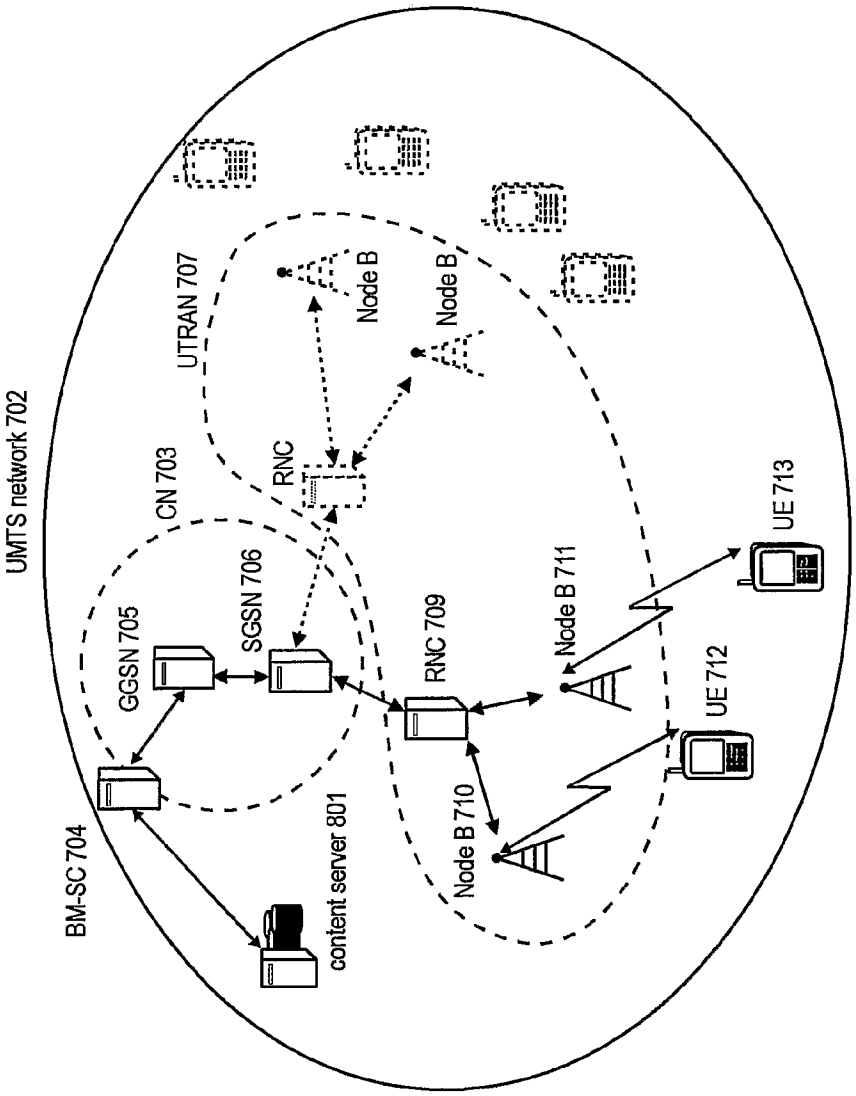
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Fig. 8

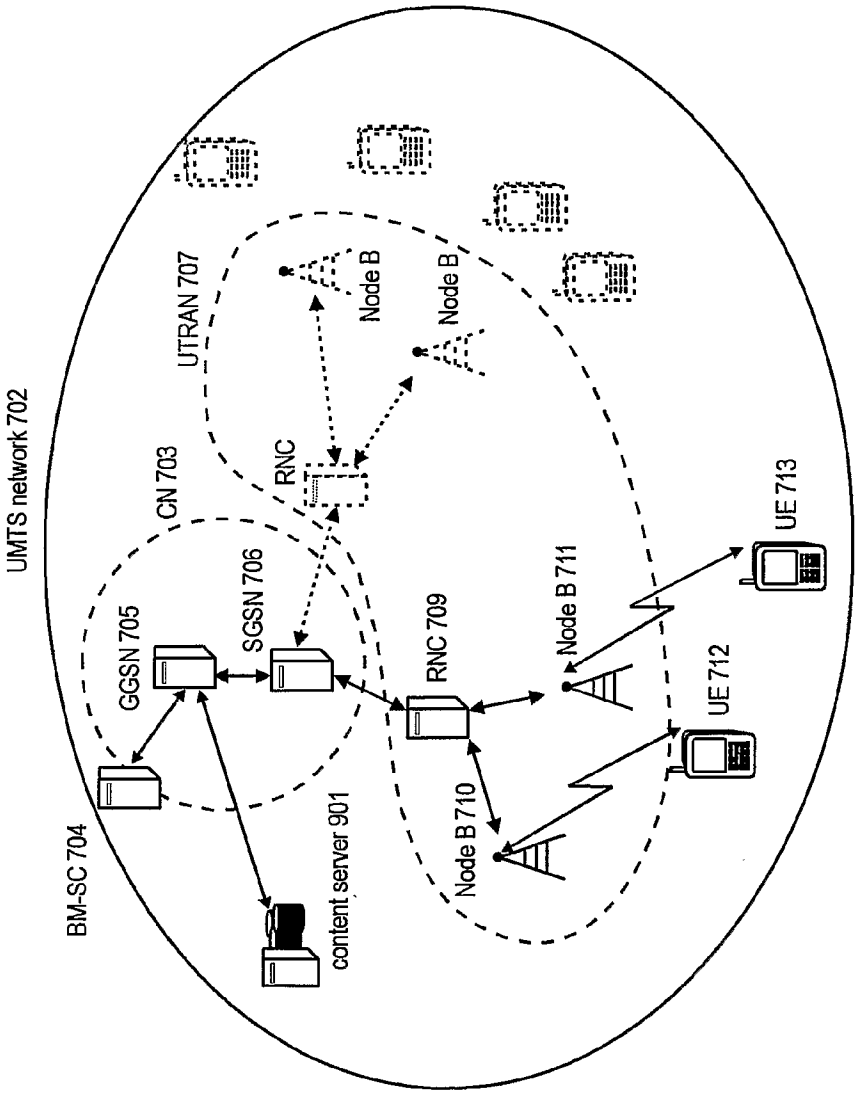
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Fig. 9

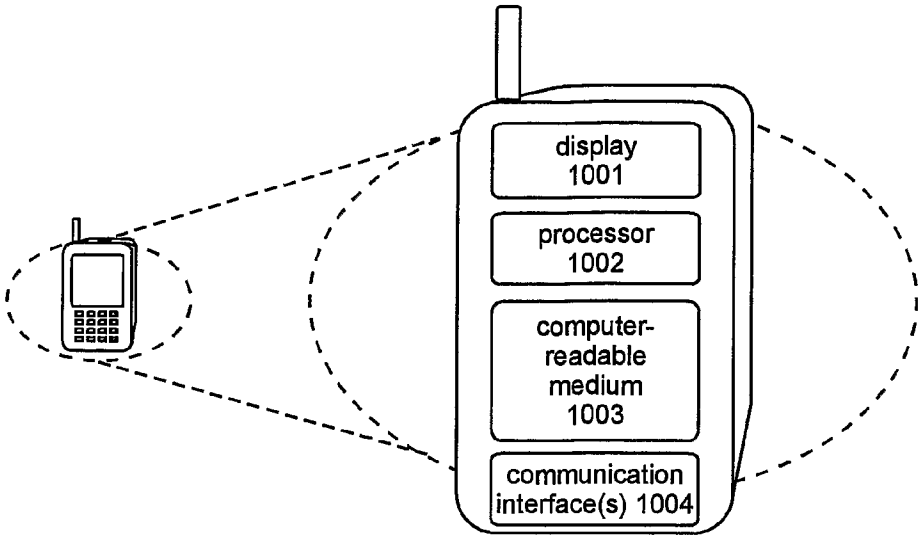
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Fig. 10

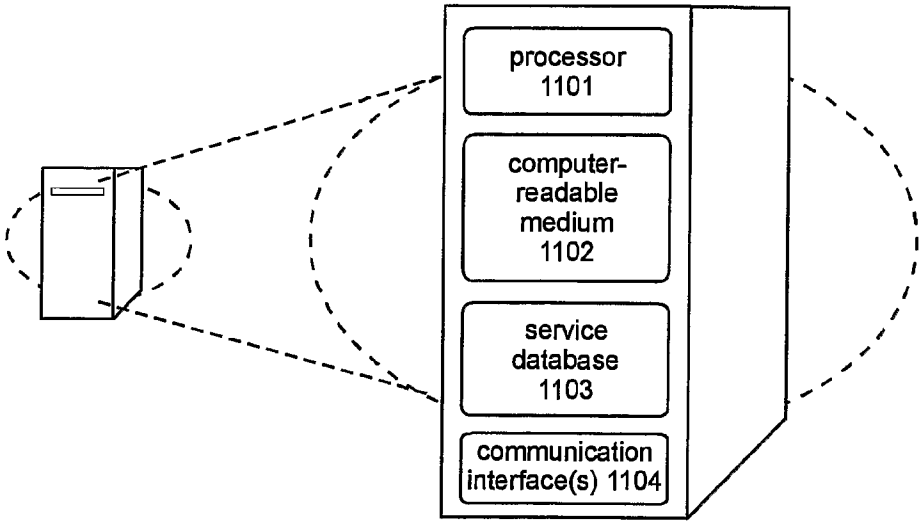
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Fig. 11

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EFS ID:	10565216
Application Number:	12159841
International Application Number:	
Confirmation Number:	3203
Title of Invention:	METHOD OF TRANSMITTING/RECEIVING A PAGING MESSAGE IN A WIRELESS COMMUNICATION SYSTEM
First Named Inventor/Applicant Name:	Young Dae Lee
Customer Number:	35884
Filer:	Sevan Savsa
Filer Authorized By:	
Attorney Docket Number:	2101-3515
Receipt Date:	20-JUL-2011
Filing Date:	22-OCT-2008
Time Stamp:	23:18:21
Application Type:	U.S. National Stage under 35 USC 371

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(Not for submission under 37 CFR 1.99)

Application Number	12159841
Filing Date	2008-10-22
First Named Inventor	Young Dae Lee
Art Unit	2617
Examiner Name	CHO, UN C
Attorney Docket Number	2101-3515

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	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

	4	20040116143		2004-06-17	Love et al.	
	5	20050059421		2005-03-17	Reed et al.	
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	2	01/05121	WO		2001-01-18	Telefonaktiebolaget LM Ericsson		☐
	3	03/047155	WO		2003-06-05	Telefonaktiebolaget LM Ericsson		☐
	4	03/087978	WO		2003-10-23	Interdigital Technology Corp.		☐
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	7	2005/006660	WO		2005-01-20	NTT CORP		☐
	8	2005119941	WO		2005-12-15	LG Electronics Inc.		☐
	9	2263415	RU		2005-10-27	Telefonaktiebolaget LM Ericsson		☐
	10	2002/039697	WO		2002-05-16	Nokia Corporation		☐
	11	2005/117317	WO		2005-12-08	LG Electronics Inc.		☐
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	1	Motorola et al., "MAC-e/es header and functional split," R2-042360, 3GPP TSG RAN WG2 Meeting#45, November 2004.	☐
	2	Ericsson, "User plane protocol enhancements," R2-052749, TSG-RAN WG2 Meeting #48bis, October 2005.	☐
	3	LG Electronics Inc., "MAC Enhancement," R2-060561, 3GPP TSG-RAN WG2 #51, February 2006.	☐

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	Examiner Name	CHO, UN C
	Attorney Docket Number	2101-3515

	4	Qualcomm, "Need for MAC-hs segmentation mechanism," R2-020769, 3GPP TSG-RAN WG2 Meeting #28, April 2002.	☐
	5	3rd Generation Partnership Project (3GPP), "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA) Medium Access Control (MAC) Protocol Specification (Release 8)," 3GPP TS 36.321 v8.4.0, January 2009.	☐

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(71) Applicant *(for all designated States except US)*: NOKIA TELECOMMUNICATIONS OY [FI/FI]; Keilalahdentie 4, FIN–02150 Espoo (FI).

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(74) Agent: KOLSTER OY AB; Iso Roobertinkatu 23, P.O. Box 148, FIN–00121 Helsinki (FI).

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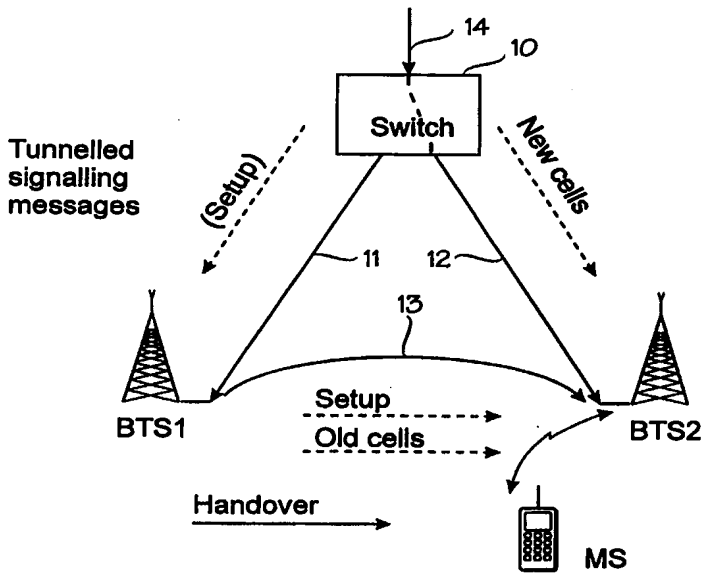
(54) Title: METHOD OF AVOIDING PACKET LOSS AT A HANDOVER IN A PACKET–BASED TELECOMMUNICATIONS NETWORK AND HANDOVER METHOD

(57) Abstract

The invention relates to connection–oriented packet–based communications network, such as ATM (Asynchronous Transfer Mode), in which the terminal (MS) and the network access point of the terminal may move in the network. When the access point of the terminal (MS) changes during an active connection, the routing of the connection must also be changed or extended from an old access point (BTS1) to a new one (BTS2). The old access point (BTS1) may comprise buffered cells, which should be transferred to the new access point without packet loss. A necessary connection (13) from the old access point to the new one is established dynamically, when it is required. Instead of being controlled by the old access point, the connection establishment is controlled by a third network element (10), which is responsible for controlling the change of access point anyway. The third network element (10) generates the required signalling and in a way "tunnels" this signalling to the old access point (BTS1), which transmits the signalling forward without interpreting it. So the old access point can be arranged to send signalling messages and to establish a connection without requiring any additional intelligence at the access point. Upon the connection being established, the old access point sends the buffered unsent packets to the new access point (BTS2).



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METHOD OF AVOIDING PACKET LOSS AT A HANDOVER IN A PACKET-BASED TELECOMMUNICATIONS NETWORK AND HANDOVER METHOD

FIELD OF THE INVENTION

The invention relates to connection-oriented packet-based telecommunications networks, such as ATM (Asynchronous Transfer Mode), and particularly to avoiding packet loss at handovers in such networks.

BACKGROUND OF THE INVENTION

At present, there are two very interesting trends of development in the telecommunication, viz. mobile communication and broadband networks, in which bit rates typically exceed 2 Mbit/s. An example of broadband networks is Broadband Integrated Services Digital Network (B-ISDN), the transfer mode of which is selected to be Asynchronous Transfer Mode (ATM). The ATM is a switching and multiplexing solution particularly relating to a data link layer (i.e. OSI Layer 2, from here on called ATM layer). ATM enables an implementation of a connection-oriented packet network in the B-ISDN networks.

In ATM data transfer, the end user's data traffic is carried from a source to a destination by means of virtual connections. Data is transferred over switches of the network in standard-size packets of 53 bytes, the packets being called ATM cells. The structure of an ATM cell is illustrated in Figure 1. An ATM cell contains a header of 5 octets and an information field of 48 octets containing actual payload. The main object of the header is to identify a connection number for a sequence of cells, forming a virtual channel for a specific call. A physical layer (i.e. OSI Layer 1) may comprise several virtual paths, which are multiplexed in the ATM layer. The virtual paths are identified by means of a VPI (Virtual Path Identifier). Each virtual path may comprise a number of virtual channels, which are identified by a VCI (Virtual Channel Identifier). The header contains also other fields, such as an HEC (Header Error Control), a GFC (Generic Flow Control), a CLP (Cell Loss Priority) and a PT (Payload Type). The ATM cell contains indirectly an information on the receiver's address, each cell thus being an independent data transfer unit. The number of cells transferred in a time unit is proportional to the user's bandwidth requirements.

The ATM is a connection-oriented traffic technique, but because there is no connection before it is established, a connection establishment re-

quest shall be routed from a source through the ATM network to a destination approximately in the same way as packets are routed in packet-switched networks. After the connection has been established, the cells travel along the same virtual path during the connection.

A third trend of development is to introduce a wireless data transfer (wireless ATM) and mobility into the ATM networks (wireless ATM). The present B-ISDN and ATM standards do not support as such the additional features required by wireless communication, but different solutions to implement for instance mobility management in connection with wireless ATM have been presented already. The aim has been to add wireless data transfer and mobility to the ATM network without significant changes in the existing ATM standards and networks. Such solutions have been presented in the applicant's copending Finnish Patent Applications 971178 and 970602, for example.

In PLMNs (Public Land Mobile Network), radio interfaces have conventionally been narrowband interfaces. The transmission systems of mobile networks have conventionally been implemented by circuit-switched connections in a star or tree network configuration. In order to increase the capacity and flexibility of the transmission systems, a use of different broadband packet-switched transfer systems or ATM technique in mobile networks has also been proposed, for instance in WO 9400959, EP 0366342 and EP 0426269. A possible future trend of development is mobile systems having a broadband radio interface. Then a broadband transmission system of the mobile system is also needed, while a potential alternative is ATM technique.

In mobile networks and in a wireless ATM network, a terminal does not have any fixed access point to the network, but the terminal and the access point may move in the network. When a virtual connection has been routed to the terminal through the ATM network, the routing must also be changed or extended from an old access point (a base station, for example) to a new one. This procedure is called handover or handoff. In a hard handover, the data transfer is interrupted, when the connection is connected from one access point to another. In a soft handover, the continuation of the data transfer is secured by the terminal having a connection both with the old and the new AP (Access Point) simultaneously during the handover.

In an ATM network, and generally in a packet-based telecommunications network, a loss of an ATM cell (packet) reduces significantly the efficiency of the connection. If one single ATM cell is lost (during handover, for in-

stance), it may be necessary to retransmit a whole PDU (Protocol Data Unit) of higher level protocol, i.e. a plurality of ATM cells. This reduces the efficiency of the connection, and for this reason, cell losses have to be avoided. A change in cell order during a connection also causes an error situation at reception and starts a retransmission of the cells. Therefore, it should also be secured that the order of the cells does not change during handover. In general, this requires a buffering of cells always when an active connection breaks for whatever reason. Some reasons for cell buffering in a wireless ATM network are described below.

Traffic from an MT (Mobile Terminal) to an AP (uplink direction) and further to the network must be buffered at least in the MT, when the radio leg of the connection is broken. This may happen during a hard handover or a fading, for instance. A buffering of uplink traffic on the network side may be necessary during a path optimization process.

In downlink direction, there are several alternatives to implement cell buffering. The access point shall buffer the downlink cells for instance for sudden radio link interruptions, congestion and retransmission. During handover, the connection breaks approximately for the time needed for establishing a new radio connection and for releasing an old one. The buffering required by handover may typically be carried out either at an old access point AP or in an ATM switch. Buffering at the old access point AP is simple, because the AP needs a buffering of some kind in any case. Buffering relating to handover is a new function in the ATM switch, besides which, some of the cells still have to be buffered at the old AP.

In both above alternatives of downlink cell buffering, the old access point AP may comprise buffered cells, which have not yet been sent over the radio path. After a handover to a new access point AP, these unsent cells should be transmitted forward to the new AP without a loss of cells and maintaining the cell sequence in order to avoid a retransmission of a whole PDU.

As a solution to this problem has been presented that there are pre-established (permanent) connections between adjacent access points, over which connections the unsent cells can be transferred from the old AP to the new AP. This approach does not require any significant intelligence at the AP and does therefore not increase the complexity of the AP (base station, for instance). However, this solution is not very dynamic and reserves network resources only for this use.

As another solution to this problem has been presented an "intelligent" access point AP being able to establish a connection to a new AP by itself and to transfer the unsent cells to the new AP. By means of this solution, a better dynamism and utilization of network resources are achieved. However, a drawback is that the necessary additional intelligence increases the complexity of the AP and thus the costs.

BRIEF SUMMARY OF THE INVENTION

The object of the invention is thus a method by which unsent cells can be transferred from an old access point to a new one without reserving network resources unnecessarily and without increasing the complexity of the access point and the price significantly.

The objects of the invention are achieved by means of a method of transferring unsent packets from an old access point to a new access point in a packet-based connection-oriented telecommunications network, in which the access point of a terminal to the network may change during an active connection, the method comprising the steps of: buffering at the old access point the packets which the old access point has not sent to the terminal before change of access point; establishing a connection from the old access point to the new access point; transferring the buffered packets from the old access point to the new access point over said connection. The method is according to the invention characterized in that said step of establishing a connection comprises the steps of: generating a signalling required for said connection establishment in a third network element, which is responsible for controlling the change of access point; tunnelling said signalling to the old access point; transmitting said signalling from the old access point to the new access point.

Another object of the invention is a packet-based connection-oriented communications network, comprising an arrangement for transferring unsent packets from an old access point to a new access point, in which arrangement the access point of a terminal to the network changes during an active connection, the arrangement comprising: means for buffering at the old access point the packets which the old access point has not sent to the terminal before change of access point; means for establishing a connection from the old access point to the new access point; means for transferring the buffered packets from the old access point to the new access point over said connection. The network is according to the invention characterized in that said

means for establishing a connection comprise means for generating a signalling required for said connection establishment in a third network element, which is responsible for controlling the change of access point; means for tunnelling said signalling to the old access point; means for transmitting said signalling from the old access point to the new access point.

Still another object of the invention is a handover method for handing a terminal over from an old access point to a new access point during an active connection in a packet-based connection-oriented communications network, the method comprising the steps of: establishing a connection between the terminal and the new access point; buffering at the old access point the packets which the old access point has not sent to the terminal before the change of access point; routing an extension from the old access point to the new access point; transferring the buffered packets from the old access point to the new access point over said extension. The method is according to the invention characterized in that said step of routing the extension comprises the steps of: generating a signalling required for the routing in a third network element, which is responsible for controlling the change of access point; tunnelling said signalling to the old access point; transmitting said signalling from the old access point to the new access point.

In the invention, a connection from an old access point to a new one is established dynamically, when it is required. However, instead of being controlled by the old access point, the connection establishment is controlled by a third network element, which is responsible for controlling the change of access point anyway. This third network element is typically a switch or a controlling element of a mobile network, which element already comprises the "intelligence" required for connection establishment. The third network element generates a necessary signalling and in a way "tunnels" this signalling to the old access point, which transmits the signalling forward without interpreting it. Thus the old access point can be made to send signalling messages and to establish a connection without needing any additional intelligence. The third network element controlling the change of access point knows the new access point and is thus able to address the signalling correctly. Tunnelling may comprise, for instance, an encapsulation of an original signalling message containing the address of the actual destination into a packet provided with the address of the old access point and sent to the old access point. The old access point decapsulates the signalling message from the packet and transmits

the signalling message forward on the basis of the actual destination address. A signalling response possibly sent from the new access point is addressed to the third network element and transmitted automatically over the old access point. After the connection has been established, the old access point sends the buffered unsent packets to the new access point, in response to a command sent by the third network element, for instance. Then the third network element can release the connection in the same way as described above, if it is not needed any longer. In another embodiment of the invention, the connection establishment according to the invention is used for carrying out a PE (Path Extension) handover. The PE handover extends an existing connection from the old access point to the new access point on the principle described above. In the PE handover, the connection established is not released, however, after the buffered packets have been sent to the new access point.

By means of the invention, the complexity of the access point (a base station, for instance) can be kept minimal, which makes the price more cost effective. On the other hand, the intelligence required in the third network element is already available, and therefore, the invention requires only some new functionality there. A connection can be established dynamically, by which a permanent reservation of network resources is avoided.

BRIEF DESCRIPTION OF THE FIGURES

The invention is now described in more detail by means of preferred embodiments with reference to the attached drawings, in which

Figure 1 illustrates an establishment of a connection according to the invention in a "make-break" handover in a wireless ATM network,

Figure 2 illustrates an establishment of a connection according to the invention in a path extension handover in a wireless ATM network.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is suitable for being used in all connection-oriented packet-based telecommunications networks, in which the access point of a terminal to the network may change as a consequence of the terminal moving during an active connection. Such telecommunications networks are for instance wireless packet networks and mobile networks, using a connection-oriented packet-based network as a transmission network between

base stations and controlling network elements. The primary application area of the invention is in ATM networks, wireless ATM networks in particular, and mobile networks using ATM technique in transmission networks.

With reference to Figure 1, a simple example is described, which illustrates how unsent ATM cells buffered at an old access point are transferred according to the invention to a new access point in a make-break handover in a wireless ATM network. Two base stations BTS1 and BTS2, i.e. access points, are connected to an ATM switch 10. Initially, it is assumed that a mobile station MS has a radio connection with the base station BTS1, and a virtual ATM connection 11 between the base station BTS1 and the ATM switch 10, and further, a virtual connection 14 over the ATM switch and the ATM network to another party. ATM cells are sent in downlink direction from the switch 10 to the base station BTS1, where they are buffered before they are sent over the radio path to the mobile station MS. An ATM layer and a physical layer MAC (Medium Access Control) preferably have a common cell buffer. It is assumed that the radio connection between the MS and BTS1 weakens so much that the MS is transferred by handover to a new base station BTS2. It is of no significance for the invention, what the criterion for the handover is or whether the mobile station MS or some network element, such as the switch 10, makes the decision on the handover. In the example of Figure 1, the switch 10 controls, however, at least the reestablishment of the connections on the network side. In a handover, a new radio connection is established between the MS and the new base station BTS1. In addition, a new virtual ATM connection 12 is established between the switch 10 and the new base station BTS2 in the make-break handover of Figure 1. The switch 10 switches a connection 13 to the new connection 12 in such a way that new cells coming from the other party are sent to the base station BTS2, where they are buffered, instead of being sent to the base station BTS1.

It is further assumed that the buffer of the old base station BTS1 contains cells which the BTS1 has not had time to send over the radio path to the mobile station MS before the handover. These "old" cells should be transferred to the new base station BTS2 and sent over the radio path to the MS before sending "new" cells received over the connection 12. In this way, loss of cells or change of cell order and thus retransmissions are avoided.

According to the invention, the switch 10 controls the establishment of the extension connection 13 between the old base station BTS1 and the

new base station BTS2. To be precise, the switch 10 creates signalling messages SETUP required for connection establishment and having an end point address BTS2. The switch 10 has participated in the handover, and therefore, it knows the new base station BTS2. The switch 10 "tunnels" the signalling messages over the connection 11 to the old base station BTS1, from where they are then sent over a signalling connection to the base station BTS2 on the basis of the end point address. Tunnelling may mean an encapsulation of the end point address into a message, which is routed through an intermediate address, called "tunnel" address. In this case, the intermediate address is BTS1. After the signalling has been tunnelled to the intermediate address BTS1, a decapsulation is performed, i.e. the signalling message is transmitted by the BTS1 forward by using the actual end address. In this way, a similar signalling is provided as if it were provided and sent by the BTS1 independently. By means of the invention, the BTS1 does not need to have the intelligence required for connection establishment. As a result of the connection establishment signalling sent by BTS1, a temporary virtual connection 3 is established between the BTS1 and BTS2. Response signalling from the base station BTS2 is transmitted via the base station BTS1 to the switch 10. In a preferred embodiment of the invention, the switch 10 then commands the base station BTS1 to send the old cells of the buffer to the new base station BTS2 over the connection 13. The BTS2 sends the cells over the radio path to the mobile station MS and starts then sending buffered new cells. After this, the connections 11 and 13 are unnecessary and they can be released. The release of the connection 13 can be performed from the switch 13 by means of the same tunnelling solution as the establishment. In other words, the switch 10 creates a release message and tunnels it to the base station BTS1, which then transmits the release message to the end point address BTS2. Upon releasing the connection 13, the connection 11 can be released in a normal way.

It shall be noted that it is not essential for the invention which type of tunnelling technique is used. For the invention, it is only essential that signalling messages created by the switch 10 can be transferred by tunnelling to the base station BTS1 to be sent forward, as if BTS1 had created and sent the messages itself. Otherwise, the signalling protocol used is a normal ATM signalling protocol. A tunnelling technique is described in (AF96-1699) Potter, Gilmurray (ORL), 1996, "Tunnelled Signalling for the Support of the Mobile ATM, ATM Forum Contribution 96-1699", incorporated herein with its cross-

references. ATM signalling and tunnelling are described in "ATM User-Network-Interface Specification", version 3.1, ATM Forum, 1994.

Referring to Figure 2, a simple example is described, which illustrates how unsent ATM cells buffered at an old access point are transferred according to the invention to a new access point in a Path Extension (PE) handover in a wireless ATM network. Two base stations BTS1 and BTS2, i.e. access points, are connected to an ATM switch 20. Initially, it is assumed that the mobile station MS has a radio connection with the base station BTS1 and a virtual ATM connection 21 between the base station BTS1 and the ATM switch 20, and a further virtual connection 23 through the ATM switch 20 and the ATM network to another party. ATM cells are sent in downlink direction from the switch 20 to the base station BTS1, where they are buffered before being sent over the radio path to the mobile station MS. It is assumed that the radio connection between the MS and the BTS1 weakens so much that the MS is transferred by handover to the new base station BTS2 in the same way as in Figure 1. In the handover, a new radio connection is established between the MS and the new base station BTS2. In the PE handover of Figure 2, a new virtual ATM connection 22 is additionally established between the old base station BTS1 and the new base station BTS2. The unsent cells remained in the buffer of the base station BTS1 and the new cells coming from the other party are transmitted over the connection 22 to the base station BTS2.

According to the invention, the switch 20 controls the establishment of an extension 22 between the old base station BTS1 and the new base station BTS2 on the same tunnelling principle as in Figure 1. To be precise, the switch 20 creates the signalling messages SETUP needed for connection establishment and tunnels them over the connection 21 to the old base station BTS1, which sends the signalling messages over a signalling connection to the base station BTS2. As a result of the connection establishment signalling sent by the BTS1, a temporary virtual connection 22 is established between the BTS1 and BTS2. In the preferred embodiment of the invention, the switch 10 then commands the base station BTS1 to send the old cells in the buffer over the connection 13 to the new base station BTS2. The BTS2 sends them over the radio path to the mobile station MS and then starts sending buffered new cells. In PE handover, the connections 21 and 22, which are needed also after the buffer of the base station BTS1 has been emptied, are not released as in Figure 1.

The invention thus enables an implementation of a PE handover without requiring any additional intelligence in the base station for establishing a connection.

The switch 10 or 20 described above may be any network element provided with an ATM switch function, such as a conventional switch of an ATM network, a switch of a wireless ATM network, or a controlling network element of another telecommunications network, provided with an ATM switch function. Examples of implementing a wireless ATM network and a mobile network using ATM technique are described e.g. in Finnish Patent Applications 971178 and 970602, incorporated herein as reference.

The figures and the description relating to them are only intended to illustrate the present invention. Accordingly, the invention and its embodiments are not restricted to the above examples, but they can vary within the scope of the claims.

CLAIMS

1. Method of transferring unsent packets from an old access point (BTS1) to a new access point (BTS2) in a packet-based connection-oriented telecommunications network, in which the access point of a terminal (MS) to the network may change during an active connection, the method comprising the steps of

buffering at the old access point (BTS1) the packets which the old access point has not sent to the terminal before change of access point,

establishing a connection (13) from the old access point (BTS1) to the new access point (BTS2),

transferring the buffered packets from the old access point (BTS1) to the new access point (BTS2) over said connection (13),

characterized in that said step of establishing a connection comprises the steps of

generating a signalling required for said connection establishment in a third network element (10, 20), which is responsible for controlling the change of access point,

tunnelling said signalling to the old access point (BTS1),

transmitting said signalling from the old access point (BTS1) to the new access point (BTS2).

2. Method according to claim 1, **characterized** in that the tunnelling comprises the steps of

encapsulating in the third network element (10, 20) a signalling message provided with an address of the actual destination into a packet provided with the address of the old access point,

sending the encapsulated signalling message to the old access point (BTS1),

decapsulating the signalling message at the old access point (BTS1),

transmitting the signalling message forward on the basis of the address of the actual destination.

3. Method according to claim 1 or 2, **characterized** by

creating a connection release message in the third network element (10, 20), after said buffered packets have been transferred from the old access point (BTS1) to the new access point (BTS2),

tunnelling the connection release message to the old access point (BTS1),

transmitting the connection release message from the old access point (BTS1) to the new access point (BTS2).

4. Method according to claim 1 or 2, **characterized** by

using said connection (13) as an extension of a path extension handover from the old access point (BTS1) to the new access point (BTS2).

5. Method according to claim 1, 2, 3 or 4, **characterized** in that the telecommunications network is an ATM-based network and the packets are ATM cells.

6. Packet-based connection-oriented communications network, comprising an arrangement for transferring unsent packets from an old access point (BTS1) to a new access point (BTS2), in which arrangement the access point of a terminal to the network changes during an active connection, the arrangement comprising

means for buffering at the old access point (BTS1) the packets which the old access point has not sent to the terminal before change of access point,

means for establishing a connection (13) from the old access point (BTS1) to the new access point,

means for transferring the buffered packets from the old access point (BTS1) to the new access point (BTS2) over said connection (13), **characterized** in that said means for establishing a connection comprise

means for generating a signalling required for said connection establishment in a third network element (10, 20), which is responsible for controlling the change of access point,

means for tunnelling said signalling to the old access point (BTS1),

means for transmitting said signalling from the old access point (BTS1) to the new access point (BTS2).

7. Network according to claim 6, **characterized** in that said tunnelling means comprise

means in the third network element (10, 20) for encapsulating a signalling message provided with the address of the actual destination into a packet provided with the address of the old access point (BTS1) and for sending the encapsulated signalling message to the old access point (BTS1),

means for decapsulating the signalling message at the old access point (BTS1) and for restoring the original signalling message to be transmitted forward on the basis of the actual destination address.

8. Network according to claim 6 or 7, **characterized** in that the arrangement additionally comprises

means for creating a connection release message in the third network element (10, 20), after said buffered packets have been transferred from the old access point (BTS1) to the new access point (BTS2),

means for tunnelling the connection release message to the old access point and for transmitting the connection release message from the old access point (BTS1) to the new access point (BTS2).

9. Network according to claim 6 or 7, **characterized** in that said connection is an extension of a path extension handover from the old access point (BTS1) to the new access point (BTS2).

10. Network according to claim 6, 7, 8 or 9, **characterized** in that the telecommunications network is an ATM-based network and the packets are ATM cells.

11. Network according to claim 10, **characterized** in that the telecommunications network is a wireless ATM network comprising mobile stations and at least one ATM switch, to which are connected base stations, and that said third network element is an ATM switch and the access points are base stations.

12. Network according to claim 10, **characterized** in that the telecommunications network is a mobile network, comprising mobile stations (MS), base stations (BTS), at least one controlling element of a mobile network and an ATM transmission network interconnecting said controlling element of the mobile network and the base stations, and that said third network element is said controlling element of the mobile network and/or an ATM switch of the ATM transmission network and the access points are base stations.

13. Handover method for handing a terminal over from an old access point to a new access point during an active connection in a packet-based connection-oriented telecommunications network, the method comprising the steps of

establishing a connection between the terminal and the new access point (BTS2),

buffering at the old access point (BTS1) the packets which the old access point has not sent to the terminal before the change of access point,

routing an extension (22) from the old access point (BTS1) to the new access point (BTS2),

transferring the buffered packets from the old access point to the new access point over said extension (22), **characterized** in that said step of routing the extension comprises the steps of

generating a signalling required for the routing in a third network element (10, 20), which is responsible for controlling the change of access point,

tunnelling said signalling to the old access point (BTS1),

transmitting said signalling from the old access point to the new access point (BTS2).

14. Method according to claim 13, **characterized** in that the tunnelling comprises the steps of

encapsulating, in the third network element (10, 20), a signalling message provided with the address of the actual destination into a packet provided with the address of the old access point,

sending the encapsulated signalling message to the old access point (BTS1),

decapsulating the signalling message at the old access point (BTS1),

transmitting the signalling message forward on the basis of the actual destination address.

15. Method according to claim 13 or 14, **characterized** in that the communications network is an ATM-based network and the packets are ATM cells.

Fig. 1

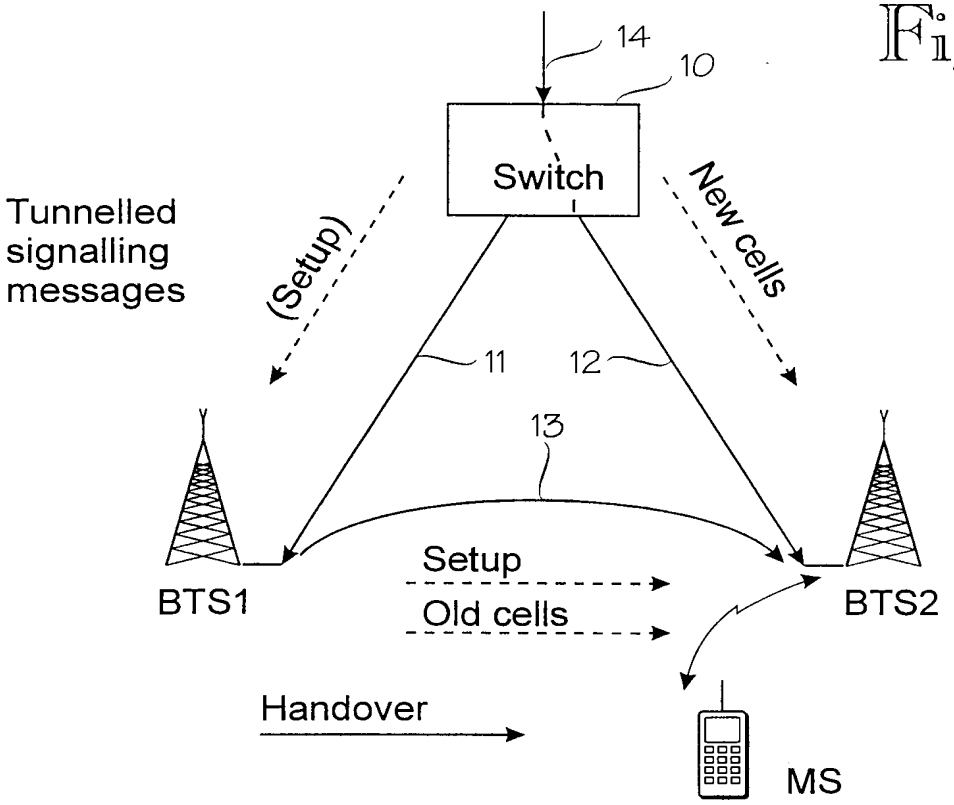
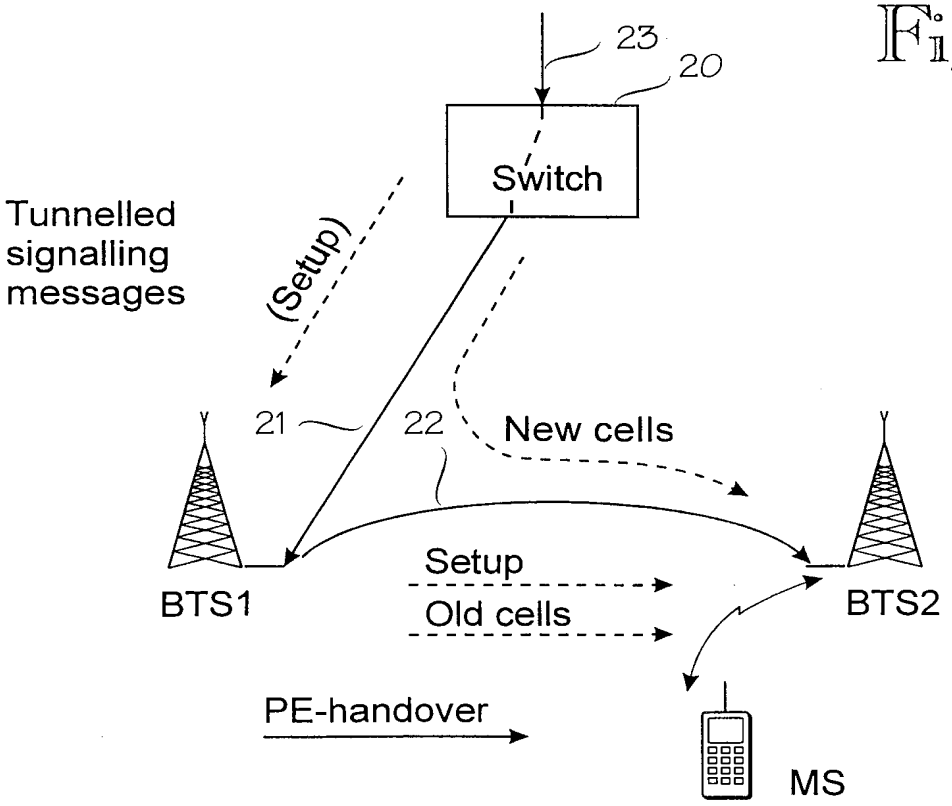

14
10
Switch
Tunnelled
signalling
messages
(Setup)
New cells
11
12
13
BTS1
BTS2
Setup
Old cells
Handover
MS

Fig. 2


23
20
Switch
Tunnelled
signalling
messages
(Setup)
21
22
New cells
BTS1
BTS2
Setup
Old cells
PE-handover
MS

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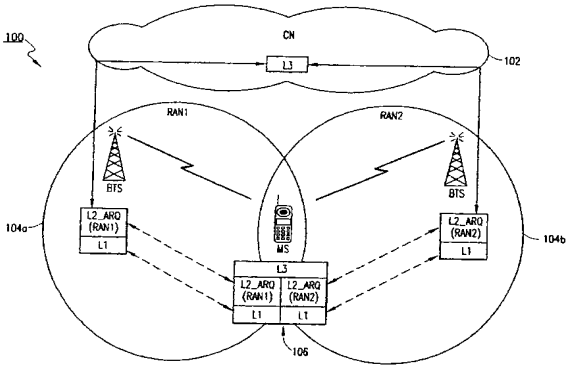

(57) Abstract: A technique for providing a secure link when transitioning between pairs of link layer protocol entities in a mobile communication system is disclosed. The first pair of link layer protocol entities includes a first transmitting link layer protocol entity and a first receiving link layer protocol entity. The second pair of link layer protocol entities includes a second transmitting link layer protocol entity and a second receiving link layer protocol entity. The technique is realized by first suspending data transmissions from the first transmitting link layer protocol entity to the first receiving link layer protocol entity, and then initiating data transmissions from the second transmitting link layer protocol entity to the second receiving link layer protocol entity. Unacknowledged segmented data in the first transmitting link layer protocol entity is then tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity.

