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UTILITY PATENT APPLICATION TRANSMITTAL (Only for new nonprovisional applications under 37 CFR 1.53(b))	Attorney Docket No.	160-126
	First Inventor	Floyd Backes
	Title	PROGRAM FOR ADJUSTING CHANNEL INTERFERENCE BETWEEN ACCESS POINTS IN A WIRELESS NETWORK
	Express Mail Label No.	Electronic filing

APPLICATION ELEMENTS See MPEP chapter 600 concerning utility patent application contents. 1. ☐ Fee Transmittal Form (e.g., PTO/SB/17) (Submit an original and a duplicate for fee processing) 2. ☐ Applicant claims small entity status. See 37 CFR 1.27. 3. ☒ Specification [Total Pages <u>94</u>] Both the claims and abstract must start on a new page (For information on the preferred arrangement, see MPEP 608.01(a)) 4. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets <u>62</u>] 5. Oath or Declaration [Total Sheets <u>3</u>] a. ☐ Newly executed (original or copy) b. ☒ A copy from a prior application (37 CFR 1.63 (d)) (for continuation/divisional with Box 18 completed) i. ☐ DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) name in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b). 6. ☐ Application Data Sheet. See 37 CFR 1.76 7. ☐ CD-ROM or CD-R in duplicate, large table or Computer Program (Appendix) ☐ Landscape Table on CD 8. Nucleotide and/or Amino Acid Sequence Submission (if applicable, items a. - c. are required) a. Computer Readable Form (CRF) i. ☐ Computer Readable Form (CRF) ii. ☐ Transfer Request (37 CFR 1.821(e)) b. Specification Sequence Listing on: i. ☐ CD-ROM or CD-R (2 copies); or ii. ☐ Paper c. ☐ Statements verifying identity of above copies	ADDRESS TO: Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450 ACCOMPANYING APPLICATION PARTS 9. ☐ Assignment Papers (cover sheet & document(s)) Name of Assignee _____ 10. ☒ 37 CFR 3.73(b) Statement ☒ Power of Attorney (when there is an assignee) 11. ☐ English Translation Document (if applicable) 12. ☐ Information Disclosure Statement (PTO/SB/08 or PTO-1449) ☐ Copies of foreign patent documents, publications, & other information 13. ☐ Preliminary Amendment 14. ☐ Return Receipt Postcard (MPEP 503) (Should be specifically itemized) 15. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed) 16. ☐ Nonpublication Request under 35 U.S.C. 122 (b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent. 17. ☐ Other: _____
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18. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in the first sentence of the specification following the title, or in an Application Data Sheet under 37 CFR 1.76:

☒ Continuation	☐ Divisional	☐ Continuation-in-part (CIP)	of prior application No.: <u>10/781,137</u>
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Prior application information: Examiner Temica M. Beamer Art Unit: 2617

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This collection of information is required by 37 CFR 1.53(b). 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 1.11 and 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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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: Floyd Backes et al.

Serial No.:

Examiner:

Filed: Herewith

Group Art Unit:

Title: Program for Adjusting Channel Interference between Access Points in a Wireless Network

Commissioner for Patents
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**COMBINED POWER OF ATTORNEY FOR
PATENT APPLICATION & STATEMENT UNDER 37 CFR 3.73(b)**

AUTOCELL LABORATORIES, INC., a corporation having principal offices at:

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the owner by assignment of the entire right, title and interest to the invention Program for Adjusting Channel Interference between Access Points in a Wireless Network by Floyd Backes et al. and in and to the application for patent and any Letters Patent, whether domestic or foreign, that may issue thereon, by virtue of the assignment (check as applicable):

☐ Recorded Concurrently Herewith
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hereby appoints the following attorneys and/or agents to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

Attorneys Associated with Customer No. 34845

its attorneys with full power of substitution and revocation, to prosecute all domestic and foreign patent applications, including PCT and EPO filings, relating to said invention and to transact all business connected therewith, including signing of all papers on its behalf and making alterations and amendments.

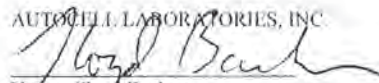
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The undersigned is the representative for the Assignee of the entire right, title, and interest in the patent application identified above, and is authorized to act on behalf of the Assignee.

19-May-2010
Date

AUTOCELL LABORATORIES, INC.


Name: Floyd Backes
Title: Chief Executive Officer

**DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATION FILED
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name, and I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**PROGRAM FOR ADJUSTING CHANNEL INTERFERENCE BETWEEN ACCESS
POINTS IN A WIRELESS NETWORK**

The application of which: (Check applicable choice)

- A. ☒ Is attached hereto.
B. ☐ Was filed on _____ as U.S. Application No. _____
C. ☐ was filed as PCT International Application No. PCT/_____ on _____
and (if applicable to U.S. or PCT application) was amended on _____

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose all information known to me to be material to patentability as defined in 37 C.F.R. §1.56.

Except as noted below, I hereby claim foreign priority benefits under 35 U.S.C. §1.119(a-d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT International Application which designated at least one other country than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate, or PCT International Application, filed by me or my assignee disclosing the subject matter claimed in this application and having a filing date (1) before that of the application on which priority is claimed, or (2) if no priority is claimed, before the filing date of this application.

PRIOR FOREIGN APPLICATION(S)

<u>Number</u>	<u>Country</u>	<u>Day/Month/Year Filed</u>	<u>Date first laid Open or published</u>	<u>Date Patented or Granted</u>	<u>Priority NOT claimed</u>
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Except as noted below, I hereby claim domestic priority benefit under 35 U.S.C. §119(e) or 120 and/or 365(c) of the indicated United States applications listed below and PCT International applications listed above or below and, if this is a continuation-in-part (CIP) application, insofar as the subject matter disclosed and claimed in this application is in addition to that disclosed in such prior applications, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in 37 C.F.R. §1.56 which became available between the filing date of each such prior application and the national or PCT International filing date of this application:

PRIOR US PROVISIONAL, NON-PROVISIONAL AND/OR PCT APPLICATIONS(S)

<u>Application No.</u>	<u>Day/Month/Year Filed</u>	<u>Status (pending, abandoned patented)</u>	<u>Priority NOT claimed</u>
60/449,602	2/24/2003	pending	
60/466,448	4/29/2003	pending	
60/472,320	5/21/2003	pending	
60/472,239	5/21/2003	pending	

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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;

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PROGRAM FOR ADJUSTING CHANNEL INTERFERENCE BETWEEN ACCESS POINTS IN A WIRELESS NETWORK

FIELD OF THE INVENTION

The invention relates generally to wireless networks, and more particularly to wireless network configuration and power level adjustment for network performance optimization.

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of application Serial No. 10/781,137 entitled Program for Adjusting Channel Interference between Access Points in a Wireless Network, filed February 18, 2004 which claims priority to provisional patent applications Serial No. 60/449,602 filed February 24, 2003, Serial No. 60/466,448 filed April 29, 2003, Serial No. 60/472,320 filed May 21, 2003 and Serial No. 60/472,239 filed May 21, 2003.

BACKGROUND OF THE INVENTION

The proliferation of laptop and hand-held portable computers has produced a concomitant need for robust, reliable, and high performance wireless networks to maximize the mobility advantages of these devices and increase the ease of construction

and management of these wireless networks. Current wireless networks, such as IEEE 802.11b, 802.11a, 802.11g, (etc) networks, are subject to certain limitations that can limit a mobile user's network performance and reliability. For instance, only a very limited number of radio channels are available. In the current state of the art, wireless access points cannot effectively share the same channel in the same area because of radio and control protocol interference. So, bandwidth over a given area is limited by the number of non-overlapping channels available. Also, current wireless networks require manual site engineering to control the placement of access points and channel distribution between access points, raising the cost and complexity of the wireless network installation process. Furthermore, user roaming between wireless access points is inconsistent. Once associated with an access point, a user will tend to remain associated with that access point even if another access point is capable of providing higher performance for the user. It would be desirable to provide wireless networking solutions which overcome the above described inadequacies and shortcomings of current wireless networks.

SUMMARY OF THE INVENTION

In accordance with the principles of the invention, various apparatus, methods, and computer program products are provided to improve the performance and ease of management of wireless communications environments. For example, a mechanism is provided to enable access points (APs) to perform automatic channel selection. A wireless network can therefore include multiple APs, each of which will automatically

choose a channel such that channel usage is optimized. Furthermore, APs can perform automatic power adjustment so that multiple APs can operate on the same channel while minimizing interference with each other. Further aspects of the invention are used to cause load balancing of stations across APs so that user bandwidth is optimized. Novel movement detection schemes provide seamless roaming of stations between APs. These and further aspects of the invention enable the provision of automatically configurable, high performance wireless communications environments.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a wireless communications environment in which wireless users interact with other networked devices via an access point (AP).

Figure 2 shows a wireless network in which wireless user devices, or stations (STAs), access the wireless network via an access point and share the available network bandwidth.

Figure 3 shows a wireless network wherein the stations access the network via two separate access points.

Figure 4 is a flow diagram representing how an AP builds a channel map for use in an automatic channel selection scheme.

Figure 5 is a flow diagram representing an automatic channel selection method.

Figure 6 is a representation of a table kept by APs for use in an alternate channel selection scheme.

Figure 7 is a flow diagram representing an alternate automatic channel selection scheme.

Figure 8 is a flow diagram representing a preferred embodiment of an automatic channel selection scheme.

Figure 9 is a representation of a Scan Table kept by APs for use in the automatic channel selection scheme of Figure 8.

Figure 10 is a representation of a Channel Map kept by APs for use in the automatic channel selection scheme of Figure 8.

Figure 11 is a representation of a Triplet Channel Map kept by APs for use in the automatic channel selection scheme of Figure 8.

Figure 12 is a representation of a Claim APs table kept by APs for use in the automatic channel selection scheme of Figure 8. Figure 13 is a flow diagram showing how an AP builds an AP KnownAPs table.

Figure 14 is an example of an AP KnownAPs table maintained by an AP, and used for power adjustment.

Figure 15 is a flow diagram representing the process by which an AP builds an AP AssociatedSTA table, for use in load balancing.

Figure 16 is an example of an AP AssociatedSTA table.

Figure 17 is a block diagram representing a general mechanism by which an AP adjusts its transmit power backoff.

Figure 18 is a block diagram representing a preferred embodiment of the transmit power backoff mechanism of Figure 13.

Figure 19 is a table showing expected standard errors related to number of power level samples.

Figure 20 is a flow diagram representing the process by which an AP adjusts its transmit power backoff during STA movement.

Figure 21 is a flow diagram representing an AP auction process, used for load balancing of STAs across APs.

Figure 22 is a flow diagram representing the AP's handling of bids during the auction.

Figure 23 is a flow diagram representing the STA initialization process.

Figure 24 is a flow diagram representing a general mechanism by which a STA in a wireless communications environment canvasses channels.

Figure 25 is a flow diagram representing the preferred embodiment of Figure 20 as implemented in an 802.11 wireless networking environment.

Figure 26 is an example of a STA Known APs table, used by STAs for power adjustment and load balancing.

Figure 27 is a flow diagram representing the process by which the STA Known APs table is built by a STA.

Figure 28 is a flow diagram representing the STA power adjustment process.

Figure 29 is a flow diagram representing the STA Bidding process.

Figure 30 is a flow diagram representing the process by which a STA calculates corrected distances for use in determining whether to bid for an AP.

Figure 31 is an example of a distance_to_rate table for use in an 802.11 wireless networking environment.

Figure 32 is an example of a rate_to_load table for use in an 802.11 wireless networking environment.

Figure 33 is a flow diagram representing the STA Bidding process in more detail.

Figure 34 is a flow diagram representing the process by which a STA detects its own movement.

Figure 35 is a block diagram showing the software architectures of APs and STAs.

Figure 36 is a more detailed block diagram of the software architecture of an AP implementing the invention in an 802.11 wireless networking environment.

Figure 37 is a more detailed block diagram of the software architecture of a STA implementing the invention in an 802.11 wireless networking environment.

Figure 38 represents the encoding of a DRCP (Dynamic Radio Control Protocol) message in an 802.11 beacon frame.

Figure 39 represents the encoding of a DRCP message in an 802.11 data frame.

Figure 40 is a table summarizing the DRCP messages used in the various aspects of the invention.

Figure 41 is a table describing the various fields used in DRCP messages.

Figure 42 is a diagram of the message format of a DRCP Preclaim message.

Figure 43 is a diagram of the message format of a DRCP Claim message.

Figure 44 is a diagram of the message format of a DRCP Announce message.

Figure 45 is a diagram of the message format of a DRCP Bid message.

Figure 46 is a diagram of the message format of a DRCP Accept message.

Figure 47 is a diagram of the message format of a DRCP Registration Request message.

Figure 48 is a diagram of the message format of a DRCP Registration Acknowledge message.

Figure 49 is a graph showing discrete measurements of received power over time from the perspective of a wireless network user.

Figure 50 is a graph showing discrete measurements of received power over time from the perspective of a wireless network user, and showing the estimated average received power for the user within a 99% confidence interval.

Figure 51 is a graph similar to Figure 3 showing two different estimated average received power measurements for small sample sizes and their 99% confidence intervals.

Figure 52 is a graph showing two different estimated average received power measurements and their 99% confidence intervals, one for a large sample size and one for a small sample size.

Figure 53 is a graph showing a long term average measurement and a short term average measurement with 99% confidence interval, the comparison showing that it can be determined that a user has moved.

Figure 54 is a table showing the number of samples that need to be taken in order to cause the long term average confidence interval range to converge toward zero.

Figure 55 is a flow diagram of the general operation of the method of the invention.

Figure 56 is a block diagram of an embodiment of a wireless network in which the invention is deployed, wherein an AP ascertains that a user has moved.

Figure 57 is a block diagram of an alternate embodiment of the invention, wherein a user ascertains that the user has moved.

Figure 58 is a block diagram of one embodiment of the invention employing ring buffers.

Figure 59 is a block diagram of an alternate embodiment of the invention employing batched means.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

In accordance with the present invention, a fully automatic control system is provided for wireless communications environments. Referring to Figure 1, a typical wireless communications environment 10 includes access devices 12 (one shown) that interface between a wired communications medium 14 and wireless devices 16 to provide network access to the wireless devices 16. Wireless devices 16 can thus communicate with wired devices 18 and with each other via the access device 12. These access devices 12 are referred to by various names depending upon the wireless architecture employed, and are herein referred to as “access points” or “APs”. The wireless devices 16 also have

various architecture dependent names and are herein referred to as “stations” or STAs. A wireless communications capable device may be an AP, or a STA, or both.

Various types of wireless communications environments 10 exist. Wireless communications environments include for example wireless data networks and wireless I/O channels. An example of a wireless data network is described in “IEEE Standard for Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements—Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications—Amendment 1: High-speed Physical Layer in the 5 GHz band”, incorporated herein by reference(hereinafter “802.11”). Furthermore, various different 802.11 “modes” are defined. For example, in IEEE 802.11 compatible wireless networks, wireless devices may be arranged in an “infrastructure mode”, whereby the network is configured such that STAs 16 communicate with other network devices via an AP 12, as shown in Figure 1. 802.11 compatible devices may also be arranged in “ad-hoc” mode, whereby all the STAs 16 are within transmission range and can communicate directly with each other. Furthermore, wireless “mesh” technologies exist, whereby each wireless device acts as both an AP and a STA. Wireless I/O channels can be used to provide I/O communications, for example, between servers and storage devices via the “Bluetooth” Standard, or between home entertainment audio and video components , or between wireless telephone handsets and base stations. The various aspects of the invention apply to generally to wireless networking architectures, including those used in wide area networks, metropolitan area networks, enterprise networks, and home

networks, and wireless I/O channel architectures, as they exist now and as they are developed.

According to aspects of the invention, an arbitrary number of wireless access points (APs) can be placed in arbitrary positions, and all APs and STAs will automatically configure themselves for optimal channel usage, power levels, and STA/AP associations. So, in a wireless networking environment, channel usage is optimized while interference between APs is minimized. Wireless devices such as wireless enabled laptops or hand-held computing devices or Internet protocol telephones, are transparently and seamlessly distributed between APs such that network performance is optimized from the perspective of the user of the wireless device. And, in a wireless I/O channel environment that might be employed for example in a home, audio, video, and other appliances may be moved without performance degradation, and channel usage for each appliance may be optimized so that the appliances do not interfere with each other.

In order to expedite the understanding of the invention, certain examples will be described as they apply to the relatively well known 802.11 wireless LAN architecture, with the understanding that the principles of the invention apply more generally to any wireless communications environment. A preferred implementation of the inventive principles will then be described as embodied in an 802.11 wireless network

The following aspects of the invention contribute to its advantages, and each will be described in detail below.

1. AP Initialization: In many wireless communications environments, multiple frequencies (“channels”) are available for use by APs. For example, in accordance with 802.11b and 802.11g, 3 non-overlapping channels are available. In accordance with IEEE 802.11a, 13 non-overlapping channels are available. In an environment where multiple APs are employed, it will be seen that it is advantageous for the APs to use different channels to optimize performance and minimize interference. In accordance with the invention, APs perform automatic channel selection. Where multiple APs are distributed in a given area, the APs execute a distributed protocol to pick channels for each AP. APs close to each other use non-overlapping channels.
2. AP Optimization:
 - a. Power Adjustment: When the number of APs in a wireless communications environment exceeds the number of non-overlapping channels, APs and STAs adjust their power such that APs and STAs on the same channel can co-exist in an area without interference. For APs using the same channel, APs continually re-adjust their power levels based on environmental factors such as signal strength changes due to movement of doors, people, background noise floor, and the like, so that the users’ optimal bandwidth is maintained without undue interference.
 - b. Auction: APs keep track of various parameters for STAs that are associated with them, and STAs will roam between APs for load balancing purposes, which can help to maximize performance over a group of STAs.

3. STA initialization: STAs associate with an initial AP. Invention enabled STAs turn on functions that allow them to receive messages from invention enabled APs.
4. STA optimization:
 - a. Channel Canvassing: In order to further optimize performance, STAs periodically canvass the other channels in the band in which the STA is operating to see if a “better” AP is present. To ascertain whether another AP is “better”, various parameters are considered, such as signal strength and load factors, to be further described.
 - b. Bidding: If a better AP is found, a STA enters a bidding process to try to cause the STA to roam to the better AP. Load balancing is thereby achieved. In addition, the bidding process accommodates STA movement by causing the STA to associate to a better AP after it has moved closer to the better AP.
 - c. Power Adjustment: STAs perform power adjustment such that they can maintain throughput to and from their currently associated AP while minimizing the interference with nearby wireless devices that may be using the same channel.
 - d. Movement Detection: STAs perform movement detection so that the bidding process can be turned off while a STA is moving, and then turned back on when the STA has stopped moving. When turned back on, a “better” AP may turn up and thus the STA will bid for it.