WO 01/05121 A1

TECHNIQUE FOR PROVIDING A SECURE LINK IN A MOBILE COMMUNICATION SYSTEM

FIELD OF THE INVENTION

The present invention relates generally to mobile communication systems and, more particularly, to a technique for providing a secure link when transitioning from a first pair of link layer protocol entities to a second pair of link layer protocol entities in a mobile communication system.

BACKGROUND OF THE INVENTION

Referring to Figure 1, there is shown a schematic diagram of a typical cellular mobile communication system 10. The system 10 includes a Core Network (CN) 12, a Radio Access Network (RAN) 14, and a plurality of Mobile Stations (MS) 16. The RAN 14 is divided into controller nodes 18 and Base Transceiver Station (BTS) nodes 20. Of course, as will be appreciated by those having ordinary skill in the art, the RAN 14 may be made up of several RANs, each having one or more controller nodes 18 and BTS nodes 20. The hierarchy of the system is such that the CN 12 is connected to several controller nodes 18, each controller node 18 is connected to several BTS nodes 20, and each BTS node 20 services one or more MS 16.

Due to error characteristics associated with the radio interface between an MS 16 and a servicing BTS node 20, an Automatic Repeat Request (ARQ) protocol can optionally be executed between the MS 16 and the RAN 14 to reduce the residual error rate. The function of the ARQ protocol is to take care of errors that are introduced as a result of the radio interface (e.g., due to interference). However, when the MS 16 moves around within the system 10, a handover may occur that results in moving the execution of the ARQ protocol between different controller nodes 18. To insure that no user data is lost during a handover, certain mechanisms must be implemented. There are presently three known mechanisms for securing user data in the case of a handover of the ARQ protocol between different controller nodes 18.

In the first known mechanism for securing user data in the case of a handover of the ARQ protocol between different controller nodes 18, which is adequately described by R. Cohen et al. in "Handover in a Micro-Cell Packet Switched Mobile Network", ACM Journal of Wireless Networks, Vol. 2, No. 1, 1996, pp. 13-25, and by E. Ayanoglu et al. in "AIRMAIL: A Link-Layer Protocol for Wireless Networks", ACM/Baltzer Wireless Networks Journal, Vol. 1, 1995, pp. 47-60, when the handover is performed, the entire protocol state, including the state variables and buffers, from the ARQ protocol entity in the RAN 14 are moved/transferred from an origination controller node 18 to a destination controller node 18. Using this mechanism, the ARQ protocol entity in the MS 16 does not need to know when the handover occurs. In the case of a General Packet Radio Service (GPRS) system having two or more Serving GPRS Support Nodes (SGSN's) wherein an inter-SGSN handover takes place, only the downlink buffer is moved/transferred from the origination SGSN to the destination SGSN, and the protocol states of the buffers are synchronized between the MS 16 and the destination SGSN by means of handover signaling (see GSM 03.60 - "Service Description").

The main benefits of this first mechanism are that no unnecessary re-transmission of the user data is required over the radio interface, and that the ARQ protocol in the MS 16 can be unaware of the handover, which also makes the implementation less expensive. However, this first mechanism is limited to intra-system handovers, where the same ARQ protocol with the same configuration is used throughout the system. Thus, it will no longer be useful in future systems where it will be possible to use different ARQ protocol configurations within the same RAN, and where there can be different sizes of protocol data units (PDU's) associated with the different ARQ protocol configurations. In addition, it can be very complex to move an entire protocol state.

In the second known mechanism for securing user data in the case of a handover of the ARQ protocol between different controller nodes 18, which is specifically used in GPRS systems, the user data is secured by having 2 levels of ARQ protocols in the system 10. The first ARQ protocol, called a Radio Link Control

(RLC) protocol, is executed between an MS 16 and the RAN 14 (e.g., at a Base Station Controller (BSC) node) and is used to take care of errors that are introduced as a result of the radio interface (see GSM 04.60 - "Radio Link Control / Medium Access Control"). The second ARQ protocol, called a Logical Link Control (LLC) protocol, is executed between an MS 16 and the CN 12 (e.g., at an SGSN node)(see GSM 04.64 - "Logical Link Control (LLC) Layer Specification"). When a handover takes place, potentially lost user data is retransmitted by the ARQ protocol within the LLC protocol. The RLC protocol, on the other hand, is re-started in both the MS 16 and the BSC when a handover is performed.

The main benefit of this second mechanism is that it can handle inter-system handovers. However, this second mechanism has major disadvantages. For instance, unnecessary radio resources are wasted due to the overhead associated with the second ARQ protocol. In GPRS, the overhead that is transmitted with a third layer (L3) PDU is on the order of 7 bytes. This can be compared to the size of a Van Jacobsen compressed Transmission Control Protocol (TCP) acknowledgment, which is under 10 bytes when using a Point-to-Point Protocol (PPP). Thus, when transmitting TCP acknowledgments in an L3 PDU, the size is almost doubled. Another disadvantage of this second mechanism is that the cost in terms of memory and processing power of having 2 levels of ARQ protocols in the MS 16 is significantly higher than for a single ARQ protocol.

In the third known mechanism for securing user data in the case of a handover of the ARQ protocol between different controller nodes 18, which is adequately described by R. Ludwig et al. in European Patent Application No. _____ (Client Reference No.: Ericsson Technical Document No. UW/T-98:289), entitled "L2_ARQ Protocol Handover Mechanisms", a sender of second layer (L2) ARQ protocol PDUs is required to keep all the L2 PDUs, carrying an L3 PDU, in a buffer until the whole L3 PDU has been acknowledged. Then, when a handover is performed, all the L3 PDUs are moved to the new L2_ARQ protocol entity, which then segments these L3 PDUs into new L2 PDUs and retransmits them.

Similar to the second mechanism, the main benefit of this third mechanism is that it can handle inter-system handovers. However, this third mechanism also has major disadvantages. For instance, extra buffer space is required because the sender of the L2_ARQ protocol PDUs is required to keep all the L2 PDUs, carrying a L3 PDU, in a buffer until the whole L3 PDU has been acknowledged. Also, when a handover takes place, all L2 PDUs of an L3 PDU are retransmitted by the new L2_ARQ protocol. That is, even the L2 PDUs which were previously acknowledged are retransmitted. This is of course not optimal and a major disadvantage of this third mechanism.

In view of the foregoing, it would be desirable to provide a technique for providing a secure link between a mobile station and a core network during a handover or a protocol reconfiguration in a mobile communication system which overcomes the above-described inadequacies and shortcomings. More particularly, it would be desirable to provide a technique for providing a secure link between a mobile station and a core network during a handover or a protocol reconfiguration in a mobile communication system which does not transfer the entire state of an ARQ protocol, which does not use a second ARQ protocol level, which does not retransmit L2_ARQ PDUs which have already been acknowledged, and which does not need to store already acknowledged L2_ARQ PDUs in a buffer of the sending L2_ARQ protocol entity.

SUMMARY OF THE INVENTION

According to the present invention, a technique for providing a secure link when transitioning from a first pair of link layer protocol entities to a second pair of link layer protocol entities in a mobile communication system is provided. The first pair of link layer protocol entities includes a first transmitting link layer protocol entity for segmenting data and transmitting segmented data, and a first receiving link layer protocol entity for receiving segmented data from the first transmitting link layer protocol entity and acknowledging the received segmented data. The second pair of link layer protocol entities includes a second transmitting link layer protocol entity for

segmenting data and transmitting segmented data, and a second receiving link layer protocol entity for receiving segmented data from the second transmitting link layer protocol entity and acknowledging the received segmented data. Both the first pair of link layer protocol entities and the second pair of link layer protocol entities are preferably automatic repeat request protocol entities.

The transition from the first pair of link layer protocol entities to the second pair of link layer protocol entities can be due to a variety of reasons such as, for example, a handover in the mobile communication system or a protocol reconfiguration in the mobile communication system. The first pair of link layer protocol entities can utilize the same protocol as the second pair of link layer protocol entities, or the first pair of link layer protocol entities can utilize a different protocol than the second pair of link layer protocol entities. If the first pair of link layer protocol entities utilizes the same protocol as the second pair of link layer protocol entities, the first pair of link layer protocol entities can still be configured differently than the second pair of link layer protocol entities.

In a preferred embodiment, the technique is realized by first suspending data transmissions from the first transmitting link layer protocol entity to the first receiving link layer protocol entity, and then initiating data transmissions from the second transmitting link layer protocol entity to the second receiving link layer protocol entity. The unacknowledged segmented data in the first transmitting link layer protocol entity is then tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity.

In accordance with other aspects of the present invention, the first pair of link layer protocol entities can be controlled by at least one first control protocol entity, and the second pair of link layer protocol entities can be controlled by at least one second control protocol entity. The data transmissions from the first transmitting link layer protocol entity to the first receiving link layer protocol entity can then be suspended by the at least one first control protocol entity, and the data transmissions from the second transmitting link layer protocol entity to the second receiving link layer

protocol entity can then be initiated by the at least one second control protocol entity. It should be noted that the at least one first control protocol entity and the at least one second control protocol entity can be the same control protocol entity.

In accordance with further aspects of the present invention, untransmitted unsegmented data in the first transmitting link layer protocol entity is preferably transferred from the first transmitting link layer protocol entity to the second transmitting link layer protocol entity. Alternatively, untransmitted unsegmented data in the first transmitting link layer protocol entity can be segmented and then transferred from the first transmitting link layer protocol entity to the second transmitting link layer protocol entity for tunneling. Meanwhile, segmented data in the first transmitting link layer protocol entity can be assembled and transferred from the first transmitting link layer protocol entity to the second transmitting link layer protocol entity.

In accordance with still further aspects of the present invention, a status message can be sent from the first receiving link layer protocol entity to the first transmitting link layer protocol entity prior to tunneling the unacknowledged segmented data from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity. Also, the first receiving link layer protocol entity can be notified of the end of the unacknowledged segmented data to be tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity. If the first pair of link layer protocol entities are controlled by at least one first control protocol entity, and the second pair of link layer protocol entities are controlled by at least one second control protocol entity, then a sequence number of a last unacknowledged data segment in the first transmitting link layer protocol entity can be sent from the at least one first control protocol entity to the at least one second control protocol entity to notify the first receiving link layer protocol entity of the end of the unacknowledged segmented data to be tunneled from the first transmitting link layer protocol entity to the first receiving

link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity. Alternatively, an indication of the number of tunneled unacknowledged segmented data can be sent from the at least one first control protocol entity to the at least one second control protocol entity to notify the first receiving link layer protocol entity of the end of the unacknowledged segmented data tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity. Alternatively still, an indication of the amount of tunneled unacknowledged segmented data can be sent from the at least one first control protocol entity to the at least one second control protocol entity to notify the first receiving link layer protocol entity of the end of the unacknowledged segmented data tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity.

In accordance with still further aspects of the present invention, a sequence number of a last unacknowledged data segment in the first transmitting link layer protocol entity can be sent from the first transmitting link layer protocol entity to the first receiving link layer protocol entity prior to tunneling the unacknowledged segmented data to notify the first receiving link layer protocol entity of the end of the unacknowledged segmented data to be tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity. Alternatively, a message indicating that the previous tunneled unacknowledged segmented data was the last tunneled unacknowledged segmented data can be sent from the first transmitting link layer protocol entity to the first receiving link layer protocol entity after the last tunneled unacknowledged segmented data to notify the first receiving link layer protocol entity of the end of the unacknowledged segmented data to be tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol

entity and the second receiving link layer protocol entity. Alternatively still, a message containing an indication of the amount of tunneled unacknowledged segmented data can be sent from the second transmitting link layer protocol entity to the second receiving link layer protocol entity to notify the first receiving link layer protocol entity of the end of the unacknowledged segmented data tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity. Alternatively even still, a message containing a sequence number of a last unacknowledged data segment in the first transmitting link layer protocol entity can be sent from the second transmitting link layer protocol entity to the second receiving link layer protocol entity prior to tunneling the unacknowledged segmented data to notify the first receiving link layer protocol entity of the end of the unacknowledged segmented data to be tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity. If such is the case, the sequence number is signaled to the second transmitting link layer protocol entity from the first transmitting link layer protocol entity prior to sending the message, and then signaled to the first receiving link layer protocol entity from the second receiving link layer protocol entity after sending the message. Alternatively even still, an indication of the number of tunneled unacknowledged segmented data can be sent from the second transmitting link layer protocol entity to the second receiving link layer protocol entity to notify the first receiving link layer protocol entity of the end of the unacknowledged segmented data tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity. If such is the case, the number of tunneled unacknowledged segmented data is signaled to the second transmitting link layer protocol entity from the first transmitting link layer protocol entity prior to sending the indication, and then signaled to the first receiving link layer protocol entity from the second receiving link layer protocol entity after sending the indication.

In accordance with still further aspects of the present invention, the end of the unacknowledged segmented data to be tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity can be signaled to the second transmitting link layer protocol entity from the first transmitting link layer protocol entity. A message indicating the end of the unacknowledged segmented data to be tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity can then be sent from the second transmitting link layer protocol entity to the second receiving link layer protocol entity. The end of the unacknowledged segmented data to be tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity can then be signaled to the first receiving link layer protocol entity from the second receiving link layer protocol entity.

In accordance with still further aspects of the present invention, the first pair of link layer protocol entities can be terminated after all of the unacknowledged segmented data has been tunneled. Alternatively, the first pair of link layer protocol entities can be terminated after a predetermined period of time.

In accordance with still further aspects of the present invention, unacknowledged segmented data in the first transmitting link layer protocol entity can be tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity by first sending the unacknowledged segmented data from the first transmitting link layer protocol entity to the second transmitting link layer protocol entity. The unacknowledged segmented data is then transmitted from the second transmitting link layer protocol entity to the second receiving link layer protocol entity. The unacknowledged segmented data is then sent

from the second receiving link layer protocol entity to the first receiving link layer protocol entity.

In accordance with still further aspects of the present invention, the unacknowledged segmented data can be marked before it is transmitted from the second transmitting link layer protocol entity to the second receiving link layer protocol entity. The unacknowledged segmented data can be marked utilizing, for example, a length indicator field in an acknowledged mode data protocol data unit, or a special field in a control protocol data unit.

In accordance with still further aspects of the present invention, the unacknowledged segmented data can be transmitted from the second transmitting link layer protocol entity to the second receiving link layer protocol entity over a dedicated communication link. The unacknowledged segmented data is preferably transmitted from the second transmitting link layer protocol entity to the second receiving link layer protocol entity before any higher layer data so as to insure sequence order integrity.

In accordance with still further aspects of the present invention, tunneled unacknowledged segmented data is typically combined with acknowledged segmented data in the first receiving link layer protocol entity, and the combined segmented data is then assembled. The assembled combined data can then be sent directly to a higher layer protocol entity. Alternatively, the assembled combined data can be sent to a higher layer protocol entity through the second receiving link layer protocol entity. In any event, the assembled combined data is preferably sent to a higher layer protocol entity before the second receiving link layer protocol entity sends any data to the higher layer protocol entity so as to insure sequence order integrity. Also, the second receiving link layer protocol entity can be notified that all the assembled combined data has been sent to the higher layer protocol entity so as to insure sequence order integrity.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to facilitate a fuller understanding of the present invention, reference is now made to the appended drawings. These drawings should not be construed as limiting the present invention, but are intended to be exemplary only.

Figure 1 is a schematic diagram of a typical mobile cellular system including a Core Network (CN), a Radio Access Network (RAN), and a plurality of Mobile Stations (MS).

Figure 2 is an illustration of a generic protocol stack for showing specific protocols on different hierarchical layers that are used within a cellular mobile communication system in accordance with the present invention.

Figure 3 is a schematic diagram of a cellular mobile communication system including a CN, two different RANs, and an MS which are involved in a technique for providing a secure link between an MS and a CN during handover scenarios or L2_ARQ protocol reconfigurations in accordance with the present invention.

Figure 4 is a flowchart showing data being transferred between two L2_ARQ protocol entities over an air interface.

Figure 5 is a flowchart showing data being transferred between two new L2_ARQ protocol entities over an air interface just after a handover or an L2_ARQ protocol reconfiguration has taken place in accordance with the present invention.

Figure 6 is a signaling chart for a handover scenario in accordance with the present invention.

Figure 7 shows the format of an L2_ARQ Acknowledged Mode Data (AMD) PDU in accordance with the present invention. Figure 8 shows the format of an L2_ARQ Control PDU in accordance with the present invention.

Figure 9 is a schematic diagram of an exemplary protocol entity processing device for implementing the signaling involved in a handover or a protocol reconfiguration in a mobile communication system in accordance with the present invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Referring to Figure 2, there is shown a generic protocol stack 50 which will be used in this detailed description to refer to specific protocols on different hierarchical layers that are used within a cellular mobile communication system operating in accordance with the present invention. It should be noted, however, that the present invention is not limited to the use of any one particular protocol on any of the different hierarchical layers. For instance, the L3 layer is used to refer to any network protocol such as, for example, Internet Protocol (IP). However, the L3 layer may also include a framing protocol such as, for example, Point-to-Point Protocol (PPP). The L3 layer may further include a control plane protocol such as, for example, Radio Resource Control (RRC), which is used in a Universal Mobile Telecommunication System (UMTS). Thus, the L3 layer refers to any protocol that produces a protocol data unit (PDU) that is transferred to the layer below, which in this case is the L2_ARQ layer.

The L2_ARQ layer is used to refer to a link layer protocol such as, for example, Radio Link Control (RLC), that potentially segments L3 PDUs into smaller L2_ARQ PDUs and/or concatenates several L3 PDUs into L2_ARQ PDUs and implements ARQ functionality on the basis of these L2_ARQ PDUs. Whatever protocol the L2_ARQ layer represents, the L2_ARQ protocol follows rules regarding the retransmission of L2_ARQ PDUs. For example, for any form of ARQ, the sending L2_ARQ has to buffer each L2_ARQ PDU until the receiving L2_ARQ positively acknowledges the receipt of same. Upon receiving the acknowledgment, the sending L2_ARQ is allowed to delete the acknowledged L2_ARQ PDU from its send buffer.

The L2_ARQ protocol may have several different operational modes such as, for example, unreliable, semi-reliable, and fully reliable, for the transmission of higher layer data (i.e., L3 PDUs). The latter two modes can either be combined with in-sequence or out-of-sequence delivery operation.

The L1 layer is used to refer to the physical layer of a radio link. It can be any radio transmission technology used in today's or future mobile communication networks (e.g., GSM, UMTS, or wireless LANs).

In state-of-the-art cellular mobile communication systems, there exist two peer entities of the L2_ARQ protocol, one running in a Mobile Station (MS) and one in a Radio Access Network (RAN). Examples of such systems are the Global System for Mobile Communications (GSM) / General Packet Radio Service (GPRS) and the UMTS systems, and the L2_ARQ protocol in both is the RLC protocol.

Referring to Figure 3, there is shown a cellular mobile communication system 100 which will be used in this detailed description to describe a technique for providing a secure link between an MS and a Core Network (CN) during handover scenarios or L2_ARQ protocol reconfigurations in accordance with the present invention. The system 100 comprises a CN 102, which is connected to two different RANs 104, and an MS 106. As seen in Figure 3, L3 PDUs are transmitted between the MS 106 and the CN 102 through different L2_ARQ protocols depending on the currently used RAN 104. The technique described in this detailed description is not limited to the number of RANs 104 that are connected to the CN 102. That is, any number of RANs 104 are allowed by the technique described herein.

It is assumed that there exists peer-to-peer communication between any two L2_ARQ protocol entities for all of the different RANs 104 which are involved. The peer entities are executed in the MS 106 and in a network node of each RAN 104 which is involved. It is also assumed that handover can take place both within one RAN 104 (intra-system), and between different types of RANs 104 (inter-system). In either case, when a handover occurs, the execution point for the L2_ARQ protocol entity may be moved to a new physical network node where a new L2_ARQ protocol entity is started which continues the communication with a new L2_ARQ peer. Optionally, an old restarted/reinitialized L2_ARQ protocol entity may be used.

After a handover or an L2_ARQ protocol reconfiguration (e.g., a Radio Access Bearer (RAB) reconfiguration) has occurred, unacknowledged L2_ARQ PDUs in the old sending L2_ARQ protocol entity are tunneled through the new L2_ARQ protocol entities to the old receiving L2_ARQ protocol entity. That is, after a handover or an L2_ARQ protocol reconfiguration has occurred, the old L2_ARQ protocol entities enter into a tunneling state wherein they do not perform any ARQ functions but still

communicate data via the new L2_ARQ protocol entities. In this tunneling state, the old L2_ARQ PDUs are tunneled via the new L2_ARQ protocol entities to the old receiving L2_ARQ protocol entity, which reassembles the old L2_ARQ PDUs into L3 PDUs and delivers them to the receiving L3 protocol entity. After all the old L2_ARQ PDUs have been tunneled via the new L2_ARQ protocol entities to the old receiving L2_ARQ protocol entity, reassembled into L3 PDUs, and then delivered to the receiving L3 protocol entity, the old L2_ARQ protocol entities are terminated.

The above-described technique requires that a complete L3 PDU is either transmitted through the old sending L2_ARQ protocol entity or through the new sending L2_ARQ protocol entity. Thus, the last PDU in the old sending L2_ARQ protocol entity consists of a last segment of an old L3 PDU and possibly padding. On the receiving side, the new receiving L2_ARQ protocol entity receives new L2_ARQ PDUs from the new sending L2_ARQ protocol entity and reassembles them into L2_ARQ SDUs. The new L2_ARQ protocol entities have to distinguish between L2_ARQ SDUs containing new L3 PDUs and L2_ARQ SDUs containing tunneled old L2_ARQ PDUs. This can be achieved by marking the PDUs and/or the SDUs, or by other means of signaling. New L2_ARQ PDUs that contain tunneled old L2_ARQ PDUs are reassembled into old L2_ARQ PDUs and passed along to the old receiving L2_ARQ protocol entity. New L2_ARQ PDUs that contain new L3 PDUs are reassembled into L3 PDUs and delivered to the receiving L3 protocol entity.

The above-described technique can be better understood with reference to Figures 4 and 5. Figure 4 shows data being transferred between two L2_ARQ protocol entities over an air interface. Both the sending L2_ARQ protocol entity (i.e., L2_ARQ 1a) and the receiving L2_ARQ protocol entity (i.e., L2_ARQ 1b) comprise an SDU data buffer 110 and a PDU data buffer 112. It shall be understood that these buffers are only logical buffers used for explaining the present invention. The data in the sending L2_ARQ protocol entity SDU data buffer 110a is higher layer data (i.e., L3 PDUs). This data has yet not been segmented into L2_ARQ PDUs or transmitted over the air interface by the sending L2_ARQ protocol entity (i.e., L2_ARQ 1a). The data in the sending L2_ARQ protocol entity PDU data buffer 112a consists of

L2_ARQ PDUs. A PDU encapsulates either a part of an SDU or a full SDU. This is referred to as segmentation. If several SDUs are part of a PDU, then the several SDUs are referred to as being concatenated within the PDU.

It is assumed that an SDU resides in the sending L2_ARQ protocol entity SDU data buffer 110a until it is segmented and potentially concatenated and transferred to the sending L2_ARQ protocol entity PDU data buffer 112a. At that point, the whole SDU is moved into the sending L2_ARQ protocol entity PDU data buffer 112a. The PDUs sent from the sending L2_ARQ protocol entity (i.e., L2_ARQ 1a) over the air interface have to be acknowledged by the receiving L2_ARQ protocol entity (i.e., L2_ARQ 1b). When the sending L2_ARQ protocol entity receives an acknowledgement for a PDU, that PDU is discarded from the sending L2_ARQ protocol entity PDU data buffer 112a.

With the above definition of the buffers, it is understood that the sending L2_ARQ protocol entity PDU data buffer 112a may encapsulate both whole SDUs and parts of SDUs depending on what PDUs have been acknowledged by the sending L2_ARQ protocol entity. The data in the receiving L2_ARQ protocol entity PDU data buffer 112b will reside there until a whole SDU can be assembled. At that point, the assembled SDU will be transferred to the receiving L2_ARQ protocol entity SDU data buffer 110b.

Figure 5 shows data being transferred between two new L2_ARQ protocol entities over an air interface just after a handover or an L2_ARQ protocol reconfiguration has taken place in accordance with the present invention. Both the old sending L2_ARQ protocol entity (i.e., L2_ARQ 1a) and the old receiving L2_ARQ protocol entity (i.e., L2_ARQ 1b) comprise an old SDU data buffer 114 and an old PDU data buffer 116. Similarly, both the new sending L2_ARQ protocol entity (i.e., L2_ARQ 2a) and the new receiving L2_ARQ protocol entity (i.e., L2_ARQ 2b) comprise a new SDU data buffer 118 and a new PDU data buffer 120. In this scenario, the old sending L2_ARQ protocol entity determines if PDUs in the old sending L2_ARQ protocol entity PDU data buffer 116a need to be reassembled into SDUs. If so, the reassembled SDUs are transferred to the old sending L2_ARQ protocol entity

SDU data buffer 114a. The old sending L2_ARQ protocol entity SDU data buffer 114a will then contain SDUs encapsulating L3 PDUs, which are denoted as S1 in Figure 5. These SDUs (S1) in the old sending L2_ARQ protocol entity SDU data buffer 114a are then transferred along path 115 to the new sending L2_ARQ protocol entity SDU buffer 118a. Meanwhile, any PDUs remaining the old sending L2_ARQ protocol entity PDU data buffer 116a, which are denoted as P1 in Figure 5, are transferred along path 117 from the old sending L2_ARQ protocol entity PDU data buffer 116a to the new sending L2_ARQ protocol entity SDU data buffer 118a. These PDUs (P1) from the old sending L2_ARQ protocol entity PDU data buffer 116a serve as SDUs in the new sending L2_ARQ protocol entity. Additionally, new L3 PDUs are transferred directly between L3 and the new sending L2_ARQ protocol entity SDU data buffer 118a along path 119 after the handover/reconfiguration has occurred.

The data in the new sending L2_ARQ protocol entity SDU data buffer 118a is segmented and sent to the new sending L2_ARQ protocol entity PDU data buffer 120a. The data in the new sending L2_ARQ protocol entity PDU data buffer 120a is sent across the air interface to the new receiving L2_ARQ protocol entity PDU data buffer 120b. The data in the new receiving L2_ARQ protocol entity PDU data buffer 120b is assembled and sent to the new receiving L2_ARQ protocol entity SDU data buffer 118b. The data in the new receiving L2_ARQ protocol entity SDU data buffer 118b is either sent to the receiving L3 protocol entity or is sent to the old receiving L2_ARQ protocol entity PDU data buffer 116b. Any data in the old receiving L2_ARQ protocol entity PDU data buffer 116b is assembled and sent to the old receiving L2_ARQ protocol entity SDU data buffer 114b and then to the receiving L3 protocol entity.

Thus, in accordance with the present invention, any data (P1) which was residing in the old sending L2_ARQ protocol entity PDU data buffer 116a and transferred along path 117 from the old sending L2_ARQ protocol entity PDU data buffer 116a to the new sending L2_ARQ protocol entity SDU data buffer 118a at the time of the handover/reconfiguration is logically tunneled through tunnel 121 from the

old sending L2_ARQ protocol entity PDU data buffer 116a to the old receiving L2_ARQ protocol entity PDU data buffer 116b.

There are mechanisms implemented in the new receiving L2_ARQ protocol entity which allow the new receiving L2_ARQ protocol entity to distinguish between L2_ARQ SDUs encapsulating tunneled old L2_ARQ PDUs and L2_ARQ SDUs encapsulating new L3 PDUs. These mechanisms are needed by the new receiving L2_ARQ protocol entity to correctly send the assembled L2_ARQ SDUs to the right buffer: the SDU data buffer 118b for new L3 PDUs and the PDU data buffer 116b for tunneled old L2_ARQ PDUs. This can be done by marking the PDUs and/or the SDUs, or, alternatively, by other rules combined with signaling.

If there is a rule that the data (P1) in the old sending L2_ARQ protocol entity PDU data buffer 116a is placed first in the new sending L2_ARQ protocol entity SDU data buffer 118a, then the new sending L2_ARQ protocol entity only needs to signal the number of L2_ARQ SDUs, or the number of new L2_ARQ PDUs, that encapsulate the tunneled old L2_ARQ PDUs in order for the receiver to distinguish between L3 PDUs and tunneled old L2_ARQ PDUs. The new receiving L2_ARQ protocol entity will then implicitly know where to send each assembled L2_ARQ SDU without having marked the PDUs and/or the SDUs. If concatenation of several L2_ARQ SDUs within a L2_ARQ PDU is supported by the new L2_ARQ protocol entities, together with signaling the number of new L2_ARQ PDUs including tunneled old L2_ARQ PDUs, then an additional rule will have to be defined. This rule defines that it is not possible to encapsulate a whole new L3 PDU in the last new L2_ARQ PDU including a tunneled old L2_ARQ PDU.

When marking is done there exist at least two different solutions. One solution is to allow two separate L2_ARQ PDU types, one corresponding to the new L3 PDUs and one corresponding to the PDUs that originate from the old sending L2_ARQ protocol entity (see description of Figure 7 below). Another solution is to add a one bit field to the L2_ARQ SDU. This field can be set to one if the L2_ARQ SDU is actually a PDU from the old sending L2_ARQ protocol entity, and it can be cleared to zero if it is a new L3 PDU.

The old and the new sending L2_ARQ protocol entities must be able to communicate with each other, just as the old and the new receiving L2_ARQ protocol entities must be able to communicate with each other. These communication links are necessary to establish the tunneling state in accordance with the present invention. The communication links are logical links which can be divided into several physical links. For example, the L2_ARQ network protocol entities could be in different nodes of the radio access network and the logical link could be established via several physical links involving several network nodes of the radio access network and/or the core network. Alternatively, both protocol entities could reside in the same node and even in the same hardware/software (e.g., in the same processing device wherein the logical link could be one or several device components (see Figure 9)). In order to establish in-sequence delivery, the old receiving L2_ARQ protocol entity must signal to the new receiving L2_ARQ protocol entity that all of the old L2_ARQ PDUs are received correctly, reassembled into L3 PDUs, and delivered to the receiving L3 protocol entity. Only after that is the new receiving L2_ARQ protocol entity allowed to send SDUs to higher layers (i.e., the receiving L3 protocol entity).

When in the tunneling state, the old receiving L2_ARQ protocol entity needs to have knowledge about when the last old L2_ARQ PDU from the old sending L2_ARQ protocol entity has arrived. The present invention allows such information to be passed from the old sending L2_ARQ protocol entity to the old receiving L2_ARQ protocol entity.

One way to do this is by a rule stating that tunneled old L2_ARQ PDUs are placed first in the new receiving L2_ARQ protocol entity SDU data buffer 118b combined with signaling of the number of PDUs or SDUs holding tunneled old L2_ARQ PDUs. Then the new receiving L2_ARQ protocol entity implicitly knows when there are no more tunneled old L2_ARQ PDUs coming because it must be able to distinguish between L2_ARQ SDUs encapsulating new L3 PDUs and L2_ARQ SDUs encapsulating tunneled old L2_ARQ PDUs.

Another way to do this is to communicate the highest sequence number of the last old L2_ARQ PDU of the old sending L2_ARQ protocol entity to the old receiving

L2_ARQ protocol entity. This sequence number may be transferred from the old sending L2_ARQ protocol entity to the old receiving L2_ARQ protocol entity via any appropriate signaling. Four solutions as to how this can be done are given below.

A first solution to this would be to signal the sequence number through a control protocol entity. This implies of course that the old L2_ARQ protocol entities inform the control protocol entity about this sequence number.

A second solution to this would be to send the sequence number in a special PDU (identified by a PDU Type field) containing the sequence number from the old sending L2_ARQ protocol entity to the old receiving L2_ARQ protocol entity. This special PDU could be the first message to be transmitted before any L2_ARQ PDUs are tunneled. This special PDU is sent via the tunnel as well.

A third solution to this would be to send a special PDU (identified by a PDU Type field) after the last tunneled old L2_ARQ PDU from the old sending L2_ARQ protocol entity to the old receiving L2_ARQ protocol entity. This special PDU would indicate that the previous L2_ARQ PDU was the last L2_ARQ PDU to be tunneled. This special PDU is sent via the tunnel as well.

A fourth solution to this would be to send the sequence number in a special PDU (identified by a PDU Type field) containing the sequence number from the new sending L2_ARQ protocol entity to the new receiving L2_ARQ protocol entity. This special PDU would be the first message to be transmitted before any L2_ARQ PDUs are tunneled. The sequence number needs to be signaled from the old sending L2_ARQ protocol entity to the new sending L2_ARQ protocol entity and from the new receiving L2_ARQ protocol entity to the old receiving L2_ARQ protocol entity.

The knowledge about when the last tunneled L2_ARQ PDU has been received is used on the receiving side to know when the old receiving L2_ARQ protocol entity may be terminated. It is also necessary to enable in-sequence delivery of L3 PDUs at the receiver. The old receiving L2_ARQ protocol entity has to deliver all its data to the receiving L3 protocol entity and then indicate that it has finished before the new receiving L2_ARQ protocol entity may start delivering data to the receiving L3 protocol entity.

Referring to Figure 6, there is shown a signaling chart 130 for a handover scenario in accordance with the present invention. The particular example shown in Figure 6 is based upon a UMTS system and involves a User Equipment Radio Resource Control protocol entity 132 (UE RRC), a first User Equipment Radio Link Control protocol entity 134 (UE RLC1), a second User Equipment Radio Link Control protocol entity 136 (UE RLC2), a first Network Radio Link Control protocol entity 140 (NW RLC1), a second Network Radio Link Control protocol entity 138 (NW RLC2), a first Network Radio Resource Control protocol entity 142 (NW RRC1), and a second Network Radio Resource Control protocol entity 144 (NW RRC2). During a handover, the UE RRC entity 132 sends a cell update message 146 (CELL UPDATE) to the NW RRC1 entity 142. In response, the NW RRC1 entity 142 requests the NW RRC2 entity 144 to set up a new RLC protocol entity using a configuration request message 148 (RRC_RLC_CONFIG.req). The NW RRC2 entity 144 then sets up the NW RLC2 entity 138 using a configuration request message 150 (CRLC_CONFIG.req). After the NW RLC2 entity 138 has been set up, the NW RRC2 entity 144 confirms the creation of the NW RLC2 entity 138 with the NW RRC1 entity 142 using a configuration confirmation message 152 (RRC_RLC_CONFIG.cfm). The NW RLC1 entity 140 is then suspended by the NW RRC1 entity 142 using a suspension request message 154 (CRLC_SUSPEND.req), which causes the NW RLC1 entity 140 to stop transmitting data and enter into the tunneling state described above. Next, the unsegmented SDUs in the NW RLC1 entity 140 are sent to the SDU buffer of the NW RLC2 entity 138 via an SDU transfer message 156 (SDU TRANSFER). A cell update confirmation message 158 (CELL UPDATE CONFIRM) is then sent from the NW RRC1 entity 142 to the UE RRC entity 132. The cell update confirmation message 158 (CELL UPDATE CONFIRM) may contain an indication of the sequence number of the last PDU in the NW RLC1 entity 140.

Upon receipt of the cell update confirmation message 158 (CELL UPDATE CONFIRM), the UE RRC entity 132 sets up the UE RLC2 entity 136 using a configuration request message 160 (CRLC_CONFIG.req). In addition, the UE RLC1

entity 134 is suspended by the UE RRC entity 132 using a suspension request message 162 (CRLC_SUSPEND.req), which causes the UE RLC1 entity 134 to stop transmitting data and enter into the tunneling state described above. Next, the unsegmented SDUs in the UE RLC1 entity 134 are sent to the SDU buffer of the UE RLC2 entity 136 via an SDU transfer message 164 (SDU TRANSFER). A cell update completion message 166 (CELL UPDATE COMPLETE) is then sent from the UE RRC entity 132 to the NW RRC1 entity 142. The cell update completion message 166 (CELL UPDATE COMPLETE) may contain an indication of the sequence number of the last PDU in the UE RLC1 entity 134.

At this point, there is no data transfer between the UE RLC1 entity 134 and the NW RLC1 entity 140. That is, the UE RLC2 entity 136 and the NW RLC2 entity 138 now perform the data transfer functions. However, any data remaining in the UE RLC1 entity 134 may now be tunneled through the UE RLC2 entity 136 once the UE RLC1 entity 134 receives a tunneling request message 168 (CRLC_TUNNELING.req) from the UE RRC entity 132. Likewise, any data remaining in the NW RLC1 entity 140 may now be tunneled through NW RLC2 entity 138 once the NW RLC1 entity 140 receives a tunneling request message 170 (CRLC_TUNNELING.req) from the NW RRC1 entity 142. It is desirable to start the tunneling with a status report, indicating which PDUs were received correctly, so that these need not be tunneled. For example, the UE RLC1 entity 134 sends a status report message 172 (STATUS) to the NW RLC1 entity 140, while the NW RLC1 entity 140 sends a status report message 174 (STATUS) to the UE RLC1 entity 134. The status report message 172 may also contain an indication of the sequence number of the last PDU in the UE RLC1 entity 134. Similarly, the status report message 174 may also contain an indication of the sequence number of the last PDU in the NW RLC1 entity 140.

After all the data in the UE RLC1 entity 134 has been tunneled and transmitted correctly, the UE RLC1 entity 134 indicates the same to the UE RRC entity 132 using a configuration indication message 176 (CRLC_CONFIG.ind). The UE RRC entity 132 then releases the UE RLC1 entity 134 using a configuration request message 180 (CRLC_CONFIG.req). Similarly, after all the data in the NW RLC1 entity 140 has

been tunneled and transmitted correctly, the NW RLC1 entity 140 indicates the same to the NW RRC1 entity 142 using a configuration indication message 178 (CRLC_CONFIG.ind). The NW RRC1 entity 142 then releases the NW RLC1 entity 140 using a configuration request message 182 (CRLC_CONFIG.req).

At this point it should be noted that if in-sequence delivery is necessary, the UE RLC2 entity 136 and the NW RLC2 entity 138 should be notified that all UE RLC1 PDUs and all NW RLC1 PDUs have been received, respectively. After that, the UE RLC2 entity 136 and the NW RLC2 entity 138 can send the UE RLC2 SDUs and the NW RLC2 SDUs to higher layers, respectively.

At this point it should also be noted that the suspension request message 154 (CRLC_SUSPEND.req) and the suspension request message 162 (CRLC_SUSPEND.req) are somewhat misleading. In general, a protocol entity may be suspended, and then later may be resumed. In the particular example shown in Figure 6, however, the RLC1 entities 134 and 140 do not resume, but rather enter a tunneling state.

Referring to Figure 7, there is shown a format of an L2_ARQ Acknowledged Mode Data (AMD) PDU 190, wherein L2_ARQ could be, for example, a Radio Link Control (RLC) protocol entity. The AMD PDU 190 includes a data/control (D/C) bit 192, indicating if the PDU is an AMD PDU or a Control PDU, a sequence number (SN) field 194, a poll (P) bit 196, a header compression (H) bit 198, one or more extension (E) bits 200, zero or more length indicator fields 202, one or more data segments 204, and an optional field 206 containing padding (PAD) or a piggybacked status PDU (STATUS PDU). The extension bits 200 and the length indicator fields 202 can be of particular interest with respect to the present invention. The extension bit 200a indicates whether the next field will be data or a length indicator. The length indicator field 202 is used when concatenation or padding takes place in the PDU. In either case, it indicates where the concatenation or padding starts. If concatenation takes place, the length indicator field 202 indicates the border between the two higher layer segments. If padding takes place, the length indicator field 202 is assigned a specific value. The extension bit 200b is then set to indicate that the next octet will

be yet another length indicator. The length indicator field 202 will then indicate the border between data and padding.

One of the length indicator fields 202 can also be used to indicate whether the data segments 204 contain tunneled RLC PDUs or L3 PDUs. To indicate the transport of tunneled RLC PDUs, the length indicator field 202 can be assigned a specific and reserved value.

Referring to Figure 8, there is shown a format of an L2_ARQ Control PDU 220, wherein again L2_ARQ could be, for example, a Radio Link Control (RLC) protocol entity. The Control PDU 220 includes a data/control (D/C) bit 222, indicating if the PDU is an AMD PDU or a Control PDU, a PDU Type field 224, specifying the type of control message, a reserved field 226, zero or more Specific Control Fields 228, depending on the type of control message, and padding (PAD) 230 to fill in the rest of the Control PDU 220. The Control PDU 220 can be used to transfer the sequence number of the last untransmitted segmented L2_ARQ PDU of the old sending L2_ARQ protocol entity to the old receiving L2_ARQ protocol entity. The control message can be defined as either a PDU of the old L2_ARQ link, which is then tunneled via the new L2_ARQ link, or a PDU of the new L2_ARQ link, in which case a sequence number is signaled between the old and new L2_ARQ protocol entities. In order to define such a control message, a specific value for the PDU Type field 224 is defined and the Specific Control Field 228 contains the sequence number.

At this point it should be noted that the signaling associated with the above-described handover scenario is typically controlled by processors acting upon instructions stored in or transmitted to associated memory devices. For example, referring to Figure 9, each of the above-described protocol entities may have an associated processing device 210 having at least one processor (P) 212, memory (M) 214, and input/output (I/O) device 216, connected to each other by a bus 218, for implementing the signaling involved in the above-described handover scenario.

The present invention is not to be limited in scope by the specific embodiments described herein. Indeed, various modifications of the present invention, in addition to those described herein, will be apparent to those of skill in the art from the

foregoing description and accompanying drawings. Thus, such modifications are intended to fall within the scope of the appended claims.

What is claimed is:

1. A method for providing a secure link when transitioning from a first pair of link layer protocol entities to a second pair of link layer protocol entities in a mobile communication system, the first pair of link layer protocol entities including a first transmitting link layer protocol entity for segmenting data and transmitting segmented data and a first receiving link layer protocol entity for receiving segmented data from the first transmitting link layer protocol entity and acknowledging the received segmented data, the second pair of link layer protocol entities including a second transmitting link layer protocol entity for segmenting data and transmitting segmented data and a second receiving link layer protocol entity for receiving segmented data from the second transmitting link layer protocol entity and acknowledging the received segmented data, the method comprising the steps of:

suspending data transmissions from the first transmitting link layer protocol entity to the first receiving link layer protocol entity;

initiating data transmissions from the second transmitting link layer protocol entity to the second receiving link layer protocol entity; and

tunneling unacknowledged segmented data in the first transmitting link layer protocol entity from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity.

2. The method as defined in claim 1, further comprising the step of:

transferring untransmitted unsegmented data in the first transmitting link layer protocol entity from the first transmitting link layer protocol entity to the second transmitting link layer protocol entity.

3. The method as defined in claim 1, further comprising the step of:

segmenting untransmitted unsegmented data in the first transmitting link layer protocol entity;

transferring the untransmitted segmented data in the first transmitting link layer protocol entity from the first transmitting link layer protocol entity to the second transmitting link layer protocol entity for tunneling.

4. The method as defined in claim 1, further comprising the step of:

assembling segmented data in the first transmitting link layer protocol entity; and

transferring the assembled segmented data in the first transmitting link layer protocol entity from the first transmitting link layer protocol entity to the second transmitting link layer protocol entity.

5. The method as defined in claim 1, wherein the first pair of link layer protocol entities are controlled by at least one first control protocol entity, and the second pair of link layer protocol entities are controlled by at least one second control protocol entity, wherein the data transmissions from the first transmitting link layer protocol entity to the first receiving link layer protocol entity are suspended by the at least one first control protocol entity, and the data transmissions from the second transmitting link layer protocol entity to the second receiving link layer protocol entity are initiated by the at least one second control protocol entity.

6. The method as defined in claim 5, wherein the at least one first control protocol entity and the at least one second control protocol entity are the same control protocol entity.

7. The method as defined in claim 1, further comprising the step of:

sending a status message from the first receiving link layer protocol entity to the first transmitting link layer protocol entity prior to tunneling the unacknowledged segmented data from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity.

8. The method as defined in claim 1, further comprising the step of:

notifying the first receiving link layer protocol entity of the end of the unacknowledged segmented data to be tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity.

9. The method as defined in claim 8, wherein the first pair of link layer protocol entities are controlled by at least one first control protocol entity, and the second pair of link layer protocol entities are controlled by at least one second control protocol entity, further comprising the step of:

sending a sequence number of a last unacknowledged data segment in the first transmitting link layer protocol entity from the at least one first control protocol entity to the at least one second control protocol entity to notify the first receiving link layer protocol entity of the end of the unacknowledged segmented data to be tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity.

10. The method as defined in claim 8, wherein the first pair of link layer protocol entities are controlled by at least one first control protocol entity, and the second pair of link layer protocol entities are controlled by at least one second control protocol entity, further comprising the step of:

sending from the at least one first control protocol entity to the at least one second control protocol entity an indication of the number of tunneled unacknowledged segmented data to notify the first receiving link layer protocol entity of the end of the unacknowledged segmented data tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity.

11. The method as defined in claim 8, further comprising the step of:

sending a sequence number of a last unacknowledged data segment in the first transmitting link layer protocol entity from the first transmitting link layer protocol entity to the first receiving link layer protocol entity prior to tunneling the unacknowledged segmented data to notify the first receiving link layer protocol entity of the end of the unacknowledged segmented data to be tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity.

12. The method as defined in claim 8, further comprising the step of:

sending a message from the first transmitting link layer protocol entity to the first receiving link layer protocol entity after the last tunneled unacknowledged segmented data indicating that the previous tunneled unacknowledged segmented data was the last tunneled unacknowledged segmented data to notify the first receiving link layer protocol entity of the end of the unacknowledged segmented data to be tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity.

13. The method as defined in claim 8, further comprising the step of:

sending a message containing a sequence number of a last unacknowledged data segment in the first transmitting link layer protocol entity from the second transmitting link layer protocol entity to the second receiving link layer protocol entity prior to tunneling the unacknowledged segmented data to notify the first receiving link layer protocol entity of the end of the unacknowledged segmented data to be tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity.

14. The method as defined in claim 13, further comprising the steps of:

signaling the sequence number to the second transmitting link layer protocol entity from the first transmitting link layer protocol entity prior to sending the message; and

signaling the sequence number to the first receiving link layer protocol entity from the second receiving link layer protocol entity after sending the message.

15. The method as defined in claim 8, further comprising the step of:

sending from the second transmitting link layer protocol entity to the second receiving link layer protocol entity an indication of the number of tunneled unacknowledged segmented data to notify the first receiving link layer protocol entity of the end of the unacknowledged segmented data tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity.

16. The method as defined in claim 15, further comprising the steps of:

signaling the number of tunneled unacknowledged segmented data to the second transmitting link layer protocol entity from the first transmitting link layer protocol entity prior to sending the indication; and

signaling the number of tunneled unacknowledged segmented data to the first receiving link layer protocol entity from the second receiving link layer protocol entity after sending the indication.

17. The method as defined in claim 8, further comprising the step of:

sending a message from the second transmitting link layer protocol entity to the second receiving link layer protocol entity containing an indication of the amount of tunneled unacknowledged segmented data to notify the first receiving link layer protocol entity of the end of the unacknowledged segmented data tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol

entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity.

18. The method as defined in claim 8, wherein the first pair of link layer protocol entities are controlled by at least one first control protocol entity, and the second pair of link layer protocol entities are controlled by at least one second control protocol entity, further comprising the step of:

sending from the at least one first control protocol entity to the at least one second control protocol entity an indication of the amount of tunneled unacknowledged segmented data to notify the first receiving link layer protocol entity of the end of the unacknowledged segmented data tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity.

19. The method as defined in claim 8, further comprising the steps of:

signaling to the second transmitting link layer protocol entity from the first transmitting link layer protocol entity the end of the unacknowledged segmented data to be tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity;

sending a message from the second transmitting link layer protocol entity to the second receiving link layer protocol entity indicating the end of the unacknowledged segmented data to be tunneled from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity; and

signaling to the first receiving link layer protocol entity from the second receiving link layer protocol entity the end of the unacknowledged segmented data to be tunneled from the first transmitting link layer protocol entity to the first receiving

link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity.

20. The method as defined in claim 8, further comprising the step of:

terminating the first pair of link layer protocol entities after all of the unacknowledged segmented data has been tunneled.

21. The method as defined in claim 1, further comprising the step of:

terminating the first pair of link layer protocol entities after a predetermined period of time.

22. The method as defined in claim 1, wherein the transition from the first pair of link layer protocol entities to the second pair of link layer protocol entities is due to a handover in the mobile communication system.

23. The method as defined in claim 1, wherein the transition from the first pair of link layer protocol entities to the second pair of link layer protocol entities is due to a protocol reconfiguration in the mobile communication system.

24. The method as defined in claim 23, wherein the first pair of link layer protocol entities utilize the same protocol as the second pair of link layer protocol entities.

25. The method as defined in claim 24, wherein the first pair of link layer protocol entities is configured differently than the second pair of link layer protocol entities.

26. The method as defined in claim 23, wherein the first pair of link layer protocol entities utilize a different protocol than the second pair of link layer protocol entities.

27. The method as defined in claim 1, wherein the step of tunneling unacknowledged segmented data in the first transmitting link layer protocol entity

from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity includes the steps of:

sending the unacknowledged segmented data from the first transmitting link layer protocol entity to the second transmitting link layer protocol entity;

transmitting the unacknowledged segmented data from the second transmitting link layer protocol entity to the second receiving link layer protocol entity; and

sending the unacknowledged segmented data from the second receiving link layer protocol entity to the first receiving link layer protocol entity.

28. The method as defined in claim 27, further comprising the step of:

marking the unacknowledged segmented data before it is transmitted from the second transmitting link layer protocol entity to the second receiving link layer protocol entity.

29. The method as defined in claim 28, wherein the unacknowledged segmented data is marked utilizing a length indicator field in an acknowledged mode data protocol data unit.

30. The method as defined in claim 28, wherein the unacknowledged segmented data is marked utilizing a special field in a control protocol data unit.

31. The method as defined in claim 27, wherein the unacknowledged segmented data is transmitted from the second transmitting link layer protocol entity to the second receiving link layer protocol entity over a dedicated communication link.

32. The method as defined in claim 27, wherein the unacknowledged segmented data is transmitted from the second transmitting link layer protocol entity to the second receiving link layer protocol entity before any higher layer data so as to insure sequence order integrity.

33. The method as defined in claim 1, further comprising the step of:

combining tunneled unacknowledged segmented data with acknowledged segmented data in the first receiving link layer protocol entity; and

assembling the combined segmented data.

34. The method as defined in claim 33, further comprising the step of:

sending the assembled combined data directly to a higher layer protocol entity.

35. The method as defined in claim 33, further comprising the step of:

sending the assembled combined data to a higher layer protocol entity through the second receiving link layer protocol entity.

36. The method as defined in claim 33, further comprising the step of:

sending the assembled combined data to a higher layer protocol entity before the second receiving link layer protocol entity sends any data to the higher layer protocol entity so as to insure sequence order integrity.

37. The method as defined in claim 36, further comprising the step of:

notifying the second receiving link layer protocol entity that all the assembled combined data has been sent to the higher layer protocol entity so as to insure sequence order integrity.

38. The method as defined in claim 1, wherein the first pair of link layer protocol entities and the second pair of link layer protocol entities are automatic repeat request protocol entities.

39. An apparatus for providing a secure link when transitioning between pairs of link layer protocol entities in a mobile communication system, the apparatus comprising:

a first pair of link layer protocol entities, the first pair of link layer protocol entities including a first transmitting link layer protocol entity for segmenting data and transmitting segmented data and a first receiving link layer protocol entity for receiving segmented data from the first transmitting link layer protocol entity and acknowledging the received segmented data; and

a second pair of link layer protocol entities, the second pair of link layer protocol entities including a second transmitting link layer protocol entity for segmenting data and transmitting segmented data and a second receiving link layer protocol entity for receiving segmented data from the second transmitting link layer protocol entity and acknowledging the received segmented data;

wherein the first pair of link layer protocol entities are configured to suspend data transmissions from the first transmitting link layer protocol entity to the first receiving link layer protocol entity when transitioning from the first pair of link layer protocol entities to the second pair of link layer protocol entities;

wherein the second pair of link layer protocol entities are configured to initiate data transmissions from the second transmitting link layer protocol entity to the second receiving link layer protocol entity when transitioning from the first pair of link layer protocol entities to the second pair of link layer protocol entities; and

wherein the first pair of link layer protocol entities and the second pair of link layer protocol entities are configured to tunnel unacknowledged segmented data in the first transmitting link layer protocol entity from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity after transitioning from the first pair of link layer protocol entities to the second pair of link layer protocol entities.

40. An article of manufacture for providing a secure link when transitioning from a first pair of link layer protocol entities to a second pair of link layer protocol entities in a mobile communication system, the first pair of link layer protocol entities including a first transmitting link layer protocol entity for segmenting data and

transmitting segmented data and a first receiving link layer protocol entity for receiving segmented data from the first transmitting link layer protocol entity and acknowledging the received segmented data, the second pair of link layer protocol entities including a second transmitting link layer protocol entity for segmenting data and transmitting segmented data and a second receiving link layer protocol entity for receiving segmented data from the second transmitting link layer protocol entity and acknowledging the received segmented data, the article of manufacture comprising:

at least one processor readable carrier; and

instructions carried on the at least one carrier; wherein the instructions are configured to be readable from the at least one carrier by at least one processor and thereby cause the at least one processor to operate so as to:

suspend data transmissions from the first transmitting link layer protocol entity to the first receiving link layer protocol entity;

initiate data transmissions from the second transmitting link layer protocol entity to the second receiving link layer protocol entity; and

tunnel unacknowledged segmented data in the first transmitting link layer protocol entity from the first transmitting link layer protocol entity to the first receiving link layer protocol entity through the second transmitting link layer protocol entity and the second receiving link layer protocol entity.

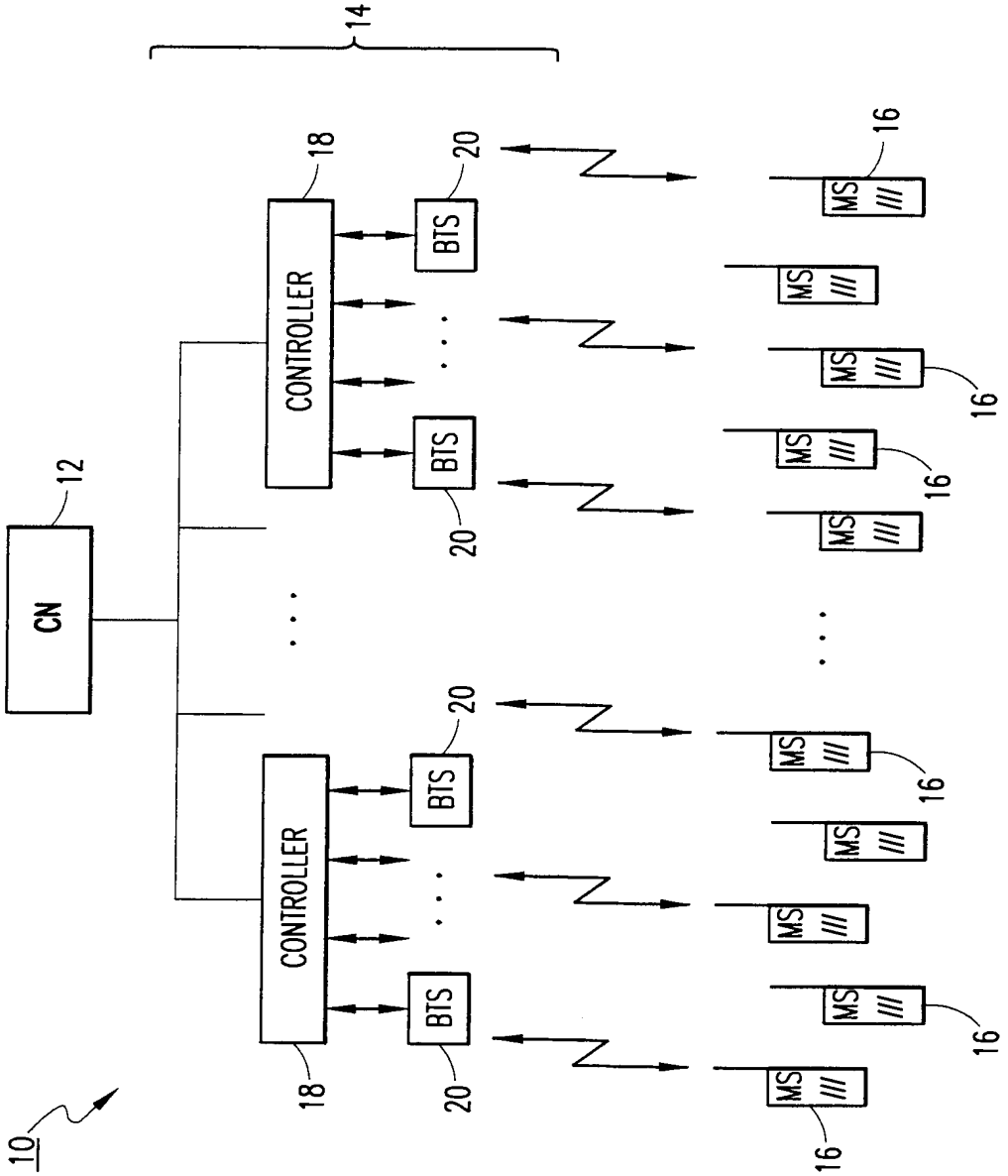

FIG. 1
(PRIOR ART)

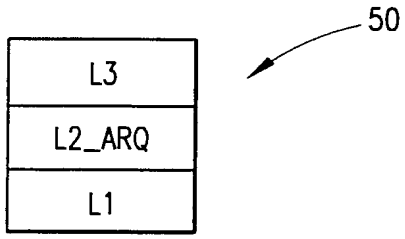
50
L3
L2_ARQ
L1

FIG. 2

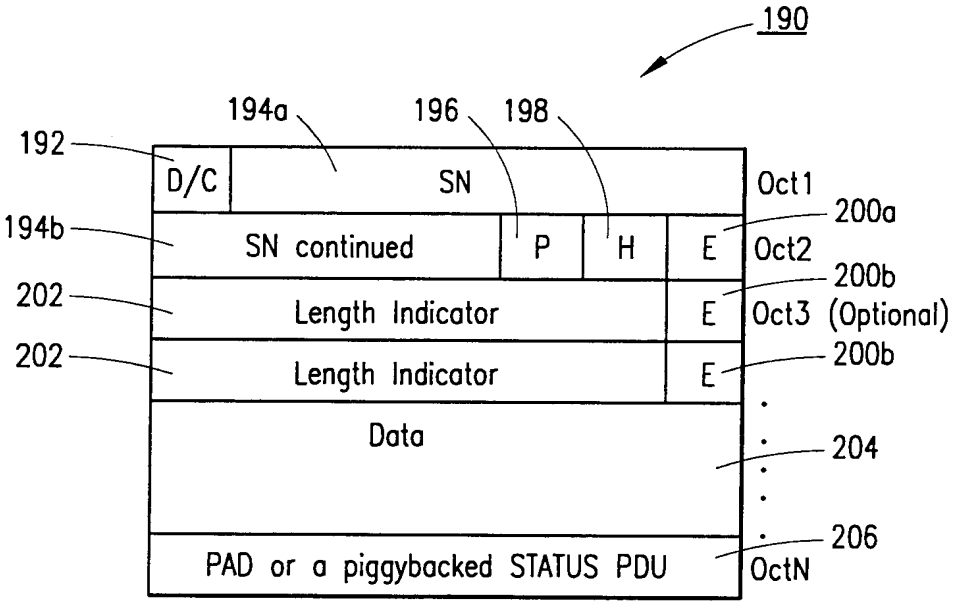
190
194a
196
198
192
D/C
SN
Oct1
200a
194b
SN continued
P
H
E
Oct2
200b
202
Length Indicator
E
Oct3 (Optional)
202
Length Indicator
E
200b
Data
204
206
PAD or a piggybacked STATUS PDU
OctN

FIG. 7

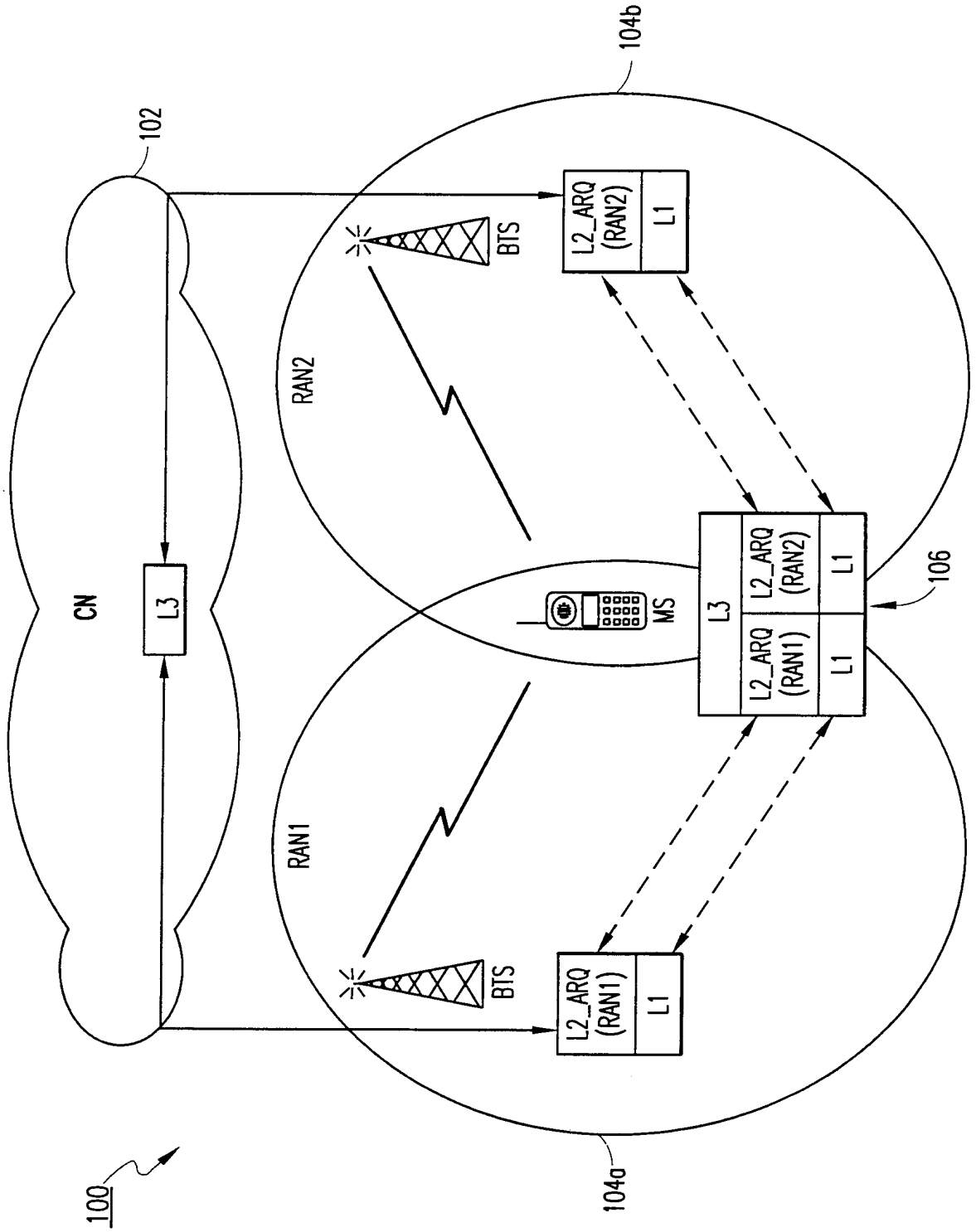
100
102
CN
L3
104b
RAN2
BTS
L2_ARQ (RAN2)
L1
MS
L3
L2_ARQ (RAN2)
L1
L2_ARQ (RAN1)
L1
106
RAN1
BTS
L2_ARQ (RAN1)
L1
104a

FIG. 3

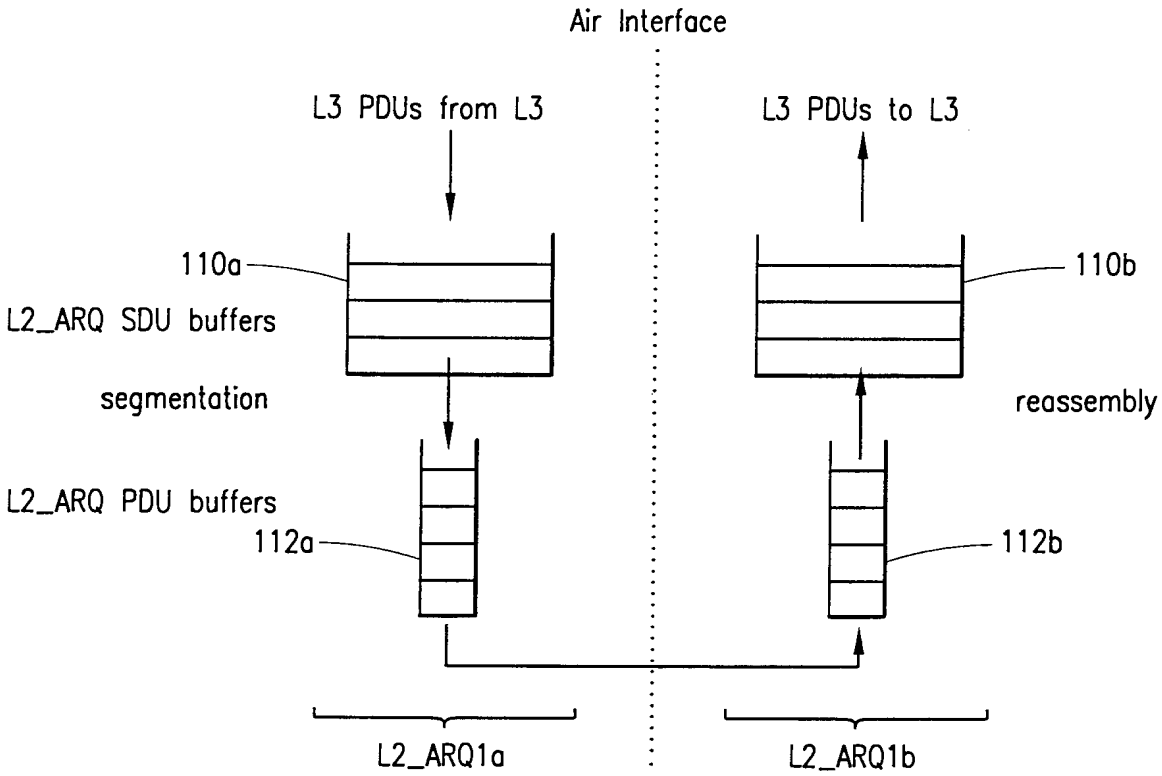
Air Interface
L3 PDUs from L3
L3 PDUs to L3
110a
110b
L2_ARQ SDU buffers
segmentation
reassembly
L2_ARQ PDU buffers
112a
112b
L2_ARQ1a
L2_ARQ1b

FIG. 4

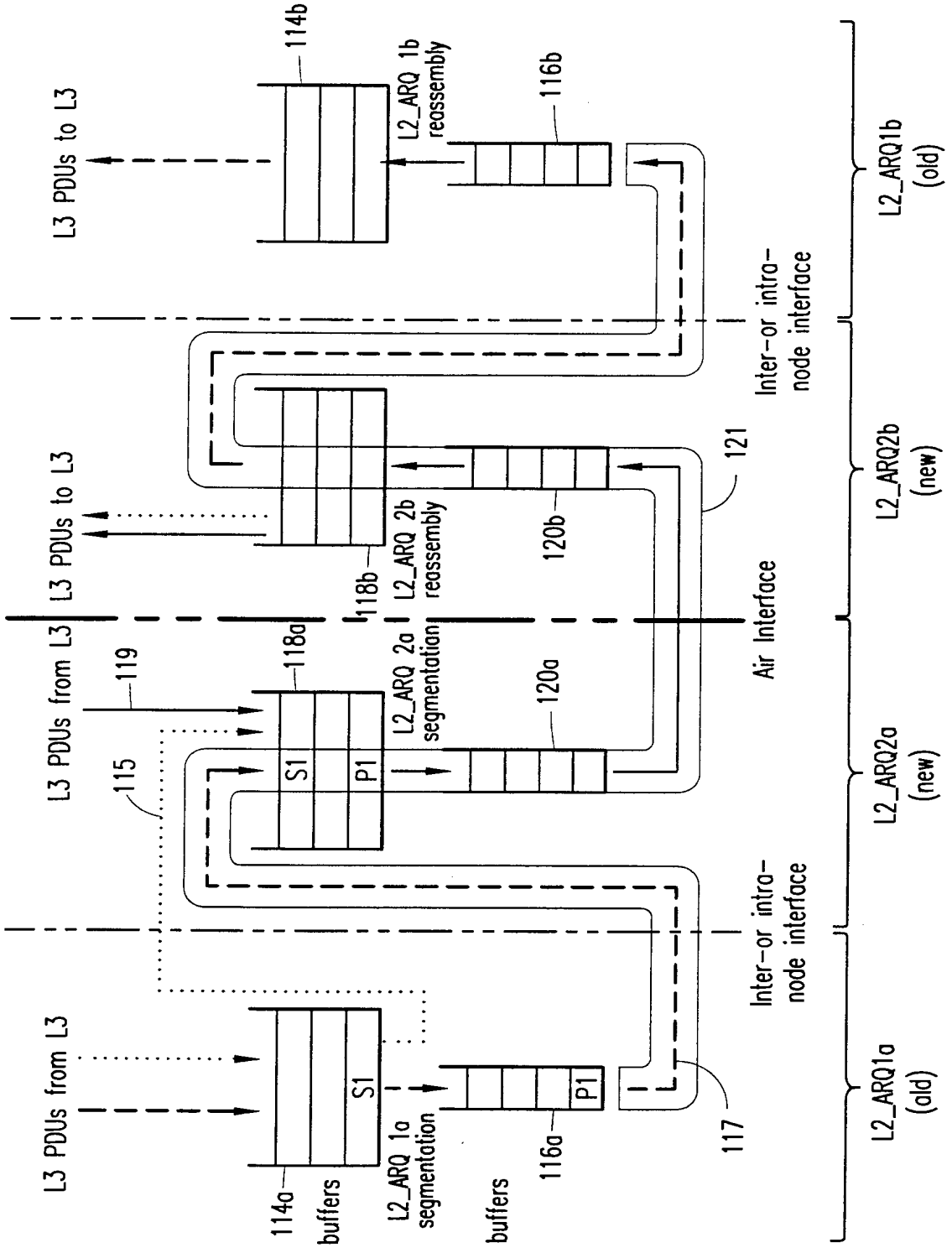
L3 PDUs to L3
L3 PDUs from L3
L2_ARQ SDU buffers
L2_ARQ PDU buffers
L2_ARQ 1a segmentation
L2_ARQ 1b reassembly
L2_ARQ 2a segmentation
L2_ARQ 2b reassembly
Air Interface
Inter-or intra-node interface
L2_ARQ1a (old)
L2_ARQ1b (old)
L2_ARQ2a (new)
L2_ARQ2b (new)
S1
P1
114a
114b
116a
116b
117
118a
118b
119
120a
120b
121
115

FIG. 5

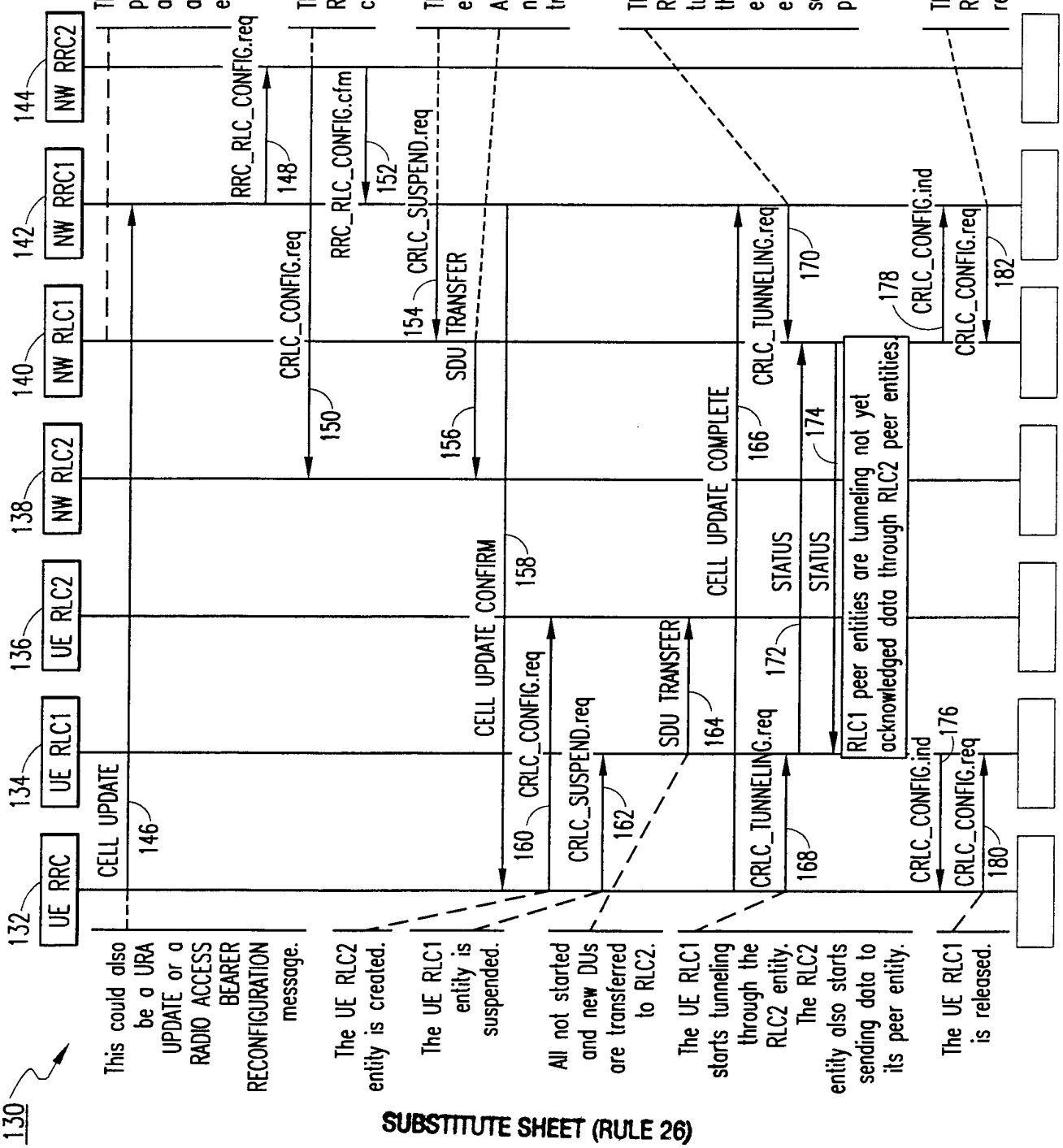
130
132 UE RRC
134 UE RLC1
136 UE RLC2
138 NW RLC2
140 NW RLC1
142 NW RRC1
144 NW RRC2
CELL UPDATE
146
RRC_RLC_CONFIG.req
148
RRC_RLC_CONFIG.cfm
152
CRLC_CONFIG.req
150
CRLC_SUSPEND.req
154
SDU TRANSFER
156
CELL UPDATE CONFIRM
158
CRLC_CONFIG.req
160
CRLC_SUSPEND.req
162
SDU TRANSFER
164
CELL UPDATE COMPLETE
166
CRLC_TUNNELING.req
170
CRLC_TUNNELING.req
168
172
STATUS
174
STATUS
RLC1 peer entities are tunneling not yet acknowledged data through RLC2 peer entities
178
CRLC_CONFIG.ind
CRLC_CONFIG.req
182
CRLC_CONFIG.ind
176
CRLC_CONFIG.req
180
This could also be a URA UPDATE or a RADIO ACCESS BEARER RECONFIGURATION message.
The two RLC1 peer entities are already established and maybe exchanging data.
The network RLC2 entity is created.
The UE RLC2 entity is created.
The network RLC1 entity is suspended.
All not started and new SDUs are transfered to RLC2.
The UE RLC1 entity is suspended.
All not started and new DUs are transferred to RLC2.
The network RLC1 starts tunneling through the RLC2 entity. The RLC2 entity also starts sending data to its peer entity.
The UE RLC1 starts tunneling through the RLC2 entity. The RLC2 entity also starts sending data to its peer entity.
The network RLC1 entity is released.
The UE RLC1 is released.

FIG. 6

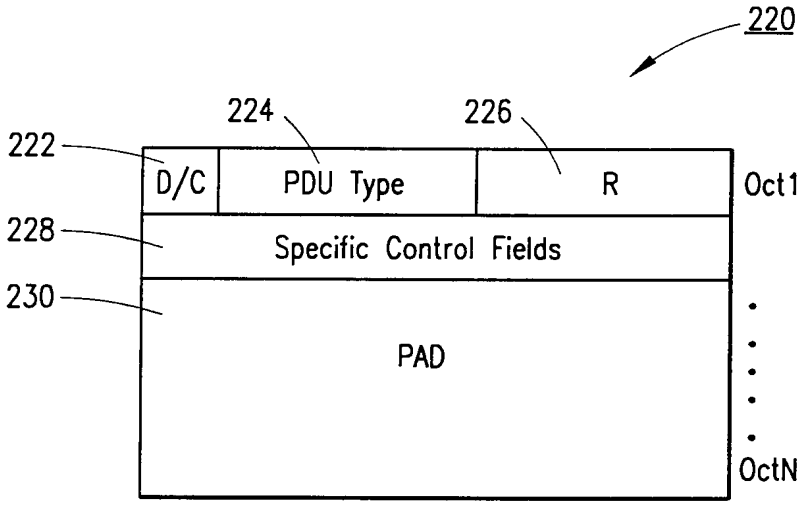
220
224
226
222
D/C
PDU Type
R
Oct1
228
Specific Control Fields
230
PAD
OctN

FIG. 8

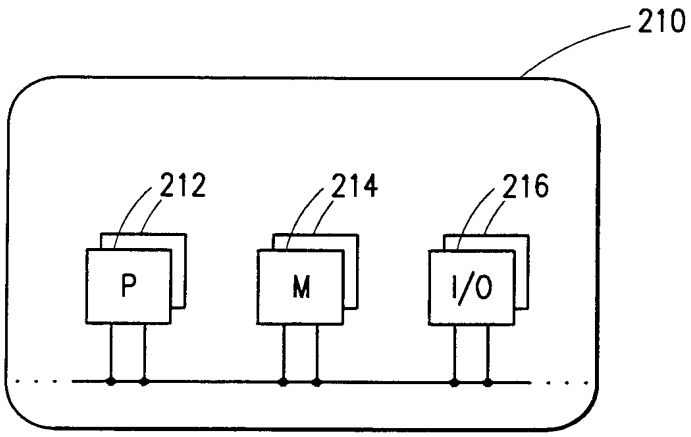

FIG. 9

INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/SE 00/01461

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04L29/06 H04Q7/22 H04L1/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04L H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, IBM-TDB, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 98 47302 A (NOKIA TELECOMMUNICATIONS OY ;RAUHALA KRISTIAN (US)) 22 October 1998 (1998-10-22) page 7, line 4 -page 9, line 2 figure 1	1,39,40
A	WO 99 34635 A (ERICSSON TELEFON AB L M) 8 July 1999 (1999-07-08) page 4, line 4 -page 5, line 3 figures 1,2	1,39,40

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 October 2000	07/11/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Eraso Helguera, J

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int[illegible]ional Application No
PCT/SE 00/01461

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9847302 A	22-10-1998	FI 971585 A	16-10-1998
		AU 6835698 A	11-11-1998
		CN 1252918 T	10-05-2000
		EP 0976269 A	02-02-2000
		ZA 9803090 A	20-10-1998
WO 9934635 A	08-07-1999	NO 976150 A	01-07-1999
		AU 2193699 A	19-07-1999

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(74) Agent: **MAGNUSSON, Monica**; Ericsson AB, Patent Unit Radio Networks, S-164 80 Stockholm (SE).

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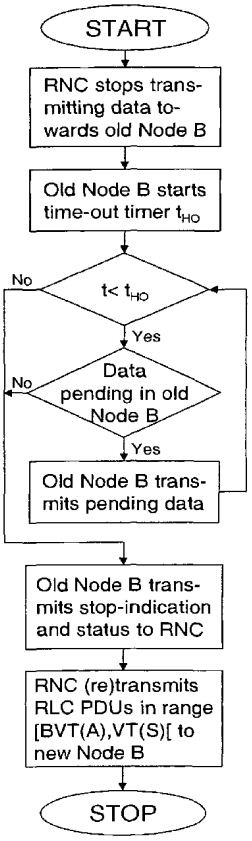
(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),

[Continued on next page]

(54) Title: METHOD AND SYSTEM OF RETRANSMISSION



(57) Abstract: The present invention relates to a method and system of transmissions and retransmissions of packet data in a communications system, introducing concatenated ARQ loops between a radio network controller and a user equipment. Particularly, the invention relates to a Universal Mobile Telecommunications System, UMTS, or WCDMA system.

WO 03/047155 A1

European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:
— *with international search report*

Method and system of retransmission

TECHNICAL FIELD OF THE INVENTION

The present invention relates to transmissions and retransmissions of packet data in a communications system. Especially, it relates to transmissions of packet data in a cellular mobile radio system, particularly a Universal Mobile Telecommunications System, UMTS, or WCDMA system.

BACKGROUND AND DESCRIPTION OF RELATED ART

Retransmission of data to or from a mobile station, MS, or user equipment, UE, is previously known. It is also known to use medium access control and radio link control layers of a UMTS protocol structure in acknowledged mode for dedicated channels.

In acknowledged mode of UMTS, retransmissions are undertaken in case of detected transmission errors not recovered by forward error control. This is also called automatic repeat request, ARQ. With ARQ, retransmissions can be undertaken unless a transmitted message is (positively) acknowledged within a predetermined time frame, or if it is negatively acknowledged.

Within this patent application, a radio network controller, RNC, is understood as a network element including a radio resource controller. The RNC is connected to a fixed network. Node B is a logical node responsible for radio transmission/reception in one or more cells to/from a User Equipment. A base station, BS, is a physical entity representing Node B.

With reference to figure 1, base stations «BS 1» and «BS 2» are physical entities representing Nodes B «Node B 1» and

«Node B 2» respectively. «Node B 1» and «Node B 2» terminate the air interface, called Uu interface within UMTS, between UE and respective Node B towards the radio network controller «RNC». A radio network controller «RNC» controlling the respective Nodes B «Node B 1», «Node B 2» is connected to each of them over an Iub interface.

Medium access control, MAC, and radio link control, RLC, are used within radio communications systems like General Packet Radio Services, GPRS, and UMTS.

U.S. Patent US5570367 discloses a wireless communications system arranged to transmit acknowledgement and request for retransmission messages. Data received in a microcell from an end user device is forwarded to a cell site. Data received by the cell site is transmitted to a cellular switch. A base station sends a poll message to the end user device, inquiring for the status of unacknowledged messages previously transmitted from the base station.

Also, a base station transmitter window is defined. A lower end pointer identifies a lowest numbered packet transmitted to and acknowledged by the base station. The upper end pointer identifies the highest numbered packet transmitted by the base station. Consequently, the window represents packets transmitted by the base station and unacknowledged by the end user device.

U.S. Patent US6118765 also recognizes an acknowledge scheme of a discriminator using a sliding window. The discriminator passes valid packets for forwarding.

International Patent Application WO0021231 relates to a system for communicating data packets over a packet switched network where a buffering network entity acts as

end-receiver of data packets transmitted from a sending host.

3rd Generation Partnership Project (3GPP): *Technical Specification Group Radio Access Network, Physical Layer Procedures, 3G TS 25.301 v3.6.0, France, September 2000,* specifies in chapter 5 Radio Interface Protocol Architecture of a UMTS system. There are three protocol layers:

- physical layer, layer 1 or L1,
- data link layer, layer 2 or L2, and
- network layer, layer 3 or L3.

Layer 2, L2, and layer 3, L3 are divided into Control and User Planes. Layer 2 consists of two sub-layers, RLC and MAC, for the Control Plane and four sub-layers, BMC, PDCP, RLC and MAC, for the User Plane. The acronyms BMC, PDCP, RLC and MAC denote Broadcast/Multicast Control, Packet Data Convergence Protocol, Radio Link Control and Medium Access Control respectively.