5. Software Architecture

- a. The above functionality is advantageously implemented in APs and STAs in a modular manner for ease of transfer between platforms.
 - b. The above functionality is described in detail as it is implemented in a preferred 802.11 network embodiment.
6. Movement Detection statistical analysis: A novel scheme for highly accurate and computationally efficient detection of a change in an attribute subject to high noise variation is described, and applied to detection of the movement of wireless STAs.

Since exemplary examples will refer to the 802.11 networking environment, the following information provides relevant context, while understandably not limiting the invention to 802.11 environments.

In an 802.11 network, APs periodically send frames called “Beacons”. STAs listen for Beacons. When an unassociated STA (i.e. a STA that is not yet able to communicate on the wireless network) hears Beacons at what it deems to be a reasonable power level, it can attempt to authenticate with the AP sending the Beacons, and then associate with that AP. Once authenticated and associated, the STA is able to send data frames to other STAs on the wireless network via the AP.

More particularly, APs and STAs send and respond to three different types of frames, known as Class 1 Frames, Class 2 Frames, and Class 3 Frames. Class 1 Frames include control frames and management frames, and can be sent regardless of whether a

STA is authenticated and associated with an AP. A Beacon is a type of Class 1 frame. Class 2 Frames are sent only once a STA is authenticated, and include for example association request / response messages. Class 3 Frames can be sent only if associated, and include data frames.

In order to maximize user bandwidth and throughput, the invention automatically optimizes the operation of multiple APs for a given wireless communications environment. In accordance with the exemplary IEEE 802.11a networking standard, 13 non-overlapping frequencies are available for use by the APs. Each AP is capable of transmitting and receiving data at a maximum rate of 54 Mbps. The actual rate at which data is transmitted and received between an AP and a STA depends upon many factors, including the distance between the AP and the STA, the structures located between the AP and the STA, and the environmental interference occurring on the particular frequency. One skilled in the art will realize that the invention is not limited by the maximum data rates of current wireless technology, nor is it limited by currently understood radio frequency attenuation factors. The principles of the invention will continue to be applicable as wireless technology evolves.

Consider an area such as the wireless network shown in Figure 2, wherein 8 users (shown as STAs 16), which may be mobile laptops, PDAs, and the like, share a space including a single AP 12 operating on one of the 13 available 802.11a frequencies, denoted "f1". The 8 users 16 share the bandwidth provided by the AP 12. If all 8 users 16 are located close enough to the AP such that the AP provides a 54Mb bit maximum data rate, then all 8 users 16 share the AP's bandwidth such that each user maintains

6.75Mb throughput on average. (The invention contemplates the fact that data traffic is bursty and that a user in the present example may attain 54Mb throughput for a short interval, but for purposes of simplicity, the average throughput over time for a given user is discussed.)

Now, referring to Figure 3, a second AP 12 has been added in the area. The second AP 12 operates on a different one of the 13 frequencies, denoted "f2", such that the two APs 12 do not interfere, nor do their associated STAs 16. As shown, 4 of the 8 users have roamed to the second AP 12. Now each user maintains 13.5Mb throughput on average. Addition of further APs on different frequencies further increases user average throughput.

In accordance with the invention, a Dynamic Radio Control Protocol (DRCP) provides a mechanism for an arbitrary collection of STAs and APs to automatically control the frequency and power of their radios in order to extend the properties exemplified in Figure 2 to maximize overall system performance. DRCP messages are passed between APs and APs, as well as between APs and STAs to implement this functionality. Eight types of messages are used: DRCP Preclaim, DRCP Claim, DRCP Announce, DRCP Bid, DRCP Accept, DRCP Registration Request, and DRCP Registration Acknowledge.

DRCP Preclaim and Claim messages are exchanged between APs during AP initialization, and are used to aid automatic channel selection in accordance with the invention. DRCP Announce messages are sent by APs and received by STAs during STA optimization. These Announce messages inform invention-enabled STAs of

available invention-enabled APs to which they may choose to associate, and provide information about APs that STAs can use to aid a decision as to whether to request to roam to another AP. DRCP Bid messages are sent by STAs to APs during STA optimization. These messages inform invention-enabled APs of invention-enabled STAs that are requesting association to the APs. DRCP Accept messages are sent by APs to STAs in response to DRCP Bid messages. These messages inform a STA that it may associate with the AP it is requesting to associate with. DRCP registration request and acknowledge messages are exchanged by invention-enabled APs and STAs to indicate to each that the other is DRCP capable.

The DRCP protocol employing these messages will first be described as used in a generic wireless communications environment. The detailed implementation of each of these messages will then be further described in terms of a preferred embodiment in an 802.11 environment.

The aspects of the invention are now described as they apply to AP initialization and optimization, and then as they apply to STA initialization and optimization. It is noted that, though many of the inventive aspects described herein with regard to STAs and APs are advantageous when implemented, they are not required to be implemented in a wireless communications environment. Performance advantages are achieved when only the APs, or only the STAs, or both implement one or more of the various aspects of the invention.

AP Initialization

During AP initialization, APs perform automatic channel selection. In accordance with the channel selection aspect of the invention, APs located in the same wireless network automatically select channels for operation such that they do not interfere with nearby APs. The invention contemplates that different bands of frequencies are available, for example based on 802.11 version and the country in which the network is deployed. According to a preferred embodiment, APs attempt to select a channel, in each band in which the AP is equipped to operate, which is least likely to interfere with other APs that are already deployed. APs also quarantine channels in accordance with rules associated with regulatory domains (Europe, etc.) so they don't interfere with other wireless applications (radar, etc.). In the event that one AP selects a free channel, and another AP selects the same free channel at the same time (i.e. a channel selection "Collision"), the APs' media access control (MAC) addresses are used as a tie breaker. If the other AP is a standard AP that does not include the improvements associated with the current invention, then the invention-enabled AP will direct its own radio to the "next best" channel. The AP repeats the channel selection phase for each band of frequencies.

More particularly, referring to Figure 4, before a newly added AP 12 starts to "Beacon" (i.e. broadcast management packets to other APs and STAs), the AP 12 first examines a list of RF bands supported by the AP 12, and the list of channels supported and not quarantined by the radio which implements the Physical Layer (PHY) for each RF band. The AP 12 then selects a channel in each band according to the following algorithm:

For each band:

Scan Intervals occur periodically. During a Scan Interval (step 20), the AP 12 passively scans all channels which the AP supports within the band (step 22). The AP 12 gathers a list of active APs 12, the channels on which they are operating, and the power at which the beacons from each AP 12 was heard. This information is used to build a table called a channel map 24 (step 26), which contains a list of all APs 12 heard from, the channel on which they were heard, and the signal strength at which they were heard. There is a separate channel map 24 for each band. The AP 12 sorts the channel map to produce a list of APs 12 in ascending order of power level (step 28).

Referring to Figure 5, a channel is now selected by the AP 12 as follows. First, the AP 12 peruses the channel map (step 30), and if there is a channel on which no AP 12 is operating (i.e. signal strength = 0) (step 32), then the AP 12 selects that channel (step 34). Otherwise, the AP 12 peruses the list for the channel transmitting the weakest signal (step 36). The AP 12 now enters a time interval referred to as the “claiming period” (step 38).

If the AP 12 selected a channel having the weakest signal strength, the AP 12 notes the channel-ID of the channel that it has selected, the received power level on the channel, and the AP-ID of the AP that generated that power level (step 40). It will use the power level value as a baseline against which to detect increases in received power on its selected channel. If the AP 12 selected an empty channel, the baseline power level will be the AP's noise floor.

The AP 12 then advertises its intention to use the selected channel by periodically transmitting DRCP Claim messages during the claiming period (step 42). Claim messages are transmitted at full power. During this claiming period, the AP 12 receives all Beacons, DRCP Claim messages, and DRCP Announce messages transmitted on the currently chosen channel (step 44) and uses the information contained therein to build an "Other APs" table 46 (Fig. 6, Fig. 5 step 48). For each Beacon it receives, the AP 12 notes the AP-ID and the received power level in the Other APs table 46. For each Claim or Announce message it receives, the AP 12 notes the AP-ID of the AP that sent the message, the received power level, and the transmit power backoff (TP backoff) in the Other APs table 46. The TP Backoff value indicates how far from maximum power the sending AP's radio has been turned down, and will be explained in more detail in the AP Power Adjustment section. The AP 12 also marks the entry for that AP-ID as being DRCP capable. A normalized received power value is calculated by adding the TP Backoff value to the received power value. The normalized received power value equalizes the AP power levels for comparison purposes. When the AP 12 receives a Beacon or DRCP message from an AP for which it already has an entry, it updates the entry and stores the received power and TP_backoff values as a list.

If another AP 12 starts to radiate significant energy on the selected channel, one of two events must have occurred. The new AP 12 is either not running DRCP, or a conflict has occurred with another DRCP-active AP, where a race condition has caused the other DRCP-active AP to select the same channel at the same time. This is called a Channel Selection Collision (CSC).

At the end of the claim period (step 50), the AP 12 stops sending Claim messages and evaluates the information it has collected, its CSC data, to determine if a CSC has occurred. It looks to see if the received power in any entry is greater than the baseline power level it recorded for the channel (step 52). If so, it looks to see if the received power is exceeded in at least half of the power level values for the entry (step 54). If so, the AP 12 checks to see whether the AP in the entry is DRCP capable (step 56).

If the other AP is not DRCP active, the AP 12 defers to the non-DRCP-active AP and starts the entire channel selection process over again.

If the other AP is DRCP-active, then a CSC is assumed to have occurred. When a CSC has occurred, the MAC address of the other AP is compared to the MAC Address of this AP 12. If the MAC address of this AP 12 is numerically higher than the observed MAC address (step 58), this AP 12 starts the channel selection process over again.

If at the end of the claiming period, the AP has succeeded in claiming the selected channel, it begins running on the channel. The AP starts beaconing, begins sending DRCP Announce messages, and prepares to enter the Optimization stage in order to run its Auction and Power Adjustment functions (step 60).

A variation on the channel selection process of Figure 5 can be employed to improve channel selection coverage when several APs 12 are powered on all at once. Referring to Figure 7, each AP, upon power-up, sends a claim message on a first channel chosen from the channel map – for purposes of example designated channel 1 (steps 62, 64). All APs scan all channels. All APs scanning on channel 1 will hear each other's claim messages. During the claiming period, an AP will ascertain whether channel 1 is in

fact available for use by it. Accordingly, the AP listens for other DRCP Claim messages on the same channel, which would indicate that another invention-enabled AP is trying to use the same channel (step 66). The AP 12 keeps track of the number of different APs it hears (based on AP IDs the claim messages received) and the average signal strength of claim messages from each AP. The AP 12 builds an adjacency vector (adjacency count, adjacency power total) (step 68). Adjacency count represents the number of APs heard on the channel. Adjacency power total represents the sum of the average power levels for each AP heard. Each AP sends its adjacency vector to all the other APs in its claim messages step 70. If a DRCP claim message is received (step 72), in this case on channel 1, the AP 12 first compares its adjacency count with the adjacency count received in the claim message (step 74). If the AP 12's adjacency count is higher than that received in the claim message, this probably indicates that the AP 12 is closer to the center of the network. The AP 12 therefore continues to claim the channel during the claim period. If the AP's adjacency count is the same as the adjacency count received in the claim message (step 76), the AP 12 then compares its own adjacency total power to the adjacency total power value received in the claim message. If the AP 12's own adjacency total power is higher than that received in the claim message (step 78), this may also indicate that the AP 12 is closer to the center of the network, and therefore the AP 12 continues to send claim messages on the channel. If the AP 12's own adjacency total power is the same as that received (step 80), then the AP 12 performs the previously described MAC address test step 82). If the AP 12 finds that its own adjacency count or adjacency power are lower than any received in claim messages, or that in the event of a

tie on these values that its MAC address is higher, it ceases to send claim messages on the channel and returns to peruse the channel map (step 84). Otherwise, the AP 12 continues to send claim messages including its adjacency vector (step 70). If, at the end of the claiming period (step 86), the AP 12's adjacencies are greater than other AP's adjacencies, the AP 12 has won the channel and proceeds to the AP optimization phase (step 88). According to this method, the APs closest to the center of a multi-AP network obtain the first channel assignments and subsequent channels are assigned to the other APs.

Referring to Figure 8, a preferred embodiment of the automatic channel selection algorithm is shown. For each band:

Scan Intervals occur periodically. During a Scan Interval (step 100), the AP 12 scans all channels which the AP supports within the band, receiving Beacons and Announce messages (step 102). The information received in the Beacon and Announce messages is used to build a table called the "Scan table" (step 104). An example of a Scan table 106 is shown in Figure 9. The Scan table 106 includes an entry for each AP 12 from which a Beacon or Announce message has been received. For each entry, there is stored the AP-ID and the channel on which that AP 12 was heard. Also stored is a "rxPowerRunningTotal" value that represents the sum of the signal strengths of each message received from that AP 12. Also stored is a "rxPowerSampleCount" value that represents the number of messages received from the AP 12. A DRCP flag is set if an Announce message has been received from the AP 12. The entryAge entry is

incremented every time the channel is scanned. The “rxPowerAvg” is calculated during a Preclaim interval as will be further described.

As the scan progresses, the rxPowerSampleCount values in the Scan table 106 are monitored, and if any one of them exceeds a threshold, herein labeled “threshold1” (step 108), the AP 12 proceeds to step 110 to build a channel map. In addition, if any entryAge value in the table exceeds a certain threshold “threshold2” (step 112), the AP 12 will proceed to step 110. Also, if the number of scans completed exceeds a certain threshold “threshold3” (step 114), the AP 12 will proceed to step 110. Otherwise the AP 12 continues scanning and updating the Scan table 106.

An example of a preferred channel map 116 is shown in Figure 10. The channel map 116 contains an entry for each channel ID. To build the channel map, the AP 12 peruses the Scan table 106 and calculates the “rxPowerAvg” value for each entry, as:

$$\text{RxPowerAvg}[I] = \text{Scan table}[i].\text{rxPowerRunningTotal} / \text{Scan table}[i].\text{rxPowerSamplecount};$$

For each channel, the AP-ID with the highest rxPowerAvg value is entered in the channel map 116. The AP’s rxPowerAvg value is entered into the channel map 116 as the highestPwrlevel parameter.

In certain network implementations, it is undesirable to locate two operating APs 12 within a certain distance of each other, because doing so does not increase network performance and may reduce it. So, according to a preferred option, once the channel map has been assembled, the AP 12 checks the channel map to see if any of the highestPwrlevel values in the map exceed a certain threshold power level (step 118). The threshold power level is chosen to indicate that the AP 12 is located too close to another

AP. If any highestPwrlevel exceeds the threshold power level, the AP 12 is placed in “Standby mode” (step 120). The AP 12 in Standby mode waits for a period of time herein referred to as “Standby Interval” before returning to start another scan interval (step 122).

If no highestPwrlevel values are found to exceed the threshold power level, the AP proceeds to assemble a triplet channel map 124 (step 126). As shown in Figure 11, the AP 12 sorts a channel map into triplets, for example, channels 1, 2 and 3, channels 2, 3 and 4, channels 3, 4 and 5, etc.. The power heard on each channel in the triplet is averaged into a triplet average. The list of triplets is sorted in ascending order, with the triplet with the lowest average power at the top of the list. The AP 12 starts at the top of the list and looks for the first triplet in which the power heard on the center channel of the triplet is less than or equal to the power heard on the two adjacent channels, and selects this channel (step 128). If no such triplet is available, the AP selects the channel with the lowest triplet average. In the example shown in Figure 11, AP 12 chooses channel 3. This process advantageously minimizes interference between channels by selecting channels that do not tend to have high power adjacent channel usage.

The AP 12 then records the baseline power for the selected channel as the highestPwrlevel value for the channel, and records the AP-ID of the AP at that power level (step 130). A Preclaim Interval is now entered (step 132). During the Preclaim interval, the AP transmits Preclaim messages on the selected channel (step 134). The AP 12 also receives Beacon, Announce, and Preclaim messages on the channel (step 136). The AP 12 uses the received messages to update the Scan table (step 138). The AP 12

continues to update the Scan table until one of two Preclaim intervals expires. During the min Preclaim interval (step 140), the rxPowerSampleCount value for each AP-ID on the selected channel is checked to see if a minimum sample size threshold has been exceeded. If so, the Preclaiming interval ends and the AP proceeds to check to see whether too many APs are operating on the selected channel (step 142). Otherwise, the Preclaiming period extends until the end of the max Preclaim interval (step 144).

In some network environments, and in particular environments of limited area, the operation of too many APs on the same channel does not increase network performance and may cause a performance reduction. So, according to a preferred option, the AP checks to see if there are too many APs operating on the network (step 142). The number of different AP-IDs present in the Preclaim APs table is used to make this determination. If there are too many APs operating on the selected channel at a power level greater than a defined threshold, the AP 12 enters Standby mode

If there are not too many APs operating on the selected channel, the AP 12 calculates an “adjacency vector sum” (step 146). The adjacency vector sum is calculated over all APs on all channels as:

$$\text{Adjacency vector sum} = \text{sum}(\text{Preclaim APs}[i].\text{ReceivedPowerTotal} / \text{Preclaim APs}[i].\text{count})$$

The adjacency vector sum is used as a tiebreaker if necessary during the Claiming interval, to be further described.

The AP 12 now enters the Claiming interval (step 148). During the Claiming interval, the AP 12 transmits Claim messages on the selected channel (step 150). Claim messages include the adjacency vector sum. The AP 12 also receives all Beacon,

Announce, and Claim messages on the selected channel (step 152). The AP 12 uses the information contained in the received messages to build a "Claim APs table" 154 (step 156). An example of the Claim APs table is shown in Figure 12. The Claim APs table 154 contains an entry for each AP-ID. The received power level of each message received from a given AP is stored in the Claim APs table 154 as a list of values (shown as column "ReceivedPowerlevel"). Furthermore, for each Announce or Claim message received, a DRCP flag is set. The AP continues to update the Claim APs table until the end of the Claiming interval (step 158).