Figure 2 illustrates a simplified UMTS layers 1 and 2 protocol structure for a Uu Stratum, UuS, or Radio Stratum, between a user equipment UE and a Universal Terrestrial Radio Access Network, UTRAN.

Radio Access Bearers, RABs, are associated with the application for transportation of services between core network, CN, and user equipment, UE, through a radio access network. Each RAB is associated with quality attributes such as service class, guaranteed bit rate, transfer delay, residual BER, and traffic handling priority. An RAB may be assigned one or more Radio Bearers, RBs, being responsible for the transportation between UTRAN and UE. For each mobile station there may be one or several RBs representing a radio link comprising one or more channels between UE and

UTRAN. Data flows (in the form of segments) of the RBs are passed to respective Radio Link Control, RLC, entities which amongst other tasks buffer the received data segments. There is one RLC entity for each RB. In the RLC layer, RBs are mapped onto respective logical channels. A Medium Access Control, MAC, entity receives data transmitted in the logical channels and further maps logical channels onto a set of transport channels. In accordance with subsection 5.3.1.2 of the 3GPP technical specification MAC should support service multiplexing e.g. for RLC services to be mapped on the same transport channel. In this case identification of multiplexing is contained in the MAC protocol control information.

Transport channels are finally mapped to a single physical channel which has a total bandwidth allocated to it by the network. In frequency division duplex mode, a physical channel is defined by code, frequency and, in the uplink, relative phase (I/Q). In time division duplex mode a physical channel is defined by code, frequency, and timeslot. As further described in subsection 5.2.2 of the 3GPP technical specification the L1 layer is responsible for error detection on transport channels and indication to higher layer, FEC encoding/decoding and interleaving/deinterleaving of transport channels.

PDCP provides mapping between Network PDUs (Protocol Data Units) of a network protocol, e.g. the Internet protocol, to an RLC entity. PDCP compresses and decompresses redundant Network PDU control information (header compression and decompression).

For transmissions on point-to-multipoint logical channels, BMC stores at UTRAN-side Broadcast Messages received from an RNC, calculates the required transmission rate and re-

quests for the appropriate channel resources. It receives scheduling information from the RNC, and generates schedule messages. For transmission the messages are mapped on a point-to-multipoint logical channel. At the UE side, BMC evaluates the schedule messages and deliver Broadcast Messages to upper layer in the UE.

3G TS 25.301 also describes protocol termination, i.e. in which node of the UTRAN the radio interface protocols are terminated, or equivalently, where within UTRAN the respective protocol services are accessible.

In UMTS, the RLC protocol is terminated in a serving RNC, SRNC, responsible for interconnecting the radio access network of UMTS to a core network. In relation to a Node B, an RNC controlling it is a Controlling RNC. The Serving RNC and Controlling RNC can be separate or co-incident. In case of separate RNCs they communicate over an Iur interface, otherwise they communicate locally. An RNC comprises an RLC entity including an L2/RLC protocol layer «L2/RLC» at UTRAN side in figure 2. There are two MAC-entities, MAC-d and MAC-c/-sh, routing dedicated channels over common or shared channels. MAC-d resides in the Serving RNC and MAC-c/-sh in the Controlling RNC. The routing comprises buffering of data in the MAC-entities MAC-d and MAC-c/-sh, to accommodate for the unsynchronized data flows into and out of MAC-d and MAC-c/-sh. The two MAC-entities MAC-d and MAC-c/-sh are responsible for the L2/MAC protocol layer functionality at UTRAN side according to figure 2.

3rd Generation Partnership Project (3GPP): *Technical Specification Group Radio Access Network, RLC Protocol Specification, 3GPP TS 25.322 v3.5.0, France, December 2000,* specifies the RLC protocol. The RLC layer provides three services to higher layers:

- transparent data transfer service,
- unacknowledged data transfer service, and
- acknowledged data transfer service.

In subsection 4.2.1.3 an acknowledged mode entity, AM-entity, is described (see figure 4.4 of the 3GPP Technical Specification). In acknowledged mode automatic repeat request, ARQ, is used. The RLC sub-layer provides ARQ functionality closely coupled with the radio transmission technique used. The 3GPP technical specification also reveals various triggers for a status report to be transmitted. The receiver shall always send a status report, if it receives a polling request. There are also three status report triggers, which can be configured

1. Missing PU(s) Detected,
2. Timer Initiated Status Report, and
3. Estimated PDU Counter.

For trigger 1, the receiver shall trigger transmission of a status report to the sender if a payload unit, PU, is detected to be missing. (One PU is included in one RLC PDU.) With trigger 2, a receiver triggers transmission of a status report periodically according to a timer. Finally, trigger 3 relates in short to a timer corresponding to an estimated number of received PUs before the requested PUs are received. The 3GPP Technical Specification specifies a status PDU used to report the status between two RLC AM ('Acknowledged Mode') entities.

3GPP TS 25.322 specifies RLC state variables at the transmitter and at the receiver. At the transmitter side some of these are

VT(S) Send state variable,

VT(A) Acknowledge state variable,

VT(MS) Maximum Send state variable, and

VT(WS) Transmitter window size state variable.

VT(S) is the sequence number of the next PU to be transmitted for the first time (i.e. excluding retransmission). VT(A) is the sequence number of the next in-sequence PU expected to be acknowledged, which forms the lower edge of the window of acceptable acknowledgements. VT(MS) is the sequence number of the first PU not allowed by the receiver [i.e. the receiver will allow up to VT(MS) - 1]. This value represents the upper edge of the transmit window. VT(WS) is the size that shall be used for the transmitter window. Consequently, VT(WS) relates to VT(A) and VT(MS) according to

$$VT(WS) = VT(MS) - VT(A).$$

One of the state variables at the receiver side is

VR(R) Receive state variable.

VR(R) is the sequence number of the next in-sequence PU expected to be received. It is set equal to SNmax+1 upon receipt of the next in-sequence PU, where SNmax is the sequence number of the highest received in-sequence PU.

None of the cited documents above discloses a method and system of transmissions and retransmissions of packet data, splitting a connection involving multiple ARQ loops and transferring transmitter state variables between the loops.

SUMMARY OF THE INVENTION

In a radio communications system operating in acknowledged mode, according to prior art, data is buffered in a Radio Network Controller. ARQ loops introduces delay and round-

trip time latency. I.e., the time for an application to perceive a response to transmitted data or undertaken action from the opposite end is not immediate. ARQ loops will also require buffering.

Higher layer applications can be, e.g., applications on the Internet. Most applications on the Internet use protocols, such as TCP (Transport Control Protocol), that control the transmission rate, based on link quality in terms of packet loss and delay characteristics. Consequently, besides the negative effect of retransmission delays as such on perceived quality, substantial queuing delay can also lead to secondary effects further reducing quality of service.

A proper introduction of a hybrid ARQ protocol in Node B, according to the invention, would render at least some of the required acknowledgements of prior art superfluous and improve system performance. Elimination of an existing ARQ loop raises requirements on proper handling of acknowledgements and status reports, between nodes involved, particularly in connection with handover involving more than one Node B.

Consequently, it is an object of this invention to eliminate or reduce delay and latency as perceived by a user.

A related object is to reduce delay and latency as perceived by a flow control algorithm in a WCDMA (Wideband Code Division Multiple Access) system.

A further object is to provide a method and system for providing an ARQ loop with handover status information from another ARQ loop.

Finally, it is an object to fast and efficiently provide a Node B with queuing data for in-sequence delivery of RLC PDUs to a user equipment at handover.

These objects are met by the invention, which is particularly well suited for a Universal Mobile Telecommunications System, UMTS, splitting an ARQ loop into two or more single loops and taking appropriate measures, explained in detail below, for queue updating at handover.

Preferred embodiments of the invention, by way of examples, are described with reference to the accompanying drawings below.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows communication, according to the invention, between a UE and a base station involved in a connection between an RNC and the UE.

Figure 2 displays a layered protocol structure, according to prior art, in a radio communications system.

Figure 3 shows a preferred layered protocol structure, a protocol stack, according to the invention.

Figure 4 shows data units and transport blocks of a preferred protocol stack, according to the invention.

Figure 5 schematically illustrate status report generation and transmissions, according to the invention.

Figure 6 illustrates a communications system with ARQ functionality located to RNC, according to the invention.

Figure 7 illustrates an alternative exemplary communications system with ARQ functionality located to RNC, according to the invention.

Figure 8 schematically illustrates a flowchart of a first embodiment according to the invention.

Figure 9 schematically depicts a flowchart of a second embodiment according to the invention.

Figure 10 shows a block diagram including elements of the first and second embodiments.

DESCRIPTION OF PREFERRED EMBODIMENTS

Figure 3 shows a preferred layered protocol structure, a protocol stack, according to the invention. The L2 MAC layer of figure 1 has been extended and divided into two sub-layers, an L2 MAC sub-layer and a MAC-HSDPA sub-layer. Essentially the L2 MAC sub-layer corresponds to the prior art L2 MAC sub-layer of figure 1. The MAC-HSDPA plus the MAC layer could be regarded as one single MAC layer extended to also include hybrid ARQ functionality. However, for reasons of explanation they are preferably regarded as separate sub-layers. Further, on the network side, considering them as separate protocol sub-layers physically better corresponds to the physical entities where they reside. As illustrated in figure 3 on the UTRAN-side (or network side) L2 MAC sub-layer is preferably located in RNC, whereas L2 MAC-HSDPA sub-layer is located in Node B. As the hybrid ARQ protocol combines successively received retransmissions it is a great advantage to have this protocol close to the physical layer and, particularly, in Node B. Among the advantages achieved thereby, e.g., the round-trip delay is reduced as compared to a location in RNC. Within this patent application the protocol layers, except for L2 MAC and L2 MAC-HSDPA as just explained, correspond to those of figure 1.

Figure 4 shows data units and transport blocks of a preferred protocol stack, according to the invention. Packet switched data is transmitted in protocol data units, PDUs, in both directions. Each PDU is transported on a transport

channel in at least one transport block, TB. Preferably there is one TB for each PDU. As described above, transmission errors on the transport channel are corrected and detected by layer L1. Each transport block, TB, can be provided an individual CRC error-detecting checksum prior to transmission on the physical channel. However, preferably a transmission unit, carrying one or more TBs, is provided only one CRC error-detecting checksum. If a transmission unit is detected to be in error on the receiving side, this is reported to the L2 MAC layer.

L2 MAC layer can request retransmission of transmission units received in error. Transmission units, detected to be in error, still carry information that should not be wasted. Preferably hybrid ARQ, utilizing information available from earlier transmission(s) of a transmission unit by proper combining with the latest retransmission, is used prior to an L2 MAC layer request for retransmission.

At the receiving end, error detection is also performed by layer L2 RLC. If an RLC protocol data unit, PDU, is received in error or the PDU is missing, it will be requested for retransmission at a point in time when a status report is established by the RLC layer. RLC PDUs are transferred to/from the MAC layer SDUs. The MAC SDU possibly includes a header not included in the RLC PDU. As explained in relation to figure 3, according to the invention there are preferably two MAC sub-layers, an L2 MAC sub-layer and an L2 MAC-HSDPA sub-layer. In a preferred embodiment of the invention, the L2 MAC sub-layer is located in RNC and the L2 MAC-HSDPA sub-layer is located in Node B. As previously described, the RLC PDUs are transferred in transport blocks, TBs, on the physical channel. The L2 MAC-HSDPA layer transfers TBs to the L1 physical layer. In the reverse direction the L2 MAC-HSDPA layer transfers TBs, pos-

sibly after combining of multiple transmissions of the respective TBs, indicated to be error-free to the L2 MAC layer. TBs not indicated to be error-free are requested for retransmission.

A network layer PDU or L3 PDU can comprise several RLC PDUs. RLC PDUs are reassembled into RLC service data units, RLC SDUs, prior to delivery to higher layer PDU. The L3 protocol can be, e.g., the Internet Protocol, IP. Upon reception from L3, RLC SDUs are segmented into RLC PDUs.

In an evolved WCDMA system, a high-speed downlink packet access channel, HSDPA channel, is a channel with similarities to a DSCH. However, it is based on a novel transport channel type. In the sequel, this is referred to as a High-Speed Downlink Shared CHannel, HS-DSCH. An HS-DSCH supports many features not supported by DSCH, but also inherits some of the characteristics of a DSCH. There are several important features of an HS-DSCH. A sample of features is:

- High data rates with peak data rates up to tens of Mbit/s.
- Data is transmitted to multiple users on a shared channel by means of time-division multiplex, TDM, or code-division multiplex, CDM.
- Higher-order modulation.
- Modulation adaptive to radio channel conditions.
- Fast retransmission with soft combining of retransmitted data at UE, also referred to as Fast Hybrid ARQ or Fast HARQ.

- Low air-interface delay, with maximum round-trip delay down to some ten milliseconds.

As an alternative to introducing the MAC-HSDPA sub-layer in Node B, the RLC protocol could reside in Node B. However, for reasons of compatibility RLC is in charge of ciphering and in-order delivery, preferably located in RNC. With RLC sub-layer residing in RNC, reliable packet delivery will be insured between Node B and RNC.

According to preferred embodiments of the invention, an L2 MAC-HSDPA sub-layer is responsible for Fast Hybrid ARQ.

One reason for terminating the Fast Hybrid ARQ in Node B is the reduction of round-trip delay as compared to terminating it in RNC. Another reason is that Node B is capable of using soft combining of multiply transmitted data packets, whereas RNC generally only receives hard-quantized bits.

L2 RLC sub-layer requires status reports acknowledging packet data units previously transferred from the L2 RLC layer, e.g. to advance the sliding transmitter window of the L2 RLC protocol. When, e.g., a poll timer times out it consequently transfers an inquiry for a status report. This inquiry is destined for the UE, in accordance with prior art. However, such an inquiry would load the scarce resource of the radio interface between Node B and UE. Further, terminating the Fast Hybrid ARQ in Node B, during stable operating conditions this node will be currently informed of the receive status of the UE in accordance with the Fast Hybrid ARQ scheme, possibly with a short delay for the most recent update of UE.

According to a preferred embodiment of the invention the Hybrid ARQ protocol entity at UTRAN-side generates status reports to the RNC-RLC. Status reports can be generated

either upon request of the RNC-RLC (polling) or as conditionally triggered locally. In case of the latter, the triggers described in prior art and referred to on page 6 apply. Another trigger to be included is the number of PDUs received by Node B from RNC. When a predefined number of PDUs have been received by Node B, a status report is established in the Hybrid ARQ protocol entity, and transmitted to RNC.

Correspondingly, when Node B deals with status report establishment, the status report triggering in the UE can be relieved, in order not to load the scarce communication link resource between Node B and UE. With reference to trigger 1 on page 6, the triggering of UE can be avoided if Node B detects the missing PU in due time for delivery to UE prior to a point in time when it would otherwise have been detected or otherwise initiated establishment and transmission of a status report from UE. Triggers 2 and 3 depend on a preset time interval or number of PDUs. By extending the parameters appropriately, the number of status reports per unit time initiated in UE by these triggers can be reduced to a sufficiently small number, not loading the scarce communication link resource between UE and Node B more than necessary.

Figures 5a and 5b schematically illustrate the status report generation and transmissions, according to the invention. In figure 5a, L2 RLC located in RNC transfers data to UE via Node B, as already described in relation to figure 2. Downlink data 3 and requests for status reports 2 are transferred 2, 3 to UE via Node B. UE can also generate status reports when properly triggered locally. Status reports 1 are transmitted from UE to RNC, as described in relation to cited prior art.

In figure 5a, the Hybrid ARQ protocol resides in Node B. Downlink data is transmitted 3 over the radio interface between Node B and UE. Depending on whether the data transmission was successful or not, acknowledgements are transmitted 4 to Node B from UE. Status reports are generated in UE if data packets are missing, or detected to be out of sequence and transmitted 1, 4 to Node B. Status reports can also be transmitted 4 from UE upon request from Node B. In the sequel acknowledgements and status reports, and possibly other signaling related to Fast Hybrid ARQ, from UE to Node B are collectively referred to as HARQ signaling 4. Consequently, Node B has a good picture of the UE status as regards data packets transmitted to UE from RNC via Node B. This status includes

BVT(S) Node B Send state variable, and

BVT(A) Node B Acknowledge state variable.

BVT(S) is the sequence number of the next PU to be transmitted for the first time (i.e. excluding retransmission) from Node B. BVT(A) is the sequence number of the next in-sequence PU expected to be acknowledged by UE. BVT(A) forms the lower edge of the window of acceptable acknowledgements.

Figure 5b shows a preferred solution according to the invention, where UE status in accordance with transmitted downlink data 3 and HARQ signaling 4 is stored in the HARQ protocol entity, preferably a MAC-HSDPA protocol.

When UE might locally generate status reports according to one or more predefined triggers, the one or more status reports are transferred 4 to Node B. Upon reception in Node B, this Node decides whether or not a received status report concerns also L2 RLC protocol layer. If so, the status report, possibly edited by Node B, is transferred 5

to L2 RLC residing in RNC. If not, Node B will undertake all actions necessary, in accordance with the status report.

An example of a UE-generated status report concerning the L2 RLC protocol of RNC is when UE-HARQ protocol, preferably in the MAC-HSDPA protocol link layer, detects a failure in UE, possibly due to a previously transmitted acknowledgment received in error by Node B. Upon detection of this failure, an RLC PDU will not be transferred from L2 MAC sub-layer to L2 RLC sub-layer of UE, as only presumably correct PDUs are transferred. When L2 RLC sub-layer of UE detects a missing RLC PDU, the sequence number of the missing RLC PDU will be included in a status report, generated by UE, and requested for retransmission from L2 RLC residing in RNC. Swedish patent application No. 0100739-2 assigned to the Applicant, and incorporated herein by reference, describes a method and system of retransmission, reducing or eliminating unnecessary retransmissions. This method and system can also be applied with the present invention, further reducing the load on the radio interface.

When L2 RLC, residing in RNC, sends a request for status report to UE, the request is first received in Node B, in both figures 5a and 5b. In figure 5a, the request for status report is forwarded 2 to UE by default. Consequently, the requests and their responses load the radio interface between Node B and UE. Between Node B and UE, signaling and packet transfer are indicated by double arrows, 1 and 4 for uplink, and 2 and 3 for downlink, due to their logical differences. However, there is only one physical radio spectrum available with a limited channel capacity in each direction. Therefore, when the HARQ protocol entity or Node B is made responsible for status report generation and replies to L2 RLC requests for status

reports, as in figure 5b, the load on the radio interface can be relieved. Hence, the elimination of arrows 1 and 2 between Node B and UE in figure 5b is not absolute. Depending on triggers selected, potential protocol failure etc. some signaling or packet transfer illustrated by the arrows in figure 5a may remain. However, the lack of these arrows in figure 5b illustrates that a substantial amount of the load can be eliminated according to the invention. In the foregoing, it was explained for various status report triggers, not limiting the invention only to this or other particular examples, how the invention can reduce the load of a scarce communication link resource in downlink, in uplink, or both.

There is a sender-receiver relationship between «RNC» and «UE», in accordance with prior art. Packets transmitted from RLC protocol entity residing in RNC are acknowledged by User Equipment «UE». The sender-receiver relationship is subject to latency due to a round-trip delay between «RNC» and «UE», not illustrated to simplify reading.

A first problem of prior art solution relates to bandwidth delay product. HS-DSCH provide high data rate, also referred to as great user bandwidth. A transmitted packet cannot be acknowledged (positively or negatively) until it has propagated to a receiver. Further, it takes a propagation time for an acknowledgement to reach from the receiver to a sender of the packet. Consequently, data that may be requested for retransmission require buffering corresponding to the bandwidth delay product, representing the amount of data that can be transmitted during a time span equivalent to the round-trip time latency. Particularly, for HS-DSCH this bandwidth delay product can be extensive for an ARQ protocol entity in RNC. This can cause RLC PDU loss, or RLC ARQ or HARQ transmissions to stall.

Of course, these shortcomings could be circumvented by increasing buffer size as only measure. However, increasing a buffer size allowing for an extended round-trip time, would necessitate time-out timers of outer ARQ loops to be increased. Further, an extended variability of buffer lengths of the inner loop could be expected, depending on the various rates and delays of a connection during its lifetime. If relying on increased buffer size only, the time-out timers of outer ARQ loops must not time out until the largest round-trip time allowed for has elapsed.

In UMTS, existing RLC protocol operates with limited buffer sizes. One reason for this is delay constraints.

The problem of prior art, as explained above, cannot be solved by increasing RLC buffer size, as long as the RLC buffer is part of an end-to-end-delay of a connection between a data provider and an end user, where the data provider awaits acknowledgements from the user, since increasing RLC buffer size would introduce additional delay and require extensive time-out limits.

As a user moves with his user equipment away from a base station «BS 1» towards another base station «BS 2» in figure 1, the connection between UE and RNC is likely to be rerouted from being over a first Node B «Node B 1» to being over a second Node B «Node B 2» or over both «Node B 1» and «Node B 2» using soft handover. In figure 1, the base stations are connected to the same radio network controller RNC. However, the invention also covers the exemplary situation where the base stations are connected to different RNCs.

Figure 6 illustrates an exemplary communications system with ARQ functionality located to RNC. The UE protocol «MAC» preferably also includes a MAC-HSDPA protocol, not

indicated to simplify reading. In UTRAN, location of MAC-HSDPA protocol «MAC-hs» to Node B is preferred, as explained in relation to figure 3. Serving RNC «SRNC» interconnects UE to a Core Network, not illustrated. «UE» is connected to «SRNC» over «Node B 2» and «CRNC 2/DRNC». According to figure 6, «SRNC» is not controlling the Node B «Node B 2». (For illustration, «SRNC» controls «Node B 1».) «Node B 2» is controlled by Controlling RNC «CRNC 2», acting as a Drift RNC «DRNC» in this exemplary illustration. The Drift RNC supports the Serving RNC when a UE needs to use cells/Nodes B controlled by an RNC different from the SRNC. The RNCs are interconnected over an Iur interface. Routing of dedicated channels over common or shared channels comprises buffering of data in Serving RNC and Node B. In figure 6, the buffering occurs in buffers «Buffer Sb» and «Buffer sB» for the sender-receiver relationship between SRNC and Node B. The latency of the loop involving the buffers «Buffer Sb» and «Buffer sB» will be substantial if the distance between Serving RNC and Node B is large. In figure 6, there is further buffering «ARQ Su» in «SRNC» associated with the ARQ-protocol in the sender-receiver relationship between «SRNC» and «UE». «UE» includes corresponding ARQ buffering «ARQ Su».

Figure 7 illustrates an alternative exemplary communications system with ARQ functionality located to RNC. The figure represents alternatives for the MAC-protocol in RNC, including MAC-HSDPA protocol. However, location of MAC-HSDPA protocol «MAC-hs» to Node B is preferred. The UE protocol «MAC» preferably also includes a MAC-HSDPA protocol, not explicitly indicated in the figure to simplify reading. Serving RNC «SRNC» interconnects UE to a Core Network, not illustrated. «UE» is connected to «SRNC» over «Node B 2» and «CRNC 2/DRNC». According to figure 7 «SRNC» is not controlling the Node B «Node B 2». (For illustra-

tion, «SRNC» controls «Node B 1».) «Node B 2» is controlled by Controlling RNC «CRNC 2», acting as a Drift RNC «DRNC» in this exemplary illustration. The Drift RNC supports the Serving RNC when a UE needs to use cells/Nodes B controlled by an RNC different from the SRNC. The RNCs are interconnected over an Iur interface. Routing of dedicated channels over common or shared channels comprises buffering of data between Serving RNC and Controlling RNC. In figure 7, the buffering occurs in buffers «Buffer Sd» and «Buffer sD» for the sender-receiver relationship between SRNC and DRNC. The latency of the loop involving the buffers «Buffer Sd» and «Buffer sD» will be substantial if the distance between Serving RNC and Controlling RNC is large. In figure 7, there is further buffering «ARQ Su» in «SRNC» associated with the ARQ-protocol in the sender-receiver relationship between «SRNC» and «UE». «UE» includes corresponding ARQ buffering «ARQ Su».

Terminating RLC AM ARQ in Node B benefits from a round-trip time being constant for a particular Node B. This will simplify setting of time-out timers, reducing the round-trip time variability of RLC AM ARQ and outer ARQ loops. The inner HARQ loop RTT is kept at a low level using soft combining of successive retransmissions and due to shorter delay times between Node B and UE than between RNC and UE. The RLC entity in Node B should send an appropriate RLC status message to the Serving RNC when it discovers a missing RLC PDU or when a Poll flag, indicating that a status report is requested, is set by RNC RLC. This poll flag should be cleared prior to passing RLC PDUs further to HARQ transmitter unit to avoid triggering of status report transmissions from UE RLC.

Channels can be switched for several reasons. One example of channel switching is handover from one base station to

another as a user moves. Another reason can be some channels being subject to heavy interference whereas others are not. By use of different channelization codes in WCDMA, users are allocated channels of different data rates. Other wireless systems, such as W-LANs (Wireless Local Area Networks) generally do not provide for handover from one base station to another including channel switching even if they allow for quasi-stationary connections to different base stations of the systems.

According to a first embodiment of the invention, schematically illustrated in figure 8, RLC Acknowledged Mode ARQ, RLC AM ARQ, is at least partly terminated in Node B and RLC state variables transferred and updated at handover and channel switching. RLC AM ARQ also retransmits data packets to Node B at data packet losses in Iub or Iur interface. At an HSDPA handover from an old Node B to a new Node B, the serving RNC stops data transmissions to the old Node B. The old Node B finishes its pending data transmissions during a predefined maximum time-period. When pending data has been transmitted or if the maximum time-period has elapsed, it transmits a stop-indication to the serving RNC. The stop-indication is accompanied by a latest Node B status of old Node B, including the next in-sequence PU expected to be acknowledged by UE, referred to as BVT(A).

When the serving RNC receives this indication it marks all its RLC PDUs within a frame of PU sequence numbers ranging from BVT(A) to VT(S) as negatively acknowledged, and scheduling these RLC PDUs for retransmission to the new Node B, via the RNC controlling new Node B.

Substituting controlling RNC for Node B, figure 8 is also valid for an implementation with MAC-HSDPA in controlling RNC, as in figure 7. The serving RNC then schedules data

packets, interpreted as negatively acknowledged RLC PDUs, for retransmission to new controlling RNC at an inter-RNC handover.

According to a second embodiment schematically depicted in figure 9, at HSDPA handover data queues of new Node B are updated from UE, i.e. over Uu interface. Preferably, the entire transmitter window of PU sequence numbers ranging from BVT(A) to BVT(S) of old Node B is transferred to new Node B, where BVT(S) denotes the sequence number of the next PU scheduled for transmission for the first time from old Node B. This transmitter window is transmitted as soon as possible, without RNC awaiting a stop-indication from old Node B. As Node B regularly transfers status reports to RNC RLC, the transmitter window from the latest update may already be available to RNC and can be transferred to new Node B without further status transfer between Node B and RNC.

As soon as UE receives a handover command, it includes additional control information to its uplink HS-DSCH control messages. This control information includes the receive state variable VR(R). If UE has multiple logical channels on the HS-DSCH, there is one receive state variable for each logical channel.

New Node B will receive this control information from UE, while still being in stand-by mode. The one or more receive state variables are used for updating the transmitter window of new Node B, the transmitter initially set in accordance with old Node B transmitter window. This updating has to be completed prior to new Node B starting its transmissions of PDUs and transport blocks to UE, to maintain in-sequence delivery of RLC PDUs to UE.

Also figure 9 is valid for an implementation with MAC-HSDPA in controlling RNC, substituting controlling RNC for Node B. The serving RNC then schedules RLC PDUs interpreted as negatively acknowledged for retransmission to new controlling RNC for an inter-RNC handover and UE updates status of controlling RNC via Node B.

Figure 10 shows a block diagram including elements of the first and second embodiments. A serving RNC «SRNC» including receive means «R_R», processing means «μ» and transmit means «T_R». Transmit means «T_R» transmits data 7 from a transmitter window comprising data packets with sequence numbers in the range of VT(A) to VT(S) to a node «Node 1» comprising a MAC-HSDPA protocol, preferably «Node 1» is a Node B, but it can also be a controlling RNC. Data packets received by receive means «R_{N1}» in «Node 1», also comprising transmit means «T_{N1}», are buffered in buffer «$Buff_{N1}$» for transmission 9 to user equipment «UE» including receive means «R_U». At handover from a channel associated with «Node 1» to a channel associated with «Node 2», «Node 1» transmits as much of its buffer content in «$Buff_{N1}$» as allowed to user equipment «UE». «Node 1» with receive means «R_{N1}» receives acknowledgements 9 of successfully transmitted packets to «UE». The sequence number of the next data packet expected to be acknowledged, BVT(A), is transmitted 6 to «SRNC» together with a stop-indication, according to the first embodiment of the invention. The status variable BVT(A) and the stop-indication are received by receive means «R_R» of «SRNC». Processing means «μ» interprets data packets with sequence numbers in the range [BVT(A),VT(S)[as negatively acknowledged and (re)transmits 10 these data packets to the new node «Node 2», where they are received by receive means «R_{N2}» and buffered in «$Buff_{N2}$».

According to the second embodiment there is no need for transmission of a stop-indication and time for emptying the buffer «Buff$_{N1}$». Old node «Node 1» transmits 6 its status variables BVT(A) and BVT(S) at the time of handover to «SRNC». Processing means «μ» interprets the data packets in the range as negatively acknowledged and retransmits 10 the data packets to new node «Node 2». Prior to new node «Node 2», with transmit means «T_{N2}», starts data transmissions 12 to user equipment «UE», having transmit means «T_U» and receive means «R_U», it updates its transmit buffer «Buff$_{N2}$» according to current receive status VR(R) of «UE» as received 12.

Preferably, all retransmission entities, interconnecting networks or channels of different characteristics, e.g. RNCs and Nodes B in UMTS, operate according to the invention for outstanding performance. However, the invention can also be used in systems also including retransmission entities, such as Nodes B, not operating according to the invention.

A person skilled in the art readily understands that the receiver and transmitter properties of a BS or a UE are general in nature. The use of concepts such as BS, UE or RNC within this patent application is not intended to limit the invention only to devices associated with these acronyms. It concerns all devices operating correspondingly, or being obvious to adapt thereto by a person skilled in the art, in relation to the invention. As an explicit non-exclusive example the invention relates to mobile stations without a subscriber identity module, SIM, as well as user equipment including one or more SIMs. Further, protocols and layers are referred to in close relation with UMTS and Internet terminology. However, this does not exclude applicability of the invention in other systems with other

protocols and layers of similar functionality. As a non-exclusive example, the invention applies for radio resource management interfacing of a connection protocol application layer as well as interfacing of a connection protocol transport layer, such as TCP.

The invention is not intended to be limited only to the embodiments described in detail above. Changes and modifications may be made without departing from the invention. It covers all modifications within the scope of the following claims.

CLAIMS

1. A method of retransmission in a communications system, wherein a retransmission loop between a sender and a receiver includes two or more concatenated retransmission subloops, the method characterized in that the retransmission loop comprises a first transmitter, a second transmitter and a receiver, and that the second transmitter transfers signaling carrying a status variable indicating next in-sequence number of packet unit expected to be acknowledged by the receiver to the first transmitter.

2. The method according to claim 1 characterized in that the signaling carrying the status variable is transferred at handover of a channel between the second transmitter and the receiver.

3. The method according to claim 1 or 2 characterized in that the second transmitter sends a stop-indication accompanying the status variable to the first transmitter.

4. The method according to any of claims 1-3 characterized in that the second transmitter sends a stop-indication when there are no more data packets for the receiver pending at the second transmitter or a time-out timer has elapsed.

5. The method according to any of claims 1-4 characterized in that one or more data packets to the receiver pending at the second transmitter are transmitted to the receiver prior to the signaling carrying the status variable is transferred.

6. The method according to any of claims 1–5 characterized in that the signaling carrying the status variable is not transferred until there are no more data packets for the receiver pending at the second transmitter or a time-out timer has elapsed.

7. The method according to any of claims 1–6 characterized in that the first transmitter interprets the status variable as a negative acknowledgement of packet units ranging from the next in-sequence number of packet unit expected to be acknowledged by the receiver to the second transmitter up to the sequence number of the next packet unit to be transmitted for the first time from the first transmitter to the second transmitter.

8. The method according to claim 7 characterized in that packet units considered negatively acknowledged are transmitted to a third transmitter.

9. The method according to claim 1 characterized in that the second transmitter transfers signaling carrying a status variable indicating sequence number of next packet unit to be transmitted for the first time from the second transmitter.

10. The method according to claim 9 characterized in that the signaling carrying the status variables is transferred at handover of a channel between the second transmitter and the receiver.

11. The method according to claim 9 or 10 characterized in that the first transmitter interprets the status variables as a negative acknowledgement of packet units ranging from the next in-sequence number of packet unit expected to be acknowledged by the receiver to the second transmitter up to the sequence number of the

next packet unit to be transmitted for the first time from the second transmitter to the receiver.

12. The method according to any of claims 9–11 characterized in that packet units considered negatively acknowledged are transmitted to a third transmitter.

13. The method according to any of claims 9–12 characterized in that the receiver transmits one or more signals carrying its receive status to a third transmitter.

14. The method according to any of claims 9–13 characterized in that a third transmitter updates its transmit status according to the receive status of the receiver.

15. The method according to any of claims 9–13 characterized in that the receive status includes the sequence number of the next in-sequence PU expected to be received.

16. The method according to any of claims 1–15 characterized in that a connection is handed over from a channel between the second transmitter and the receiver to a channel between a third transmitter and the receiver

17. The method according to any of claims 2, 10 and 16 characterized in that the channel is an HSDPA channel or an HS-DSCH.

18. The method according to any of claims 12–15 characterized in that the third transmitter is a radio network controller, a Node B or a base station.

19. The method according to any of claims 1–18 characterized in that the second transmitter is a radio network controller, a Node B or a base station.

20. The method according to any of claims 1–19 characterized in that the first transmitter is a radio network controller.

21. The method according to any of claims 1–20 characterized in that the receiver is a user equipment.

22. The method according to any of claims 1–17 characterized in that the communications system is a universal mobile telecommunications system or a WCDMA system.

23. A network element for retransmission in a communications system, wherein a retransmission loop between a sender and a receiver includes two or more concatenated retransmission subloops, the network element comprising a first transmitter and being characterized by receive means for receiving signaling carrying a status variable from a second transmitter, the status variable indicating next in-sequence number of packet unit expected to be acknowledged by the receiver.

24. The network element according to claim 23 characterized by receive means for receiving a stop-indication accompanying the status variable.

25. The network element according to claim 23 or 24 characterized in that the network element comprises processing means for interpreting reception of the status variable as a negative acknowledgement of packet units ranging from the sequence number indicated by the

status variable up to the sequence number of the next packet unit to be transmitted for the first time from network element to the second transmitter.

26. The network element according to claim 23 characterized by receive means for receiving signaling carrying a status variable from a second transmitter, the status variable indicating sequence number of next packet unit to be transmitted for the first time from the second transmitter.

27. The network element according to claim 26 characterized by processing means for interpreting reception of the status variables as a negative acknowledgement of packet units within a range as indicated by the status variables.

28. The network element according to any of claims 25–27 characterized in that the signaling carrying the status variable is transferred at handover of a channel between the second transmitter and the receiver.

29. The network element according to any of claims 23–28 characterized by transmit means for transmitting packet units considered negatively acknowledged to a third transmitter.

30. The network element according to claim 29 characterized in that the third transmitter is, or is included in, a radio network controller, a Node B or a base station.

31. The network element according to any of claims 23–30 characterized in that the communications system is a universal mobile telecommunications system or a WCDMA system.

32. A network element for retransmission in a communications system, wherein a retransmission loop between a sender and a receiver includes two or more concatenated retransmission subloops, the network element comprising a second transmitter and being c h a r a c t e r i z e d b y transmit means for transferring signaling carrying a status variable, indicating next in-sequence number of packet unit expected to be acknowledged by the receiver to a first transmitter.

33. The network element according to claim 32 c h a r a c t e r i z e d i n that the signaling carrying the status variable is transferred at handover of a channel between the second transmitter and the receiver.

34. The network element according to claim 32 or 33 c h a r a c t e r i z e d b y transmit means for sending a stop-indication accompanying the status variable to the first transmitter.

35. The network element according to any of claims 32–34 c h a r a c t e r i z e d i n that the second transmitter sends a stop-indication when there are no more data packets for the receiver pending at the second transmitter or a time-out timer has elapsed.

36. The network element according to any of claims 32–35 c h a r a c t e r i z e d b y a packet data transmit buffer.

37. The network element according to any of claims 32–36 c h a r a c t e r i z e d i n that one or more data packets to the receiver pending at the second transmitter are transmitted to the receiver prior to the signaling carrying the status variable is transferred.

38. The network element according to any of claims 32–37 characterized in that the signaling carrying the status variable is not transferred until there are no more data packets for the receiver pending at the second transmitter or a time-out timer has elapsed.

39. The network element according to claim 32 characterized by transmit means for transferring signaling carrying a status variable indicating sequence number of next packet unit to be transmitted for the first time from the second transmitter.

40. The network element according to claim 39 characterized in that the signaling carrying the status variables is transferred at handover of a channel between the network element and the receiver.

41. The network element according to any of claims 32–40 characterized by receive means for receiving signaling carrying receiver receive status.

42. The network element according to any of claims 32–41 characterized by circuitry for updating the network element transmit status according to the receive status of the receiver.

43. The network element according to claim 41 or 42 characterized in that the receive status includes the sequence number of the next in-sequence PU expected to be received.

44. The network element according to any of claims 32–43 characterized in that it is involved in a handover of a channel between the network element and the receiver.

45. The network element according to any of claims 28, 33, 40, 41, 44 characterized in that the channel is an HSDPA channel or an HS-DSCH.

46. The network element according to any of claims 23–45 characterized in that the first transmitter is, or is included in, a radio network controller.

47. The network element according to any of claims 23–46 characterized in that the second transmitter is, or is included in, a radio network controller.

48. The network element according to any of claims 23–47 characterized in that it is a radio network controller, a Node B or a base station.

49. The network element according to any of claims 23–48 characterized in that the communications system is a universal mobile telecommunications system or a WCDMA system.

50. A receiving device for receiving transmissions and retransmissions on a communications channel in a communications system, wherein a retransmission loop between a sender and the receiving device includes two or more concatenated retransmission subloops, the receiving device characterized by transmit means for transferring one or more signals carrying its receive status to a network element.

51. The receiving device according to claim 50 characterized in that the receive status is transmitted for updating of the network element transmit status.

52. The receiving device according to claim 50 or 51 characterized by transmit means for trans-

mitting the receive status to the network element at hand-over.

53. The receiving device according to any of claims 50–52 characterized in that the receive status is transmitted prior to the receiving device starts receiving transmissions from the network element.

54. The receiving device according to any of claims 50–53 characterized in that the receive status includes the sequence number of the next in-sequence PU expected to be received.

55. The receiving device according to any of claims 50–54 characterized in that the communications channel is an HSDPA channel or an HS-DSCH.

56. The receiving device according to any of claims 50–55 characterized in that the communications system is a universal mobile telecommunications system or a WCDMA system.

57. The receiving device according to any of claims 50–56 characterized in that the receiving device is a user equipment.

58. The receiving device according to any of claims 50–57 characterized in that the network element is a radio network controller, a Node B or a base station.

59. A radio communications system characterized by means for carrying out the method in any of claims 1–22.

60. A radio communications system characterized by a plurality of network elements according to any of claims 23-49.

61. A radio communications system characterized by a plurality of receiving devices according to any of claims 50-58.

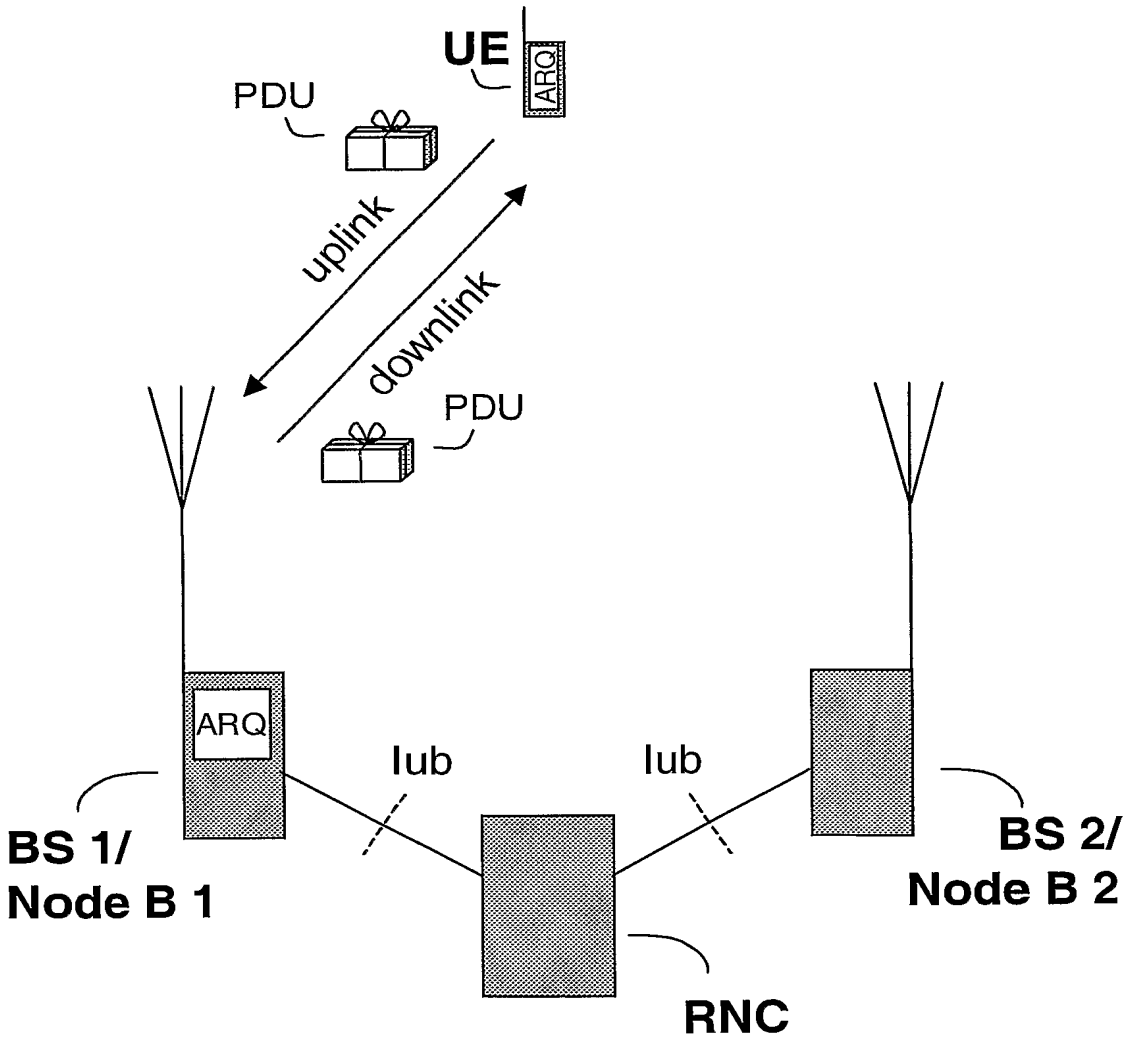

UE
ARQ
PDU
uplink
downlink
PDU
ARQ
Iub
Iub
BS 1/
Node B 1
BS 2/
Node B 2
RNC

Fig. 1

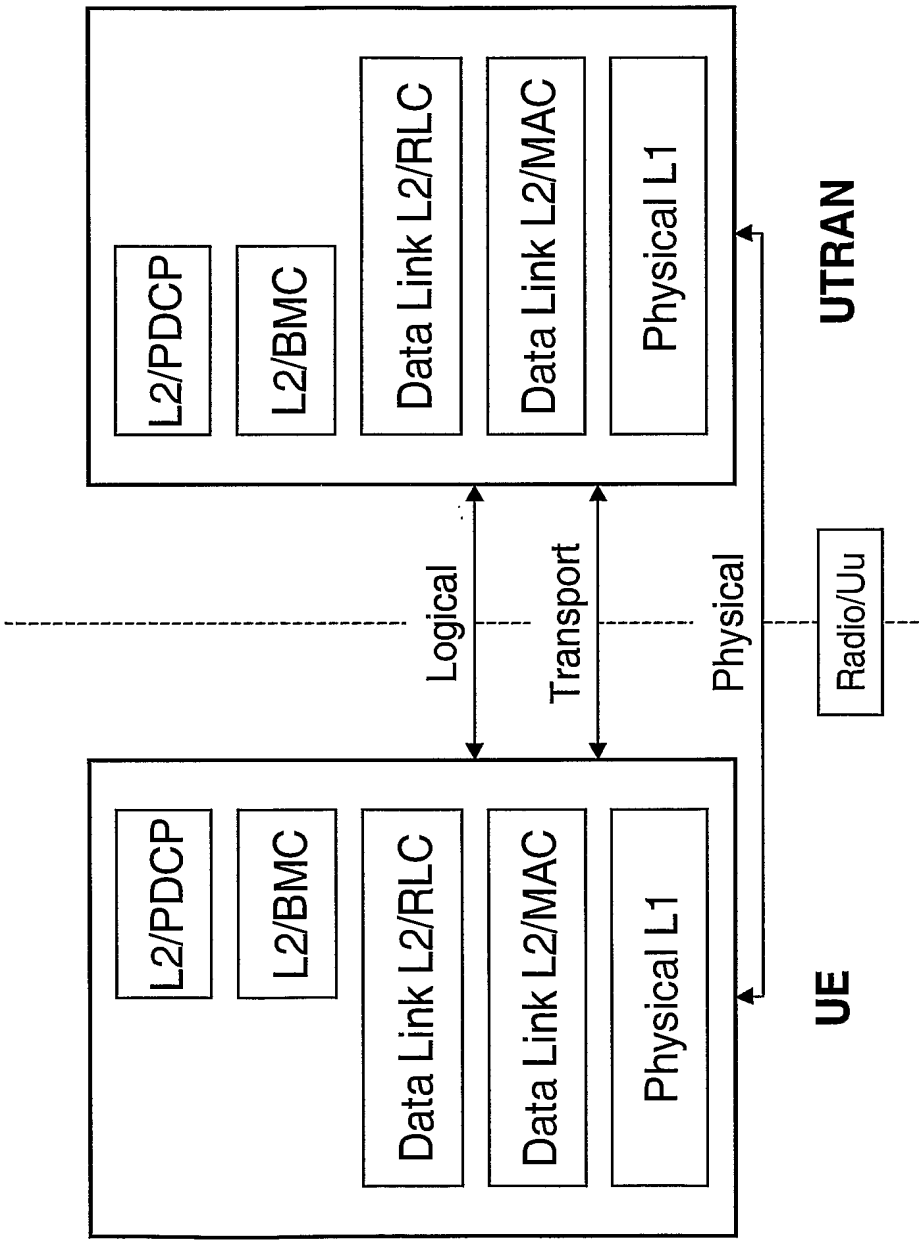

L2/PDCP
L2/BMC
Data Link L2/RLC
Data Link L2/MAC
Physical L1
UTRAN
Logical
Transport
Physical
Radio/Uu
L2/PDCP
L2/BMC
Data Link L2/RLC
Data Link L2/MAC
Physical L1
UE

Fig. 2

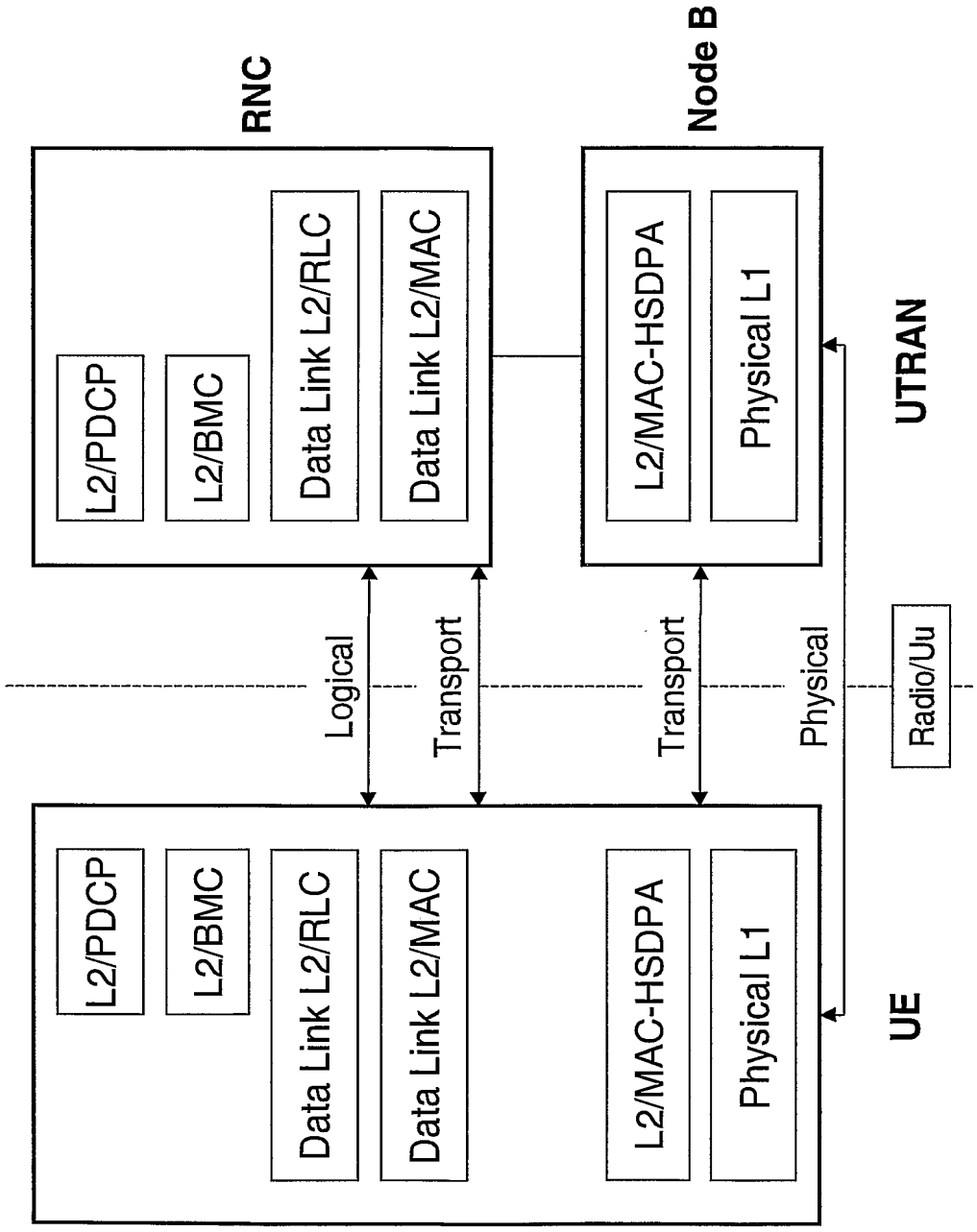

RNC
Node B
L2/PDCP
L2/BMC
Data Link L2/RLC
Data Link L2/MAC
L2/MAC-HSDPA
Physical L1
UTRAN
Logical
Transport
Transport
Physical
Radio/Uu
L2/PDCP
L2/BMC
Data Link L2/RLC
Data Link L2/MAC
L2/MAC-HSDPA
Physical L1
UE

Fig. 3

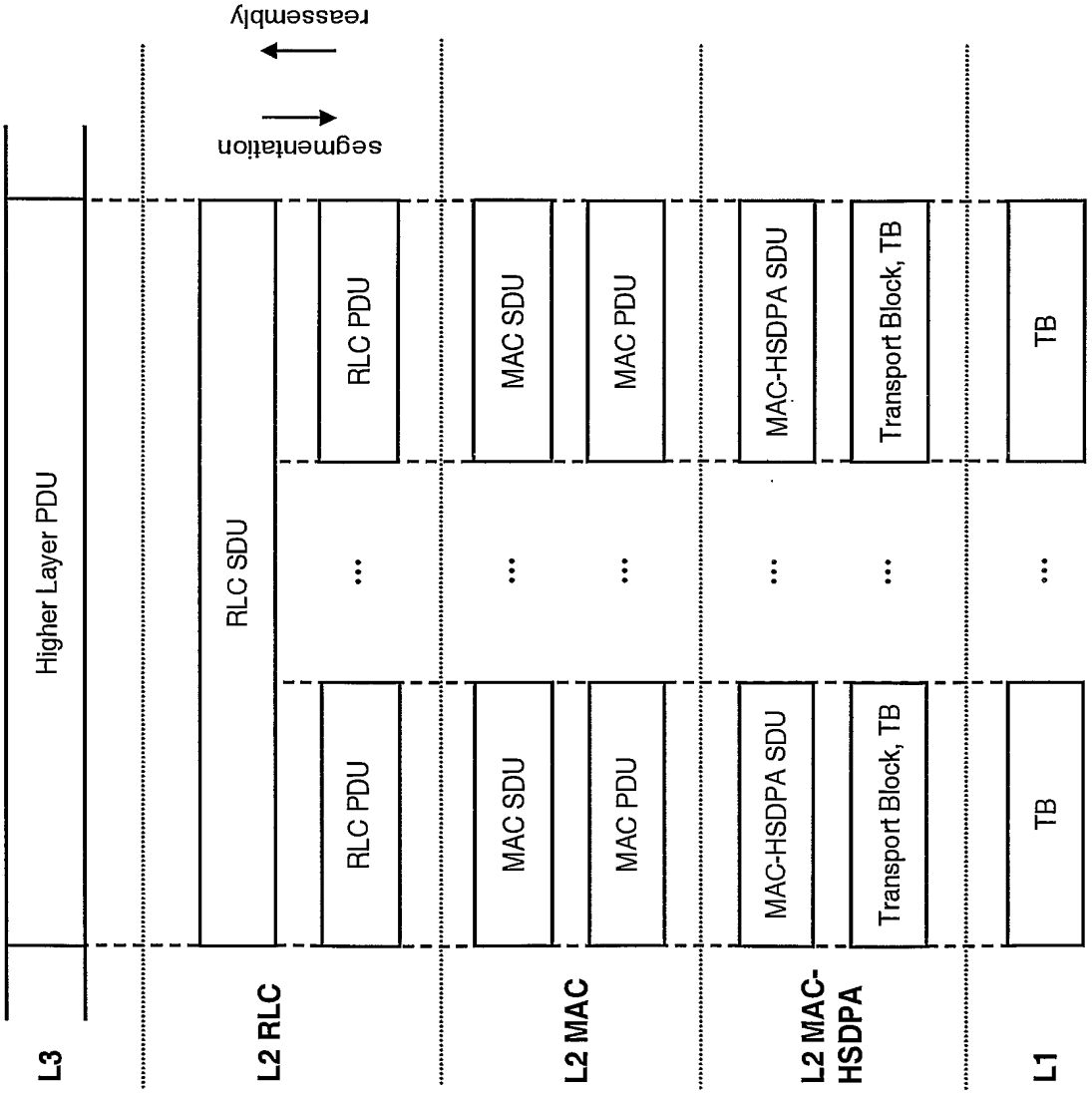

reassembly
segmentation
Higher Layer PDU
RLC SDU
RLC PDU
RLC PDU
MAC SDU
MAC PDU
MAC SDU
MAC PDU
MAC-HSDPA SDU
Transport Block, TB
MAC-HSDPA SDU
Transport Block, TB
TB
TB
L3
L2 RLC
L2 MAC
L2 MAC-HSDPA
L1

Fig. 4

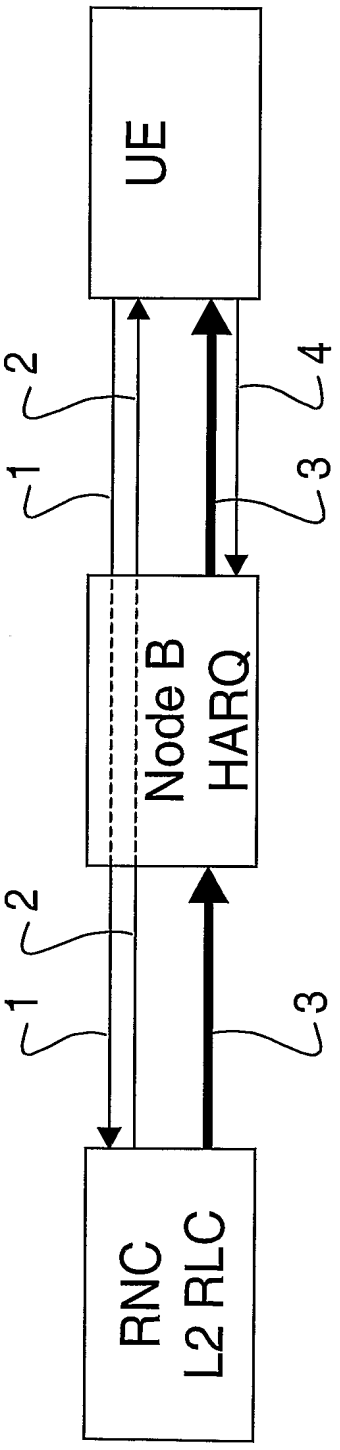

UE
2
1
4
3
Node B
HARQ
2
1
3
RNC
L2 RLC

Fig. 5a

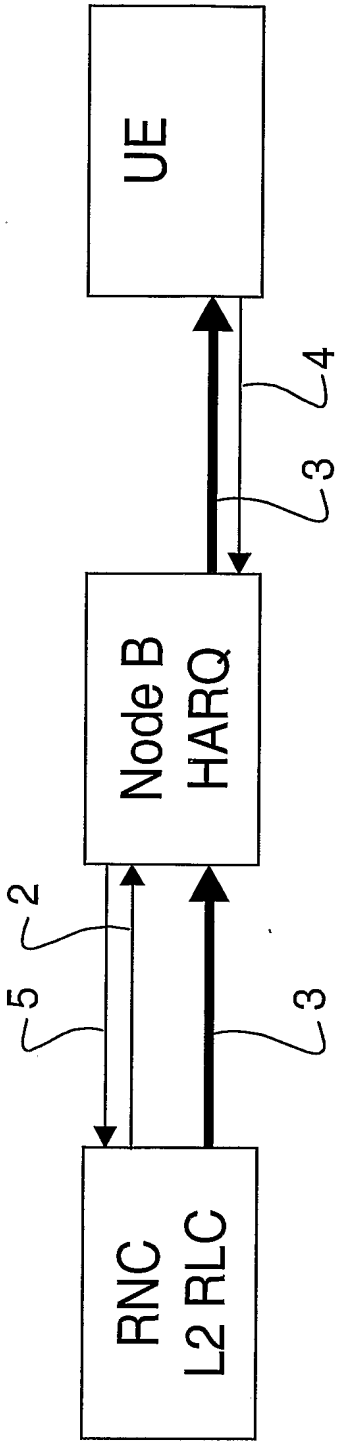

UE
4
3
Node B
HARQ
2
5
3
RNC
L2 RLC

Fig. 5b

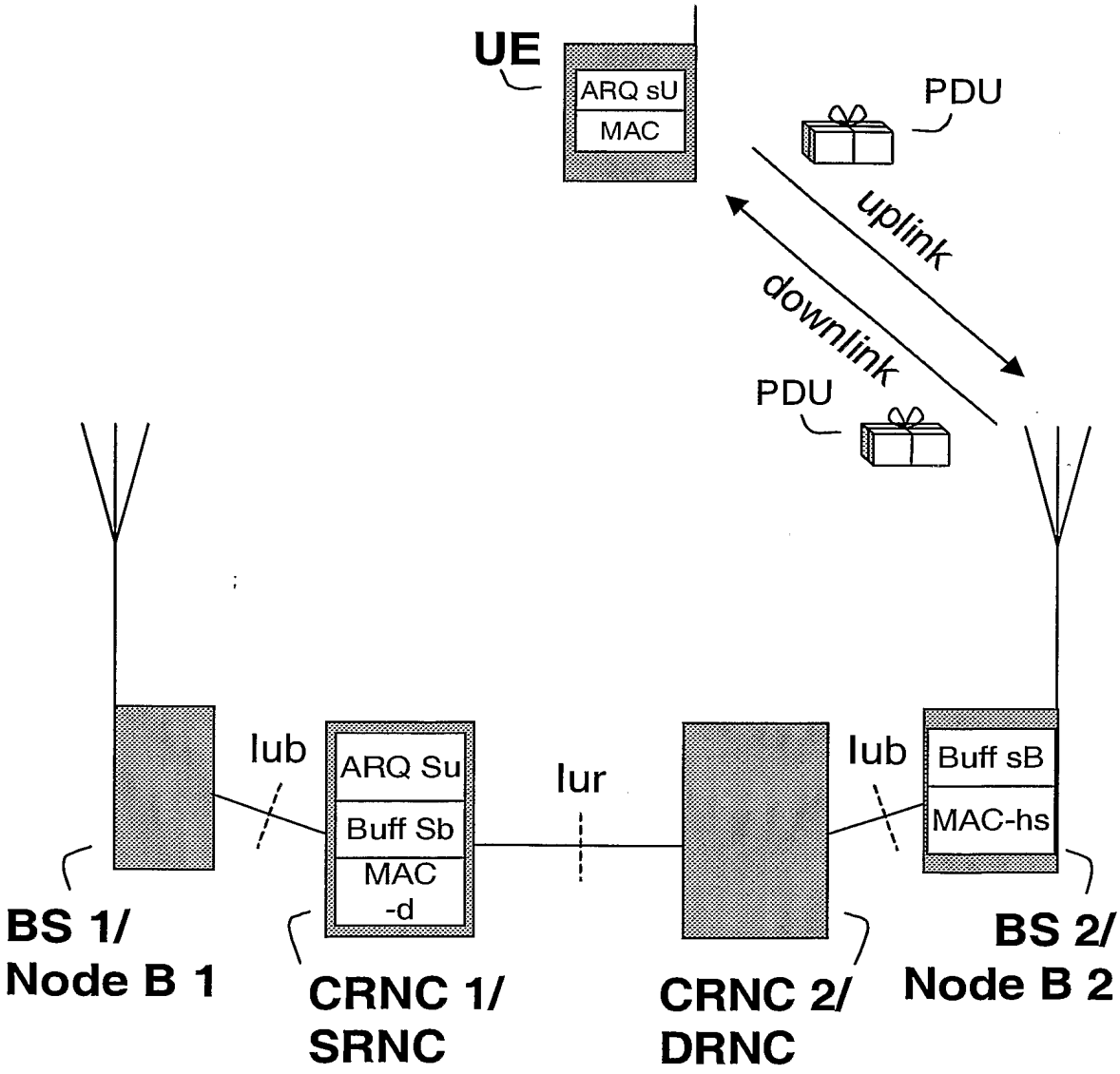

UE
ARQ sU
MAC
PDU
uplink
downlink
PDU
Iub
ARQ Su
Buff Sb
MAC
-d
Iur
Iub
Buff sB
MAC-hs
BS 1/
Node B 1
CRNC 1/
SRNC
CRNC 2/
DRNC
BS 2/
Node B 2

Fig. 6

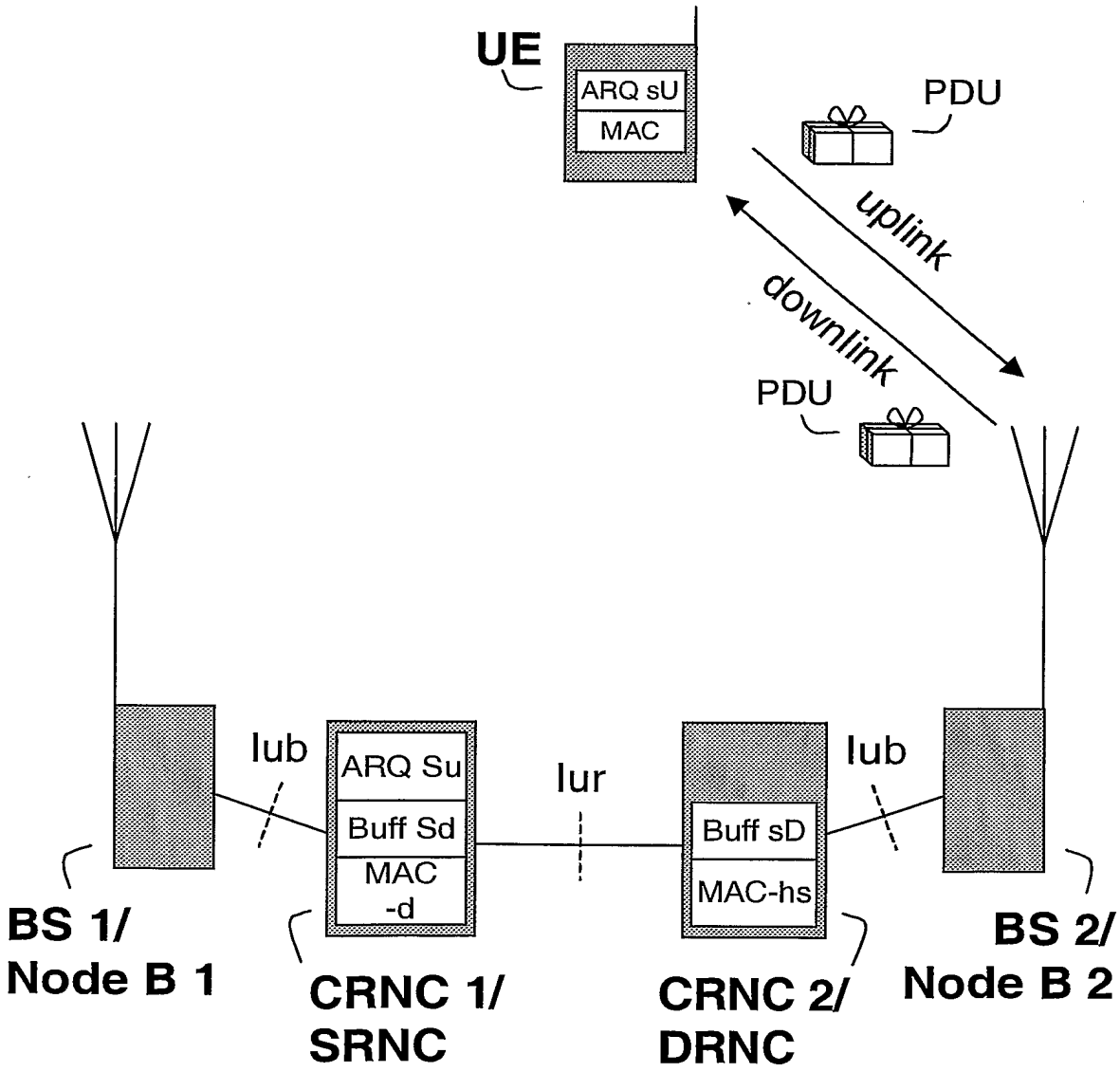

UE
ARQ sU
MAC
PDU
uplink
downlink
PDU
lub
ARQ Su
Buff Sd
MAC
-d
Iur
Buff sD
MAC-hs
lub
BS 1/
Node B 1
CRNC 1/
SRNC
CRNC 2/
DRNC
BS 2/
Node B 2

Fig. 7

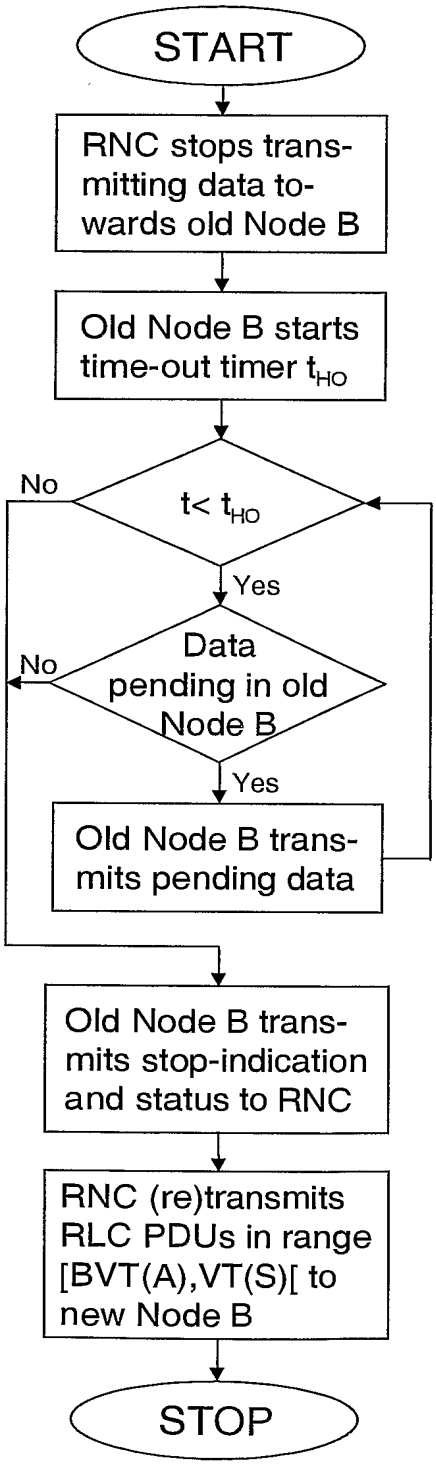

START
RNC stops transmitting data towards old Node B
Old Node B starts time-out timer t_{HO}
$t < t_{HO}$
No
Yes
Data pending in old Node B
No
Yes
Old Node B transmits pending data
Old Node B transmits stop-indication and status to RNC
RNC (re)transmits RLC PDUs in range [BVT(A),VT(S)[to new Node B
STOP

Fig. 8

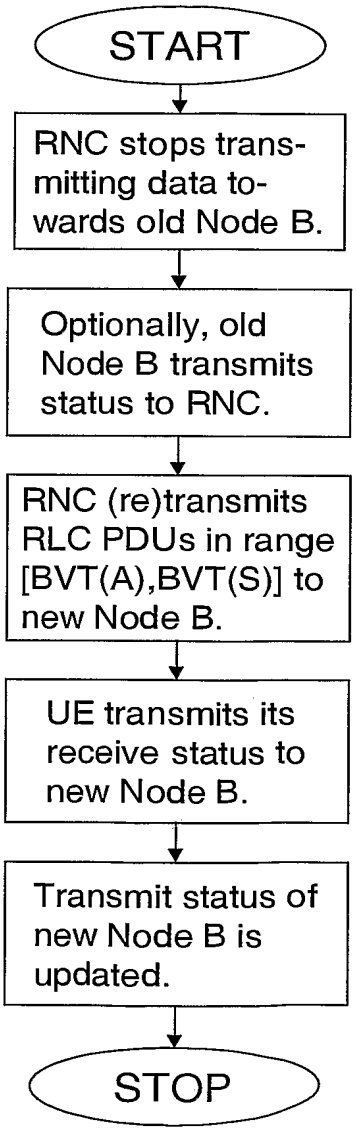

START
RNC stops transmitting data towards old Node B.
Optionally, old Node B transmits status to RNC.
RNC (re)transmits RLC PDUs in range [BVT(A),BVT(S)] to new Node B.
UE transmits its receive status to new Node B.
Transmit status of new Node B is updated.
STOP

Fig. 9

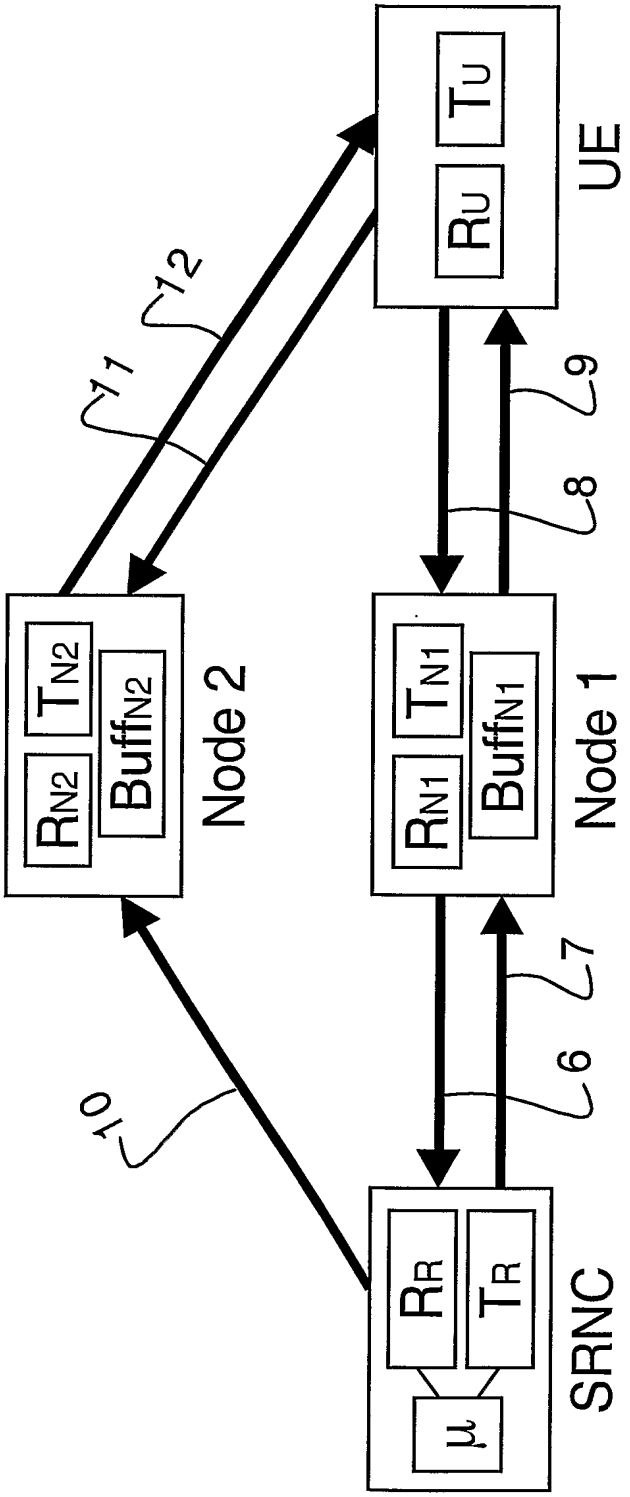

UE
RU
TU
Node 2
RN2
TN2
BuffN2
Node 1
RN1
TN1
BuffN1
SRNC
RR
TR
μ
6
7
8
9
10
11
12

Fig. 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 02/02186

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04L 1/18
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04L, H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	ENGELS, V. et al. "Radio access to an ATM network with a TDD/TDMA-OFDM system". In: VEHICULAR TECHNOLOGY CONFERENCE, 1997 IEEE 47th, Phoenix, AZ, USA, 4-7 May 1997, Vol. 3, pages 1654 - 1658, INSPEC: 5780602, see paragraph III., B.	1-61
	--	
A	WO 9959354 A2 (NOKIA NETWORKS OY), 18 November 1999 (18.11.99), abstract	1-61
	--	

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 March 2003	17 -03- 2003
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Åsa Hällgren /OGU Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 02/02186

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	LEFEVRE, F. et al. "Optimizing UMTS link layer parameters for a TCP connection". In: VEHICULAR TECHNOLOGY CONFERENCE, 2001. VTC 2001 SPRING. IEEE VTS 53rd, Rhodes, Greece, 6-9 May 2001, Vol. 4, pages 2318 - 2322, INSPEC: 7183792, see abstract; paragraph 1-3. --	1-61
A	STEPHANE, A. et al. "Mechanism and hierarchical topology for fast handover in wireless IP networks". In: IEEE COMMUNICATIONS MAGAZINE, November 2000, Vol. 38, Issue 11, pages 112 - 115, ISSN: 0163-6804, INSPEC: 6766392, see abstract -- --------	1-61

Form PCT/ISA/210 (continuation of second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

Information on patent family members

30/12/02

International application No.
PCT/SE 02/02186

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9959354 A2	18/11/99	AU 4042299 A	29/11/99
		EP 1078539 A	28/02/01
		FI 107364 B	00/00/00
		FI 981042 A	12/11/99
		JP 2002515708 T	28/05/02

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(19) World Intellectual Property Organization
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(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW.

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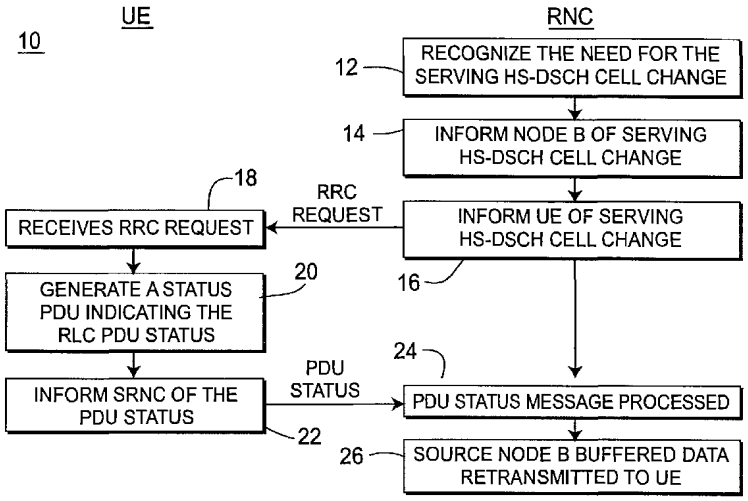
Published:
— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: SYSTEM FOR EFFICIENT RECOVERY OF NODE B BUFFERED DATA FOLLOWING SERVING HIGH SPEED DOWNLINK SHARED CHANNEL CELL CHANGE



(57) Abstract: The present invention relates to efficient recovery of High Speed Downlink Packet Access (HSDPA) data following handover. The present invention discloses a method and system for the UE to perform a serial of actions in order to reduce the latency and potentially prevent loss of PDU transmission during the serving HS-DSCH cell change procedure. A new criterion is introduced for UE generation of the status report of RLC PDU. The UE generates status report of the PDUs as soon as possible following notification of the HS-DSCH cell change indicated by the RRC procedure to more efficiently recover source Node B buffered data. PDU status may be signaled for each AM RLC instance associated with the HS-DSCH transport channel. Furthermore, upon Inter Node B serving HS-DSCH cell change the SRNC may wait for PDU status report before initiating transmission of new data in target cell.

WO 03/087978 A2

[0001] # SYSTEM FOR EFFICIENT RECOVERY OF NODE B BUFFERED DATA FOLLOWING SERVING HIGH SPEED DOWNLINK SHARED CHANNEL CELL CHANGE

[0002] ## FIELD OF INVENTION

[0003] The present invention relates to the field of wireless communications. More specifically, the present invention relates to efficient recovery of buffered data following handover in a wireless system that distributes data from an intermediate point. Third generation (3G) systems having a remote network controller (RNC) which is coupled to one or more Node Bs, which are in turn wirelessly coupled to a plurality of User Equipment (UEs), employing adaptive modulation and coding (AMC) and hybrid automatic repeat request (H-ARQ) techniques are just one example of this kind of system.

[0004] ## BACKGROUND

[0005] A 3G Universal Terrestrial Radio Access Network (UTRAN) comprises several RNCs, each of which can be coupled to several Node Bs. A node B is an entity comprising one or more base stations, each managing traffic for one or more cells.

[0006] The 3G FDD and TDD systems typically use the RNC to buffer and schedule data transmissions to the UE. However, for the high speed channels of 3G cellular systems, data is buffered and scheduled for transmission by a Node B. One of these high speed channels, for example, is the High Speed Downlink Shared Channel (HS-DSCH). Since data is distributed by the Node B, it is necessary to buffer data for transmission in Node B. A result of this architecture is the RNC does not have an up-to-date status of the Node-B controlled transmissions of Packet Data Units (PDU). Therefore, upon handover between cells, it is necessary to coordinate the scheduling of data transmissions with the cell change. Otherwise following the cell change it is necessary to resynchronize data transmission to avoid loss or duplication of transmitted data. In 3G networks handover between cells is controlled by the RNC. Since the RNC that controls the cell the UE is in may change there is the possibility data may be lost

or duplicated as a result of the handover. This problem is aggravated due to the architecture whereby there are several Node Bs associated with each RNC. There is a much higher likelihood that a mobile UE will require a Node B change than a change of RNC as a result of UE cell handovers.

[0007] The HS-DSCH utilizes AMC to enable high speed transmission of data and H-ARQ to increase the possibility of successful delivery of data. A serving HS-DSCH cell change is when the UE has to change the cell associated with the UTRAN access point that is performing transmission and reception of the serving HS-DSCH radio link. The serving HS-DSCH cell change is invoked when improved physical channel conditions and/or improved physical capacity is realized in an alternate cell. Unlike other channels in 3G networks that terminate at RNC within the UTRAN, the HS-DSCH terminates at Node B.

[0008] There are two types of HS-DSCH cell changes. An Intra-Node B serving HS-DSCH cell change is when the UE changes between two cells that are associated with the same Node B. An Inter-Node B serving HS-DSCH cell change is when the UE changes between two cells that are associated with different Node Bs. In an Inter-Node B cell change, the Node B before the serving HS-DSCH cell change is called the source Node B, and the Node B after the serving HS-DSCH cell change is called the target Node B.

[0009] There are peer Radio Link Control (RLC) entities in both the RNC and the UE providing an automatic repeat request (ARQ) function for transmission of data. The sending RLC entity signals a sequence number (SN) in the PDU header, which is used by the receiving RLC entity to ensure that no PDUs are missed in the transmission. If there are PDUs missed during the transmission, realized by out-of-sequence delivery of PDUs, the receiving RLC entity sends a status report PDU to inform the sending RLC entity that certain PDUs are missing. The status report PDU is used to describe the status of the data transmission. It identifies the SNs of the PDUs that are missed or received. If a PDU is missed, the sending RLC entity will retransmit a duplicate of the missed PDU to the receiving RLC.

[0010] It is also possible for the sending RLC entity to poll for a status report PDU from the receiving RLC entity, or to generate status reports periodically. The polling function provides a mechanism for the sending RLC entity to request the status of PDU transmissions.

[0011] A H-ARQ function in the Node B also provides for retransmission of failed transmissions. Although the H-ARQ operation removes some failed transmissions and increases the probability of successful delivery of data, it is the RLC protocol layer that ultimately ensures successful delivery.

[0012] Due to dynamic changes in propagation conditions, the HS-DSCH cell change must be performed rapidly to maintain quality of service. During the serving HS-DSCH cell change, it is possible that the UE stops transmission and reception in the source cell before all PDUs currently stored in the source Node B are successfully transmitted. Since the source Node B performs scheduling and buffering of the data, and since the data rates are very high, (for example 10 Mb/sec or higher), when the UE performs a serving HS-DSCH cell change, (especially for an Inter-Node B handover), there is a possibility that considerable amounts of data buffered in the source Node B will be lost. One reason for this data loss is that no mechanism exists within the UTRAN architecture for data buffered at the source Node B to be transferred to the target Node B. Upon serving a HS-DSCH cell change, the RNC has no information on how much, if any, data is lost since the RNC is not informed of Node B data transmission scheduling and if the transmission have been successfully acknowledged by the UE. Therefore when data is buffered in the source Node B upon serving HS-DSCH cell change to maintain transmission without loss of data, the RNC RLC must recover this data.

[0013] There are currently two preferred ways that prior art systems handle the recovery of data buffered at the source Node B. Following the HS-DSCH cell change: 1) the RNC can explicitly request a status PDU from the UE; or 2) the RNC can just start transmitting where it stopped in the source cell and out-of-sequence delivery realized by the UE will generate the status PDU.

[0014] In the first case, where the RNC explicitly requests a status PDU by polling the UE, the RNC must first wait until the physical channel is established in the new cell. The status PDU request is then sent and is received and processed by the UE. The UE generates the status PDU and sends it back to the RNC, which processes the status PDU and determines which PDUs are in need of retransmission.

[0015] In the second case, where the RNC just starts transmitting PDUs from where it stopped in the source cell, the UE recognizes the out-of-sequence delivery of data and generates a status PDU back to the RNC. The RNC processes the status PDU and learns which PDUs are in need of retransmission.

[0016] In either of these two cases, if data buffered in the source Node B needs to be recovered, then a status PDU will be processed, but proper reception of retransmitted data by the UE will be considerably delayed. This is due to delayed generation of the status PDU by the UE and reception of the status PDU in the RNC.

[0017] If transmission is being performed in RLC acknowledged mode, data is not passed to higher layers until in-sequence delivery of data can be performed. Accordingly, the UE will be required to buffer the out-of-sequence data until the missing PDUs can be retransmitted. This not only results in a delay of the transmission, but requires the UE to have a memory which is sufficiently large enough to buffer data until the data stored in the source Node B can be successfully delivered. Otherwise, the effective data transmission rate is reduced, thereby effecting quality of service. Since memory is very expensive, this is an undesirable design constraint.