The AP 12 then evaluates the Claim APs table 154 (step 160) to ascertain whether any other APs were heard from. If no entries exist in the Claim APs table 154 (step 162), the AP 12 has "won" the selected channel. The AP 12 can then begin Beaconsing and sending Announce messages on the channel (step 164). If the Claim APs table 154 includes one or more entries, then if the selected channel was empty at the beginning of the Claiming Interval (step 166), the AP 12 concedes the channel and returns to re-scan (step 100). Otherwise, if the channel was not empty, then if the ReceivedPowerlevel values for all entries in the table are less than the baseline level recorded during Preclaiming plus a threshold level (e.g. 2db) (step 168), then the AP has won the channel (step 164). However, if the AP does find a ReceivedPowerlevel value that exceeds the baseline power level plus the threshold level, and that entry is associated with an AP-ID that was not the one recorded on the channel during the Preclaiming Interval, then the AP checks the entry's DRCP flag (step 170). If the DRCP flag indicates that the AP-ID associated with the entry is not DRCP capable, then the AP returns back to the scan

interval to re-start the channel selection process. If the DRCP flag indicates that the AP-ID associated with the entry is DRCP capable, then the AP compares its adjacency vector with the adjacency vector received in the other AP's claim messages (step 172). If the AP's adjacency vector is less than the other AP's adjacency vector, the AP concedes the channel and returns to re-scan. If the AP's adjacency vector is not less than the other AP's adjacency vector, then the AP checks to see if the adjacency vectors are equal (step 174). If they are, the MAC addresses of the two APs are compared (step 176). If the AP's MAC address is greater than the other AP's MAC address, the AP has "won" the channel (step 164). Otherwise, the AP concedes the channel and returns to re-scan (step 100). One skilled in the art will realize that the MAC address comparison decision is arbitrary and can be made in the opposite manner.

2. AP Optimization

Once an AP is running on a channel, it continuously performs the following functions to optimize its configuration in the wireless LAN:

- **Radio Power Adjustment.** Each DRCP-enabled AP adjusts its power as appropriate, to accommodate the nearest AP operating on its channel while maintaining its connection to its farthest associated STA. The AP conveys a TP_backoff parameter in its Announce messages. The TP_backoff value provides an indication of how far the sending AP has turned its transmit radio down. This TP_backoff value is used by other APs to determine their own

TP_backoff values. A STA that is associated to the AP can then adopt the communicated TP_backoff value to adjust its radio power, and can track this value as it changes.

- Auction. The AP runs the Auction process to accept new DRCP STAs for association, as appropriate, based on received DRCP Bid messages. These two functions are now described in terms of a preferred embodiment.

2.a. Radio Power Adjustment

2.a.1 AP maintained tables

In order to perform Radio Power Adjustment, the AP 12 maintains a number of tables. The tables include information received from other APs and STAs operating on the selected channel. This information is used to ascertain such things as power levels of other devices on the channel, and distances between devices on the channel, in order to control the AP's power level.

2.a.1.1 AP KnownAPs table

Each AP 12 maintains a number of tables that it consults to perform power adjustment. One such table is the AP KnownAPs Table 200. As shown in Figure 13, once initialized on a channel, an AP 12 receives Beacons and DRCP Announce messages from all other APs 12 operating within the range of its radio, on its channel (steps 202,

204, 206). The AP 12 uses these received messages to build the AP KnownAPs table 200. For each message it receives, the AP 12 checks to see if it has an entry in the AP knownAPs table for the AP-ID in the message (step 208). If found, the AP 12 updates the entry (step 210), otherwise it creates a new one (step 212), up to a maximum of Max_APs entries (step 214). The value of Max_AP is design dependent.

Referring to Figure 14, the AP 12 stores the following fields in the corresponding AP knownAPs table 200 entries:

- AP-ID
- TP Backoff
- Max Power
- DRCP capable
- Age
- Normalized power
- Sample size
- Corrected power

The AP-ID, TP Backoff, and Max Power fields are extracted from each DRCP Announce and Hello message received. The TP Backoff value is stored as a list of values for each message received from each AP-ID. The sample size is the number of TP Backoff values received for each AP-ID.

Since Announce messages are only sent by DRCP-enabled APs, the AP 12 also marks the entry as DRCP-active. APs sending Beacons which contain no DRCP fields are not marked DRCP-active. For each message received, the AP adds the TP Backoff value to the received power level to determine a normalized received power level, as follows:

$$\text{normalized_power} = \text{avg}(\text{received_power} + \text{tp_backoff});$$

Accounting for the TP backoff in the normalized power level provides a value that is consistent and can be used for comparison with power level measurements from other APs.

Received beacons do not explicitly carry a TP backoff value, however, since beacons are always transmitted at full power they effectively carry a TP backoff value of zero. Thus, the AP 12 can update the AP KnownAPs table 200 based on a received Beacon. In this case the AP 12 stores the TP backoff value as zero, and sets the normalized power and the Max Power to the received power level value.

Additionally, the AP 12 keeps an Age for each entry. The Age is reset to zero, "0", each time a Beacon or DRCP Announce is received from the AP corresponding to the entry. Entries are aged as part of the AP Power Adjustment process.

2.a.1.2 AP AssociatedSTAs table

APs 12 also continuously maintain a table of the STAs 16 that are associated with it – the AP AssociatedSTA table. Referring to Figure 15, for every associated STA 16, the AP 12 monitors and collects signal strength information for data packets received (step 220). If an entry for the STA already exists in the AP AssociatedSTAs table (step 222), that entry is updated (step 224). Otherwise a new entry is created for the STA (step 226). The collected data is periodically analyzed by the AP for AP power adjustment purposes. In addition, whenever a DRCP-active STA 16 becomes associated with an AP 12, it sends a Registration Request message to the AP 12. Registration Request messages are sent by the STA 16 to the AP 12 periodically until a Registration Acknowledge

message is received by the STA 16. Upon receipt of a Registration Request from an STA 16 (step 228), the AP 12 updates the entry in the AssociatedSTA Table and marks it as a DRCP-active STA (step 230) and sends a Registration Acknowledge message to the STA 16 (step 232).

As shown in Figure 16, the AP 12's AP AssociatedSTA Table 240 maintains the following information about each STA:

- STA-ID – MAC Address of the Station
- Quiet-time – A value representative of the amount of time since data was last received from this STA
- DRCP-Active – defaults to false, set to true upon receipt of a Registration Request
- Distance – Distance (in Banzais, to be further described) to this STA, calculated based on signal strength information and TP Backoff
- Max Power – list of power values
- Power samples – number of power samples received
- Normalized_power
- Corrected_power
- sta_load_factor – The load of this STA on this AP, see section 4.c.

2.a.1.3 AP Power Adjustment

During the channel selection process, the AP 12 transmits at maximum power, that is, it uses a TP backoff value of zero. Once the AP 12 has successfully claimed a channel, it calculates a TP Backoff value and adjust its transmit power for data transmissions down, in accordance with this value to minimize same channel interference and maximize channel coverage. The calculation of the TP Backoff value is now further described.

Generally, with reference to Figure 17, AP power adjustment is accomplished as follows: The AP 12 peruses its AP KnownAPs table (step 260). The AP 12 finds the AP in the table with the highest TP Backoff value. The AP 12 then sets its own Max TP backoff value to the highest TP Backoff value (step 262). This Max TP Backoff value, if used as the AP 12's TP Backoff value, would reduce the AP 12's transmit power to a level just below the range of the nearest AP operating on the same channel.

Once the Max TP backoff is calculated, the AP then scans the AssociatedSTA table to ascertain the distance to the farthest associated STA 16 (step 264). The distance to the farthest associated STA 16 is compared to the distance to the closest AP 12 operating on the same channel (step 266). If the distance to the farthest associated STA 16 is less than the distance to the closest AP 12, the AP's TP Backoff value is left at Max TP Backoff (step 268). If the distance to the farthest associated STA is greater than the distance to the closest AP operating on the same channel (step 266), then the Max TP backoff value is adjusted back down to accommodate this STA (step 270), and the AP's TP backoff is set to this adjusted value (step 272). This power adjustment is periodically

repeated to account for changes in the AP KnownAPs table and the AP AssociatedSTAs tables change (step 274). Power adjustment may be repeated every second, for example, in an 802.11 environment.

In accordance with the preferred embodiment for use in a wireless data networking environment, as shown in Figure 18, APs perform the above described power adjustment as follows. First, the AP 12 checks to see if its Avoid Other WLANs flag is set (step 280). The AvoidOtherWLANs flag is a configuration parameter which can affect Power Adjustment. In many wireless networking architectures, it is possible for several APs to occupy the same channel while serving different physical networks. For example, in the 802.11 architecture, several APs can serve different ESSs. The AvoidOther WLANs flag is false by default. When set to false, the AP 12 will ignore any other APs on the same channel who's physical network is different from this AP 12's physical network (e.g. ESS ID). This option is useful for cases when there are multiple APs in relatively close proximity that are on different networks. In this case, the operator may prefer to run his AP at the maximum power level to provide the best possible signal for all stations on his network.

If the Avoid Other WLANs flag is not set, the AP 12 sets its TP Backoff to 0 (step 282). The AP 12 will therefore transmit at full power as long as the Avoid Other WLANs flag is not set. If the Avoid Other WLANs flag is set, the AP proceeds with the power adjustment process and will not interfere with other APs even if they are operating on a different network.

The AP 12 processes the information in the AP KnownAPs table every Hello Interval (step 284), to perform power adjustment. The Hello Interval is architecturally and design dependent. In an 802.11 environment, the Hello Interval may be for example the 100ms beacon interval. The knownAPs table entries are first aged before other processing is performed. The age of each entry is incremented (step 286), and any entries whose age exceeds Max AP Entry Age are deleted (steps 288, 290). Thus, if an AP hasn't been heard from in a while, it is aged out of the table to prevent it from affecting this AP 12's power adjustment calculations.

As previously described, the normalized power field of an entry, "n", of the AP KnownAPs table is determined by averaging over several received power measurement samples. The greater the number of samples used to derive the value, the more accurate the measurement. The AP accounts for the inaccuracy in this value by subtracting a standard error, based on the sample size, from the normalized power level, as shown in the following formula. Note, in an 802.11 environment, the normalized power level is expected to be a negative number, ranging in value from -25 to -90 dBm.

$$\text{AP knownAPs}[n].\text{corrected_power} = \text{AP knownAPs}[n].\text{normalized_power} - \text{getStandardError}(\text{sample_size});$$

In this formula, the function "getStandardError" would return the standard error for the sample size of "sample_size" in each entry "n". For example, table I in Figure 19 shows the standard error values for a number of sample sizes for RF signal

measurements. This formula is applied to each entry “n” in the AP KnownAPs table to calculate the corrected_power values for each entry (step 292).

The AP KnownAPs table is then scanned for the entry corresponding to the AP which was heard at the highest corrected_power level. This corrected_power level is compared to the AP 12’s noise floor (step 294). (The AP’s noise floor is a measure of background power on the channel.) If the AP 12 finds that the highest corrected_power level is less than the AP 12’s noise floor, then the AP 12 may transmit at maximum power without interfering with the other APs on the channel. It therefore leaves its Max TP Backoff value at 0 (step 296). If the AP 12, however, finds that the highest corrected_power level is higher than the AP 12’s noise floor, it needs to set a TP Backoff to avoid interfering with that AP. In this case the AP 12 calculates Max TP Backoff by subtracting its noise floor from the corrected_power associated with that AP (step 298).

Once it has calculated Max TP Backoff, the AP 12 must then determine if there are any associated STAs 16 that are farther away (ie who’s signal strength is weaker than) the highest_power_AP. The AP 12’s AssociatedSTAs table is analyzed to find the STA 16 that is the greatest distance from the AP (step 300). The normalized_power and sample size values for this STA are used to calculate a corrected_power value for this STA as previously described. The lowest power STA’s corrected_power level is compared to the AP 12’s noise floor (step 302). If the corrected_power level is less than the noise floor, then the AP 12 needs to run at full power to cover the STA, so the AP TP Backoff value is set to 0 (step 304). If the corrected_power level is greater than the AP

12's noise floor, then the STA TP Backoff value is set to the corrected power level minus the noise floor (step 306).

Next, Max TP Backoff is compared to STA TP Backoff (step 308). The AP's TP Backoff ("my TP Backoff") is set to the lower of the two backoff values to avoid interference with the closest AP while ensuring coverage for the farthest STA. So, If STA TP Backoff is less than Max TP Backoff, then my TP Backoff is set to the Max TP Backoff value (step 310). If STA TP Backoff is greater than Max TP Backoff, then the my TP Backoff value is set to the STA TP Backoff value (step 312).

The AP 12 then adjusts its transmit power by the value of my TP Backoff (step 314), and uses my TP Backoff as the value of TP Backoff in its Announce messages. According to the preferred embodiment, the AP will transmit data at a power level adjusted by TP Backoff, but will transmit DRCP management messages (e.g. Claim, Announce, Accept) at full power. So, APs can always hear management messages passed between each other.

Furthermore, various different wireless networking architectures may provide a mechanism for clearing the wireless channel, further increasing the probability that the management messages will be received. For example, in the 802.11 architecture, the AP issues a Clear to Send (CTS) message to clear the channel (step 316), and then sends a DRCP Announce message at maximum power (step 318). After sending the Announce message at maximum power level, the AP resumes use of its calculated TP backoff value for data packets to minimize same-channel interference, as described above.

2.a.1.3.i AP Power Adjustment During Station Movement

When a STA 16 is associated with an AP 12, the AP 12 keeps track of the distance between the STA 16 and the AP 12. If the AP 12 is using a non-zero TP Backoff value, and the AP 12 ascertains that the STA 16 is moving out of range of the AP 12 at backed off power, then the AP 12 can adjust its TP Backoff value to accommodate the STA 16's movement.

The distance between an AP 12 and an associated STA 16 is calculated and stored in the AssociatedSTAs table in units of "Banzais". The Banzai is a unit of distance derived from a measurement of received signal strength from an AP 12 operating with a known transmit power backoff. In an 802.11 environment, for example, a received signal strength measurement is generally expected to range in value from -25 dBm to -90 dBm, but depending upon possible antenna gain at the high end or sensitivity at the low end, may range from 0 dBm down to -100 dBm. A transmit power backoff is generally expected to range in value from 0 dB to 65 dB. Given a received signal strength measurement of "received_power" and transmit power backoff of "TP Backoff" from an AP, the distance to that AP in Banzais is calculated as follows:

$$\text{distance_in_banzais} = \text{ABS} [\text{MIN} [0, (\text{received_power} + \text{tpbackoff})]]$$

Algorithms for movement detection are described in more detail later. For purposes of AP power adjustment, as previously described, the AP 12 collects multiple samples of received_power and TP Backoff values for each STA 16 over time, and the

distance between the AP and the STA is calculated over all these samples. The AP 12 detects movement by continuously checking to see if the difference between the distance to each station, derived from a set of long term samples, is sufficiently smaller than the current distance measurement based on the most recently collected samples, to indicate that the STA 16 is moving away from its AP 12.

If the AP 12 detects that the STA 16 is moving away and the STA 16 is within a given Short Term Standard Error Banzais of the current edge of the transmit signal (based on the current TP Backoff), then the AP 12 switches to a TP Backoff of 0 until it no longer has any moving STAs associated with it.

More particularly, referring to Figure 20, to detect STA movement, the AP 12 collects a long term samples of distance values for a STA 16 (step 320), and then continuously collects short term sample size distance values for the STA 16 (step 322). The difference between the long term distance and short term distance values is compared to a Moving Threshold value plus the standard error in the two distance measurements in order to eliminate false movement detection. (See section 6 for more information.) A station is considered to be moving when the short term distance exceeds the long term distance by more than the Moving Threshold plus the sum of the errors in the two measurements. The following pseudo code describes this comparison.

```
IF ((AssociatedSTAs[n].short_term_distance - AssociatedSTAs[n].distance) >
    (movingThreshold + longTermStdError + shortTermStdError)) (step 324)
THEN
    moving = TRUE (step 326)
ELSE moving = FALSE; (step 328)
```

If the AP 12 detects that the STA 16 is moving, the AP 12 sets its TP Backoff to 0 so that it transmits data at maximum power (step 328). The AP 12 remains at maximum power until it detects that the STA 16 is no longer moving, or quiet. If the AP 12 determines that it is no longer moving before the STA 16 loses the association to its AP, the AP 12 resumes normal processing of received signal strength to determine a new appropriate TP Backoff value as previously described (step 334).

Once the AP 12 detects that the STA 16 is moving, it begins using another test to detect when the STA 16 has stopped moving. To detect that the STA 16 has stopped moving, the AP 12 compares the distance to the STA 16, derived using the Long Term Sample Size, to the distance derived from the most recent Short Term Sample Size samples. The AP 12 looks to see when this difference is less than just the standard error in the two measurements to determine that the STA 16 has stopped moving. This test is performed as follows (step 330):

```
IF ((AssociatedSTAs[n].short_term_distance - AssociatedSTAs[myAP].distance)
< (longTermStdError + shortTermStdError)) THEN
    moving = FALSE; (step 332)
```

2.b AP Auction

The purpose of the Auction is to accomplish the distribution of STAs 16 across APs 12 in a manner that optimizes wireless communications performance. The goal is to have STAs 16 associate to their nearest AP 12 while taking loading (the sum of the individual loads of the STAs 16 already associated to the AP 12) into account. This

allows the RF footprints of the APs 12 and STAs 16 to be minimized, while ensuring that no AP 12 is overloaded.

STAs 16 learn of available APs 12 through the Announce messages transmitted by the APs 12. As will be further described with regard to STA optimization, a STA 16 calculates a "biased distance" to each AP 12 it hears from, including its own AP, using the received power and loading information from the Announce messages. A STA 16 will send a Bid message to an AP that is "better" than the STA's current AP, where better means that the AP has a lower biased distance. The Bid message contains the value of the difference between the biased distance from the STA 16 to the destination AP 12 and the biased distance to the STA 16's current AP. This value is called the biased distance delta.

In particular, referring to Figure 21, the AP 12 collects any received Bids over a period of Auction Interval (steps 340,342). If a Bid is received from a STA 16 from which a Bid has already been received (step 344), the new bid information replaces the previous bid information (step 346). Otherwise a new entry is created for the STA 16 (step 348). In either case the bid entry's age is reset (step 350).

At the end of Auction Interval (step 352), the AP 12 processes the received bid information. (The Auction Interval in an exemplary 802.11 environment may be on the order of, for example, 7.5 seconds.) The age of all bid entries is incremented by one (step 354) and then any bid entry whose age is greater than Max Bid Age is deleted (step 356). The list is then sorted by biased_distance_delta value (step 358).

The AP 12 selects the bid entries with the highest biased distance delta values, up to acceptsPerAuction entries, and sends a DRCP Accept message to each of the STAs 16

corresponding to those entries (step 360). The IDs of each STA 16 being sent an Accept is put in a list of outstanding accepts (step 362), and a count of accepted STAs who have not yet associated and registered is noted as numAcceptsOut (step 364). At this point the next auction period begins.

In addition to receiving DRCP Bids, the AP 12 also receives an indication any time a STA 16 associates to the AP 12. Referring to Figure 22, on receipt of the indication (step 366), the AP checks to see if it has bid information from the newly associated STA 16 (step 368). Any bid information found for the newly associated STA 16 is deleted (step 370). The AP 12 also checks to see if the STA 16 is in the list of outstanding accepts (step 372), and if the STA 16 is in the accepts outstanding list that entry is deleted (step 374) and the numAcceptsOut count is decremented (step 376). At the end of the Auction Interval, any outstanding accepts from the previous auction cycle are considered to have timed out, hence the list of outstanding accepts is emptied and numAcceptsOut is reset. These processes continue as long as the AP 12 is active on a given channel.

3. STA Initialization:

The purpose of the STA initialization phase is to find and associate to a suitable AP 12 to provide the STA 16 with access to the wireless LAN, and to prepare for the operation of the DRCP protocol and algorithms.

Referring to Figure 23, when started, the STA 16 produces a list of channels supported by the STA 16 (step 380). In multi-PHY-variant STAs (e.g., STAs supporting

multiple bands such as 802.11a/b/g), the channel list will include all of the channels that are supported across the various supported bands.

First, the STA 16 scans for beacons on all channels across all supported bands (e.g., STAs supporting multiple bands such as 802.11a/b/g will scan all channels in each of the a, b, and g bands.) (step 382) The AP 12 that is received at the greatest signal strength is selected (step 384).

Preferably, where multiple bands are supported, the selection of an AP 12 also takes into account a preference for the higher bandwidth bands so that, for example as implemented in an 802.11 environment, an AP 12 on an 802.11a or 802.11g channel is given some preference to one operating on an 802.11b channel.

Once an AP 12 is chosen, the STA 16 authenticates and associates to that AP (step 386). Any security policies that control association are executed at this point.

During initialization, the STA 16 also enables the DRCP protocol so that the STA 16 will receive DRCP Announce messages (step 388). The STA 16 then proceeds to the STA optimization phase (step 390).

4. STA Optimization

Once it has made its initial association and has access to the wireless LAN, the STA continuously performs the following functions to optimize its configuration:

- Canvassing. The STA periodically tunes its radio to listen on other channels, while retaining its association to its AP on its operating channel. This canvassing of other

channels is done to allow the STA to receive DRCP Announce messages from APs operating on other channels.

- **Bidding.** The STA receives and processes DRCP Announcements from all APs that are operating within its range on any of its supported channels. It evaluates the received power and loading information from the Announce messages and if it finds an AP to which it would be more optimally associated than its current AP, the STA makes a bid to move to that AP.
- **Radio Power Adjustment.** The STA adopts the TP Backoff value communicated in Announce messages from its AP, tracking this value as it changes.
- **Movement Detection.** The STA continuously checks to see if it is moving away from the AP to which it is currently associated. If it detects that it is moving, it stops participating in the DRCP bidding process and adopts a process of next AP selection that is invoked when the association to its AP degrades.

These functions are described more particularly as follows:

4.a STA Canvassing

The process by which the STA 16 canvasses the other channels to determine whether to send a DRCP Bid message is now described in further detail. In order to monitor DRCP Announce messages, a STA 16 periodically tunes its radio to the channels other than the one to which it is currently associated. However, the STA 16 must remain associated to its current AP 12 so that it does not lose data packets. So, packets must be

buffered during the time that the STA 16 is canvassing. Various wireless communications architectures may provide different means for packet buffering.

Generally, referring to Figure 24, during a periodic scan interval (step 400), the STA 16 causes the AP 12 to which it is currently associated to temporarily buffer the packets destined for the STA 16 (step 402). Packet buffering can be initiated in a variety of ways. For example, the STA 16 may send a DRCP message to the AP 12 to cause the buffering, or the AP 12 may periodically turn on buffering and notify the STA 16 that it has done so. While the STA 16's packets are being buffered, the STA 16 tunes its radio to another channel and listens for Beacons and DRCP Announce messages on that channel (step 404). This information is used by the AP 12 to determine whether to bid for another AP. When the scan interval is complete, packet buffering is turned off and the STA 16 receives its buffered packets from the AP 12 (step 406).

Figure 25 sets forth a STA canvassing mechanism for use in an 802.11 wireless networking environment. The 802.11 architecture conveniently provides a power save mode that, in accordance with the principles of the invention, can be used for this purpose.

The 802.11 power save mode is intended for use by STAs 16 so that they can turn off their radios for periods of time in order to save power. STAs 16 can indicate to APs 12 that they are entering this power save mode. In response, APs 12 buffer the STAs' packets while the STAs 16 are "sleeping". APs 12 periodically send special Beacon messages to the STAs 16. STAs 16 wake up in response to these special Beacon

messages. These Beacon messages include information as to whether any data is buffered for the STA 16. The STA 16 “wakes up” if data is buffered for it.

STAs 16 operating in an 802.11 environment in accordance with the preferred embodiment of the invention use the 802.11 power save mode to go off-channel and canvass other channels for DRCP Announce messages. After the channel canvass is complete, the STA 16 reverts to normal power save mode. Stations that have not been set to Power Save Mode by management are caused by the STA 16 to act as if they’ve been set to the Power Save Mode. STAs 16 that have already been set to Power Save Mode by management will have even more time to canvass.

In particular, referring to Figure 25, at the start of a scan interval (step 410), the STA 16 inquires about the current state of its power save mode. The power save mode that was set by management (active, power save) is remembered (step 412). The power save mode is set to power save, and the listen time (time the STA 16 stays asleep), if any, is increased by a period of time herein referred to as scan time (step 414). At the beginning of the power save cycle, the STA 16 actually stays awake temporarily, instead of dozing as it told the AP it was going to do. It is during this time that other channels are canvassed for beacons and DRCP Announce messages (step 416). After the canvass is done the STA 16 resumes its power save cycle (step 418). This process repeats every scan interval. Whenever the STA 16 is not canvassing, it restores the remembered management set power save mode. The scan interval may be for example twice per Beacon interval.

Stations that have not been set to Power Save Mode by management are caused by the STA 16 to act as if they've been set to Power Save Mode, with listen interval set to the minimum value (i.e., every Beacon). STAs 16 that have already been set to Power Save Mode by management will have the most amount of time to canvass.

During the canvass time the STA 16 tunes its radio to a different channel in order to passively listen for beacons and DRCP Announce messages. The STA 16 keeps track of which channels have been canvassed, stepping through all of the channels until all supported channels have been canvassed. The STA 16 keeps track of all DRCP Announce messages, and the power level at which they were received.

4.a.1 STA KnownAPs Table

The STA 16 receives beacons and DRCP Announce messages from all APs 12 within the range of its radio. These are processed to build a table of all known APs 12, the "STA knownAPs" table 430, as shown in Figure 26. The STA knownAPs table includes the following parameters for each entry:

- AP-ID
- age
- Channel ID
- Load factor
- TP Backoff
- Max Power
- Distance_samples
- Distance
- My_load_factor
- Biased_distance

The STA Known APs table 430 is built as shown in Figure 27. For each Beacon or Announce message received (steps 432, 434), the STA 16 checks to see if it has an entry in the STA KnownAPs table 430 for the AP-ID in the message (step 436). If found, the STA updates the entry (step 438), otherwise it creates a new one (step 340), up to a previously set maximum herein referred to as Max APs entries (step 442).

The STA 16 stores the following fields from received beacons in the STA knownAPs table entries:

- AP-ID
- Channel ID
- Max Power

The STA 16 stores the following fields from received Announce messages in the corresponding STA knownAPs table entry:

- AP-ID
- Channel ID
- Received Power
- Load Factor
- TP Backoff

The STA 16 also notes the received power level that accompanied the beacons and Announce messages and uses these values along with the TP backoff values to calculate the distance to the APs in Banzais, as previously described. (Again, since non-

DRCP APs will always send beacons at full-power, the TP Backoff value for these is set to 0.)

The Received Power and TP Backoff entries are lists, where each entry in each list corresponds to a Beacon or Announce message received for the corresponding AP-ID. The received power level value and correspondingly, the distance in Banzais, are subject to variability in the RF channel. The STA 16 saves a number of these distance measurements for each entry in the knownAPs table, so that it can use averaging to compensate for this variance, to be further described. For its own AP (i.e. the AP to which the STA is currently associated), the STA 16 averages over a relatively large number of distance values, herein referred to as “Long Term Sample Size” distance values. For all other entries, the STA uses fewer, “Bid Sample Size”, distance values.

Additionally, the STA keeps an Age for each entry. The Age is reset to zero, “0”, each time an Announce message is received from the AP corresponding to the entry. Entries are aged as part of the STA Bidding process, described below.

4.b STA Power Adjustment

Referring to Figure 28, an associated and registered STA 16 receives all Announce messages from the AP 12 to which it is associated. Upon receipt of an Announce message (step 556), the STA notes the TP Backoff value in the Announce message and adopts that value as the STA’s own TP Backoff (step 558).

4.c STA Bidding

Each time the STA Canvassing function completes a canvass of all channels, the STA 16 analyzes the information in the STA knownAPs table to see if there is a potential “better” AP 12 with which to associate. The notion of what constitutes a better AP takes into account the distance to the AP in Banzais, the available data rate, and the loading (number of associated STAs) on the AP, if known.

Referring to Figure 29, the STA Bidding process operates generally as follows. When the canvass is complete and a sufficient number of samples have been collected on each channel (step 450), the STA knownAPs table 330 entries are aged before other processing is performed (step 452). The age of each entry is incremented, and any entries whose age exceeds Max AP Entry Age are deleted (step 454). Since the age field is cleared each time an Announce message or Beacon is received, this aging process will eliminate APs from whom nothing has been heard for “Max AP Entry Age” bidding cycles.

As mentioned, the STA 16 uses averaging to compensate for variance in its distance measurements. It requires Long Term Sample Size distance values for the STA knownAPs entry corresponding to its AP, before it performs further processing of the table (step 456). Once the STA 16 has Long Term Sample Size distance values for its own AP, it then waits until it has Bid Sample Size distance values for all entries in the

knownAPs list at that time before it begins looking for a better AP (step 458). This is to avoid making a decision to move to a new AP before it has sufficient information about the other APs in the network. However, to avoid the potential for waiting indefinitely, it will not delay processing the knownAPs list for any new APs that were added after it has Long Term Sample Size distance values for its own AP.

Working with the entries for which there are sufficient distance measurement samples, the STA 16 looks for a potential better AP. In summary, a biased distance is calculated for each entry, which takes into account the available data rate as well as the loads on the APs (step 460). The data rate is deduced based on the received signal strength and the technology being used (i.e., in an 802.11 environment, the 802.11 mode of operation (a,b,g)). After calculating the biased distances for all of the entries in the STA knownAP table, the AP with the lowest biased distance is considered to be the best candidate and, if it appears better than its current AP (step 462), a Bid is sent (step 464).

More particularly, referring to Figure 30, for each entry “n” in the STA knownAPs table (denoted KnownAPs[n]), the following processing is performed on entry knownAPs[n]. An index of “myAP” corresponds to the entry for the AP to which the STA is currently associated, i.e., knownAPs[myAP] is the entry for the STA 16’s current AP.

As previously described, the distance field in the STA knownAPs table 430, knownAPs[n].distance per entry, is the distance in Banzais, to the corresponding AP, averaged over a number, Bid Sample Size, of measurement samples. As previously noted, this value is subject to variance in the RF channel. The bid selection process

should preferably yield the choice of a “better” AP only when the new AP actually would provide better performance for the STA, and not when the new AP simply appears to be better due to this variance. The variance in the new AP’s distance measurement is represented by a “Bid Sample Std Error” value related to the bid sample size, and the variance in the current AP’s distance measurement is represented by a “Long Term Std Error” value related to the long term distance sample size. It is advantageous to minimize the error in the distance measurement for a given entry n, in comparison to the STA’s current AP. This is done by using a corrected distance that is set to the distance to the STA’s current AP, if the entry falls within the sum of the standard errors on the two distance measurements. The corrected distance, “corrected_distance”, is determined as follows:

```

IF ( ABS [knownAPs[n].distance – knownAPs[myAP].distance] ≤
    (Bid Sample Std Error + Long Term Std Error) ) (step 470) THEN
    corrected_distance = knownAPs[myAP].distance (step 472)
ELSE corrected_distance = knownAPs[n].distance; (step 474)

```

4.c.1 Distance to Load Factor Conversion

The corrected distance to each AP 12 is recorded in the STA knownAPs list. This distance is then used in conjunction with data related to the particular wireless environment in which the AP 12 is operating to derive an estimate on the expected load factor for the STA. For example, in an 802.11 environment, the distance and 802.11

mode (a,b,g) are used to retrieve the expected data rate for the STA 16 from the distance_to_rate table:

```
knownAPs[n].data_rate = distance_to_rate [knownAPs[n].mode ]  
                        [ knownAPs[n].corrected_distance ] ;  
                        (step 376)
```

An example of distance to rate calculations for 802.11 modes is shown in Table II in Figure 31.

Then, the expected load for this datarate is retrieved from the rate_to_load table:

```
knownAPs[n].my_load_factor = rate_to_load[ knownAPs[n].data_rate ]; (step  
478)
```

An example of a rate_to_load table for 802.11 networks is shown in Table III in Figure 32. One skilled in the art will realize how to implement distance-to-rate and rate-to-load tables from specifications for other wireless environments. The corrected_distance and my_load_factor parameters are determined in this manner for each entry n in the STA Known APs table 430.

Any entries in the knownAPs list that represent non-DRCP APs need to be given default values for their load_factors so that they can be considered by the Stations for associations as well. These default load_factors are derived from a default number of STAs per AP value that should be consistent across the network and a default “average data rate” per technology. That is:

```
if (knownAPs[n].DRCP_Enabled == FALSE) then  
    knownAPs[n].load_factor = STAs_per_AP *
```

rate_to_load [default_rate [knownAPs[n].mode]];

When determining the load of the STA 16's current AP (myAP), when myAP is a non-DRCP AP, then its default load_factor value is preferably incremented by the STA's load on that AP. This helps to support a consistent view of the load of that AP both before and after a STA associates with it – that is, since the STA adds its own load to the default load of its prospective (non-DRCP) AP before it makes a decision to associate with it, it must also add its load to the default load for this AP after it has associated with it.

4.c.2 Biased distance calculation

Using the my_load_factor to the AP 12, the load_factor currently on the AP 12 (received from Announce messages) and the corrected distance to the AP 12, the STA 16 calculates a biased_distance value to account for the loading on the prospective AP 12 in comparison to the loading on the STA 16's current AP, as shown in Figure 29. The biased distance is calculated as described by the following formula:

$$\text{knownAPs}[n].\text{biased_distance} = \frac{\text{knownAPs}[n].\text{corrected_distance} * (\text{knownAPs}[n].\text{load_factor} + \text{knownAPs}[n].\text{my_load_factor})}{\text{knownAPs}[\text{myAP}].\text{load_factor}} \quad (\text{step 490})$$

Next, a biased distance to the STA 16's current AP 12 is calculated to account for the loading on the current AP 12 relative to the loading on the prospective AP. This calculation is made as follows:

```

knownAPs[n].my_ap_rel_biased_distance =
    knownAPs[myAP].distance *
    knownAPs[myAP].load_factor /
    (knownAPs[n].load_factor + knownAPs[n].my_load_factor) (step 492)

```

Finally, the difference between the biased distance to the prospective AP and the relative, biased distance to the STA 16's current AP is determined, as follows:

```

knownAPs[n].biased_distance_delta =
    knownAPs[n].my_ap_rel_biased_distance - knownAPs[n].biased_distance
(step 494)

```

After calculating the biased_distances and biased_distance_deltas for all of the APs in the knownAPs list, the STA 16 checks to see if any of the biased_distance_delta values are positive (step 496). If not, then the STA 16's current AP is still the best AP, so the STA 16 remains associated with its current AP (step 498). Of any positive biased_distance_delta values, the best AP is the one with the highest positive biased_distance_delta value (step 500). If the best AP is not DRCP enabled (step 502), then the STA 16 associates with that AP (step 504). If the best AP is a DRCP AP (step 502), then a Bid is sent (step 506) and the STA 16 resumes normal operation until it either receives a DRCP Accept or it completes another Canvass Sample Number passes of all channels. If there is more than one AP with the same highest biased_distance_delta values (step 508), the STA 16 checks to see if any of them is the last AP to which it Bid (step 510) and if so, it selects that one again (step 512).

If a DRCP Accept is received with the AP-ID matching the selected APs AP-ID (step 514), the STA sets its TP backoff value to zero (step 516) and associates with the

AP from which the Accept was received (step 518). The STA 16 now sends a DRCP Registration Request to the AP (step 520) and starts a timer (step 522) to go off every Registration Timeout Interval. When the timer expires (step 524), the STA 16 sends out another DRCP Registration Request and resets the timer. Upon receipt of a DRCP Registration Acknowledge (step 526), the timer is disabled (step 528).

If no DRCP Accept is received (step 414) in response to the STA's Bid message after a certain period of time (step 530), the STA remains associated with its current AP.

After the STA 16 has associated with a new AP, the STA 16 waits until it has collected a large number, Long Term Sample Size, of distance measurements to its new AP before it resumes this process of evaluating the knownAPs table for bidding.

4.d STA Movement Detection

When a STA 16 is associated with an AP 12, the STA 16 receives DRCP Announce messages from all APs 12 within the range of its radio. Referring to Figure 34, once the STA 16 has collected Long Term Sample Size of distance measurements from Announce messages received from its AP 12 (step 540), it can begin the movement detection process.

The STA 16 continuously collects Short Term Sample Size distance values to the current AP (step 542). To detect movement, the STA 16 compares the distance to its AP 12, derived from averaging over the long term using Long Term Sample Size, to the short term distance, derived from averaging the most recent Short Term Sample Size samples.

This difference is compared to a Moving Threshold value plus the standard error in these two measurements in order to eliminate false movement detection. A station is considered to be moving when the short term distance exceeds the long term distance by more than the Moving Threshold plus the sum of the errors in the two measurements. The following pseudo code describes this comparison.

```
IF ((knownAPs[myAP].short_term_distance - knownAPs[myAP].distance) >
    (movingThreshold + longTermStdError + shortTermStdError)) (step
544) THEN
    moving = TRUE      (step 546)
ELSE moving = FALSE;  (step 547)
```

Once the STA 16 detects that it is moving (step 446), and as long as the STA 16 does not detect that it has stopped moving, the STA 16 refrains from participating in the bidding process (step 548), seeking a new AP only if warranted by the deterioration of its current association. If the STA 16 determines that it is no longer moving before the STA 16 loses the association to its AP, the STA 16 resumes normal operation including participation in the bidding process.