[0018] Accordingly, the prior art methods of recovering data that is buffered in a source Node B prior to transfer to a target Node B have very undesirable consequences. It is desirable to have a system and method where data buffered in the source Node B can be more efficiently recovered with less delay to properly maintain user quality of service requirements.

[0019] SUMMARY

[0020] The present invention is a method and system which implement a series of actions in order to reduce latency, and potentially prevent loss of PDU transmissions during the serving HS-DSCH cell change procedure. A new criterion is introduced for UE generation of the status report of RLC PDUs. The UE autonomously generates status reports of the PDUs as soon as possible following notification of the HS-DSCH cell change indicated by the RRC handover procedure to more efficiently recover source Node B buffered data. PDU status may be signaled for each acknowledged mode (AM) RLC instance associated with the HS-DSCH transport channel.

[0021] BRIEF DESCRIPTION OF THE DRAWING(S)

[0022] Figure 1 is a flow diagram of an efficient procedure in accordance with the present invention for efficient recovery of Node B buffered data following an HS-DSCH cell change.

[0023] Figure 2 is a flow diagram of an alternative method whereby the RNC waits for a status PDU prior to initiating a transmission of new data in the target cell.

[0024] DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

[0025] The preferred embodiment of the present invention will be described with reference to the drawing figures wherein like numerals represent like elements throughout.

[0026] According to the present invention, in order to reduce the latency for the RNC to obtain the status of the PDUs and recover data buffered in the source Node B, after the serving HS-DSCH cell change, the UE autonomously sends the status of the PDUs to the RNC following notification of the HS-DSCH cell change indicated by the RRC procedure. The generation of PDU status may be applied for each AM RLC instance associated with the HS-DSCH transport channel.

[0027] Referring to the flow diagram of Figure 1, a method 10 of efficiently recovering Node B buffered data in accordance with the present invention is

shown. The RNC recognizes the need for the serving HS-DSCH cell change (step 12). The Node B is then informed of the serving HS-DSCH cell change (step 14). The UE is informed of the serving HS-DSCH cell change, as indicated via the RRC Request message (step 16). It should be noted that it is also possible to invoke step 16 in advance of step 14 with no adverse consequences.

[0028] Once the RRC Request message is received by the UE in step 18, in order to reduce delay in recovering data buffered in the source Node B, the UE autonomously generates a status report (step 20) indicating the RLC PDU status as soon as possible following notification of the HS-DSCH cell change indicated by the RRC procedure. The UE does not wait for any of the prior art triggers for generating a status PDU, (for example, either a request by the RNC to generate a status PDU or the detection by the UE of out-of-sequence delivery of data).

[0029] In the UE, there are many different alternative methods that the UE may implement to trigger the generation of a PDU status report following a serving HS-DSCH cell change. However, several examples are presented herein. Preferably, as a first option, the MAC-hs informs the RLC once its reordering buffers are flushed. A second option is that the RRC informs the RLC of the Level 3 (L3) RRC procedure indicating the serving HS-DSCH cell change. Third, the physical layer can inform the RLC of the reception of HS-DSCH control channels in the target cell, or the physical layer can inform the RLC upon switch over of HS-DSCH control to the target cell. One skilled in the art would certainly realize that there may be other methods for triggering the RLC PDU status message to be sent from the UE to the RNC. As a result of this procedure, the PDU status is generated and sent to the RNC (step 22) with less delay, which results in more efficient recovery of source Node B buffered data.

[0030] In accordance with step 22, there are several alternatives for the UE to send the status report of the PDUs to the RNC. These methods of sending the status PDU are examples of how the status PDU can be signaled from the UE to the RNC and are not primary to the invention, which relates to generating a status PDU upon a new criterion. Preferably, the UE generates a RLC status report for each AM RLC instance mapped to the HS-DSCH transport channel.

[0031] In a second alternative, the UE sends the PDU status report via the first existing uplink message from the UE to the RNC as soon as a status report is obtained. For Intra-Node B serving cell changes, (and assuming that the HS-DSCH transport channel and radio bearer parameters are not changed), the message is "PHYSICAL CHANNEL RECONFIGURATION COMPLETE" on the DCCH. If the HS-DSCH transport channel and radio bearer parameters are changed and/or for Inter-Node B serving cell changes, the message is "TRANPSORT CHANNEL RECONFIGURATION COMPLETE" on the DCCH. The PDU status can be identified in any RRC signaling message. The RNC RRC entity then informs the status of the PDUs to the RLC to resume the transmission to the target Node B.

[0032] In a third alternative, the UE sends the status report on a new L3 signaling message on DCCH from the UE to the RNC. This new message is sent from the Radio Resource Control (RRC) layer of the UE to the RRC layer of the RNC. The RNC then informs the status of the PDUs to the RLC layer to resume the transmission to the target Node B. In this case, the PDU status message shown in Figure 1 may comprise two separate messages "RRC Complete" and "RLC Status".

[0033] It should be noted that the specific format of the status report of the PDUs can vary. For example, the format of the status reports of the PDUs may include: 1) the sequence number (SN) of the last in-sequence successfully delivered PDUs; 2) the highest SN of the PDUs received successfully; 3) the SNs of the PDUs that are not received successfully, (i.e., missed PDUs) up to the highest SN of the PDU that are received successfully; 4) or a list of list the SNs of the PDUs that are received successfully.

[0034] Once the RNC receives the message carrying the PDU status, the PDU status message is processed by the RNC RLC (step 24) to determine the missed PDUs. The data lost as a result of the cell change is now realized by the RNC and can be retransmitted to the UE (step 26). It should be noted that the message can be of many alternatives, and is not necessarily limited to just carrying the PDU status report.

[0035] It should also be noted that in this embodiment of the present invention, the RNC, between steps 16 and 24, may continue to forward data in the target cell for transmission to the UE. Since the data will be out-of-sequence if all source Node B buffered data has not been successfully transmitted, the UE RLC will be forced to buffer the data to maintain in-sequence delivery to higher layers. This requires the UE to have sufficient memory to store the out-of-sequence PDUs. Following any loss of sequential data, transmission is limited to the UE memory capability until the lost sequential data is successfully transmitted.

[0036] Referring to the flow diagram of Figure 2, a method 40 of efficiently recovering Node B buffered data in accordance with an alternative embodiment of the present invention is shown. This method 40 is similar to the method 10 shown in Figure 1, and the steps of Figure 2 that are labeled the same as in Figure 1 are identical. However, in accordance with this embodiment of the present invention, the method 40 includes a new step 17 whereby the RNC halts all downlink HS-DSCH transmissions to the UE until the PDU status message is processed at step 24. This embodiment minimizes delay for retransmission of source Node B buffered data and limits the amount of data that must be buffered at the UE.

[0037] With respect to the minimization of delay, the Node B is unaware of RLC transmission sequence numbers and transmission scheduling within Node B is FIFO-based. Therefore, if data is forwarded by the RNC in the target cell before the PDU status is processed, it will be sent first. This data queuing in Node B results in a possibly further delay of retransmission of the source Node B buffered data.

[0038] The present invention may be applicable to both the HS-DSCH cell change in Inter-Node B cell changes and Intra-Node B cell changes. Since in the Intra-Node B case it may not be possible for the Node B to redirect the buffered HS-DSCH data to the target cell due to internal design issues, the RNC may indicate the need for generation of PDU status for both cases. It is also possible that the UE may be unable to distinguish between an Inter-Node B cell change

and an Intra-Node B cell change, which would also result in generation of PDU status for both Inter and Intra cases. The status PDU sent in such a fashion will be useful in the Inter-Node B cell change or Intra-Node B case where the buffered data cannot be switched to the target cell.

[0039] Although the present invention has been described in detail, it is to be understood that the invention is not limited thereto, and that various changes can be made therein without departing from the spirit and scope of the invention, which is defined by the attached claims.

* * *

CLAIMS

What is claimed is:

1. A system for facilitating a high speed-downlink shared channel (HS-DSCH) cell change, the system including a remote network controller (RNC) coupled to at least one Node B, said at least Node B being further coupled to at least one user equipment (UE), the system comprising:

a radio resource control (RRC) unit, located at the RNC, for determining when an HS-DSCH cell change is necessary and for generating a notification of said cell change;

a control unit located within said UE for receiving said notification and generating a status message which indicates the status of each PDU, and for sending said status message to said RNC; and

a control unit at said RNC for reading said status message and retransmitting PDUs to the UE based upon such status message.

2. A method for high speed-downlink shared channel (HS-DSCH) cell change in a system having a remote network controller (RNC) coupled to at least one Node B, which is further coupled to at least one user equipment, the method comprising:

detecting at the RNC the need for an HS-DSCH cell change;

notifying the UE of said cell change;

determining the status of data received at the UE;

generating a status report based upon said status of the receipt of data at the UE;

transmitting from the UE to the RNC said status report;

determining at said RNC based upon said status report the data which is to be transmitted to the UE.

3. A UE which facilitates high speed-downlink shared channel (HS-DSCH) cell change from a source cell to a target cell comprising:

means at said UE for determining when a cell change is necessary;

means for determining the status of data transmitted to the UE prior to said cell change;

means for generating a status report based upon said determination;

means for transmitting said data status report.

4. The UE of claim 3, whereby said data comprises packet data units (PDUs).

5. The system of claim 4, wherein said status report comprises a status PDU.

6. The system of claim 3, whereby said first determining means comprises means for receiving a request message indicating an HS-DSCH cell change.

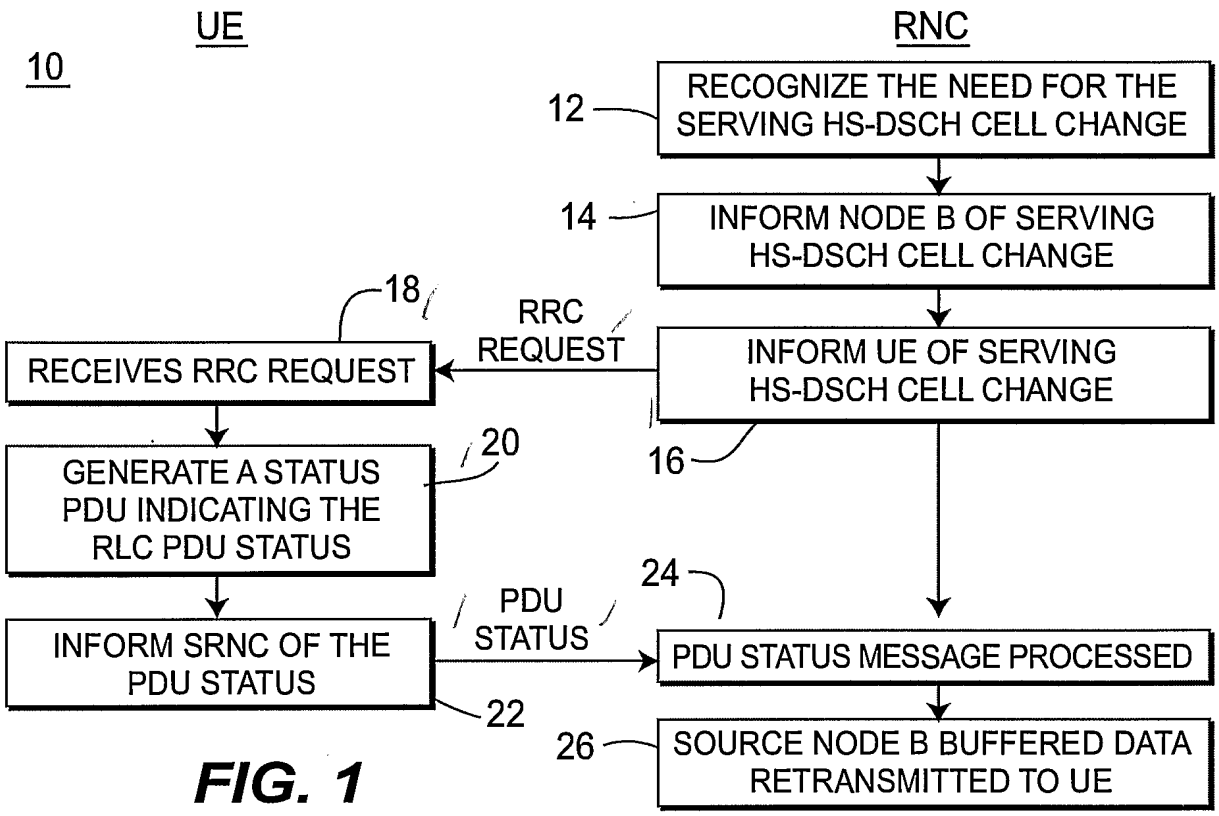

UE
10
RNC
12
RECOGNIZE THE NEED FOR THE SERVING HS-DSCH CELL CHANGE
14
INFORM NODE B OF SERVING HS-DSCH CELL CHANGE
18
RRC REQUEST
RECEIVES RRC REQUEST
INFORM UE OF SERVING HS-DSCH CELL CHANGE
16
20
GENERATE A STATUS PDU INDICATING THE RLC PDU STATUS
24
PDU STATUS
INFORM SRNC OF THE PDU STATUS
PDU STATUS MESSAGE PROCESSED
22
26
SOURCE NODE B BUFFERED DATA RETRANSMITTED TO UE

FIG. 1

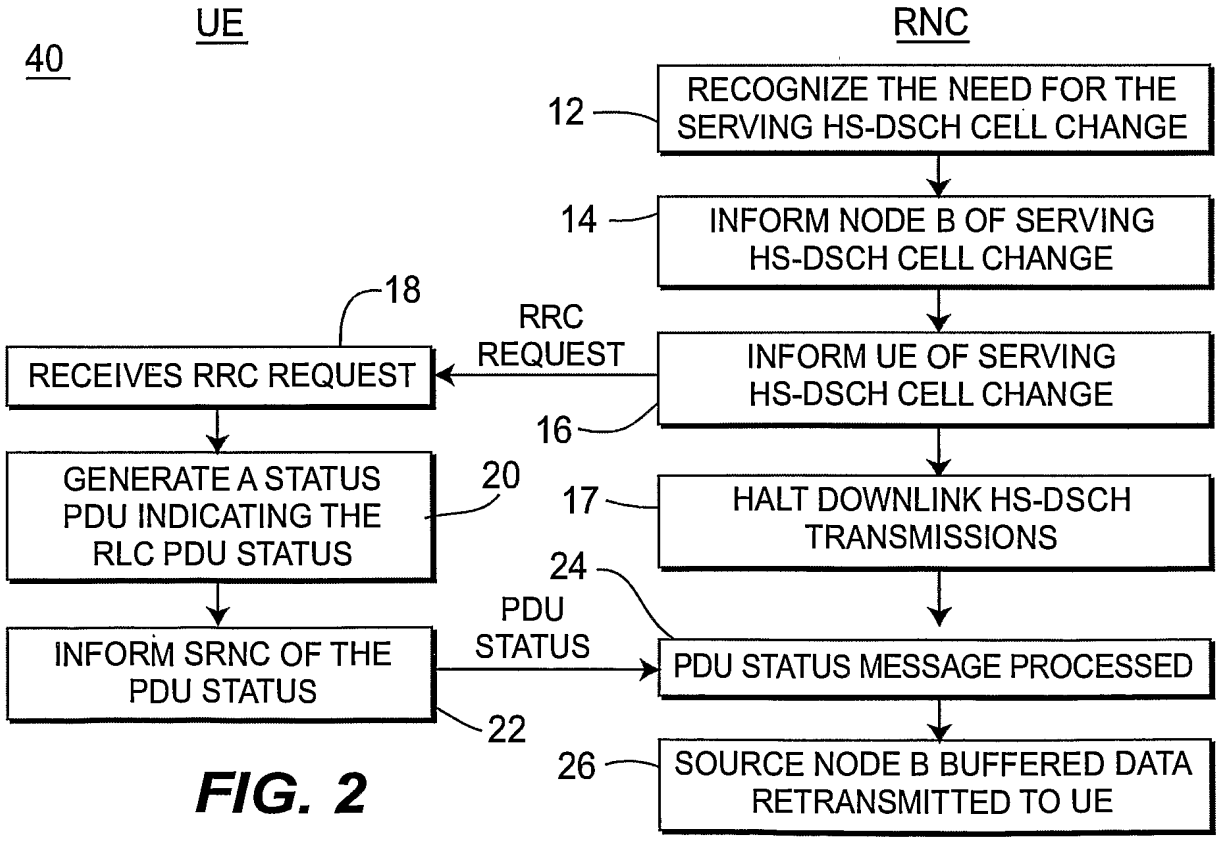

UE
40
RNC
12
RECOGNIZE THE NEED FOR THE SERVING HS-DSCH CELL CHANGE
14
INFORM NODE B OF SERVING HS-DSCH CELL CHANGE
18
RRC REQUEST
RECEIVES RRC REQUEST
INFORM UE OF SERVING HS-DSCH CELL CHANGE
16
20
GENERATE A STATUS PDU INDICATING THE RLC PDU STATUS
17
HALT DOWNLINK HS-DSCH TRANSMISSIONS
24
PDU STATUS
INFORM SRNC OF THE PDU STATUS
PDU STATUS MESSAGE PROCESSED
22
26
SOURCE NODE B BUFFERED DATA RETRANSMITTED TO UE

FIG. 2

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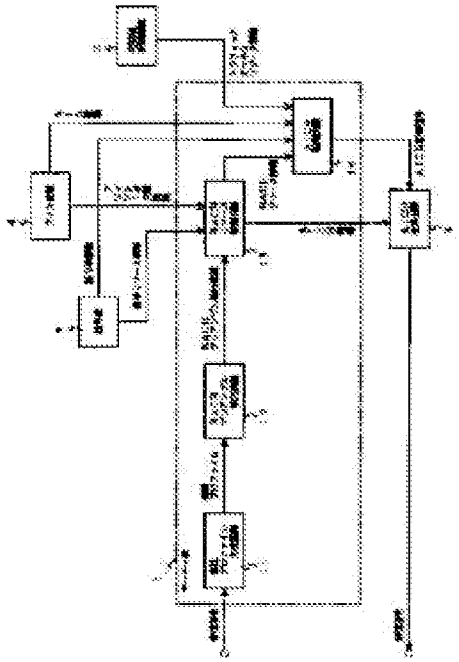
(71)Applicant : NEC CORP
(72)Inventor : HONDOU SHINYA

(54) MOBILE COMMUNICATION SYSTEM, RADIO BASE STATION DEVICE AND RANDOM ACCESS CONTROL METHOD TO BE USED THEREFOR

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a radio base station device in which stable communication quality is secured even when a using rate of an RACH or a traffic channel is high, system capacity is increased and useless power consumption in radio terminal equipment is suppressed.
SOLUTION: Based upon RACH resource information from an RACH resource managing circuit 13, SIR information from a finger part 4, error rate information from a decoding part 5 and traffic channel resource information from a call processing controller 2, an AICH control circuit 14 outputs an AICH control signal to an AICH generating circuit 3. The AICH generating circuit 3 generates an AICH by using AICH information from the RACH resource managing circuit 13 and the AICH control signal and transmits the AICH as a transmitting signal.



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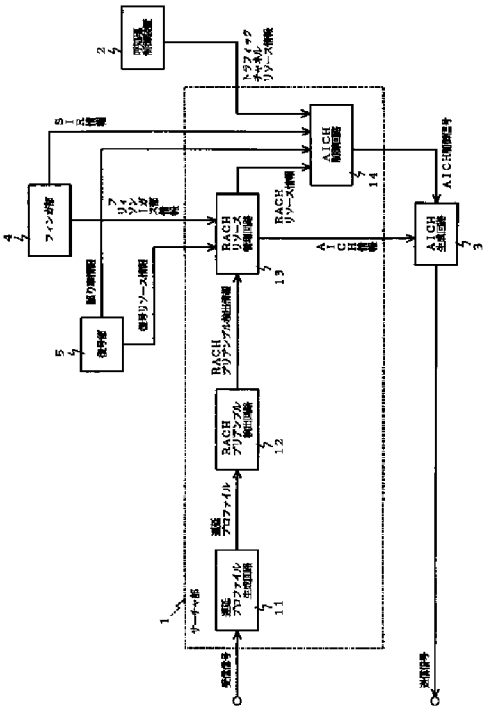
5K067 AA13 AA21 BB02 BB21 CC08
DD11 DD17 DD51 EE02 EE10
EE16 FF02 GG01 GG11 HH22
HH24

(54)【発明の名称】　移動通信システム、無線基地局装置及びそれらに用いるランダムアクセス制御方法

(57)【要約】
【課題】　ＲＡＣＨやトラフィックチャネルの使用率が高い時でも安定した通信品質を確保し、システム容量を増やすとともに、無線端末装置の無駄な電力消費を抑えること可能な無線基地局装置を提供する。
【解決手段】　ＡＩＣＨ制御回路１４はＲＡＣＨリソース管理回路１３からのＲＡＣＨリソース情報、フィンガ部４からのＳＩＲ情報、復号部５からの誤り率情報、呼処理制御装置２からのトラフィックチャネルリソース情報を基にＡＩＣＨ制御信号をＡＩＣＨ生成回路３に出力する。ＡＩＣＨ生成回路３はＲＡＣＨリソース管理回路１３からのＡＩＣＨ情報及びＡＩＣＨ制御信号を用いてＡＩＣＨを生成し、送信信号としてＡＩＣＨを送信する。



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【特許請求の範囲】

【請求項１】　移動局が発呼しようとする時にそのメッセージの送信に先立って基地局に対して前記メッセージが発生したことを通知するためのＲＡＣＨ（Ｒａｎｄｏｍ　Ａｃｃｅｓｓ　Ｃｈａｎｎｎｅｌ）プリアンブルを送信し、前記基地局が前記ＲＡＣＨプリアンブルを検出した時にＡＩＣＨ（Ａｃｑｕｉｓｉｔｉｏｎ　Ｉｎｄｉｃａｔｏｒ　Ｃｈａｎｎｅｌ）を前記移動局に送信する移動通信システムであって、少なくともリソース使用率及び受信回線の状態に応じて前記移動局のＲＡＣＨプリアンブル送信を制御することを特徴とする移動通信システム。

【請求項２】　前記基地局は、前記リソース使用率及び前記受信回線の状態に応じて前記移動局のメッセージ送信を不許可とする情報を前記移動局に送信することを特徴とする請求項１記載の移動通信システム。

【請求項３】　前記基地局は、前記移動局のメッセージ送信を不許可とする情報を前記ＡＩＣＨにて前記移動局に送信することを特徴とする請求項２記載の移動通信システム。

【請求項４】　移動局が発呼しようとする時にそのメッセージの送信に先立って前記メッセージが発生したことを通知するために送信するＲＡＣＨ（Ｒａｎｄｏｍ　Ａｃｃｅｓｓ　Ｃｈａｎｎｎｅｌ）プリアンブルを検出した時にＡＩＣＨ（Ａｃｑｕｉｓｉｔｉｏｎ　Ｉｎｄｉｃａｔｏｒ　Ｃｈａｎｎｅｌ）を前記移動局に送信する無線基地局装置であって、少なくともリソース使用率及び受信回線の状態に応じて前記移動局のＲＡＣＨプリアンブル送信を制御する手段を有することを特徴とする無線基地局装置。

【請求項５】　前記移動局のＲＡＣＨプリアンブル送信を制御する手段は、前記リソース使用率及び前記受信回線の状態に応じて前記移動局のメッセージ送信を不許可とする情報を前記移動局に送信することを特徴とする請求項４記載の無線基地局装置。

【請求項６】　前記移動局のＲＡＣＨプリアンブル送信を制御する手段は、前記移動局のメッセージ送信を不許可とする情報を前記ＡＩＣＨにて前記移動局に送信することを特徴とする請求項５記載の無線基地局装置。

【請求項７】　受信信号から遅延プロファイルを生成する遅延プロファイル生成回路と、移動局がメッセージの発生を通知するために送信するＲＡＣＨ（Ｒａｎｄｏｍ　Ａｃｃｅｓｓ　Ｃｈａｎｎｎｅｌ）プリアンブルを前記遅延プロファイルを基に検出するＲＡＣＨプリアンブル検出回路と、前記ＲＡＣＨプリアンブルが検出された時にＡＩＣＨ（Ａｃｑｕｉｓｉｔｉｏｎ　ＩｎｄｉｃａｔｏｒＣｈａｎｎｅｌ）を前記移動局に送信するＡＩＣＨ生成回路とを含む無線基地局装置であって、

ＲＡＣＨリソース情報とＳＩＲ（Ｓｉｇｎａｌ　ｔｏ　Ｉｎｔｅｒｆｅｒｅｎｃｅ　Ｒａｔｉｏ）情報と誤り率情報とトラフィックチャネルリソース情報とを基に前記移動局のＲＡＣＨプリアンブル送信を制御するためのＡＩＣＨ制御信号を前記ＡＩＣＨ生成回路に出力するＡＩＣＨ制御回路を有することを特徴とする無線基地局装置。

【請求項８】　前記ＡＩＣＨ生成回路は、前記ＡＩＣＨ制御信号が出力されている間、前記ＲＡＣＨリソース情報に基づいたＡＩＣＨ情報の内容に関わらず、前記移動局のＲＡＣＨプリアンブル送信を抑制するための信号を送信し続けることを特徴とする請求項７記載の無線基地局装置。

【請求項９】　前記ＡＩＣＨ生成回路は、前記移動局のメッセージ送信を不許可とする情報を前記ＡＩＣＨにて前記移動局に送信することを特徴とする請求項８記載の無線基地局装置。

【請求項１０】　移動局が発呼しようとする時にそのメッセージの送信に先立って前記メッセージが発生したことを通知するために送信するＲＡＣＨ（Ｒａｎｄｏｍ　Ａｃｃｅｓｓ　Ｃｈａｎｎｎｅｌ）プリアンブルを検出した時にＡＩＣＨ（Ａｃｑｕｉｓｉｔｉｏｎ　Ｉｎｄｉｃａｔｏｒ　Ｃｈａｎｎｅｌ）を前記移動局に送信する無線基地局装置のランダムアクセス制御方法であって、少なくともリソース使用率及び受信回線の状態に応じて前記移動局のＲＡＣＨプリアンブル送信を制御するステップを有することを特徴とするランダムアクセス制御方法。

【請求項１１】　前記移動局のＲＡＣＨプリアンブル送信を制御するステップは、前記リソース使用率及び前記受信回線の状態に応じて前記移動局のメッセージ送信を不許可とする情報を前記移動局に送信することを特徴とする請求項１０記載のランダムアクセス制御方法。

【請求項１２】　前記移動局のＲＡＣＨプリアンブル送信を制御するステップは、前記移動局のメッセージ送信を不許可とする情報を前記ＡＩＣＨにて前記移動局に送信することを特徴とする請求項１１記載のランダムアクセス制御方法。

【請求項１３】　受信信号から遅延プロファイルを生成する遅延プロファイル生成回路と、移動局がメッセージの発生を通知するために送信するＲＡＣＨ（Ｒａｎｄｏｍ　Ａｃｃｅｓｓ　Ｃｈａｎｎｎｅｌ）プリアンブルを前記遅延プロファイルを基に検出するＲＡＣＨプリアンブル検出回路と、前記ＲＡＣＨプリアンブルが検出された時にＡＩＣＨ（Ａｃｑｕｉｓｉｔｉｏｎ　Ｉｎｄｉｃａｔｏｒ　Ｃｈａｎｎｅｌ）を前記移動局に送信するＡＩＣＨ生成回路とを含む無線基地局装置ランダムアクセス制御方法であって、

ＲＡＣＨリソース情報とＳＩＲ（Ｓｉｇｎａｌ　ｔｏ　Ｉｎｔｅｒｆｅｒｅｎｃｅ　Ｒａｔｉｏ）情報と誤り率情報とトラフィックチャネルリソース情報とを基に前記移動局のＲＡＣＨプリアンブル送信を制御するためのＡ

ＩＣＨ制御信号を前記ＡＩＣＨ生成回路に出力するステップを有することを特徴とするランダムアクセス制御方法。

【請求項１４】　前記ＡＩＣＨ制御信号が出力されている間、前記ＲＡＣＨリソース情報に基づいたＡＩＣＨ情報の内容に関わらず、前記移動局のＲＡＣＨプリアンブル送信を抑制するための信号を前記ＡＩＣＨ生成回路から送信し続けることを特徴とする請求項１３記載の無線基地局装置。

【請求項１５】　前記移動局のメッセージ送信を不許可とする情報を前記ＡＩＣＨにて前記ＡＩＣＨ生成回路から前記移動局に送信することを特徴とする請求項１４記載の無線基地局装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は無線基地局装置及びそれに用いるランダムアクセス制御方法に関し、特にスペクトラム拡散通信方式を使用した無線通信システムにおけるランダムアクセス制御方法に関する。

【０００２】

【従来の技術】近年、移動通信システムに適用する通信方式の一つとして、干渉や妨害に強いスペクトラム拡散通信方式が注目されている。スペクトラム拡散通信方式を使用した無線通信システムにおいて、例えば、送信側の装置はディジタル化された音声データや画像データに対してＰＳＫ（Ｐｈａｓｅ　Ｓｈｉｆｔ　Ｋｅｙｉｎｇ）またはＦＳＫ（Ｆｒｅｑｕｅｎｃｙ　Ｓｈｉｆｔ　Ｋｅｙｉｎｇ）変調方式等のディジタル変調方式によって変調を行った後、この変調された送信データを疑似雑音符号（ＰＮコード：Ｐｓｅｕｄｏｒａｎｄｏｍ　Ｎｏｉｓｅ　ｃｏｄｅ）等の拡散符号を用いて広帯域のベースバンド信号に変換し、その後、無線周波数の信号に変換して送信している。

【０００３】一方、受信側の装置は受信した無線周波数信号に対して送信側の装置で使用した拡散符号と同じ符号を用いて逆拡散を行い、その後、ＰＳＫまたはＦＳＫ復調方式によってディジタル復調を行って受信データを再生するように構成されている。

【０００４】ＣＤＭＡ（Ｃｏｄｅ　Ｄｉｖｉｓｉｏｎ　Ｍｕｌｔｉｐｌｅ　Ａｃｃｅｓｓ）移動通信システムでは、複数の移動局がランダムアクセスチャネル（ＲＡＣＨ：Ｒａｎｄｏｍ　Ａｃｃｅｓｓ　Ｃｈａｎｎｎｅｌ）を用いて任意のタイミングで適宜基地局にアクセスを行い、基地局はそのアクセスに対して基地局のメッセージ送信を制御している。

【０００５】この従来のＣＤＭＡ移動通信システムにおけるランダムアクセス制御方法では、移動局が発呼しようとする時、移動局がメッセージの送信に先立ち、基地局に対してメッセージが発生したことを通知するプリアンブルを送信する。ここで、プリアンブルは１６種類のシグニチャコードから生成され、移動局は１６種類の中からランダムに１つを選び、プリアンブルを生成する。

【０００６】基地局はプリアンブルを受信すると、予め指定された閾値と相関値を比較し、相関値の方が大きければプリアンブルを検出したと判断し、そのシグニチャに対応したＡＩＣＨ（Ａｃｑｕｉｓｉｔｉｏｎ　Ｉｎｄｉｃａｔｏｒ　Ｃｈａｎｎｅｌ）を移動局に送信する。基地局は全１６種類のシグニチャをサーチし、１つも検出しなかった場合にはＡＩＣＨの送信を行わない。ＡＩＣＨには基地局が検出したシグニチャ番号と、基地局が移動局のメッセージ送信を許可するＡＣＫ（ａｃｋｎｏｗｌｅｄｇｅｍｅｎｔ）及び不許可とするＮＡＣＫ（ｎｅｇａｔｉｖｅａｃｋｎｏｗｌｅｄｇｅｍｅｎｔｓ）の情報とが含まれている。

【０００７】移動局は規定時間内に自らが送信したシグニチャ番号に対応するＡＩＣＨを受信した場合、ＡＣＫであればメッセージを送信し、ＮＡＣＫであれば、一連のランダムアクセス手順を抜ける。

【０００８】また、移動局は一定時間内に自らが送信したシグニチャ番号に対応するＡＩＣＨを受信しなかった場合、送信電力をランピング（徐々に上げる）し、再度プリアンブルを送信する。

【０００９】従来の無線基地局装置の構成を図６に示す。図６を参照すると、無線基地局装置は遅延（ディレイ）プロファイル生成回路６１と、ＲＡＣＨプリアンブル検出回路６２と、ＲＡＣＨリソース管理回路６３とからなるサーチャ部６と、ＡＩＣＨ生成回路８と、フィンガ部９と、復号部１０と、呼処理制御装置７とから構成されている。

【００１０】図６における簡単な信号の流れについて説明する。まず、遅延プロファイル生成回路６１に入力された受信信号はシグニチャ毎のＲＡＣＨプリアンブルコードとの相関演算が行われ、その相関演算結果によってそれぞれ遅延プロファイルが生成される。ここで、遅延プロファイル生成回路６１はＲＡＣＨプリアンブルの到来する一定の周期で起動がかかるものとする。

【００１１】各遅延プロファイルはＲＡＣＨプリアンブル検出回路６２に出力され、予め指定された閾値以上のレベルを持つピークが存在すれば、該当シグニチャのＲＡＣＨプリアンブルを検出したと判断し、全シグニチャのＲＡＣＨプリアンブル検出情報がＲＡＣＨリソース管理回路６３に出力される。ここで、ＲＡＣＨプリアンブル検出情報の内容は検出したシグニチャ番号、そのレベル、及び検出位置である。但し、全てのシグニチャが未検出であっても、ＲＡＣＨプリアンブル検出情報は出力され、ＲＡＣＨリソース管理回路６３が起動されるものとする。

【００１２】ＲＡＣＨリソース管理回路６３はＲＡＣＨプリアンブル検出情報及びＲＡＣＨメッセージの復号処理に必要なサーチャ部６、フィンガ部９、復号部１０の

リソース情報を基に、各検出シグニチャに対してリソース使用許可を表すＡＣＫ或いはリソース使用不可を表すＮＡＣＫを与え、ＡＩＣＨ情報としてＡＩＣＨ生成回路８に出力する。

【００１３】サーチャ部６のリソース情報に関してはＲＡＣＨリソース管理回路６３内で得ることができるとして、特に結線は記していない。ここで、検出したシグニチャ数と比べて残りリソース数が少ない時には、ＲＡＣＨリソース管理回路６３は各検出シグニチャの相関レベル順及び検出位置から各シグニチャに順位を付け、上位のシグニチャから優先的にリソースを割り当て、今回使用したＲＡＣＨリソース情報をＡＩＣＨ生成回路８に出力する。

【００１４】ＡＩＣＨ生成回路５はＡＩＣＨ情報を用いてＡＩＣＨを生成し、送信信号としてＡＩＣＨを送信する。また、フィンガ部９は受信信号に対して逆拡散、フェージングベクトル生成、検波等の復調処理及びＲＡＫＥ合成を行い、復号部１０はＲＡＫＥ合成後のデータに対して誤り訂正、データフォーマット変換、上位装置へのデータ送信を行うものである。

【００１５】

【発明が解決しようとする課題】しかしながら、上述した従来のランダムアクセス制御方法では、通信を行っているユーザ数が多いほど干渉が大きくなるため、ＲＡＣＨプリアンブルによる干渉の影響が大きくなること、またＲＡＣＨ用リソースが不足しているので、エリア内にいて発呼している複数の無線端末装置が該当するＡＩＣＨを受信するまでの間、ＲＡＣＨプリアンブルの送信電力をランピングし、再送信を行ってしまうため、ＲＡＣＨプリアンブルによる干渉が大きくなる。

【００１６】そのため、従来のランダムアクセス制御方法では、無線端末装置によるＲＡＣＨプリアンブル送信が通信品質を劣化させるという問題がある。特に、無線基地局装置のＲＡＣＨ或いはトラフィックチャネル用のリソースよりも、発呼あるいは通信を行おうとする無線端末装置の数が多い、過密状態のエリアで問題となりやすい。

【００１７】また、従来のランダムアクセス制御方法では、上記のような過密状態のエリアで、無線端末装置が何度もＲＡＣＨプリアンブルの送信電力をランピングし、移動局の電力消費量が大きくなってしまうという問題もある。

【００１８】そこで、本発明の目的は上記の問題点を解消し、ＲＡＣＨやトラフィックチャネルの使用率が高い時でも安定した通信品質を確保することができ、システム容量を増やすことができるとともに、無線端末装置の無駄な電力消費を抑えることできる無線基地局装置及びそれに用いるランダムアクセス制御方法を提供することにある。

【００１９】

【課題を解決するための手段】本発明による移動通信システムは、移動局が発呼しようとする時にそのメッセージの送信に先立って基地局に対して前記メッセージが発生したことを通知するためのＲＡＣＨ（Ｒａｎｄｏｍ　Ａｃｃｅｓｓ　Ｃｈａｎｎｎｅｌ）プリアンブルを送信し、前記基地局が前記ＲＡＣＨプリアンブルを検出した時にＡＩＣＨ（Ａｃｑｕｉｓｉｔｉｏｎ　Ｉｎｄｉｃａｔｏｒ　Ｃｈａｎｎｅｌ）を前記移動局に送信する移動通信システムであって、少なくともリソース使用率及び受信回線の状態に応じて前記移動局のＲＡＣＨプリアンブル送信を制御している。

【００２０】本発明による無線基地局装置は、移動局が発呼しようとする時にそのメッセージの送信に先立って前記メッセージが発生したことを通知するために送信するＲＡＣＨ（Ｒａｎｄｏｍ　Ａｃｃｅｓｓ　Ｃｈａｎｎｅｌ）プリアンブルを検出した時にＡＩＣＨ（Ａｃｑｕｉｓｉｔｉｏｎ　Ｉｎｄｉｃａｔｏｒ　Ｃｈａｎｎｅｌ）を前記移動局に送信する無線基地局装置であって、少なくともリソース使用率及び受信回線の状態に応じて前記移動局のＲＡＣＨプリアンブル送信を制御する手段を備えている。

【００２１】本発明による他の無線基地局装置は、受信信号から遅延プロファイルを生成する遅延プロファイル生成回路と、移動局がメッセージの発生を通知するために送信するＲＡＣＨ（Ｒａｎｄｏｍ　Ａｃｃｅｓｓ　Ｃｈａｎｎｅｌ）プリアンブルを前記遅延プロファイルを基に検出するＲＡＣＨプリアンブル検出回路と、前記ＲＡＣＨプリアンブルが検出された時にＡＩＣＨ（ＡｃｑｕｉｓｉｔｉｏｎＩｎｄｉｃａｔｏｒ　Ｃｈａｎｎｅｌ）を前記移動局に送信するＡＩＣＨ生成回路とを含む無線基地局装置であって、ＲＡＣＨリソース情報とＳＩＲ（Ｓｉｇｎａｌ　ｔｏ　Ｉｎｔｅｒｆｅｒｅｎｃｅ　Ｒａｔｉｏ）情報と誤り率情報とトラフィックチャネルリソース情報とを基に前記移動局のＲＡＣＨプリアンブル送信を制御するためのＡＩＣＨ制御信号を前記ＡＩＣＨ生成回路に出力するＡＩＣＨ制御回路を備えている。

【００２２】本発明によるランダムアクセス制御方法は、移動局が発呼しようとする時にそのメッセージの送信に先立って前記メッセージが発生したことを通知するために送信するＲＡＣＨ（Ｒａｎｄｏｍ　Ａｃｃｅｓｓ　Ｃｈａｎｎｎｅｌ）プリアンブルを検出した時にＡＩＣＨ（Ａｃｑｕｉｓｉｔｉｏｎ　ＩｎｄｉｃａｔｏｒＣｈａｎｎｅｌ）を前記移動局に送信する無線基地局装置のランダムアクセス制御方法であって、少なくともリソース使用率及び受信回線の状態に応じて前記移動局のＲＡＣＨプリアンブル送信を制御するステップを備えている。

【００２３】本発明による他のランダムアクセス制御方法は、受信信号から遅延プロファイルを生成する遅延プロファイル生成回路と、移動局がメッセージの発生を通

知するために送信するＲＡＣＨ（Ｒａｎｄｏｍ　Ａｃｃｅｓｓ　Ｃｈａｎｎｎｅｌ）プリアンブルを前記遅延プロファイルを基に検出するＲＡＣＨプリアンブル検出回路と、前記ＲＡＣＨプリアンブルが検出された時にＡＩＣＨ（Ａｃｑｕｉｓｉｔｉｏｎ　Ｉｎｄｉｃａｔｏｒ　Ｃｈａｎｎｅｌ）を前記移動局に送信するＡＩＣＨ生成回路とを含む無線基地局装置ランダムアクセス制御方法であって、ＲＡＣＨリソース情報とＳＩＲ（Ｓｉｇｎａｌ　ｔｏ　Ｉｎｔｅｒｆｅｒｅｎｃｅ　Ｒａｔｉｏ）情報と誤り率情報とトラフィックチャネルリソース情報とを基に前記移動局のＲＡＣＨプリアンブル送信を制御するためのＡＩＣＨ制御信号を前記ＡＩＣＨ生成回路に出力するステップを備えている。

【００２４】すなわち、本発明の無線基地局装置は、基地局のリソース使用率や受信回線の状態によって移動局のＲＡＣＨ（Ｒａｎｄｏｍ　Ａｃｃｅｓｓ　Ｃｈａｎｎｅｌ）プリアンブル送信を制御し、通信品質の向上、システム容量の増加、周辺の基地局、移動局への干渉抑圧、移動局の電力消費低減を実現するものである。

【００２５】より具体的に説明すると、本発明の無線基地局装置では、受信信号から遅延プロファイル生成回路で遅延プロファイルが生成され、これを基にＲＡＣＨプリアンブル検出回路でＲＡＣＨプリアンブルが検出される。ＡＩＣＨ（Ａｃｑｕｉｓｉｔｉｏｎ　Ｉｎｄｉｃａｔｏｒ　Ｃｈａｎｎｅｌ）制御回路ではＲＡＣＨリソース管理回路からのＲＡＣＨリソース情報、フィンガ部からのＳＩＲ（Ｓｉｇｎａｌ　ｔｏ　Ｉｎｔｅｒｆｅｒｅｎｃｅ　Ｒａｔｉｏ）情報、復号部からの誤り率情報、呼処理制御装置からのトラフィックチャネルリソース情報を基にＡＩＣＨ生成回路にＡＩＣＨ制御信号を出力する。

【００２６】ＡＩＣＨ生成回路はＲＡＣＨリソース管理回路からのＡＩＣＨ情報を基にＡＩＣＨを生成するが、ＡＩＣＨ制御回路からＡＩＣＨ制御信号が出力されている間、ＡＩＣＨ情報の内容に関わらず、全シグニチャに対するＮＡＣＫ（ｎｅｇａｔｉｖｅ　ａｃｋｎｏｗｌｅｄｇｅｍｅｎｔｓ）を送信し続ける。これによって、過密状態のエリアにいる移動局のＲＡＣＨプリアンブル送信を抑制する。