As in movement detection, to detect that the STA 16 has stopped moving, the STA 16 compares the distance to its AP 12, derived using the Long Term Sample Size, to the distance derived from the most recent Short Term Sample Size samples. The STA 16 looks to see when this difference is less than just the standard error in the two measurements to determine that the STA 16 has stopped moving. The following pseudo code describes this test.

IF ((knownAPs[myAP].short_term_distance - knownAPs[myAP].distance) < (longTermStdError + shortTermStdError)) (step 550) THEN
moving = FALSE (step 552)

If the STA 16 determines that it has stopped moving, the bidding process is restarted (step 554).

5. Software Architecture

In accordance with the preferred embodiment, the previously described functionality is implemented in software in APs 12 and STAs 16 respectively. Referring to Figure 35, the software is implemented in accordance with a layered architecture, such that it contains a platform dependent module that interacts with a platform independent module. This architecture is advantageous for porting the inventive functionality between different wireless architecture platforms. As shown each AP 12 includes a platform independent module 560 that interacts via an AP API 562 with an AP platform dependent module 564. Likewise, each STA 16 (one shown) includes a STA platform independent module 566 that interacts via a STA API 568 with a STA platform dependent module 570. In environments where the APs 12 are connected to each other via a wired network 14, DRCP messages may be passed directly between the APs 12 via the wired network 14. In environments where the APs are interconnected via only the wireless network 15, APs 12 interact with each other and with STAs 16 by passing DRCP messages to the respective platform dependent layer, which causes wireless platform

specific protocol messages to be passed between the APs 12 and STAs 16 to implement the DRCP protocol.

Referring to Figure 36, there is shown a representation of the AP architecture of Figure 35 as it applies to in an 802.11 networking environment. The AP Radio Management Agent (ARMA) 580 is the platform independent layer of the software. The AP Radio Manager (ARM) 582 is the platform dependent layer of the software. The ARM software is actually implemented within several different 802.11 platform specific elements of the AP. More information on these elements can be found in the incorporated 802.11 specification.

Referring to Figure 37, the Station Radio Manager (SRM) 584 is the platform dependent portion of the STA software. As shown, the SRM communicates with various 802.11 platform specific elements. The Station Radio Management Agent (SRMA) 586 is the platform independent portion of the STA software. Likewise, the AP radio manager is the platform dependent portion of the AP software, communicating with 802.11 platform specific elements. SRMAs communicate with ARMAs through the use of DRCP messages as previously described.

These DRCP messages are now described in further detail. Generally, DRCP messages could be encoded as standard LLC data frames, and the invention does not preclude such an implementation. But, according to the preferred embodiment as implemented in an 802.11 networking environment, DRCP management messages are encoded as new types in existing Class 1 Frames. DRCP messages are addressed either to a Group MAC Address, or to an individual MAC address, and are distinguished by the

presence of the DRCP Protocol Identifier in the Protocol Identification Field of a SNAP PDU.

The DRCP messages are now described in detail as they operate on an IP WLAN. Some DRCP messages are transmitted as IEEE 802.11 MAC management frames of subtype Beacon on the wireless LAN only, while others are transmitted as data frames encoded as LLC 1 Unnumbered SNAP PDUs on the wireless LAN or the wired/wireless network between APs.

Figure 38 shows the encoding of a DRCP message in an IEEE 802.11 Beacon frame. The DA field is set to a specific DRCP group MAC address as appropriate to the message type, and the BSS ID is a DRCP specific BSS-ID. The fixed portion of the Beacon frame is as defined in the 802.11 standard, and the variable portion of the frame is replaced by the information element created to carry a DRCP protocol message. In accordance with a preferred embodiment, it is desirable for DRCP enabled APs to perform automatic channel selection and load balancing by exchanging DRCP Claim, Preclaim, and Announce messages in management frames of subtype Beacon, while preventing STAs from attempting to associate with an AP in response to receipt of one of these messages. Several steps are therefore taken in addition to the DRCP protocol specific address fields already mentioned. First of all, the "Element ID" field includes an OUI specific to the DRCP protocol, which alerts DRCP enabled APs and STAs that the frame holds a DRCP message. Furthermore, standard (non-DRCP) 802.11 Beacons include in the body of the frame field certain fields such as "Supported Rates", "FH Parameter Set", "DS Parameter Set", "CF Parameter Set", etc. (Refer to the incorporated

802.11 standard document for more information.) Management frames of type Beacon encoding 802.11 Claim, Preclaim, and Announce messages either do not include these fields, or set them to a null value. Non-DRCP STAs that might otherwise attempt to use the DRCP Beacon type frames for association cannot do so due to the lack of this information.

Figure 39 shows the encoding of a DRCP message within an 802.11 MAC Data frame, of subtype Data. DRCP messages are addressed either to an individual MAC address or to one of the DRCP Group MAC addresses, and are distinguished by the presence of the DRCP Protocol Identifier in the Protocol Identification Field of a SNAP PDU. DRCP messages that are transmitted over the DS may be formatted as shown, or may be similarly encoded in another MAC data frame depending upon the DS media.

In accordance with the preferred embodiment, the SRMAs and ARMAs interact with the SRMs and ARMs to generate and/or collect information needed to produce or interpret DRCP protocol messages. It is noted that the DRCP protocol could be implemented over non-802-11 primitives without departing from the principles of the invention. The following describes the primitives used in an 802.11 environment.

5.a Enhancements to Standard 802.11 MAC Service Interface

The ARMAs and SRMAs transmit and receive DRCP messages over a standard 802 MAC Service Interface, with some enhancement. The receive interface is enhanced in both the STA and the AP to allow the SRM and the ARM to indicate to the SRMA and ARMA respectively, the power at which DRCP messages are received. In particular, the

semantics of the 802.11 **MA-UNITDATA.indication** service primitive are modified as shown by the underlined text, to add a received power parameter as follows:

```
MA-UNITDATA.indication    (  
    source address,  
    destination address,  
    routing information,  
    data,  
    reception status,  
    priority,  
    service class,  
    received power  
    )
```

The received power parameter specifies the signal strength, expressed in dBm, at which the MSDU was received. The received power value indicates the current level at which the sending device is heard, but does not provide an indication of whether or not the sending device is transmitting at full power. The potential power level at which a device might be heard can be determined when the transmit power backoff (i.e., the amount, in dB, by which the radio is turned down) in use by the device is also known.

5.b Enhancements to the Standard 802.11 Management Interface

BSS Description

The BSSDescription Parameter contains a list of elements that describe the BSS.

An additional element is added to this list:

Name	Type	Valid Range	Description
Received Power	Integer	-1 to -99	Indicates the power (in dBm) at which the Beacon from this BSS was received.

Send DRCP

This mechanism is provided to allow the ARMA to send DRCP Messages encoded in 802.11 Management frames of type Beacon.

MLME-SENDDRCP.request

This primitive is used by the ARMA to request that the ARM send a DRCP Message over the wireless media, encoded in an 802.11 Management frame of type Beacon. As shown in Figure 34, this is a special type of Beacon frame wherein the fixed portion of the Beacon frame is as defined as in the 802.11 standard, and the variable portion of the frame is replaced by a single information element that carries the DRCP message.

The primitive parameters are as follows:

MLME-SENDDRCP.request (Destination Address
 Message Length
 DRCP Message
 Quiet Channel
 CTS Duration
)

Name	Type	Valid Range	Description
Destination Address	MAC Address	N/A	A specific DRCP group MAC address as appropriate to the message type.
Message Length	Unsigned Integer	0..2312	Indicates the number of octets in the DRCP Message field.
DRCP Message	DRCP Message	N/A	DRCP Message

Name	Type	Valid Range	Description
Quiet Channel	Boolean	FALSE (0), TRUE (1)	Indicates whether the STAs associated to the AP should be quieted for the Beacon transfer by the transmission of a Clear To Send (CTS) frame immediately prior to the Beacon transfer.
CTS Duration	unsigned integer	16..255 μ sec	Indicates the value to be placed in the duration field of the CTS frame. The value represents the time, in microseconds, required to transmit the pending Beacon frame, plus one short interframe space (SIFS) interval. This parameter is only used when the quiet channel parameter is true.

This primitive is generated by an ARMA to request that a DRCP Message be sent on the wireless media encoded in an 802.11 Management frame of type Beacon. DRCP Claim and Hello messages are sent in this manner. As previously described, the ARMA may optionally quiet the channel before sending a DRCP Hello message by first by sending a CTS frame. In particular, if the Quiet Channel parameter is TRUE, the ARM transmits a Clear To Send (CTS) frame immediately prior to the Beacon transfer. The DRCP Hello CTS Destination MAC Address is placed in the Receiver Address (RA) of the CTS frame. The duration field of the CTS is set to the value of the CTS Duration parameter.

The fixed portion of the Beacon frame is as defined in the 802.11 standard. The DA is set to the Destination Address parameter value, the SA is the AP's MAC address, and the BSS ID is the DRCP Default BSS-ID.. The variable portion of the frame is

replaced by a single information element with an Element ID of DRCP Protocol, with a Length field value of the Message Length parameter and the Information field containing the DRCP Message.

This primitive confirms the transmission of a DRCP message to the ARMA. The primitive parameters are as follows:

Name	Type	Valid Range	Description
ResultCode	Enumeration	SUCCESS, INVALID_PARAMETERS, NOT_SUPPORTED	Indicates the result of the MLME-SENDDRRCP.request

Power Management Fib

indicate to the AP that it is in power save mode, without actually going into power save mode.

MLME-POWERMGTIFB.request

This primitive requests the SME to use the power save mode interaction with the AP to allow time to canvass other channels. The primitive parameters are as follows:

MLME-POWERMGTIFB.request ()

Name	Type	Valid Range	Description
Null	N/A	N/A	No parameters

This primitive is generated by an SRMA to cause the MLME to borrow part of the doze time (if the STA is in power save mode) or all of the doze time (if the STA is in active mode) in order to canvass other channels.

This request causes the SRM to:

1. save the current power management mode settings
2. set:
 - a. power management = Power_Save
 - b. WakeUp = FALSE
 - c. ReceivedDTIMs = FALSE
3. signal the AP that it is using power management mode.

This request prepares the SRM to:

1. at the start of the power save cycle, signal the SRMA by sending an **MLME-PSSTART.indication** while actually keeping the power on.
2. catch any user or net manager power mode management operations and cause them to use the saved settings, not the active settings.

MLME-POWERMGTFIB.confirm

This primitive confirms the change in power management mode to the SRMA.

The primitive parameters are as follows:

MLME-POWERMGTFIB.confirm (
 ResultCode
)

Name	Type	Valid Range	Description
ResultCode	Enumeration	SUCCESS, INVALID_PARAMETERS, NOT_SUPPORTED	Indicates the result of the MLME- POWERMGTFIB.request

This primitive is generated by the MLME as a result of an **MLME-POWERMGTFIB.request** to mimic power save mode. The SRMA is thus notified of the change of power mode indicated.

Power Save Start

This mechanism notifies the SRMA that it can begin to canvass.

MLME-PSSTART.indication

This primitive indicates to the SRMA the start of the power save cycle. The STA does not actually power off its radio and enter the sleep state at this point, but preferably, it should not transmit outgoing frames after sending this indication until it receives an **MLME-PWRMGMTFIBCONTINUE.request**. The primitive parameters are as follows:

MLME-PSSTART.indication

(
)

Name	Type	Valid Range	Description
Null	N/A	N/A	No parameters

This primitive is generated by an SME to indicate the start of power save cycle. The SRMA is thereby notified of the start of the power save cycle.

Power Management Restore

This mechanism further supports a STA's ability to indicate to the AP that it is in power save mode, without actually going into power save mode.

MLME-PWRMGMTRESTORE.request

This primitive tells the MLME that it should restore the user-configured power save mode. This primitive allows the SRMA to tell the MLME that it no longer needs to lie to the AP about power save (that control over power save is passed back to the MLME). The primitive parameters are as follows:

MLME-PWRMGMTRESTORE.request (
)
)

Name	Type	Valid Range	Description
Null	N/A	N/A	No parameters

This primitive is generated when the canvass mechanism is taken out of service. The receipt of this primitive causes the SRM to restore the saved power management mode settings and:

1. if saved power mode was ACTIVE, immediately force the awake state;
2. if saved power mode was POWER_SAVE, continue normal power save mode operation.

MLME-PWRMGMTRESTORE.confirm

This primitive confirms the change in power management mode to the SRMA.

The primitive parameters are as follows:

MLME-PWRMGMTRESTORE.confirm (
 ResultCode
)
)

Name	Type	Valid Range	Description
ResultCode	Enumeration	SUCCESS, INVALID_PARAMETERS, NOT_SUPPORTED	Indicates the result of the MLME.PWRMGMTRESTORE.request

This primitive is generated by the MLME to confirm that the SME has executed an **MLME-PWRMGMTRESTORE.request**. It is not generated until the change has been

indicated. Upon receipt of this primitive, the SRMA is notified of the change of power mode indicated.

Power Management Fib Continue

Once canvassing is complete, this mechanism informs the SRMA that it “has control” of the radio and communicates power save state (awake or doze).

MLME-PWRMGMTFIBCONTINUE.request

This primitive tells the MLME that it’s safe to enter the awake state and transmit frames if desired. The primitive parameters are as follows:

MLME-PWRMGMTFIBCONTINUE.request ()

Name	Type	Valid Range	Description
Null	N/A	N/A	No parameters

This primitive is generated when the SRMA is has completed canvassing. Upon receipt, the MLME enables transmission of user data frames, if necessary.

MLME-PWRMGMTFIBCONTINUE.confirm

This primitive confirms the change in allowed power management state. The primitive parameters are as follows:

This primitive is generated by the MLME when a channel becomes unavailable. Receipt of this primitive causes the ARMA to remove the channel from its channel map.

Channel In

This mechanism provides the ability to indicate to an ARMA that a channel has gone into service.

MLME-CHANNELIN.indication

This primitive reports to the ARMA that a channel that was previously unavailable has become available. The primitive parameters are as follows:

MLME-CHANNELIN.indication (
 Channel
)

Name	Type	Valid Range	Description
Channel	Integer	0 - 255	Channel identifier

This primitive is generated by the MLME when a channel becomes available. Receipt of this primitive causes the ARMA to add the channel to its channel map.

Beacon Notify

This mechanism supports the ability to detect any other APs using the same channel.

MLME-BEACONNOTIFY.request

This primitive requests the MLME to notify the ARMA whenever a beacon is received. There is one indication for each Beacon received. An indication is generated any time a Beacon is received on the current channel. The primitive parameters are as follows:

MLME-BEACONNOTIFY.request (
 Notify Enable
)

Name	Type	Valid Range	Description
Notify Enable	Boolean	True or False	When True, indicates that the PIOTE is to be notified of any Beacons received. When False, this mechanism is to be disabled.

This primitive is generated by an ARMA when it wants to be notified of any beacons received on its own channel. Receipt of this primitive by an MLME causes the MLME to enable a mode whereby the ARMA will be notified if any Beacon is received.

MLME-BEACONNOTIFY.confirm

This primitive confirms the change in the beacon notification mechanism. The primitive parameters are as follows:

MLME-BEACONNOTIFY.confirm (
 ResultCode
)

Name	Type	Valid Range	Description
ResultCode	Enumeration	SUCCESS, INVALID_PARAMETERS, NOT_SUPPORTED	Indicates the result of the MLME- BEACONNOTIFY.request

This primitive is generated by the MLME as a result of an **MLME-BEACONNOTIFY.request**. Receipt of this primitive by the ARMA serves as notification of the change of Beacon Notify as indicated.

MLME-BEACONNOTIFY.indication

This primitive reports to the ARMA that a Beacon was received on the data channel. The primitive parameters are as follows:

MLME-BEACONNOTIFY.indication (
 BSSDescription
)

Name	Type	Valid Range	Description
BSSDescription	BSSDescription	N/A	The BSS Description (including any additional Description Elements defined in 0) pertaining to an individual Beacon that was received.

This primitive is generated by the MLME if a beacon is received on the data channel. Note that a separate **MLME-BEACONNOTIFY.indication** is generated for each beacon received, so the primitive parameter will only ever contain a single

BSSDescription. Upon receipt of this primitive, The ARMA is notified of the Beacon and the signal strength at which it was received.

5.c DRCP Messages Preferred Implementation

The following describes the manner in which the above described primitives are used to implement DRCP messages in an 802.11 environment. Figure 40 shows a summary of the DRCP messages that are used to implement the previously described functionality. Figure 41 shows field definitions used in DRCP messages, as follows:

DRCP Preclaim

Fig. 42 shows the format of the DRCP Preclaim message. A DRCP Preclaim message is encoded in an 802.11 Management frame of type Beacon. The ARMA sends a DRCP Preclaim message using the MLME-SENDDRCP.request management primitive with the following parameters:

Destination Address -	DRCP All ARMAs Group MAC Address
Message Length -	12
DRCP Message -	Preclaim Message
Quiet Channel -	FALSE (0)
CTS Duration -	0

DRCP Claim

Fig. 43 shows the format of the DRCP Claim message. A DRCP Claim message is encoded in an 802.11 Management frame of type Beacon. The ARMA sends a DRCP

Claim message using the MLME-SENDDRCP.request management primitive with the following parameters:

- Destination Address - DRCP All ARMAs Group MAC Address
- Message Length - 16
- DRCP Message - Claim Message
- Quiet Channel - FALSE (0)
- CTS Duration - 0

DRCP Announce

Figure 44 shows the format of the DRCP Announce message. A DRCP Announce message is encoded in an 802.11 Management frame of type Beacon. The ARMA sends a DRCP Announce message using the MLME-SENDDRCP.request management primitive with the following parameters:

- Destination Address - DRCP All Agents Group MAC Address
- Message Length - 16
- DRCP Message - Announce Message
- Quiet Channel - FALSE (0)
- CTS Duration - 0

DRCP Bid

Figure 45 shows the format of the DRCP Bid message. A DRCP Bid message is encoded as an LLC 1 Unnumbered SNAP PDU in a data frame. The message is addressed to the Individual MAC Address of the AP in which the target ARMA is instantiated. The SRMA sends a DRCP Bid message over the standard MAC Service Interface.

DRCP Accept

Figure 46 shows the format of the DRCP Accept message. A DRCP Accept message is encoded as an LLC 1 Unnumbered SNAP PDU in a data frame. The message is addressed to the Individual MAC Address of the STA in which the target SRMA is instantiated. The ARMA sends a DRCP Accept message over the standard MAC Service Interface for relay to the DS.