【００２７】本発明の無線基地局装置では、上記のように、無線基地局装置から全シグニチャに対してＮＡＣＫが送信されている間、その無線基地局装置に対してＲＡＣＨプリアンブルを送信する全ての無線端末装置がランピング（電力値を徐々に上げて送信する方法）を行わない。すなわち、無線端末装置はＡＩＣＨ受信を待たずにランダムアクセス手順を抜ける。

【００２８】また、無線端末装置は再度ランダムアクセス手順に入ったとしても、送信されるＲＡＣＨプリアンブルが最低電力となる。これはＲＡＣＨメッセージ、トラフィックチャネルで既に無線基地局と通信を行っている他のユーザから見ると、ノイズが減り、通信品質が向上することにつながる。

【００２９】さらに、該無線基地局装置のエリアとオーバーラップしている他の無線基地局装置のエリアに対してもノイズ逓減効果が得られる。特に、トラフィックチャネルを使用してパケット通信を行っているユーザに関しては、パケットの再送率が低くなるため、１ユーザ当たりの通信時間が短くなる可能性が高く、無線基地局装置のリソースに空きがでるのが早くなる。すなわち、より多くのＲＡＣＨ、トラフィックチャネルを扱うことが可能となる。

【００３０】これによって、本発明の無線基地局装置では、ＲＡＣＨやトラフィックチャネルの使用率が高い時でも安定した通信品質を確保することが可能となり、システム容量を増やすことが可能となる。

【００３１】一方、本発明の無線基地局装置では、ＲＡＣＨ用のリソースが余っていても、トラフィックチャネル用のリソース不足で通信できなくなり、最初のＲＡＣＨによる通信が無駄になるケースや、ＲＡＣＨ用のリソースがないにも関わらず、無線基地局装置の閾値にＲＡＣＨプリアンブルの電力が達しないために、無線基地局装置がＡＩＣＨを送信せず、ＡＩＣＨを受信することができない無線端末装置がＲＡＣＨプリアンブルのランピング送信を続けてしまうケースを事前に防ぐことが可能となる。よって、本発明の無線基地局装置では、ＲＡＣＨあるいはトラフィックチャネルの使用率が高い時に、無線端末装置の無駄な電力消費を抑えることが可能となる。

【００３２】また、本発明の無線基地局装置では、無線基地局においてＡＩＣＨ送信用のリソースが既に存在しており、また無線端末装置においてＡＩＣＨを未受信あるいは該当シグニチャが未検出であれば、ランピング送信、該当シグニチャがＮＡＣＫであれば、ランダムアクセス手順を抜け、ＲＡＣＨプリアンブルの送信を停止する機能を既に具備している。このため、本発明の無線基地局装置では、上記の効果を得るために無線基地局装置のリソースを新たに消費せず、かつ無線端末装置の変更を必要としない。

【００３３】さらに、本発明の無線基地局装置では、ＡＩＣＨがもともとＲＡＣＨプリアンブルが送信されてから規定された短い時間内に送信しなければならないものであり、この無線基地局装置の既存の仕組みを利用することによって、例えば他の周期的に送信されているチャネルより素早く、全無線端末装置に送信することが可能である。したがって、本発明の無線基地局装置では、無線端末装置に対して素早い制御が可能となる。

【００３４】

【発明の実施の形態】次に、本発明の実施例について図面を参照して説明する。図１は本発明の一実施例による無線基地局装置の構成を示すブロック図である。図１に

おいて、本発明の一実施例による無線基地局装置はサーチャ部１と、呼処理制御装置２と、ＡＩＣＨ（Ａｃｑｕｉｓｉｔｉｏｎ Ｉｎｄｉｃａｔｏｒ Ｃｈａｎｎｅｌ）生成回路３と、フィンガ部４と，復号部5 とを含んで構成されている。

【００３５】サーチャ部１は遅延（ディレイ）プロファイル生成回路１１と、ＲＡＣＨ（Ｒａｎｄｏｍ Ａｃｃｅｓｓ Ｃｈａｎｎｎｅｌ）プリアンブル検出回路１２と、ＲＡＣＨリソース管理回路１３と、ＡＩＣＨ制御回路１４とから構成されている。

【００３６】図１における簡単な信号の流れについて説明する。まず、遅延プロファイル生成回路１１に入力された受信信号はシグニチャ毎のＲＡＣＨプリアンブルコードとの相関演算が行われ、その相関演算結果によってそれぞれ遅延プロファイルが生成される。ここで、遅延プロファイル生成回路１１はＲＡＣＨプリアンブルの到来する一定の周期で起動がかかるものとする。

【００３７】各遅延プロファイルはＲＡＣＨプリアンブル検出回路１２に出力され、予め指定された閾値以上のレベルを持つピークが存在すれば、該当シグニチャのＲＡＣＨプリアンブルを検出したと判断し、全シグニチャのＲＡＣＨプリアンブル検出情報がＲＡＣＨリソース管理回路１３に出力される。ここで、ＲＡＣＨプリアンブル検出情報の内容は検出したシグニチャ番号、そのレベル、検出位置である。但し、全てのシグニチャが未検出であっても、ＲＡＣＨプリアンブル検出情報は出力され、ＲＡＣＨリソース管理回路１３が起動されるものとする。

【００３８】ＲＡＣＨリソース管理回路１３はＲＡＣＨプリアンブル検出情報及びＲＡＣＨメッセージの復号処理に必要なサーチャ部１、フィンガ部４、復号部５のリソース情報を基に、各検出シグニチャに対してリソース使用許可を表すＡＣＫ（ａｃｋｎｏｗｌｅｄｇｅｍｅｎｔ）あるいはリソース使用不可を表すＮＡＣＫ（ｎｅｇａｔｉｖｅ ａｃｋｎｏｗｌｅｄｇｅｍｅｎｔｓ）を与え、ＡＩＣＨ情報としてＡＩＣＨ生成回路１３に出力する。

【００３９】サーチャ部１のリソース情報に関してはＲＡＣＨリソース管理回路１３内で得ることができるとして、特に結線は記していない。ここで、検出したシグニチャ数と比べて残りリソース数が少ない時には、ＲＡＣＨリソース管理回路１３が各検出シグニチャの相関レベル順及び検出位置から各シグニチャに順位を付け、上位のシグニチャから優先的にリソースを割り当て、今回使用したＲＡＣＨリソース情報をＡＩＣＨ制御回路１４に出力する。

【００４０】ここで、ＡＩＣＨ制御回路１４はＲＡＣＨリソース管理回路１３からのＲＡＣＨリソース情報、フィンガ部４からのＳＩＲ（Ｓｉｇｎａｌ ｔｏ Ｉｎｔｅｒｆｅｒｅｎｃｅ Ｒａｔｉｏ）情報、復号部５からの誤り率情報、呼処理制御装置２からのトラフィックチャネルリソース情報を基にＡＩＣＨ制御信号をＡＩＣＨ生成回路３に出力する。

【００４１】ＡＩＣＨ生成回路３はＡＩＣＨ情報及びＡＩＣＨ制御信号を用いてＡＩＣＨを生成し、送信信号としてＡＩＣＨを送信する。また、フィンガ部４は受信信号に対して逆拡散、フェージングベクトル生成、検波等の復調処理及びＲＡＫＥ合成を行い、復号部５はＲＡＫＥ合成後のデータに対して誤り訂正、データフォーマット変換、上位装置へのデータ送信を行うものである。

【００４２】図２は本発明の一実施例で用いる一般的な無線端末装置の構成を示すブロック図である。図２において、無線端末装置は遅延プロファイル生成回路２１と、ＡＩＣＨ検出回路２２と、送信電力制御回路２３と、ＲＡＣＨプリアンブル生成回路２４とから構成されている。

【００４３】図２における簡単な信号の流れについて説明する。まず、遅延プロファイル生成回路２１に入力された受信信号は、無線基地局装置で用いられた拡散符号と同じ拡散符号を用いて相関演算が行われ、その相関演算結果によって遅延プロファイルが生成される。遅延プロファイルはＡＩＣＨ検出回路２２に出力され、ＡＩＣＨ検出回路２２で自らが送信したＲＡＣＨプリアンブルが無線基地局装置で検出されたかどうか、リソースが割り当てられたかどうかが判定される。

【００４４】規定時間内に該当するシグニチャのＡＩＣＨを受信しなければ、ＡＩＣＨ検出回路２２はＲＡＣＨプリアンブル送信電力制御回路２３及びＲＡＣＨプリアンブル生成回路２４にＲＡＣＨプリアンブル再送制御信号を出力する。

【００４５】ＲＡＣＨプリアンブル生成回路２４はＲＡＣＨプリアンブル再送制御信号を受け取ると、ＲＡＣＨプリアンブル信号をＲＡＣＨプリアンブル送信電力制御回路２３に出力し、ＲＡＣＨプリアンブル送信電力制御回路２３は前回より電力値をあげてＲＡＣＨプリアンブル信号を送信する。

【００４６】また、無線端末装置は該当するシグニチャのＡＩＣＨを受信し、且つ“ＮＡＣＫ”であれば、ランダムアクセス手順を抜け、ＲＡＣＨプリアンブルの送信を停止する。

【００４７】図３は図１のＲＡＣＨリソース管理回路１３の動作を示すフローチャートであり、図４は図１のＡＩＣＨ制御回路１４の動作を示すフローチャートである。これら図１～図４を参照してＲＡＣＨリソース管理回路１３及びＡＩＣＨ制御回路１４の動作について説明する。

【００４８】ＲＡＣＨリソース管理回路１３はＲＡＣＨプリアンブル検出情報あるいはサーチャ部１、フィンガ部４、復号部５のいずれかのリソース情報（リソースの獲得／解放状況の更新）を受信すると、動作を開始す

る。

【００４９】ＲＡＣＨリソース管理回路１３はＲＡＣＨプリアンブル検出情報を受信し（図３ステップＳ１）、検出したシグニチャが存在すると（図３ステップＳ２）、割り当て可能なＲＡＣＨリソース数と検出したシグニチャ数とを比較し、等しいかあるいはＲＡＣＨリソース数の方が多ければ、検出した全てのシグニチャにＲＡＣＨリソースを割り当てる（図３ステップＳ３，Ｓ４）。

【００５０】また、ＲＡＣＨリソース管理回路１３はＲＡＣＨリソース数の方が少なければ、検出したシグニチャの優先順位付けを行い、上位から順番にＲＡＣＨリソースを割り当てる（図３ステップＳ３，Ｓ５）。その後、ＲＡＣＨリソース管理回路１３はＡＩＣＨ情報（各シグニチャの検出／未検出及びＡＣＫ／ＮＡＣＫ）をＡＩＣＨ生成回路３に出力し（図３ステップＳ６）、保存していた前回のＲＡＣＨリソース情報をＡＩＣＨ制御回路１４に出力し（図３ステップＳ７）、今回のＲＡＣＨリソース割り当てによって更新されたＲＡＣＨリソース情報を保存する（図３ステップＳ８）。

【００５１】ＲＡＣＨリソース管理回路１３は全てのシグニチャが未検出であると（図３ステップＳ２）、保存していた前回のＲＡＣＨリソース情報をＡＩＣＨ制御回路１４に出力し（図３ステップＳ７）、今回のＲＡＣＨリソース割り当てによって更新されたＲＡＣＨリソース情報を保存する（図３ステップＳ８）。

【００５２】また、ＲＡＣＨリソース管理回路１３はサーチャ部１、フィンガ部４、復号部５のいずれかのリソース情報を受信した場合（図３ステップＳ１）、その内容をＲＡＣＨリソース情報に反映かつ保存し（図３ステップＳ９）、ＡＩＣＨ制御回路１４に出力する（図３ステップＳ１０）。

【００５３】また、ＲＡＣＨリソース管理回路１３はＲＡＣＨプリアンブル情報を入力した場合に、今回のＲＡＣＨリソース情報を保存し（図３ステップＳ８）、保存していた前回のＲＡＣＨリソース情報を出力する（図３ステップＳ７）。これによって、ＲＡＣＨリソースの使用率が設定値を上回った時についても、ＡＩＣＨ生成回路５から正しく（全シグニチャをＮＡＣＫにすることなく）、ＡＩＣＨを出力することができる。

【００５４】ＡＩＣＨ制御回路１４も、ＲＡＣＨリソース管理回路１３からのＲＡＣＨリソース情報、フィンガ部４からのＳＩＲ情報、復号部５からの誤り率情報、呼処理制御装置２からのトラフィックチャネルリソース情報のうちのいずれかを受信すると、動作を開始する。

【００５５】ＡＩＣＨ制御回路１４は呼処理制御装置２からのトラフィックチャネルリソース情報で、無線基地局装置のトラフィックチャネル用リソースの使用率が高ければ（図４ステップＳ１１）、ＡＩＣＨ制御信号をＯＮにしてＡＩＣＨ生成回路１５に出力する（図４ステップＳ１２）。

【００５６】ＡＩＣＨ制御回路１４は無線基地局装置のトラフィックチャネル用リソースの使用率が低いが（図４ステップＳ１１）、ＲＡＣＨリソース管理回路１３からのＲＡＣＨリソース情報で、ＲＡＣＨ用リソースの使用率が高く（図４ステップＳ１３）、かつフィンガ部４からのＳＩＲ情報でＳＩＲが目標値より低いか（図４ステップＳ１４）、復号部５からの誤り率情報で、受信信号の誤り率が高ければ（図４ステップＳ１５）、ＡＩＣＨ制御信号をＯＮにしてＡＩＣＨ生成回路３に出力する（図４ステップＳ１２）。

【００５７】一方、ＡＩＣＨ制御回路１４はＲＡＣＨ用リソースが十分ある時（図４ステップＳ１３）、あるいはＲＡＣＨ用リソースは不足しているが、ＳＩＲが目標値以上であり、誤り率が低い場合（図４ステップＳ１４，Ｓ１５）、ＡＩＣＨ制御信号をＯＦＦにする（図４ステップＳ１６）。

【００５８】ＡＩＣＨ生成回路３はＡＩＣＨ制御信号がＯＮの時に、ＲＡＣＨリソース管理回路１３からのＡＩＣＨ情報の内容に関わらず、全シグニチャに対してＮＡＣＫとし、ＯＦＦの時にＡＩＣＨ情報にしたがってＡＩＣＨ信号を出力する。

【００５９】このように、本実施例では、無線基地局装置から全シグニチャに対してＮＡＣＫが送信されている間、その無線基地局装置に対してＲＡＣＨプリアンブルを送信する全ての無線端末装置がランピング（電力値を徐々に上げて送信する方法）を行わない。すなわち、無線端末装置はＡＩＣＨ受信を待たずにランダムアクセス手順を抜ける。

【００６０】また、本実施例では再度ランダムアクセス手順に入ったとしても送信されるＲＡＣＨプリアンブルが最低電力となる。これはＲＡＣＨメッセージ、トラフィックチャネルで既に無線基地局と通信を行っている他のユーザから見ると、ノイズが減り、通信品質が向上することにつながる。

【００６１】さらに、本実施例では該無線基地局装置のエリアとオーバーラップしている他の無線基地局装置のエリアに対してもノイズ逓減効果が得られる。特に、トラフィックチャネルを使用してパケット通信を行っているユーザに関しては、パケットの再送率が低くなるため、１ユーザ当たりの通信時間が短くなる可能性が高く、無線基地局装置のリソースに空きがでるのが早くなる。つまり、より多くのＲＡＣＨ、トラフィックチャネルを扱うことが可能となる。

【００６２】これによって、本実施例では、ＲＡＣＨやトラフィックチャネルの使用率が高い時でも安定した通信品質を確保することができ、システム容量を増やすことができる。

【００６３】一方、本実施例では、ＲＡＣＨ用のリソースが余っていてもトラフィックチャネル用のリソース不

足で通信できなくなり、最初のＲＡＣＨによる通信が無駄になるケースや、ＲＡＣＨ用のリソースがないにも関わらず、無線基地局装置の閾値にＲＡＣＨプリアンブルの電力が達しないために無線基地局装置がＡＩＣＨを送信せず、ＡＩＣＨを受信することができない無線端末装置がＲＡＣＨプリアンブルのランピング送信を続けてしまうケースを事前に防ぐことができる。これによって、本実施例では、ＲＡＣＨあるいはトラフィックチャネルの使用率が高い時に、無線端末装置の無駄な電力消費を抑えることができる。

【００６４】また、本実施例では、無線基地局においてＡＩＣＨ送信用のリソースが既に存在しており、また無線端末装置において、ＡＩＣＨを未受信あるいは該当シグニチャが未検出であればランピング送信、該当シグニチャがＮＡＣＫであればランダムアクセス手順を抜け、ＲＡＣＨプリアンブルの送信を停止する機能を既に具備しているため、上記の効果を得るために無線基地局装置のリソースを新たに消費せず、かつ無線端末装置の変更を必要としない。

【００６５】さらに、本実施例では、ＡＩＣＨがもともとＲＡＣＨプリアンブルが送信されてから規定された短い時間内に送信しなければならないものであり、この無線基地局装置の既存の仕組みを利用することによって、例えば他の周期的に送信されているチャネルより素早く、全無線端末装置に送信することが可能である。そのため、本実施例では、無線端末装置に対して素早い制御を行うことができる。

【００６６】図５は本発明の他の実施例によるＡＩＣＨ制御回路の動作を示すフローチャートである。本発明の他の実施例は、ＡＩＣＨ制御回路１４の動作が異なる以外は図１に示す本発明の一実施例と同様の構成となっている。そこで、これら図１及び図５を参照して本発明の他の実施例によるＡＩＣＨ制御回路の動作について説明する。

【００６７】上述したトラフィックチャネルリソース情報、ＲＡＣＨリソース情報、ＳＩＲ情報、誤り率情報を用いてＡＩＣＨ制御信号をＯＮ／ＯＦＦする組合せに制限はない。また、トラフィックチャネル用リソースの使用率及びＲＡＣＨ用リソースの使用率は任意に設定することができる。この場合の動作について図５を参照して説明する。

【００６８】ＡＩＣＨ制御回路１４はＲＡＣＨリソース管理回路１３からのＲＡＣＨリソース情報で、ＲＡＣＨ用リソースの使用率が高ければ（図５ステップＳ２１）、ＡＩＣＨ制御信号をＯＮにしてＡＩＣＨ生成回路３に出力する（図５ステップＳ２２）。

【００６９】一方、ＡＩＣＨ制御回路１４はＲＡＣＨ用リソースが十分ある時（図５ステップＳ２１）、ＡＩＣＨ制御信号をＯＦＦにする（図５ステップＳ２３）。このように、トラフィックチャネルよりもＲＡＣＨによる通信（例えば、発呼だけでなく、伝送量の少ないパケット通信をＲＡＣＨで扱う場合）を優先し、かつＲＡＣＨ用リソースがなくなった（リソース使用率が１００％）時のみ、ＡＩＣＨ制御信号をＯＮにする動作も考えられる。

【００７０】本発明の無線基地局装置では無線端末装置にＲＡＣＨプリアンブル送信を停止させる伝達手段としてＡＩＣＨを使用しているが、全無線端末装置に一斉に伝達できるものであれば、その代わりとなるチャネルの種類に制限はない。

【００７１】

【発明の効果】以上説明したように本発明は、移動局が発呼しようとする時にそのメッセージの送信に先立って基地局に対してメッセージが発生したことを通知するためのＲＡＣＨプリアンブルを送信し、基地局がＲＡＣＨプリアンブルを検出した時にＡＩＣＨを移動局に送信する移動通信システムにおいて、少なくともリソース使用率及び受信回線の状態に応じて移動局のＲＡＣＨプリアンブル送信を制御することによって、ＲＡＣＨやトラフィックチャネルの使用率が高い時でも安定した通信品質を確保することができ、システム容量を増やすことができるとともに、無線端末装置の無駄な電力消費を抑えることできるという効果が得られる。

【図面の簡単な説明】

【図１】本発明の一実施例による無線基地局装置の構成を示すブロック図である。

【図２】本発明の一実施例で用いる一般的な無線端末装置の構成を示すブロック図である。

【図３】図１のＲＡＣＨリソース管理回路の動作を示すフローチャートである。

【図４】図１のＡＩＣＨ制御回路の動作を示すフローチャートである。

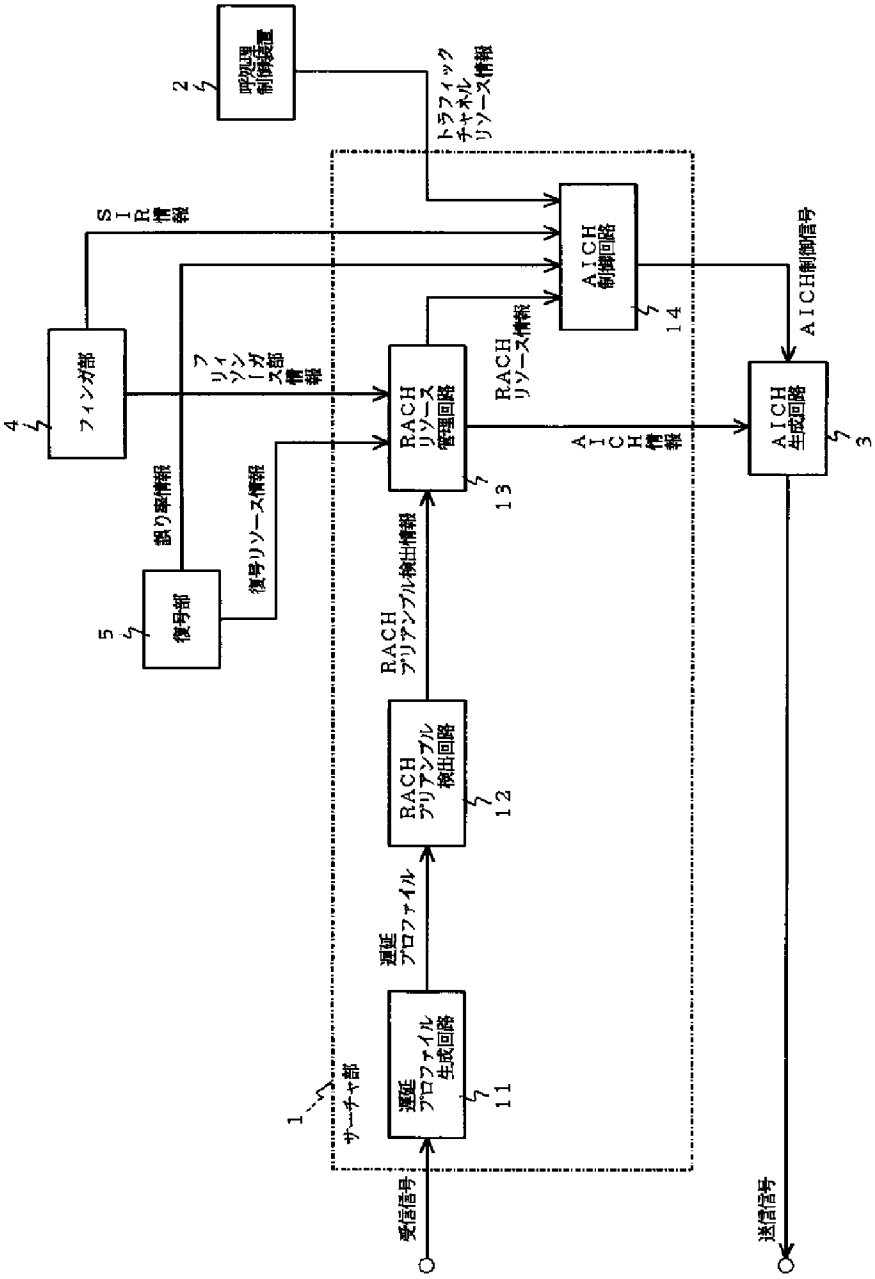
【図５】本発明の他の実施例によるＡＩＣＨ制御回路の動作を示すフローチャートである。

【図６】従来例による無線基地局装置の構成を示すブロック図である。

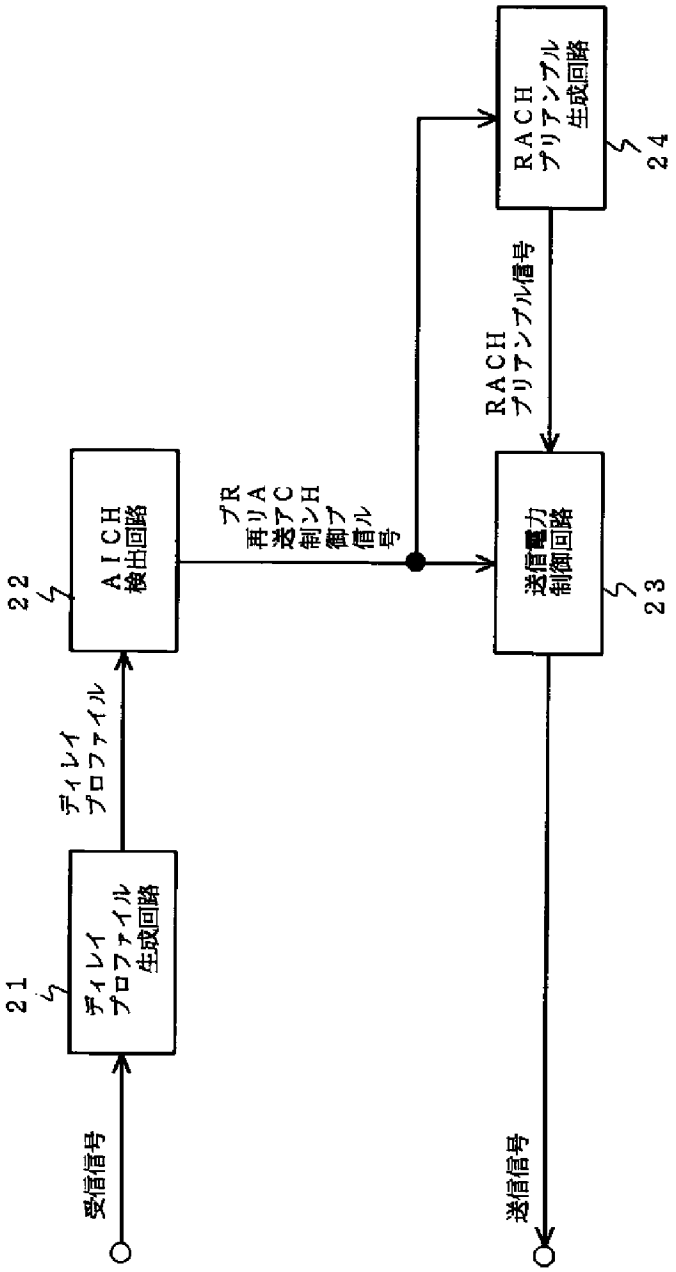
【符号の説明】

１　サーチャ部
２　呼処理制御装置
３　ＡＩＣＨ生成回路
４　フィンガ部
５　復号部
１１　遅延プロファイル生成回路
１２　ＲＡＣＨプリアンブル検出回路
１３　ＲＡＣＨリソース管理回路
１４　ＡＩＣＨ制御回路
２１　遅延プロファイル生成回路
２２　ＡＩＣＨ検出回路
２３　送信電力制御回路
２４　ＲＡＣＨプリアンブル生成回路

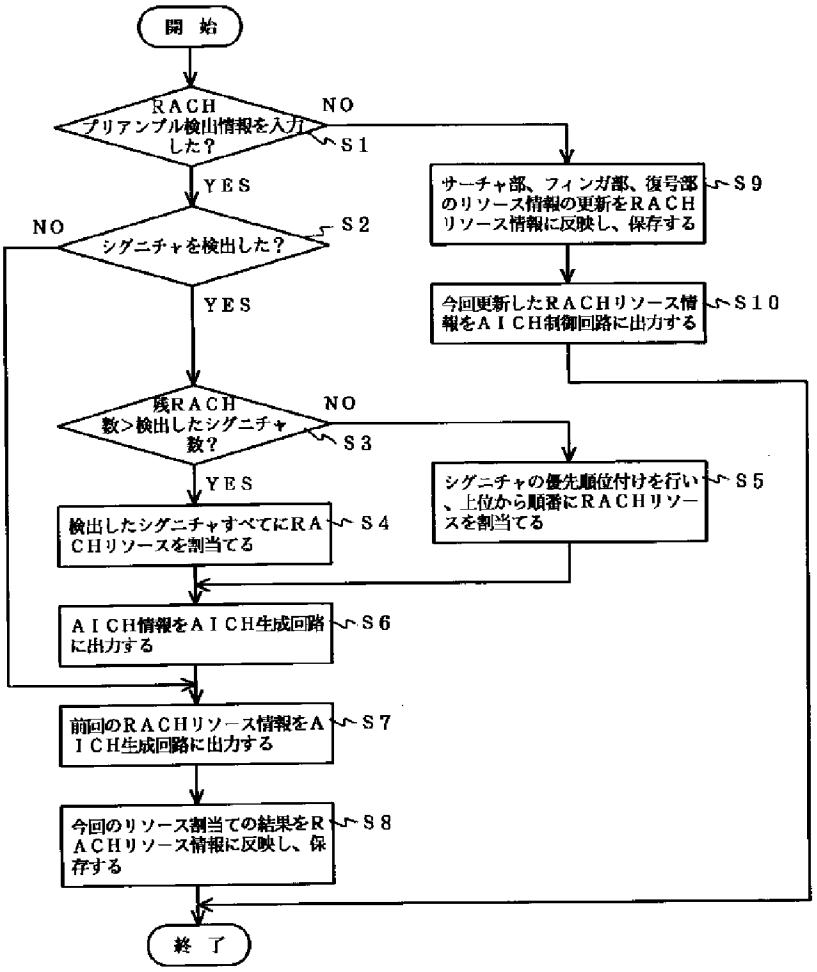
【図１】


呼処理制御装置
2
トラフィックチャネルリソース情報
SIR情報
AICH制御回路
14
AICH制御信号
フィンガ部
4
フィンガ部情報
RACHリソース情報
RACHリソース管理回路
13
AICH情報
AICH生成回路
3
誤り率情報
復号リソース情報
復号部
5
RACHプリアンブル検出情報
RACHプリアンブル検出回路
12
遅延プロファイル
遅延プロファイル生成回路
11
サーチャ部
1
受信信号
送信信号

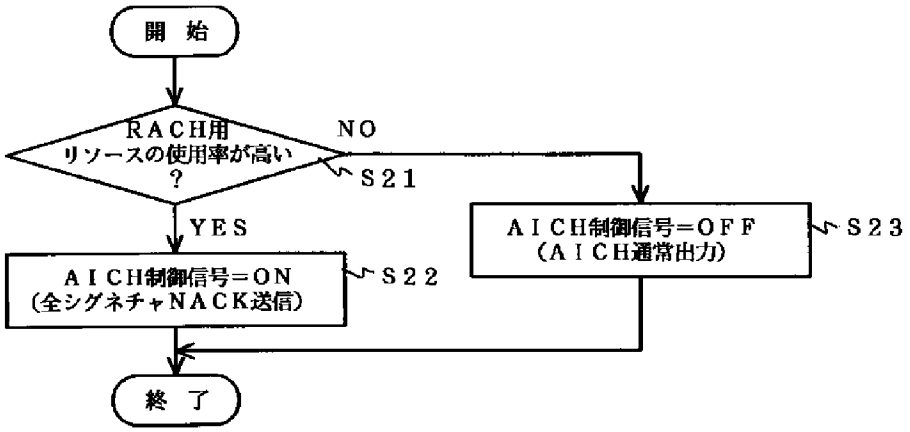
【図２】


受信信号
21
ディレイプロファイル生成回路
ディレイプロファイル
22
AICH検出回路
プリアンブル再送AICH制御信号
RACHプリアンブル信号
RACHプリアンブル生成回路
24
送信電力制御回路
23
送信信号

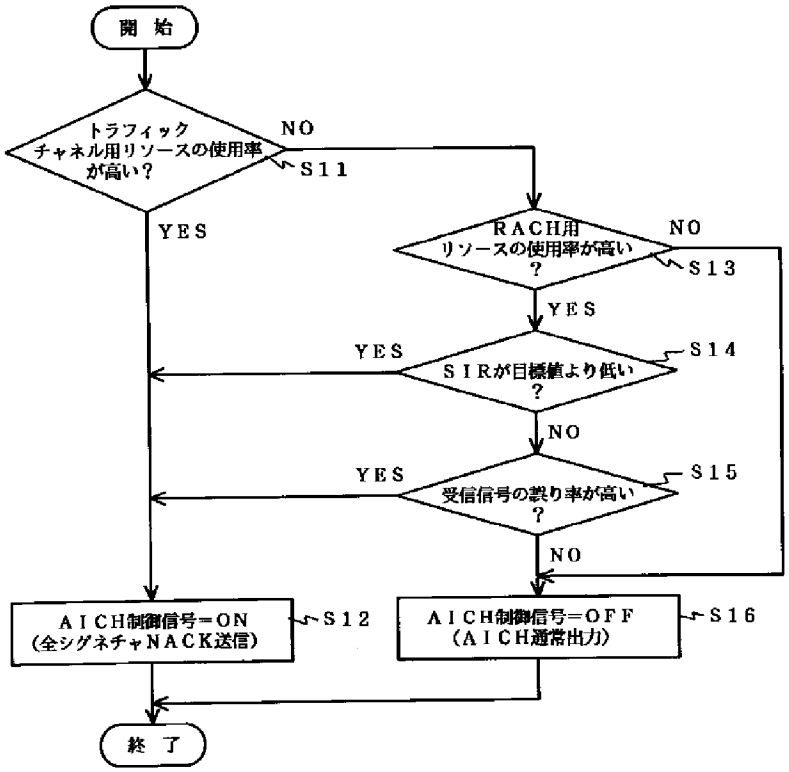
【図３】


開　始
RACHプリアンブル検出情報を入力した？
S1
NO
YES
シグニチャを検出した？
S2
NO
YES
残RACH数>検出したシグニチャ数？
S3
NO
YES
検出したシグニチャすべてにRACHリソースを割当てる
S4
AICH情報をAICH生成回路に出力する
S6
前回のRACHリソース情報をAICH生成回路に出力する
S7
今回のリソース割当ての結果をRACHリソース情報に反映し、保存する
S8
終　了
サーチャ部、フィンガ部、復号部のリソース情報の更新をRACHリソース情報に反映し、保存する
S9
今回更新したRACHリソース情報をAICH制御回路に出力する
S10
シグニチャの優先順位付けを行い、上位から順番にRACHリソースを割当てる
S5

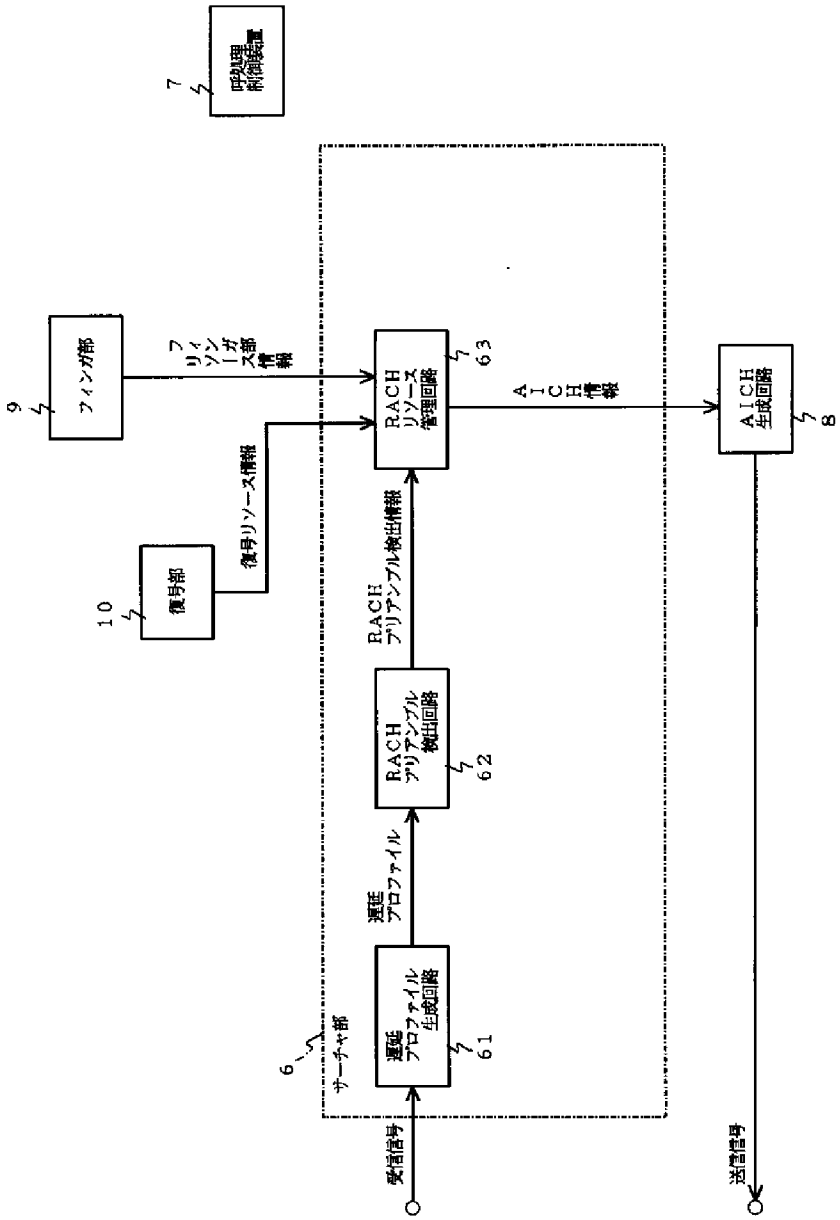
【図５】


開　始
RACH用リソースの使用率が高い？
S21
NO
YES
AICH制御信号＝ON
(全シグネチャNACK送信)
S22
AICH制御信号＝OFF
(AICH通常出力)
S23
終　了

【図４】


開　始
トラフィック
チャネル用リソースの使用率
が高い？
NO
S11
YES
RACH用
リソースの使用率が高い
？
NO
S13
YES
YES
S14
ＳＩＲが目標値より低い
？
NO
YES
S15
受信信号の誤り率が高い
？
NO
ＡＩＣＨ制御信号＝ＯＮ
（全シグネチャＮＡＣＫ送信）
S12
ＡＩＣＨ制御信号＝ＯＦＦ
（ＡＩＣＨ通常出力）
S16
終　了

【図６】


7
呼処理制御装置
9
フィンガ部
フィンガ部情報
RACH リソース管理回路
63
AICH情報
AICH 生成回路
8
10
復号部
復号リソース情報
RACH プリアンブル検出情報
RACH プリアンブル検出回路
62
遅延プロファイル
遅延プロファイル生成回路
61
6
サーチャ部
受信信号
送信信号

PATENT ABSTRACTS OF JAPAN

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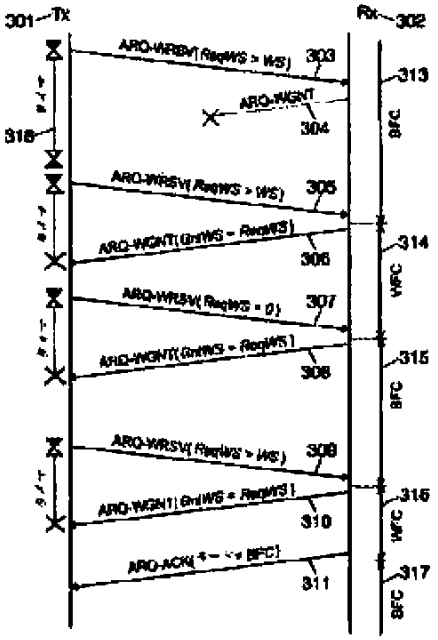
(30)Priority
Priority number : 2004 04290541 Priority date : 27.02.2004 Priority country : EP

(54) MANAGEMENT METHOD AND DEVICE OF DYNAMIC ARQ WINDOW

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a management method of a dynamic ARQ window to enable adapting many different types of applications with various QoS constrained conditions.
SOLUTION: An ARQ managing entity selects a given control mode of operation, a transmitter transmits two or more PDUs of a given data link to a receiver. The receiver memorizes the received PDU in a shared memory. A receiver ARQ instance sends back a corresponding ARQ-ACK message which has specific data including the selected control mode of operation or control data of flow, distributes responded PDU in a high-level layer, and eliminates the responded PDU from the shared memory.