DRCP Registration Request

Figure 47 shows the format of the DRCP Registration Request message. A DRCP Registration Request message is encoded as an LLC 1 Unnumbered SNAP PDU in a data frame. The message is addressed to the Individual MAC Address of the AP in which the target ARMA is instantiated. The SRMA sends a DRCP Registration Request message over the standard MAC Service Interface for relay to the DS.

DRCP Registration Acknowledge

Figure 48 shows the format of the DRCP Registration Acknowledge message. A DRCP Registration Acknowledge message is encoded as an LLC 1 Unnumbered SNAP PDU in a data frame. The message is addressed to the Individual MAC Address of the AP in which the target SRMA is instantiated. The ARMA sends a DRCP Registration Request message over the standard MAC Service Interface for relay to the DS.

6. Movement detection

As previously described, APs and STAs ascertain movement based upon evaluation of short and long term averages of parameters, along with expected error measurements. In accordance with an aspect of the invention, movement detection is achieved through application of a broader inventive concept that provides a way to ascertain the dynamic attributes of a system based upon short and long term averages of discrete data measurements. The principles of this invention apply to any system in which a discretely measured variable may change widely. For purposes of clarity, however, the invention is now described in terms of its particular application to wireless networks.

In a wireless network such as the one shown in Figure 1, a wireless networking user (heretofore also referred to as "STA") is associated with an access point (AP). The AP provides associated users with network connectivity via radio frequency (RF) signals. Various APs are used to provide seamless RF coverage, so that when the user moves away from one AP toward another AP, the user will associate with the closer AP (or the AP that is more lightly loaded) and seamless network functionality is thereby maintained. It is therefore important to be able to ascertain the location of a user relative to an AP so that a determination can be made as to whether the user is currently moving. This allows the system to assure that the user rapidly becomes associated with the closest AP so the overall system performance is maximized. As a user moves toward or away from an AP, the received power level (i.e. the power of the RF signal received by the user from the

AP) goes up or down respectively. Thus, one way to ascertain user movement is by monitoring received power levels.

However, received power levels can appear to vary greatly even when a user is not moving. For example, the opening or closing of a doorway can cause either a gain or attenuation in the user's received power level. A person waving their hand near the user's antenna can even cause a gain or attenuation in received power level.

Environmental interference can also cause changes in received power levels. These various changes in power level can cause a user to appear to be moving when in fact he or she is not. This can cause the user to roam needlessly between APs, particularly in environments where APs are close together and their transmit power levels are lower than maximum power. Alternatively, variations in signal power due to these effects can mask the fact that the user is indeed moving. In this case, the system could fail to detect the motion and fail to associate the user with the appropriate AP. Figure 49 shows an example graph of discrete measurements of received power vs. time for a user who is not moving. As can be seen, the inaccuracies in data sampling prevent any assumption of movement in one direction or the other.

As a more particular example, consider an 802.11a wireless network. APs in such a network provide a maximum bandwidth of 54Mbps. Bandwidth drops with distance from the AP. Assume that adjacent APs have their transmit power adjusted so that each provides a 54 Mbps cell on the order of about 10 feet in diameter. A walking user might be able to transition through such a cell in 2 seconds. On the other hand, a user sitting at his desk (near the center of the cell, right next to the AP) who gets up and leaves travels

only 5 ft, not 10 ft to the edge of the cell – so, it may take the user only just over a second to be in the aisle and out of the cell. These examples provide a motivation for why rapid power estimates based on discrete measurements must be made. Increasing sampling rates increases accuracy, but this also causes more overhead in terms of wireless channel bandwidth, interrupt activity and processing overhead on the user device. Some user devices could be simple appliances such as phones, digital assistants, etc. and have very limited processing power. So a trade-off must be made between sample rate and overhead.

According to one possible implementation, power levels are measured at intervals over a window of time and a roaming decision is made. In an 802.11a network, when a user is about 1 ft from an AP whose power is set so that it has a 54 Mbps cell which is about 10 ft in diameter, the user's true mean power level should be about -38dbm. Assume a 99% confidence interval around the true mean (i.e. the power level to be estimated) is desired. Yet, there is a variability to the measurements because of environmental effects (hand waving, etc.) as well as inherent inaccuracy in the implementation measurement itself. Assume these inaccuracies and statistical variability in the data result in distribution of the data with a standard deviation, $\sigma = 15$ dbm. Referring to Figure 50, if only 8 samples are taken in such a statistical distribution, then the 99% confidence interval around this (true) mean is -23.4 dbm to -52.6 dbm.

The 99% confidence interval has a range of $|52.6 - 23.4| = 29.2$ dbm, or about 30dbm. This is about ± 15 dbm. So, because of the variability in the signal, if only 8

samples are taken, all that can be known is that the “true power” lies somewhere between -23.4dbm and -52.6dbm and that such conclusion can be drawn with 99% assurance.

If less accuracy can be tolerated, for example 95% or even 90% confidence, the resultant range would be narrower. But, lower confidence intervals increase the likelihood of “false positives”. A false positive occurs when a user is ascertained to be moving when in fact he or she is not, causing the user to needlessly roam to another AP. It is desirable to minimize such false positives as they needlessly consume valuable bandwidth.

When a user doubles his or her distance from an AP, the user’s received power decreases by 6db. So, when a user moves from 1 foot away to 2 feet to 4 feet away from the AP (almost to the edge of the cell), the (true) average received power has decreased from -38dbm to -44dbm to -50dbm respectively. But, as seen in Figure 51, when trying to estimate the average received power from eight samples taken during this motion with a 99% confidence interval in the data, it cannot be ascertained that the user has moved. This is because the true mean is really unknown. All that is known is that it lies somewhere between -23.4dbm and -52.6dbm. So, when only these few samples are taken, it cannot be ascertained whether the user is moving away from the AP, getting closer to the AP, or not moving at all.

Of course increasing the number of samples taken decreases the range of error. If 20 power samples are taken, then the 99% confidence interval is -29.1dbm to -46.9dbm. But, taking lots and lots of samples will take too long unless channel overhead is increased.

Now consider taking n samples to produce an estimate, and then taking n more to produce a second estimate. The two estimates are then compared to see if a conclusion can be drawn as to whether the user is moving. If the confidence intervals around each estimator are large, e.g. 99%, then there exists a spectrum of outcomes and again it cannot be ascertained as to whether the user is moving toward or away from the AP, or not moving at all. In Figure 51, to tell that the user is moving away from the AP with 99% assurance, the upper edge of the right confidence interval must be positioned below the lower edge of the left confidence interval.

Consider two basic scenarios regarding motion in wireless networks:

- (1) The user stays in one place for a reasonable time and then moves to a new place. The user requires communication while moving, but, the user tends to move and then stop and stay somewhere for a while. Or similarly, the user may move very slowly within one confined area, and then move more rapidly to another area.
- (2) The user is constantly in motion.

In the instance of scenario #1, which describes the very large majority of user activity in wireless networks, the accuracy of the power estimate can be greatly improved. In accordance with the principles of the invention, two averages of the received signal strength are maintained as above. But, one is the most recent N_1 samples taken over a sliding window, and the other is a long term average, using N_2 samples. So both a long term average and a short term average are maintained. Referring to Figure 52, the confidence interval around the long term average is very small. The error in the

estimate is almost completely removed. Therefore, the potential uncertain outcomes in the decision are reduced.

In Figure 53, when the user is moving away from the AP, the upper edge of the right confidence interval will fall below the long term average (which has essentially a confidence interval of close to $\pm 0\text{db}$.)

For a given application, one needs to ascertain how many samples (N_2) must be taken such that the long term average estimate has essentially 0 error. Also, it is desirable to ascertain how few samples (N_1) are needed in the short term average to be able to make a decision with 99% accuracy.

Assume a user starts at a position 1 foot away from the AP and moves towards the edge of the 10 ft cell. The goal is to find out how few samples are required to ascertain that the user is moving with 99% accuracy, in order to produce the most robust implementation from an overall performance perspective. If it were possible to “perfectly” measure power, a -6 db drop would be observed each time the user doubles his distance from the AP. Referring to Figure 54, if the power level is -38 dbm when the user is at 1 foot, it is -44 dbm at 2 feet and -50 dbm at 4 feet which is almost at the edge of the cell. As can be seen in the Figure, when the short term average is -50 dbm and the upper edge of the 99% confidence interval is just below -38 dbm , then the confidence interval has a width of $\pm 12\text{db}$. To achieve such a confidence interval, 14 samples (N_1) are required in the short term, given the previously assumed standard deviation of the data, $\sigma = 15\text{db}$. With these 14 samples, the 99% confidence interval is $-60.7\text{dbm} < -50 < -39.2\text{dbm}$.

In this wireless network example, it has been assumed that a user can walk from the center of the cell to the edge of the cell in 1.5 seconds. So, samples need be taken every $1.5 \div 14 \approx 100$ milliseconds. As a further improvement, it would be desirable to use 16 samples so that division can be done by a processor via a shift operation. This increases computational efficiency on the user's machine. This increases the sample rate a negligible amount.

Regarding the long term average, it may be reasonable to tolerate a ± 1 db confidence interval around the long term estimate. The tighter this interval needs to be, the longer the user has to stay near the AP, or stay relatively stationary within a certain area, to cause the average to converge. It is desirable to calculate how little time the user needs to stay in place to achieve an accuracy of ± 1 db with 99% confidence. Assume, reasonably, that signal strength samples are taken based on messages received from the AP every 50 milliseconds. Referring to the table shown in Figure 54, it is seen that if the user stays near the AP (1 ft) for about 1.5 minutes, and samples occur every 50 milliseconds, the accuracy of the power estimate becomes less than ± 1 db.

The preferred implementation for the current wireless network example thus utilizes: (a) a short term average over $N_1 = 16$ samples, (b) a long term average over 2048 samples, and (c) " N_2 " which is the number of samples taken so far in computing the long term average. The process is as follows:

- (1) continually calculate the long term average. The long term average is not "stable" until at least 2000 samples have been taken. This takes 1.5 minutes at 50

milliseconds per sample. An implementation preferably accumulates 2048 samples to make the division a shift operation.

- (2) calculate a short term average with the most recent $N_1 = 16$ samples. (16 is used instead of 14 so that the division is accomplished via a shift.)
- (3) When the difference between the short term and long term averages is greater than 12db then it is known with 99% accuracy that the user is moving.
- (4) When the user roams to a new AP, the counter used to calculate the long term average samples is reset to 0. Then the long term average is not stable again for another 2048 samples.

In an environment where users tend to remain in a cell for less than 1 second, the long term estimate could be used based on fewer samples. However, this will result in an increased risk of false positives. Several alternatives can be considered to mitigate the occurrence of false positives:

- (1) if the user has just arrived in a new cell (i.e. $N_2 \leq 32$) then require at least 32 samples before allowing a power-based roaming decision. This puts some hysteresis into the system. There will be some false positives though. If the user roams to a new AP and then back to the old one, false positives may be occurring. It may then help to require that $N_2 \leq 64$ for example. This helps the confidence interval making it - 42.8dbm < -38 < -33.1dbm.

- (2) Take into account the signaling rate. For example, the long term average accumulates while the number of samples (N_2) grows. But, if the user's data rate has dropped, then the user has moved outside the 54 Mbps inner circle by definition. Roaming should be initiated at this point.
- (3) Once a user has roamed to a new cell, the user should become "sticky" and try to stay there until the user is near the edge of the cell. Here it may be useful to require that $N_2 \geq 128$, for example, plus see the data rate drop.

To generalize, in a system wherein particular dynamic attributes are to be ascertained (e.g. "is the wireless network user in motion"), short term and long term averages of a system variable (e.g. signal strength) are calculated. An acceptable difference between the short and long term averages is calculated which positively identifies the system characteristic (e.g. the user has moved.)

Referring to Figure 55, the steps are generally as follows:

1. Define a system dynamic attribute to be ascertained (step 600). For example, in the wireless network example, the dynamic attribute to be ascertained is whether a user is moving. In the network usage example, the dynamic attribute to be ascertained is whether bandwidth for a user should be increased.
2. Define a system variable to be monitored to ascertain the dynamic attribute (step 602). For example, in the wireless network example, the variable is received signal strength. In the network usage example, the variable could be number of packets injected onto the network by the user.

3. Ascertain the statistical characteristics of the system variable measurements (step 604). This will include specification and analysis of individual system and environmental factors that contribute to statistical variations in the system variable(s). In the wireless network example, the standard deviation of the signal strength measurement is affected by environmental noise, implementation imprecision, spatial events and motion. In the network usage example the standard deviation is affected by the degree of burstiness in the traffic generated by the user, the speed of the user's computer, contention and interleaving effects with other network traffic, and higher layer network protocol parameters.
4. Choose the range of the true mean for the system variable that would indicate that the dynamic system attribute has been identified (step 606). For example, in the wireless network example, when the true mean of the signal strength has changed by 12db, the system attribute– the user has moved – has been positively identified. In the network usage example, one may decide that when the true mean for number of packets injected into the network by a user has exceeded a threshold, the user's bandwidth should be increased.
5. Pick a confidence interval based on the accuracy of decisions to be made regarding the dynamic system attribute (step 608). The rate of "false positive" decisions and "false negative" decisions is controlled by how accurately the dynamic system attribute is estimated. Calculating that attribute with a higher confidence interval improves that accuracy. In the wireless network example, the confidence interval was 99%.

6. Calculate the number of samples of the variable that must be taken such that the confidence interval around a given metric (such as the average) results in a spread that is minimized to a pre-determined amount based on the decision accuracy desired (step 610). In the wireless network example, this was +/- 1db.
7. Set a long term average based on at least the number of samples obtained in step 6 (step 612). (This average is cumulative as opposed to a moving window.)
8. Given the range chosen in step 4, calculate the number of samples of the variable that must be taken such that the confidence interval around a given metric (such as the average) results in a spread that is less than the range (step 613). This calculation depends upon the standard deviation in a known manner. This calculation is well known in the field of statistics as "sample size estimation". Statistical studies which use a subset (N) of members of a population need to be designed so that inferences taken from the sample set are statistically significant and representative of the entire population. Specific knowledge, or implicit assumptions, regarding the statistical characteristics of the dynamic system variables obtained in Step 3 are used to compute the sample set size. For more information on known statistical methods for sample size computation, reference is made to "Statistical Analysis", Sam Kash Kachigan, Radius Press, NY 1986 (ISBN: 0-942154-99-1), and in particular to Section 8-11, pg 157, "Parameter Estimation, Sample Size Selection for Limiting Error", and Section 9-10, pg 189, "Sample Size Selection for Desired Power"

9. Set a short term average moving window based on the number of samples obtained in step 8 (step 614).
10. Calculate the absolute difference between the long term average and the short term average (step 516). If the difference is greater than the range chosen in step 4, then the dynamic system attribute has been positively identified (step 618). In the wireless network example, when the difference exceeded the range, it was known with 99% confidence that the user was moving or had moved. In the network usage example, if the difference between short term average packet count and long term average packet count exceeds the chosen range, this indicates that the user should be granted higher bandwidth. If the difference between the long term average and the short term average is greater than the range chosen in step 4, then the dynamic system attribute has not been positively identified (step 620), and N1 moving window samples continue to be collected.

In Figure 56 there is shown a block diagram showing a wireless networking system that implements the invention. A user (STA 16) communicates with an AP 12 over the wireless network. The user sends messages to the AP that indicate the received signal strength from the AP as perceived by the user. These messages are collected by the AP (640). A processor 642 in the AP uses the messages to compute the short and long term averages according to the process as described in Figure 55. When it is ascertained that the user has moved, an indication 644 is set.

In Figure 57 there is shown a block diagram of a preferred embodiment of a wireless networking system that implements the invention. A user device (STA 16)

communicates with an AP over the wireless network. The user message collection mechanism 646 receives messages from the AP and monitors the received signal strength of the messages. A processor or hardware state machine 648 in the user device uses the signal strength of the messages to compute the short and long term averages according to the process as described in Figure 55. When the user device ascertains that it is moving, the user sends an indication or message 650 to the AP requesting to roam.

In Figure 58 there is shown one mechanism that can be used by the processor in the implementations of either Figure 56 or Figure 57 to maintain the short and long term averages needed to perform the process of Figure 55 to ascertain movement. Two ring buffers 652 and 654 are maintained – one for the short term average and one for the long term average. Ring buffers are used so that power sample averaging can be accomplished over a sliding window in time. In a ring buffer, as a new sample is added to the buffer, the oldest sample is removed. In the wireless networking example previously described, the short term average ring buffer stores the most recent 16 samples, and the long term average ring buffer stores on the order of 1024 or 2048 samples. Of course these sample sizes will vary depending on the application. It may also be reasonable to use an accumulator-based average for the long term average, but such an approach could be subject to buffer overflow.

A short term average 656 and long term average 658 are calculated based on the contents of the respective ring buffers 652 and 654. A comparator 660 uses a stored allowed range 662 and the short term average 656 and long term average 658 to produce the movement indication 650 in accordance with the process of Figure 55.

In Figure 59 there is shown an alternate mechanism that can be used by the processor in either Figure 57 or Figure 56 to maintain the short and long term averages needed to perform the process of Figure 55 to ascertain movement. According to this mechanism, a ring buffer accumulates a small number of samples, for example 16, for computation of the short term average. Each short term average computation is saved (656a – 656n). After a certain number of short term averages have been computed and saved, the long term average is computed as the average of all the accumulated short term averages. This approach is known as “batched means”. This approach is advantageous for use in systems containing limited memory resources.

Though the above described aspects of the invention have been exemplified as they apply to wireless networks and, in some particularity, 802.11 networks, it will be clear to the skilled practitioner that the invention can be employed in any wireless communications environment, including wireless data networks, wireless phone networks, and wireless I/O channels. All aspects of the invention may be implemented in either hardware or software. The preferred embodiment has been described as a software architecture because of its advantageous ease of portability between various hardware platforms.

It will be understood that each block of the flowchart illustrations, and combinations of blocks in the flowchart illustrations, can be implemented by computer program instructions. These computer program instructions may be loaded onto a computer, embedded device microprocessor (such as that found in an AP or STA), or

other programmable data processing apparatus to produce a machine, such that the instructions which execute on the computer or other programmable data processing apparatus create means for implementing the functions specified in the flowchart block or blocks. These computer program instructions may also be stored in a computer-readable memory that can direct a computer or other programmable data processing apparatus to function in a particular manner, such that the instructions stored in the computer-readable memory produce an article of manufacture including instruction means which implement the function specified in the flowchart block or blocks. The computer program instructions may also be loaded onto a computer or other programmable data processing apparatus to cause a series of operational steps to be performed on the computer or other programmable apparatus to produce a computer implemented process such that the instructions which execute on the computer or other programmable apparatus provide steps for implementing the functions specified in the flowchart block or blocks.

Those skilled in the art should readily appreciate that programs defining the functions of the present invention can be delivered to a computer in many forms; including, but not limited to: (a) information permanently stored on non-writable storage media (e.g. read only memory devices within a computer such as ROM or CD-ROM disks readable by a computer I/O attachment); (b) information alterably stored on writable storage media (e.g. floppy disks and hard drives); or (c) information conveyed to a computer through communication media for example using baseband signaling or broadband signaling techniques, including carrier wave signaling techniques, such as over computer or telephone networks via a modem.

While the invention is described through the above exemplary embodiments, it will be understood by those of ordinary skill in the art that modification to and variation of the illustrated embodiments may be made without departing from the inventive concepts herein disclosed. Moreover, while the preferred embodiments are described in connection with various illustrative program command structures, one skilled in the art will recognize that the system may be embodied using a variety of specific command structures. Accordingly, the invention should not be viewed as limited except by the scope and spirit of the appended claims.

We claim:

1. A computer program product recorded on a computer-readable medium for a first access point capable of communicating in a wireless communications network via a radio frequency channel, comprising:

logic for detecting that a second access point is also using the radio frequency channel, the detecting logic including:

logic for receiving messages from the second access point; and

logic for maintaining indications of the transmit power levels of other access points including the second access point; and

logic, responsive to the indications of the transmit power levels of other access points maintained by the detecting logic, for adjusting transmit power to decrease interference with the second access point detected to be using the radio frequency channel;

wherein the detecting logic and the reducing transmit power logic are executed by the first access point.

ABSTRACT OF THE DISCLOSURE

The performance and ease of management of wireless communications environments is improved by a mechanism that enables access points (APs) to perform automatic channel selection. A wireless network can therefore include multiple APs, each of which will automatically choose a channel such that channel usage is optimized. Furthermore, APs can perform automatic power adjustment so that multiple APs can operate on the same channel while minimizing interference with each other. Wireless stations are load balanced across APs so that user bandwidth is optimized. A movement detection scheme provides seamless roaming of stations between APs.

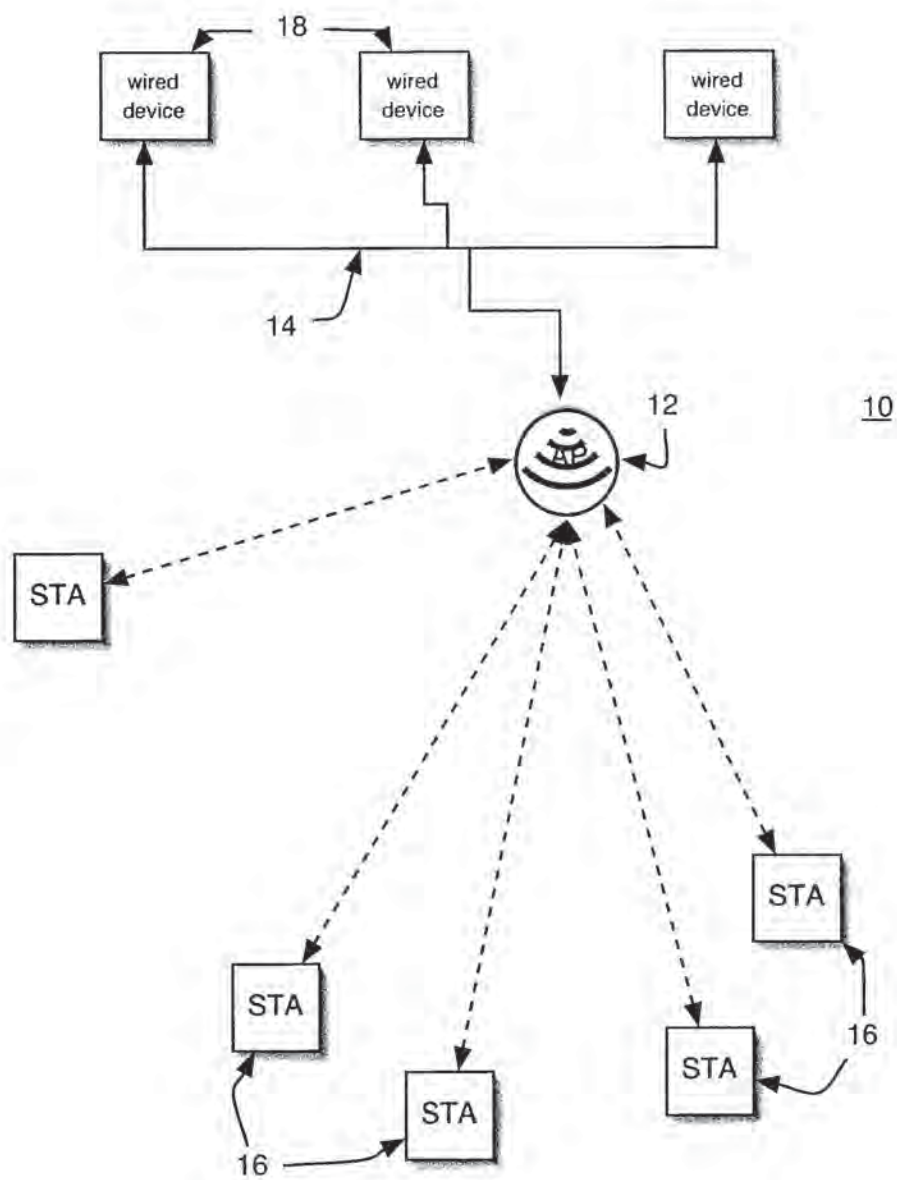


Fig. 1

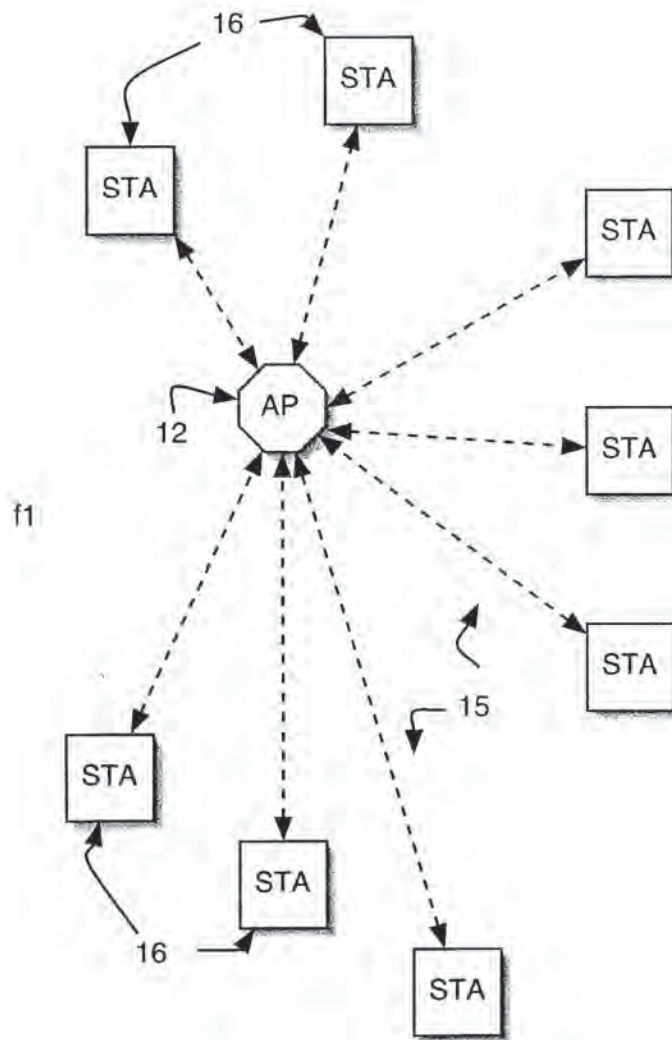


Fig. 2

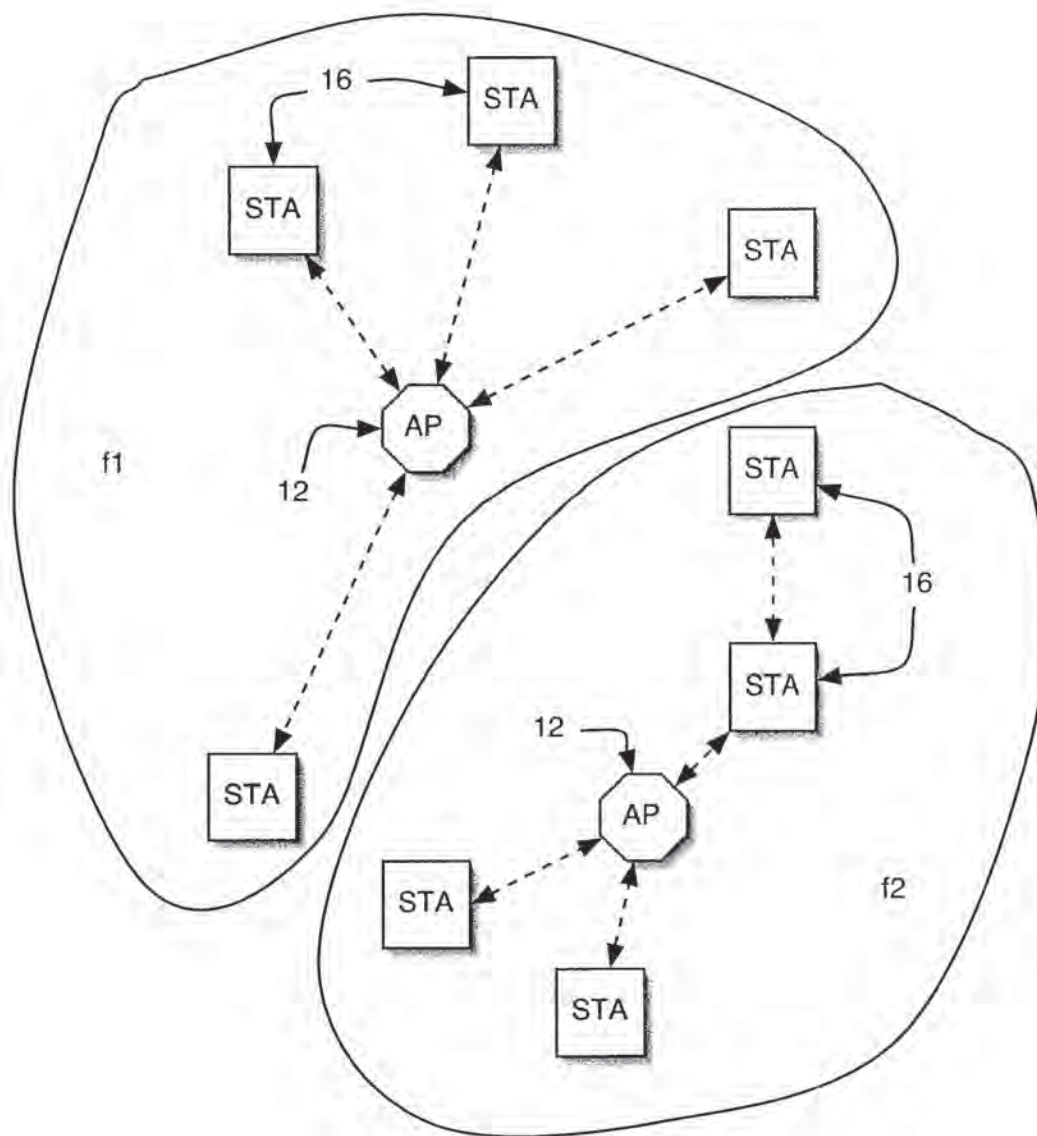


Fig. 3

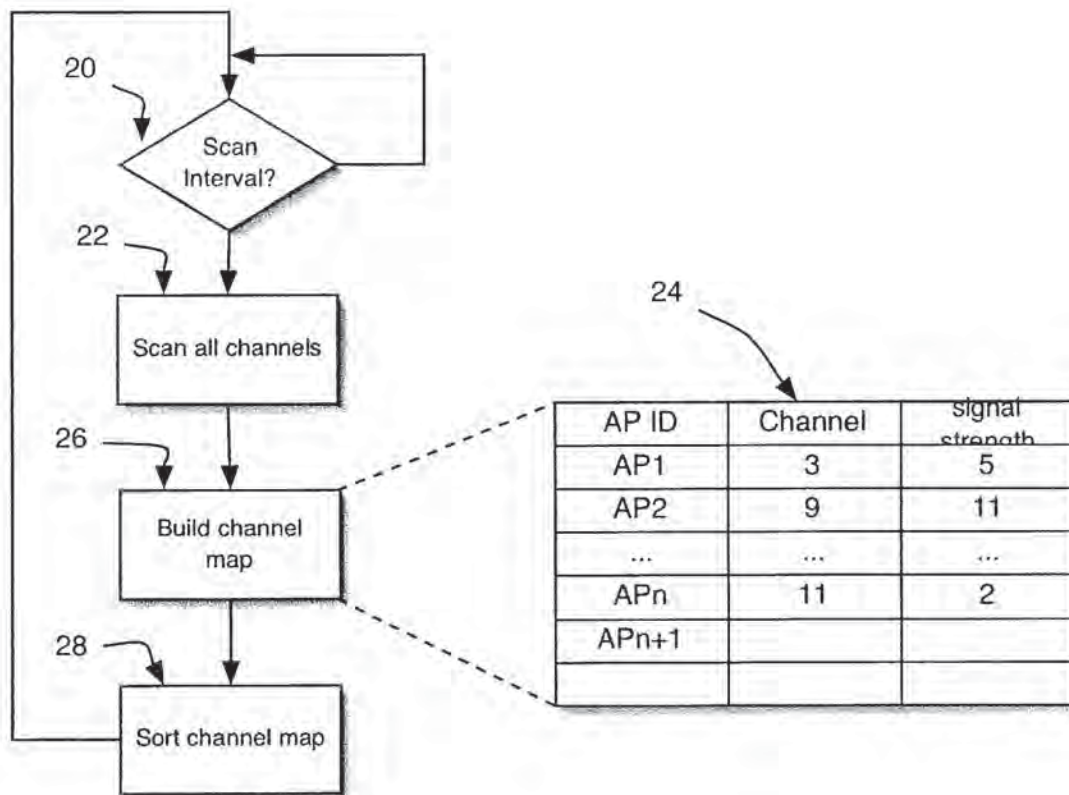


Fig. 4

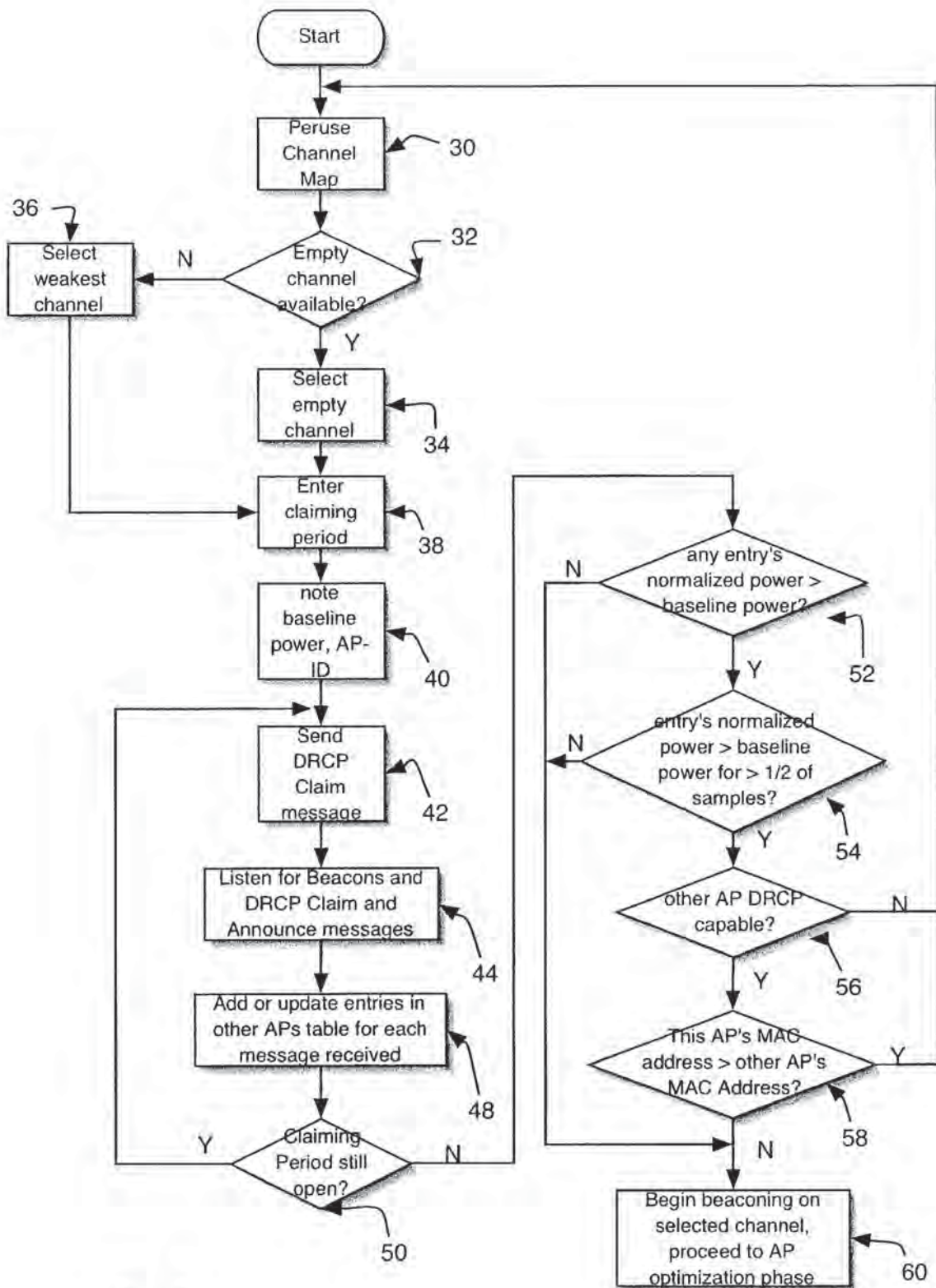


Fig. 5

46



AP_ID	received power	TP Backoff	DRCP	Normalized received power
AP[1]	<list>	<list>	1	
AP[2]	0	?	0	
...	...	...	...	...
AP[n]	<list>	<list>	1	