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(54)【発明の名称】動的ＡＲＱウィンドウ管理方法およびデバイス

(57)

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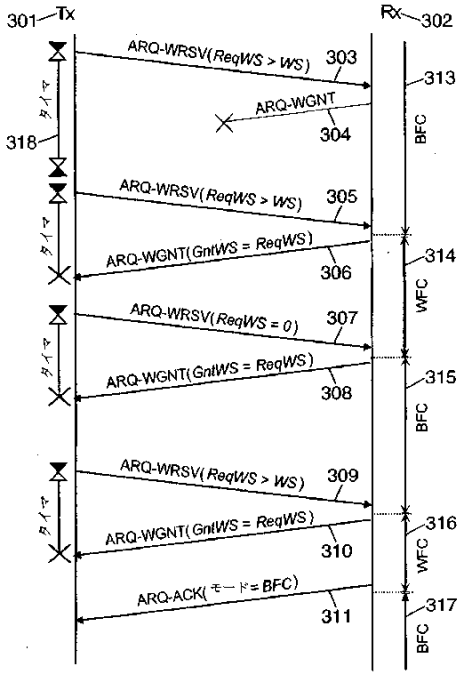

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Window Size

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ユーザ優先度	頭字語	トラフィックタイプ
1	ＢＫ	バックグラウンド
2	－－	スペア
０（デフォルト）	ＢＥ	ベストエフォート
3	ＥＥ	エクセレントエフォート
4	ＣＬ	負荷制御
5	ＶＩ	「ビデオ」＜１００ｍｓ待ち時間およびジッタ
6	ＶＯ	「音声」＜１０ｍｓ待ち時間およびジッタ
7	ＮＣ	ネットワーク制御

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Stop/Resume

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Resume

Stop

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Window ReSerVation

Window GraNT …

Re 50

quests for FeedBack

Requested Window Size

Granted Window Size

↑↑【

↑↑【…

Memory Buffer Manager

↑↑【

↑↑…

データリンクＩＤ	クラス	モード	ウィンドウサイズ

↑↑【【

↑↑【

↑↑【=

↑↑【

$$BMRsv=\sum_{i} WSi$$

```
if (ReqWS_i     WS_i)
    if (ReqWS_i = 0)
        Mode_i = BFC
    endif

    GntWS_i = ReqWS_i
    WS_i = GntWS_i
else
    if (ReqWS_i < (BMSize  BMRsv))
        if (WS_i = 0)
            Mode_i = WFC
        endif

        GntWS_i = ReqWS_i
        WS_i = GntWS_i
    else
```

$$\text{if } \sum_{j<i} BMRsv(CLj) \geq ReqWS_i$$

```
            if (WS_i = 0)
                Mode_i = WFC
            endif

            GntWS_i = ReqWS_i
            WS_i = GntWS_i
```

$$\sum_{n} WS_n \geq ReqWS_i$$

```
        else

            GntWS_i = WS_i
        endif
    endif
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endif

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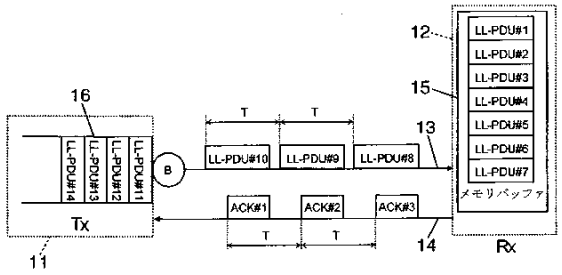
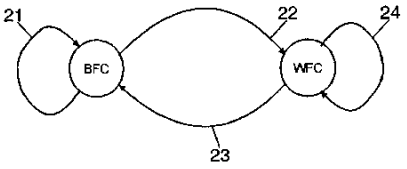
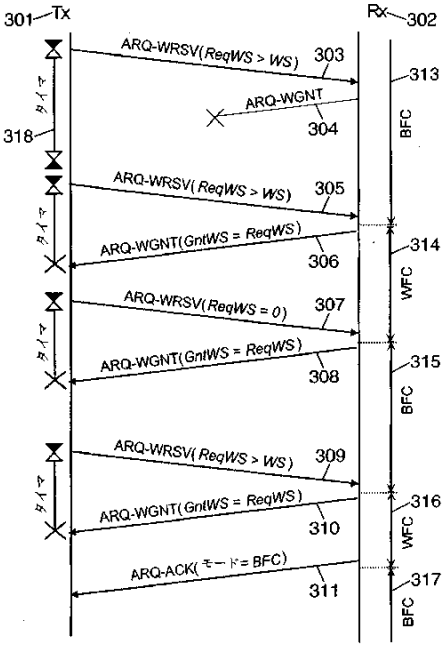

12
LL-PDU#1
LL-PDU#2
LL-PDU#3
LL-PDU#4
LL-PDU#5
LL-PDU#6
LL-PDU#7
メモリバッファ
15
16
13
T
T
LL-PDU#14
LL-PDU#13
LL-PDU#12
LL-PDU#11
B
LL-PDU#10
LL-PDU#9
LL-PDU#8
ACK#1
ACK#2
ACK#3
T
T
Tx
Rx
11
14

...


21
22
24
BFC
WFC
23


301
Tx
Rx
302
ARQ-WRSV(ReqWS > WS)
303
313
ARQ-WGNT
304
BFC
タイマ
318
ARQ-WRSV(ReqWS > WS)
305
ARQ-WGNT(GntWS = ReqWS)
306
314
WFC
ARQ-WRSV(ReqWS = 0)
307
ARQ-WGNT(GntWS = ReqWS)
308
315
BFC
ARQ-WRSV(ReqWS > WS)
309
ARQ-WGNT(GntWS = ReqWS)
310
316
WFC
ARQ-ACK(モード= BFC)
311
317
BFC

(74) 100110423

(74) 100084010

(74) 100094695

(74) 100111648

(74) 100116953

(72)

(72)

( ) 5K014 AA01 CA02
5K034 DD03 HH01 HH02 HH11 HH65
5K067 AA21 BB21 CC08 DD24 DD51 FF02 HH23 HH25 HH28 KK15

Title of the Invention

METHOD AND DEVICE FOR A DYNAMIC ARQ WINDOW MANAGEMENT

BACKGROUND OF THE INVENTION

1. Technical Field

The present invention relates generally to communication networks, and more particularly to an ARQ windows management in a network based on an ARQ protocol.

2. Related Art

A communication network comprising several stations (STA) and nodes is considered herein. The data generated by the applications running on the STAs are exchanged over data links in respective data flows. Each data flow corresponds to a given transmitter, a given receiver and a given application. One or more data flows can be transported over a given data link. A data link is established from one transmitter STA to a receiver STA, passing through intermediate nodes or not. Referring to a network protocol layering model according to the ISO ("International Standardization Organization"), the data link is ruled by a Link Layer (LL) protocol, which includes a Medium Access Control sub-layer (MAC). At the LL level, the data are transported in LL Protocol Data Units (LL-PDUs) which are inserted in, or extracted from, the physical medium by the MAC sub-layer. In the following, a transmitter STA and a receiver STA will be respectively referred to as a transmitter and a receiver.

In case of an error prone physical medium (e.g. radio, power line, etc...), the LL layer includes an Error Control (EC) mechanism that is in charge of recovering the transmission errors experienced by the LL-PDUs. EC mechanisms are usually based on repetition of the lost or corrupted LL-PDUs as detected by the receiver. Protocols managing such repetitions schemes are also known as Automatic Repeat reQuest (ARQ) protocols. Generally, an ARQ instance is running both on the receiver and on the transmitter. A reverse data link is then provisioned so that the ARQ instance of the receiver can inform the ARQ instance of the transmitter about the reception status of the transmitted LL-PDUs. This ARQ protocol information is transported in specific signalling LL-

PDUs also referred to as ARQ feedback messages or ARQ ACKnowledgement (ARQ-ACK) messages. In this type of protocols, the transmitter can send data to the receiver over a given data link only if an ARQ-ACK message relative to the previously sent LL-PDU has been correctly received. Consequently, when the transmitter is waiting for an ARQ-ACK message, the data transmission is blocked until the reception of the ARQ-ACK message. This blocking in a data transmission impacts the data link and then the transmission efficiency. In order to improve transmission efficiency by avoiding transmission blocking, a sliding window mechanism is generally introduced. The sliding window represents the number of LL-PDUs the transmitter can transmit without having received an ARQ-ACK message. The size of such a sliding window is defined by two boundaries, generally referred to as Bottom of Window (BoW) and Top of Window (ToW). Depending on the protocol, the size of the sliding window can be fixed, as for example with the HiperLAN/2 standard defined by the European Telecommunication Standard Institute (ETSI), or variable as for example with the Transmission Control Protocol (TCP). If the size of the sliding window is fixed, it is chosen at the time of the establishment of the data link. If the size of the sliding window is variable, it is advertised to the transmitter through the ARQ-ACK messages sent by the receiver. In this latter case, the reception of an ARQ-ACK updates the sliding window boundaries. During the data transmission, the transmitter controls the data flows over the corresponding data link based on these boundaries. Stated otherwise, the transmitter stops, resumes or continues LL-PDUs transmission by controlling the number of LL-PDUs sent without reception of ARQ-ACK. It results therefrom that the sliding window has a flow control effect that can disadvantageously affect the data link throughput even when no error occurs.

ARQ protocols rely on the identification of the PDUs that is common to the transmitter and the receiver and used by the protocol signalling so that the receiver can indicate in an ARQ-ACK message sent to the transmitter which PDUs are not correctly received. The data unit identification is typically a sequence number specific to the data units handled by the considered layer only.

On the other hand, the applications running on the STAs can have

various Quality of Service (QoS) requirements. For example, these QoS requirements can be expressed in terms of bit rate (or bandwidth) or transmission delay constraints. The fulfilment of these constraints is possible if the data link offers the required bandwidth and/or transmission delay. In particular, bandwidth provisioning can be performed through resource reservation procedures. If successful, the resource reservation guaranties that the application data flow will be transported with the required bit rate. In the following section, for the sake of better understanding, only the bit rate QoS requirement is considered.

A single data link can be used to transport several application data flows with similar QoS requirements. Thus, the bit rate of a data link can vary in time, depending on the activity of the different application data flows.

This section exposes the basic principles and definitions for such ARQ protocols. As it has already been described, a sliding window is defined by its two boundaries and its size: respectively ToW, BoW and Window Size (WS). In the following, they are all expressed in the same unit, which can be a LL-PDU number, when LL-PDUs are of fixed size, as for example in HiperLAN/2, or a number of bytes as in TCP.

This unit is also used to define the sequence number space used to identify each LL-PDU. The sequence number range is determined so that no ambiguity arises in LL-PDU numbering and each LL-PDU can be uniquely identified. BoW and ToW are then sequence numbers of the LL-PDUs respectively located at the bottom and at the top of the sliding window. In the following for the sake of better understanding, an LL-PDU sequence number and the corresponding LL-PDU are considered to be equivalent.

BoW refers to the missing or corrupted LL-PDU of the lowest sequence number which is detected by the receiver, and ToW is determined from BoW by the following equation:

$$ToW = BoW + WS - 1$$

The transmitter can transmit or retransmit any LL-PDU comprised between BoW and ToW included.

BoW is updated by the receiver and advertised to the transmitter in the ARQ-ACK messages. When the size of the sliding window is variable, WS is

also generally advertised in the ARQ-ACK messages, whereas when this size is fixed, WS is selected upon data link establishment.

Commonly, the Round Trip Time (RTT) of a data link is defined as the time elapsed between the emission of an LL-PDU and the reception of the corresponding ARQ-ACK message, i.e. an ARQ-ACK message covering the emitted LL-PDU, by the transmitter. RTT includes transmission delays due to the physical medium and processing in the various intermediate nodes, as well as processing in the transmitter and in the receiver.

This type of protocols is correctly adapted to data links where transmission errors occur. Conversely, a data link without any transmission errors may be impacted by such a protocol.

Actually, when no transmission error occurs, the maximum data link throughput, referred to as B_{max}, the corresponding RTT and WS are linked by the following equation:

$$B_{max} = WS / RTT$$

This relation can be deduced from the following simplification assumptions.

All transmitted LL-PDUs have the same size and the ARQ-ACK message transmission rate is not limited on the reverse data link, from the receiver to the transmitter. Stated otherwise, the reverse data link is transparent to the ARQ-ACKs.

Assuming that the transmitter emits LL-PDUs at a constant throughput B, time gap between LL-PDUs can be referred to as T. The receiver emits one ARQ-ACK per received LL-PDU. If the first LL-PDU ever sent by the transmitter is considered as the BoW, the ARQ-ACK message acknowledging this LL-PDU is received after the RTT. The sliding window allows the transmitter to further transmit a given number n of other LL-PDUs until the first ARQ-ACK is received, n being an integer lower than WS. The following equation is deduced:

$$n = B \times RTT$$

The received ARQ-ACK message gives the transmitter the opportunity to send one more LL-PDU. Stated otherwise, the BoW and consequently the sliding window progress. The subsequent ARQ-ACK messages are received every T, thus allowing a new LL-PDU to be sent every T, and therefore the

transmitter continues emitting LL-PDUs at a throughput which equals B.

Thus, in order to achieve the throughput B, a minimum value of WS has to be chosen so as to verify the following relation:

$$WS_{min} = B \times RTT$$

Figure 1 illustrates a transmitter 11, a receiver 12 and a given data link 13. The data link 13 transports a data flow at a bit rate referred to as B. A corresponding reverse data link 14 allows transmission of ARQ-ACK messages from the receiver 12 to the transmitter 11. On the transmitter side, a queue of LL-PDUs pending for transmission, referenced 16, comprises the LL-PDUs from LL-PDU#11 to LL-PDU#14. The previous LL-PDUs, from LL-PDU#1 to LL-PDU#10, have already been sent. Further, it assumes that the LL-PDUs from LL-PDU#1 to LL-PDU#7 have been received on the receiver side and that they are stored in a memory buffer referenced 15 until the receiver has sent their corresponding ARQ-ACK messages. As the receiver spends some time in LL-PDU and ARQ-ACK message processing, it is considering in the example shown that only the ARQ-ACK messages corresponding to the LL-PDUs from LL-PDU#1 to LL-PDU#3 have been processed and sent over the reverse data link 14. An ARQ-ACK message, corresponding to a LL-PDU emitted at time t, is received at time t + RTT on the transmitter side. It results therefrom that the memory buffer 15 must be able to store the number of LL-PDUs received during a time of RTT at most. In the example illustrated in Figure 1, when the data flow is transmitted at a given bit rate B, during the time of RTT, the receiver stores 7 LL-PDUs.

In case of an error-prone transmission, a great part of the RTT can be spent in LL-PDU and ARQ-ACK processing in the receiver. It results therefrom that the receiver is provided with enough memory to store the LL-PDU transmitted during that time. Indeed, LL-PDUs are retransmitted upon reception of ARQ-ACKs indicating incorrectly received LL-PDUs. Apparent RTT becomes longer due to the time elapsed to obtain the retransmitted LL-PDU status through further ARQ-ACK messages. It is then preferable not to block the transmission of the transmitter while waiting for the ARQ-ACK messages. It results therefrom that a larger sliding window is preferably provided to compensate as much as possible for the latency due to retransmissions.

Consequently, a large space of memory resource shall be reserved for some data links which exhibit stringent QoS constraints so that these constraints can be guarantied even when these data links experience errors.

Regarding the previous description, either ARQ protocols are based on memory reservation and then a given throughput is guaranteed or they are based on a usage of memory without any reservation and then no throughput is guaranteed.

It results therefrom that it is difficult to apply an efficient dynamic ARQ windows management on different data links having different QoS and having different sliding window size requirements, particularly since these sliding window size requests are variable as a function of transmission errors notably.

SUMMARY OF THE INVENTION

Memory buffer used to implement a sliding window for a given data link is generally a limited resource taken in a shared memory resource between all the data links ending in the same receiver. Some applications have specific throughput requirements that have to be fulfilled by the underlying data link. It is then desirable to manage the sliding windows memory buffer to accommodate as well as possible all data links that share that common resource. In view of the foregoing, there is a need for a dynamic ARQ windows management adaptable to many types of applications having different QoS constraints.

In a first aspect, the invention thus proposes method of dynamic ARQ windows management in a network comprising:

- at least one transmitter managing a plurality of different data links, or a plurality of transmitters each managing at least one data link, said transmitter or transmitters sending sliding window memory requests, said data links transporting PDUs according to an ARQ protocol and being associated to a respective QoS priority belonging to a set of predetermined QoS priorities;
- at least one receiver for receiving a plurality of said data links and acknowledging each transmitted PDU by sending an ARQ acknowledgement or ARQ-ACK message to said transmitter;
- a memory shared among said data links, which is comprised in said receiver for storing received PDUs, at least until they are

acknowledged;

- an ARQ management entity comprising a transmitter ARQ instance and a receiver ARQ instance for receiving said sliding window memory requests from said transmitter or transmitters, and for controlling each of said data links according to an operational control mode selected out of a predetermined set of operational control modes;

the method comprising the step of:

- said ARQ management entity selecting a given operational control mode;
- the transmitter or at least one of said transmitters sending one or more PDUs of a given data link to said receiver;
- said receiver storing said received PDUs in said shared memory;
- said receiver ARQ instance sending back said corresponding ARQ-ACK message including a specific information comprising said selected operational control mode and / or a flow control data,
- said receiver ARQ instance removing acknowledged PDUs from said shared memory when delivering them to an upper layer;
- upon reception of said ARQ-ACK message, said transmitter ARQ instance continuing or stopping PDUs transmission on said data link, based on said specific information comprised in said ARQ-ACK message;

wherein the step of selecting the operational control mode is repeated dynamically on a per data link basis during PDUs transmission, while taking into account the available memory space within said shared memory, said respective associated QoS priority and the sliding window memory requests received from said transmitters by said receiver

A second aspect of the invention relates to a device for controlling data flow transmission comprising means for carrying out the method according to the first aspect.

DESCRIPTION OF PREFERRED EMBODIMENTS

One embodiment of the present invention proposes a method of ARQ windows management which defines a predetermined set of operational control modes and applies one of the operational control modes according to some specific characteristics. These characteristics can be the QoS constraints of a given application.

A transmitter and a receiver are linked by a set of data links. Each data link has transmission characteristics corresponding to a given level of QoS offered to the served applications of which PDUs are transported over that data link. These transmission characteristics can correspond to classes of traffic. The IEEE 802.1D standard proposes a classification that is exposed herein below.

user_priority	Acronym	Traffic type
1	BK	Background
2	--	Spare
0 (Default)	BE	Best Effort
3	EE	Excellent Effort
4	CL	Controlled Load
5	VI	"Video," < 100 ms latency and jitter
6	VO	"Voice," < 10 ms latency and jitter
7	NC	Network Control

The traffic classes exposed herein above and which are equivalent to QoS levels can be used, for example, to associate a QoS level to data flows managed by one embodiment of the present invention.

A data flow corresponding to a given application transmitted from the transmitter to the receiver is mapped onto the data link whose class corresponds to the traffic requirements or QoS constraints of the given application. It is to be noted that an implementation of a proposed mechanism according to one embodiment of the present invention may rely on less or more traffic classes, which can be defined using other traffic characteristics or parameters. Classes will be identified as follows: C_1, C_2, ..., C_n, with C_1 having lower priority than C_2, and so forth. A data link k belonging to class C_n will be referred to as $DL_k(C_n)$.

The data links preferably offer a reliable data transfer thanks to an ARQ protocol. The ARQ protocol can be based on a sliding window mechanism which is well known by a person skilled in the art.

As it has already been described above, an ARQ protocol requires a buffer memory on the receiver side to make the receiver able to manage the ARQ protocol. The memory used to implement such an ARQ protocol on each data link in the receiver is shared between all the data links.

A dynamic ARQ window management according to one embodiment of the present invention is managed by an entity referred to as ARQ management

entity. The ARQ entity comprises a receiver ARQ instance (ARQ-RX) on the receiver side and a transmitter ARQ instance (ARQ-TX) on the transmitter side. The ARQ-RX instance is located at the destination end of the data link which manages the ARQ window of the data link. A single ARQ Memory Buffer Manager (ARQ-MBM) is in charge of managing the available memory buffer on the receiver side. It is invoked by the ARQ-RX instance. The ARQ-TX instance is located at the source end of the data link and triggers the requests of memory reservation for management of a sliding window based on traffic requirements.

In one embodiment of the present invention, for the sake of better understanding the predetermined set of operational control modes comprises two operational control modes. Of course, the invention encompasses an embodiment based on more operational control modes.

The ARQ entity performs a selection of one of the operational control modes on a per data link basis. A first selection is performed at the time of a data link establishment. Such a selection can be preferably performed at any time during the data transmission of a given data link. A first operational control mode will be referred to as Binary Flow Control (BFC). The second operational control mode will be referred to as Window Flow Control (WFC).

When the ARQ entity selects the BFC mode for a given data link, the ARQ-TX instance is preferably flow controlled using a flag in the ARQ-ACK messages. This flow control flag is referred to as S/R for Stop/Resume. Actually, this flow control flag comprises a flow control data to inform the transmitter about the fact that it has to stop or can continue (or Resume) the data transmission. In BFC mode, the receiver sets this flag based on the comparison between a threshold value and the available memory space, the threshold value being administratively set. When the available memory space is greater than the threshold value, the ARQ-RX instance set the flag to R for Resume and then the transmitter is allowed to continue the transmission corresponding to the given data link. Conversely, the ARQ-RX instance sets the flag to S for stop and the transmitter stops the respective data transmission.

When the ARQ entity selects the WFC mode for a given data link, an ARQ Window Size (ARQ-WS) is fixed through a window reservation

mechanism based on a memory reservation mechanism. ARQ-WS is a parameter used by both ARQ-TX instance and ARQ-RX instance. The Flow Control mechanism introduced in the BFC mode is reproduced in the WFC mode so that the transmitter can temporarily exceed the negotiated ARQ-WS.

The memory reservation mechanism is preferably implemented through simple reservation messages that are added to the ARQ protocol message set. Of course, the present invention encompasses different protocol implementations. Two types of messages are defined: Window ReSerVation (ARQ-WRSV) message and Window GraNT (ARQ-WGNT) message. They can be transported in specific signalling LL-PDUs of the data link or integrated in already existing messages such as Requests for FeedBack (ARQ-RFB) and ARQ-ACK message. In that latter case, additional fields are preferably provided in the ARQ-RFB and ARQ-ACK messages. The ARQ-WRSV message includes information about the requested space of memory which is referred to as a Requested Window Size (ReqWS) field. The ARQ-WGNT message includes information about the reserved memory space which is really reserved in the shared memory of the receiver and which is referred to as a Granted Window Size (GntWS) field. Of course, the reserved memory space can be different from the requested memory space.

Such a protocol also preferably uses a flow control flag that is piggy-backed in the ARQ-ACK messages. When the flow control flag is set to R, the ARQ-ACK message also preferably contains a sequence number of the last correctly received LL-PDU (LastRx). This information is provided so that the ARQ-TX can determine the LL-PDU from which it can resume the data transmission. In addition, the current selected operational control mode (BFC or WFC) is indicated by the ARQ-RX instance, preferably included in each ARQ-ACK message in order to use an existing ARQ protocol message, through a flag which is referred to as a mode flag.

The ARQ Memory Buffer Manager (ARQ-MBM) is in charge of sharing the receiver shared memory between all ARQ-RX instances of data links ending in a given receiver. It maintains a table, referred to as ARQ-Table, of which each entry contains status information of one data link, as shown below. Such a table contains a Data Link Id field, a Class field, a Mode field and

Window Size field.

Data Link ID	Class	Mode	Window Size

Data Link ID is the identifier attached to the Data Link i (DL_i).

Class is the priority class of DL_i.

Mode is the current operational mode of DL_i ($Mode_i$)

Window Size if the currently reserved window size of DL_i (WS_i).

To perform sharing of the memory according to the memory reservation requests corresponding to all data links, the ARQ-MBM takes as input the ReqWS field as passed by the ARQ-TX instance through the ARQ-WRSV message and the contents of the different table entries.

The following algorithm for sharing memory can be implemented in the ARQ-MBM:

BMSize : Total buffer memory size

BMRsv : Space of buffer memory occupied by all reserved windows

BMRsv(CL_i) : Portion of buffer memory occupied by the reserved windows of class i data links

DL_i : data link i

$Mode_i$: Current data link operation mode of data link i

WS_i : currently reserved window size of data link i (equals zero when in BFC mode)

$ReqWS_i$: Window size requested for data link i

$GntWS_i$: Window size granted by the receiver for data link i

Upon reception of an ARQ-WRSV message on DL_i :

$BMRsv = \sum_i WSi$

if ($ReqWS_i \leq WS_i$)

if ($ReqWS_i = 0$)

$Mode_i$ = BFC

"reservation accepted"

$GntWS_i = ReqWS_i$

$WS_i = GntWS_i$

else

if ($ReqWS_i$ < (BMSize – BMRsv))

if ($WS_i = 0$)

$Mode_i$ = WFC

endif

"reservation accepted"

$GntWS_i = ReqWS_i$

$WS_i = GntWS_i$

else

if $\sum_{j<i} BMRsv(CLj) \geq ReqWS_i$

if ($WS_i = 0$)

$Mode_i$ = WFC

endif

"reservation accepted"

$GntWS_i = ReqWS_i$

$WS_i = GntWS_i$

force BFC mode for all DL_n of class j < i such as $\sum_n WS_n \geq ReqWS_i$, that is, set the Mode field to BFC in the table for the corresponding Data Link.

else

"reservation denied"

$GntWS_i = WS_i$

endif

endif

endif

At any time, the ARQ-MBM monitors the space of available buffer memory which can be calculated according to the following equation:

(BMSize – BMRsv).

Figure 2 illustrates a state machine presenting the transitions between the BFC and the WFC modes. These transitions are triggered upon transmission (for the ARQ-RX instance), respectively reception (for the ARQ-TX instance), of an ARQ-WGNT or ARQ-ACK messages. Actually, the ARQ entity manages a transition referenced 22 from the BFC operational control mode to the WFC operational control mode when the receiver sends back, in response to an ARQ-WRSV comprising a requested memory space whose size is not equal zero, an ARQ-WGNT message to inform the transmitter that the memory reservation has been correctly performed. The ARQ entity manages a transition referenced 23 from the WFC operational control mode to the BFC operational control mode either upon reception of an ARQ-WRSV message comprising a requested memory space whose size is equal zero, or when the receiver is no longer able to guarantee the previously accepted memory reservation. In that case, the transition is triggered upon emission/reception of an ARQ-ACK message with the Mode field set to BFC. The transition referenced 24 illustrates the case where the transmitter requires a greater sliding window than the current one. In this case, the ARQ entity keeps the WFC operational control mode and only the reserved memory size is changed. On the other hand, the transition referenced 21 illustrates the case where the transmitter sends a ARQ-WRSV message to reserve a given memory space whose size is not equal zero and where the ARQ-RX instance is not able to accept this memory reservation. It results therefrom that the ARQ entity keeps the BFC mode.

The following section describes the operations performed on the receiver side by the ARQ-RX instance according to one embodiment of the invention.

Considering a given data link and whatever its operational mode is, upon reception of an LL-PDU, the ARQ-RX instance checks the available memory space in the shared memory buffer, which is calculated according to the following equation:

BMSize – BMRsv.

If the available memory space is lower than a given low threshold, the ARQ-RX instance sends an ARQ-ACK message with the flow control flag set to S, causing the ARQ-TX instance to stop the PDU transmission for the corresponding data link. LL-PDUs received after the ARQ-RX instance has sent

an ARQ-ACK message with the flow control flag set to S may be discarded if the receiver is out of memory buffer.

If the available memory space in the memory buffer is greater than a given high threshold and the ARQ-TX instance has stopped the LL-PDUs transmission on the corresponding data link, i.e. after a last ARQ-ACK has been sent with the flow control flag set to S, the ARQ-RX instance sends an ARQ-ACK message with the flow control flag set to R including a valid LastRx field, to indicate to the transmitter the last valid received PDU.

In every other case when the ARQ-RX sends an ARQ-ACK message, the flow control flag is set to R.

In any case, the ARQ-RX instance indicates the current data link operational control mode through the mode flag located in the ARQ-ACK. The mode flag is determined from the Mode field of the entry associated to the data link in the ARQ-Table.

Considering a Data Link operating in BFC mode, upon reception of an ARQ-WRSV message, the ARQ-RX instance invokes the ARQ-MBM with the requested window size indicated in the ReqWS field. If the ARQ-MBM returns a "reservation accepted" indication, the ARQ-RX instance sends an ARQ-WGNT message with GntWS field comprising the same value as the ReqWS field and the operational control mode of the corresponding data link switches from the BFC mode to the WFC mode. If the ARQ-MBM returns a "reservation denied" indication, the ARQ-RX instance sends an ARQ-WGNT message with GntWS field set to zero and the data link remains in the BFC mode.

Considering a given data link operating in WFC mode, upon reception of an ARQ-WRSV message, the ARQ-RX instance checks if the newly requested window size indicated in the ReqWS field can be accommodated with the available memory buffer space by invoking the ARQ-MBM. If the ARQ-MBM returns a "reservation accepted" indication, the ARQ-RX instance sends an ARQ-WGNT message with GntWS field comprising the same value as the ReqWS field. If the requested window size modification is denied, the ARQ-RX instance sends an ARQ-WGNT message with GntWS field set to the value previously in use. If GntWS field is set to zero, the ARQ entity switches to the BFC mode.

The following section describes the operations performed on the transmitter side by the ARQ-TX instance according to one embodiment of the invention.

Whatever the operational mode is, upon reception of an ARQ-ACK message with the flow control flag set to S, the ARQ-TX instance stops emitting new LL-PDUs on the given data link but can still retransmit erroneous LL-PDUs.

Upon reception of an ARQ-ACK message with the flow control flag set to R, the ARQ-TX can continue to emit new LL-PDUs on the given data link if not stopped beforehand. If this message is received when stopped, the ARQ-TX instance resumes new LL-PDU transmissions starting from the sequence number indicated in the LastRx field.

In one embodiment of the invention, considering a given data link operating in the BFC mode, the ARQ-TX instance can preferably trigger a window memory reservation procedure at any time when in the BFC mode, by transmitting an ARQ-WRSV message containing the requested window size in the ReqWS field. A timer is started while waiting for the reception of the corresponding ARQ-WGNT message. If the timer expires before the ARQ-WGNT message is received, the same ARQ-WRSV message can be repeated. Upon reception of the ARQ-WGNT message, the ARQ-TX instance checks the GntWS field of the latter. If the returned window size equals the requested value, the memory reservation is successful. If the returned value is different from the requested value, notably if the returned value is zero, the reservation has failed and the data link remains in the BFC mode.

Considering a given data link operating in the WFC mode, the window size is fixed to the value returned in the most recently received ARQ-WGNT message containing a non-zero value in the respective GntWS field.

The window size can be modified at any time upon request of the ARQ-TX instance by using the same procedure as in the BFC mode.

Upon reception of a ARQ-WGNT message, the ARQ-TX instance updates the window size with the returned GntWS field value. If GntWS field equals zero, the data link mode switches to the BFC mode.

Upon reception of an ARQ-ACK message with the operational control mode flag set to the BFC mode, the data link mode switches to the BFC mode.

As mentioned before, the control flow flag set to S is interpreted as in the BFC mode. This last feature allows the ARQ-TX instance to overrun the negotiated window size when memory buffer resource is available in the receiver.

Figure 3 illustrates some cases of switching between the BFC mode and the WFC mode for a given data link on a given data link via exchanged messages in one embodiment of the present invention. Initially, the ARQ entity has selected the BFC mode 313. It results therefrom that no memory space is reserved on the receiver side for the given data link. The transmitter 301 sends an ARQ-WRSV message 303 to the receiver 302 to reserve a memory space and simultaneously starts a timer 318. The size of the requested memory space is set in the ReqWS field of the ARQ-WRSV message. The receiver 302 sends back to the transmitter 301 a ARQ-WGNT message 304. The transmitter 301 does not receive the latter before the timer expiration. The transmitter 301 repeats the same ARQ-WRSV message 305. As the available space of memory is greater than the memory space requested for reservation, the receiver 302 sends back to the transmitter a ARQ-WRSV message 306 accepting the memory reservation. The ARQ entity switches to the WFC mode 314 for the given data link. In order to release the reserved resource, the transmitter 301 sends an ARQ-WRSV message 307 comprising a requested memory size of zero. Upon reception of this message 307, the receiver releases the corresponding memory space and sends back to the transmitter 301 an ARQ-WGNT message 308. The ARQ entity switches to the BFC mode 315. Latter on, the transmitter 301 requires a memory reservation procedure by sending an ARQ-WRSV message 309 comprising a memory space size in the ReqWS field. The receiver accepts this reservation by sending back an ARQ-WGNT message 310 comprising the reserved memory space size which is equal to the requested memory space size. The ARQ entity switches to the WFC mode 316. Latter on, the receiver pre empts the memory space reserved to the given data link and then sends an ARQ-ACK message 311 comprising the mode flag set to BFC. Consequently, the ARQ entity switches to the BFC mode 317.

One embodiment of the present invention can be advantageously

applied to a network where different application data flows presenting various QoS constraints are transmitted. Notably, a great flexibility is offered to application data flows without any particular QoS requirements. Actually, this type of application can advantageously use memory resource depending on their instant throughput, without having to use fixed size of reserved memory. Consequently, the memory buffer distribution between the data links can be dynamically performed. On the other hand, the application data flows with stringent QoS constraints are guarantied resources by using the reservation procedures. Moreover, every application data flow can instantly reach the maximum throughput offered by lower layer as soon as there is enough memory buffer in the receiver. It results therefrom that the transmission efficiency is improved by a dynamic flexible and efficient memory management which uses the memory resource as long as it is available and which avoids to waste memory resource.

BRIEF DESCRIPTION OF THE DRAWINGS

Further features and advantages of the present invention will become more apparent from the description below. The latter is given purely by way of illustration and should be read in conjunction with the appended drawings, of which:

- Figure 1 illustrates a classical ARQ scheme according to the prior art;
- Figure 2 illustrates a state machine between two operational control modes according to one embodiment of the invention;
- Figure 3 illustrates exchanged messages between a transmitter and a receiver according to one embodiment of the invention.

1. Method of dynamic ARQ windows management in a network comprising:

- at least one transmitter managing a plurality of different data links, or a plurality of transmitters each managing at least one data link, said transmitter or transmitters sending sliding window memory requests, said data links transporting PDUs according to an ARQ protocol and being associated to a respective QoS priority belonging to a set of predetermined QoS priorities;
- at least one receiver for receiving a plurality of said data links and acknowledging each transmitted PDU by sending an ARQ acknowledgement or ARQ-ACK message to said transmitter;
- a memory shared among said data links, which is comprised in said receiver for storing received PDUs, at least until they are acknowledged;
- an ARQ management entity comprising a transmitter ARQ instance and a receiver ARQ instance for receiving said sliding window memory requests from said transmitter or transmitters, and for controlling each of said data links according to an operational control mode selected out of a predetermined set of operational control modes;

the method comprising the step of:

- said ARQ management entity selecting a given operational control mode;
- the transmitter or at least one of said transmitters sending one or more PDUs of a given data link to said receiver;
- said receiver storing said received PDUs in said shared memory;
- said receiver ARQ instance sending back said corresponding ARQ-ACK message including a specific information comprising said selected operational control mode and / or a flow control data,
- said receiver ARQ instance removing acknowledged PDUs from said shared memory when delivering them to an upper layer;
- upon reception of said ARQ-ACK message, said transmitter ARQ instance continuing or stopping PDUs transmission on said data link, based on said specific information comprised in said

ARQ-ACK message;

wherein the step of selecting the operational control mode is repeated dynamically on a per data link basis during PDUs transmission, while taking into account the available memory space within said shared memory, said respective associated QoS priority and the sliding window memory requests received from said transmitters by said receiver.

2. Method according to claim 1, wherein the set of predetermined operational control modes comprises at least a first operational control mode in which no memory space is reserved in the shared memory for a given data link and a second operational control mode in which a given memory space is reserved in said shared memory for a given data link exclusively.

3. Method according to claim 2, wherein the second operational control mode is based on a sliding window mechanism.

4. Method according to claim 2 or 3, wherein the flow control data is provided based on the following steps:

- if the available memory space in the shared memory is greater than a first threshold value set administratively, the flow control data advertises the respective transmitter ARQ instance to continue transmission of PDUs in respect of the data link;
- else, the flow control data advertises the respective transmitter ARQ instance to stop transmission of PDUs in respect of the data link.

5. Method according to claim 4, further comprising the following step after the step of stopping transmission of PDUs:

- if the available memory space in the shared memory is greater than a second threshold value set administratively, the receiver ARQ instance advertises the transmitter ARQ instance to continue transmission of PDUs by sending a message including information about the last correctly received PDU;
- the transmitter ARQ instance continues transmission of PDUs based on said information.

6. Method according to any one of claims 2 through 5, wherein the ARQ management entity switches the operational control mode from the first operational control mode to the second operational control mode when a memory reservation is performed according to the following steps of:

- the transmitter ARQ instance sending a memory reservation request message comprising a requested memory space in the shared memory for a given data link;
- the receiver ARQ instance sending back a corresponding response message comprising memory information about a reserved memory space in the shared memory for said given data link; and

wherein the receiver ARQ instance determines said reserved memory space as a function of said requested memory space, of the respective QoS priority of said given data link and of the available memory space in the shared memory.

7. Method according to claim 6, wherein, when no memory space is available in the shared memory, the receiver ARQ instance sends back a corresponding response message to refuse said memory reservation request, said response message comprising information about currently reserved memory space.

8. Method according to claim 6 or 7, wherein the transmitter ARQ instance requests to change the size of the reserved memory space by further sending a memory reservation request defining a new requested memory space in the shared memory.

9. Method according to any one of claims 6 through 8, wherein, when the available memory space is not sufficient to achieve a memory reservation:

- the receiver ARQ instance groups the memory spaces reserved for low QoS data links which are associated to a QoS priority lower than that of said given data link;
- if said grouped memory spaces are greater than the requested memory space, the receiver ARQ instance reserves the requested memory space to the given data link by pre empting memory spaces reserved for said low QoS data links;

and forces said low QoS data links to switch from the second operational control mode to the first operational control mode.

- else, the receiver ARQ instance sends back a corresponding response message to refuse said memory reservation comprising information about currently reserved memory space.

10. Method according to any one of claims 6 through 9, wherein the transmitter ARQ instance further performs the following steps:

- starting a timer when a memory reservation request is sent;
- resetting said timer upon reception of a response message corresponding to said memory reservation request message;
- sending again said memory reservation request message upon expiration of said timer.

11. Method according to any one of claim 6 through 10, wherein the ARQ entity switches the operational control mode from the second operational control mode to the first operational control mode upon transmission for the receiver ARQ instance, respectively reception for the transmitter ARQ instance, of a response message, corresponding to a memory reservation request, comprising a reserved memory space which size equals zero or upon reception of an ARQ-ACK message comprising the first operational control mode.

12. Method according to any one of claims 2 through 11, wherein the first operational control mode is selected for data links associated to a comparatively lower QoS priority and the second operational control mode is selected for data links associated to a comparatively higher QoS priority.

13. Method according to any one of the preceding claims, wherein the receiver ARQ instance discards PDUs of a data link when no more memory space is available in the shared memory.

14. Device for controlling data link transmission, comprising means for carrying out a method according to any one of the preceding claims.

ABSTRACT

There is disclosed a method and a device of method of dynamic ARQ windows management in a network for controlling data link transmission. The method comprises an ARQ management entity selecting a given operational control mode, and a transmitter sending one or more PDUs of a given data link to a receiver. The receiver stores received PDUs in a shared memory. A receiver ARQ instance sends back corresponding ARQ-ACK message including a specific information comprising selected operational control mode and/or a flow control data. It further removes acknowledged PDUs from the shared memory when delivering them to an upper layer. The transmitter ARQ instance continues or stops PDUs transmission upon reception of the ARQ-ACK message, based on the specific information comprised therein. The step of selecting the operational control mode is repeated dynamically on a per data link basis during PDUs transmission, while taking into account the available memory space within the shared memory, said respective associated QoS priority, as well as the sliding window memory requests received from the transmitters by the receiver.

Representative Drawing

Figure 3

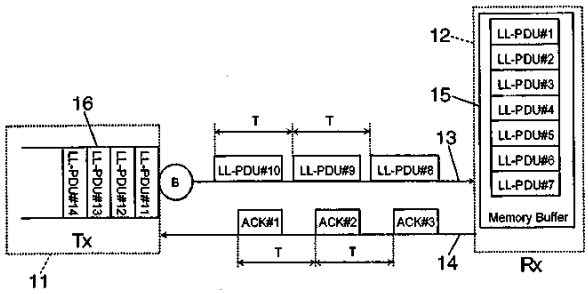


FIG. 1

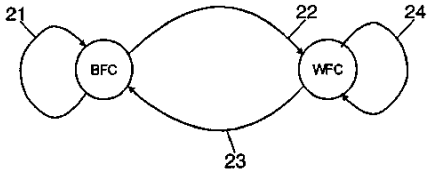


FIG. 2

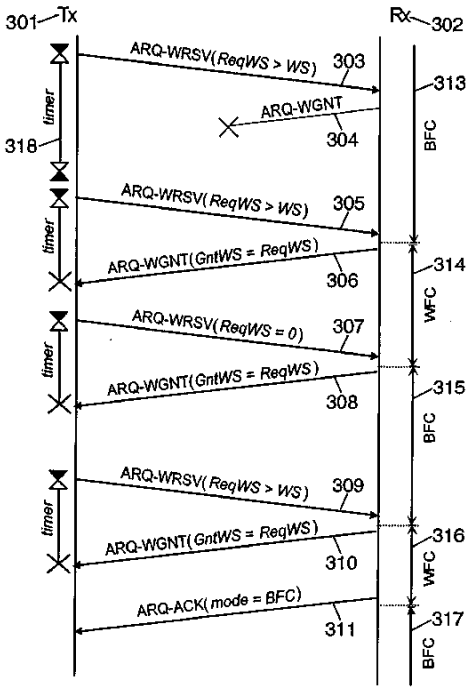


FIG. 3

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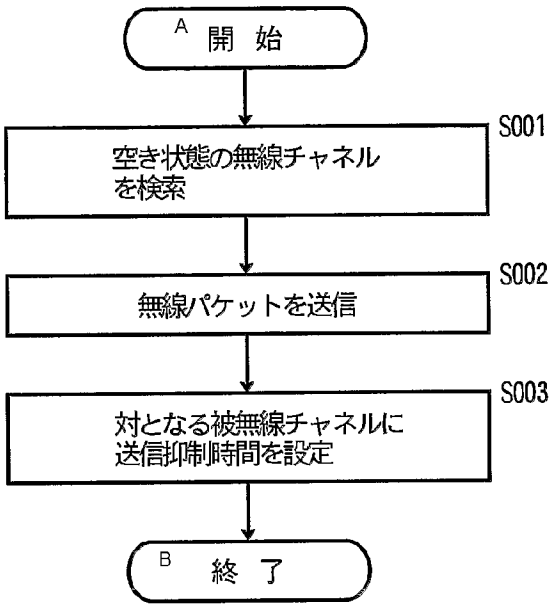
[続葉有]

(54) Title: RADIO PACKET COMMUNICATION METHOD AND RADIO PACKET COMMUNICATION DEVICE

(54) 発明の名称: 無線パケット通信方法および無線パケット通信装置



A...START
S001...SEARCH RADIO CHANNEL IN EMPTY STATE
S002...TRANSMIT RADIO PACKET
S003...SET TRANSMISSION SUPPRESSION PERIOD FOR RADIO CHANNEL FORMING A PAIR
B...END

(57) Abstract: A transmission side radio station transmits a radio packet by using a radio channel judged to be empty by both of a physical carrier detection judging whether busy state or empty state according to the reception power and a virtual carrier detection judging busy state during a set transmission suppression period. Here, a transmission suppression period used for the virtual carrier detection is set for a radio channel forming a pair and affected by leak from the transmission radio channel. Thus, even when normal reception cannot be performed in the radio channel affected by the leak from the transmission radio channel, a transmission suppression period can be set for the radio channel affected.

(57) 要約: 送信側無線局が、受信電力に応じてビジー状態か空き状態かを判定する物理的なキャリア検出と、設定された送信抑制時間中はビジー状態とする仮想的なキャリア検出の双方により、空き状態と判定された無線チャネルを利用して無線パケットを送信する。このときに、送信する無線チャネルから漏れこみの影響を受ける対となる被無線チャネルに対して、仮想的なキャリア検出に用いる送信抑制時間を設定する。これにより、送信する無線チャネルからの漏れこみの影響により被無線チャネルで正常に受信ができない場合でも、被無線チャネルに送信抑制時間を設定することができる。

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