Other APs Table

Fig. 6

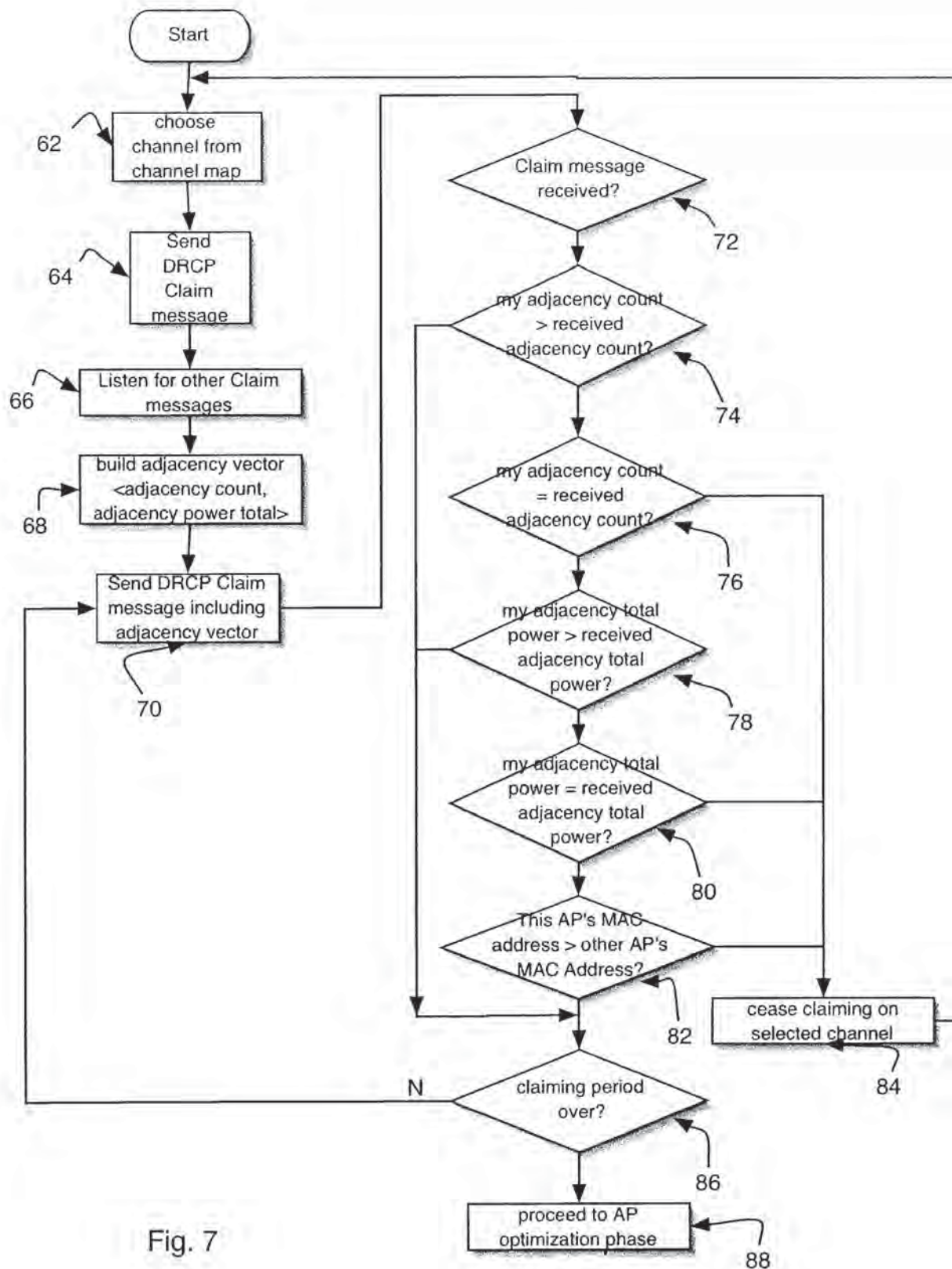


Fig. 7

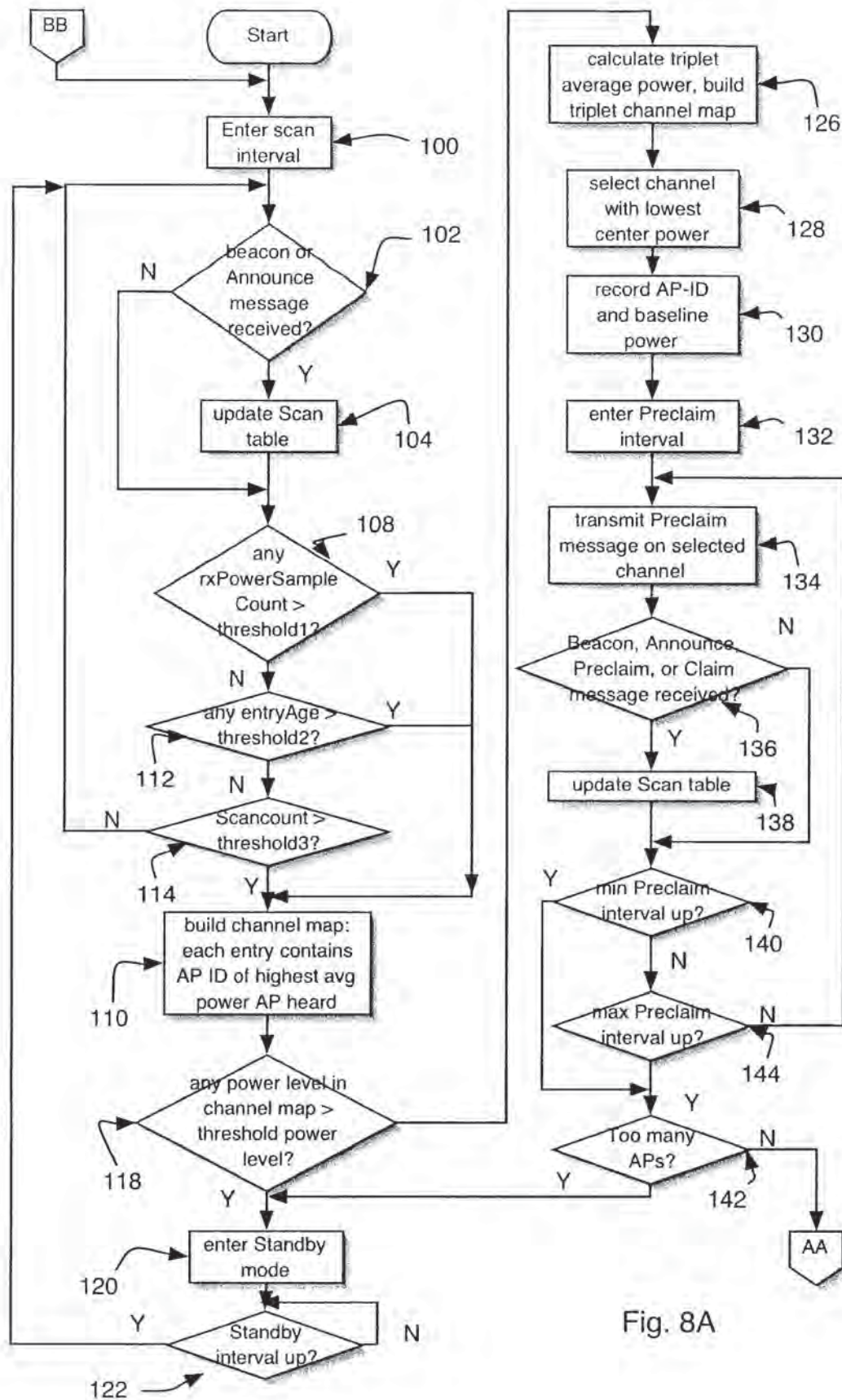


Fig. 8A

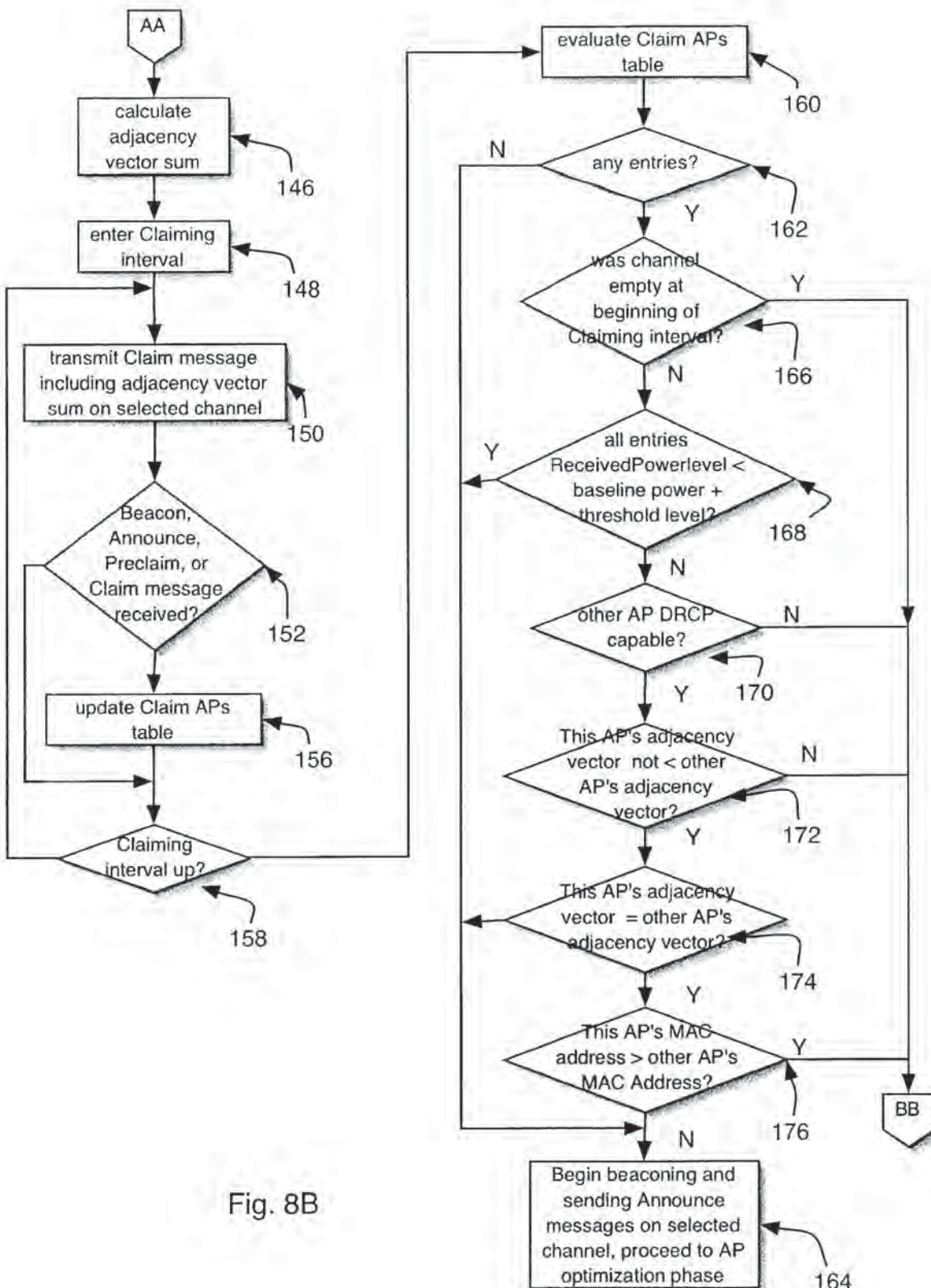


Fig. 8B

106



AP_ID	Channel_ID	rxPowerRunning Total	rxPowerSample Count	rxPowerAvg	DRCP	Age
AP[1]	3	dbm	3	dbm	1	3
AP[2]	3	dbm	5	dbm	0	7
...	...	dbm	...	...	...	...
AP[n]	5	dbm	8	dbm	1	4

Scan Table

Fig. 9

116



Channel_ ID	highestPwr AP_ID	highestPwrlevel
2	AP[1]	dbm
3	AP[2]	dbm
...	...	...
8	AP[n]	dbm

Channel Map

Fig. 10

124 →

Channel	signal strength	Triplet avg	AP ID
2	5	5	3
3	2	5	11
4	8	5	2
1	3	6	8
2	9	6	6
3	6	6	1

Triplet channel map

Fig. 11

154 →

AP-ID	ReceivedPowerlevel	DRCP
2	<list>	5
3	<list>	7
4	<list>	3
7	<list>	6
9	<list>	9
11	<list>	12

Claim APs table

Fig. 12

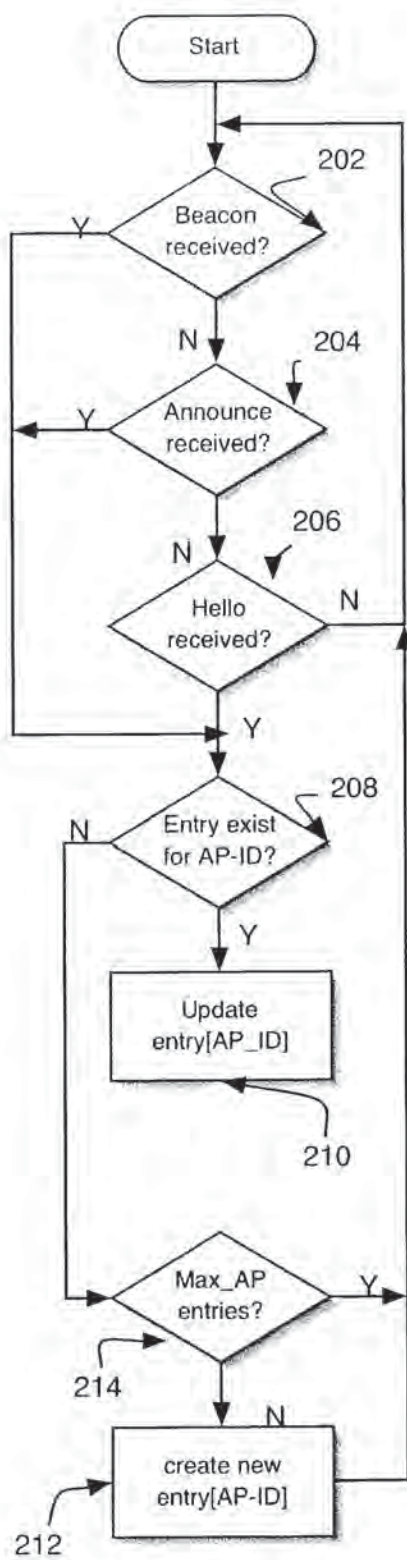


Fig. 13

200

AP_ID	TP_Backoff	Max Power	DRCP	Age	Normalized power	sample size	corrected power
AP[1]	<list>	<list>	1	2	dbm	3	dbm
AP[2]	0	max power	0	3	dbm	4	dbm
...	...	...	...	...	...	...	...
AP[MAX_AP]	<list>	<list>	1	1	dbm	1	dbm

AP Known APs Table

Fig. 14

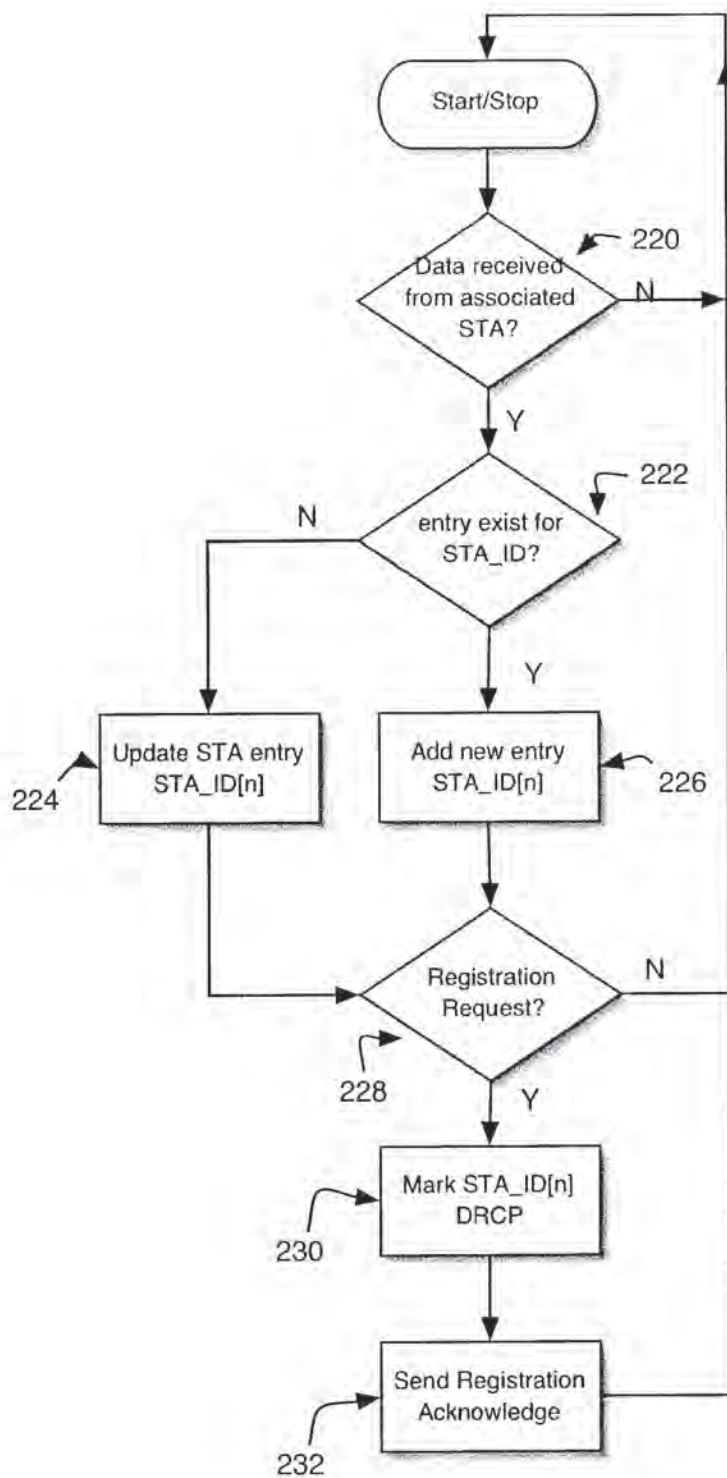


Fig. 15

240

STA_ID	Quiet-time	DRCP-Active	Distance	max power	sta_load_factor	power samples	normalized_power	corrected_power
STA[1]	4	1	1	1	2	1	1	1
STA[2]	0	0	0	0	3	0	0	0
...	...	...	...	...	...	...	...	...
STA[n]	6	1	3	1	1	1	1	1

AP Associated STA Table

Fig. 16

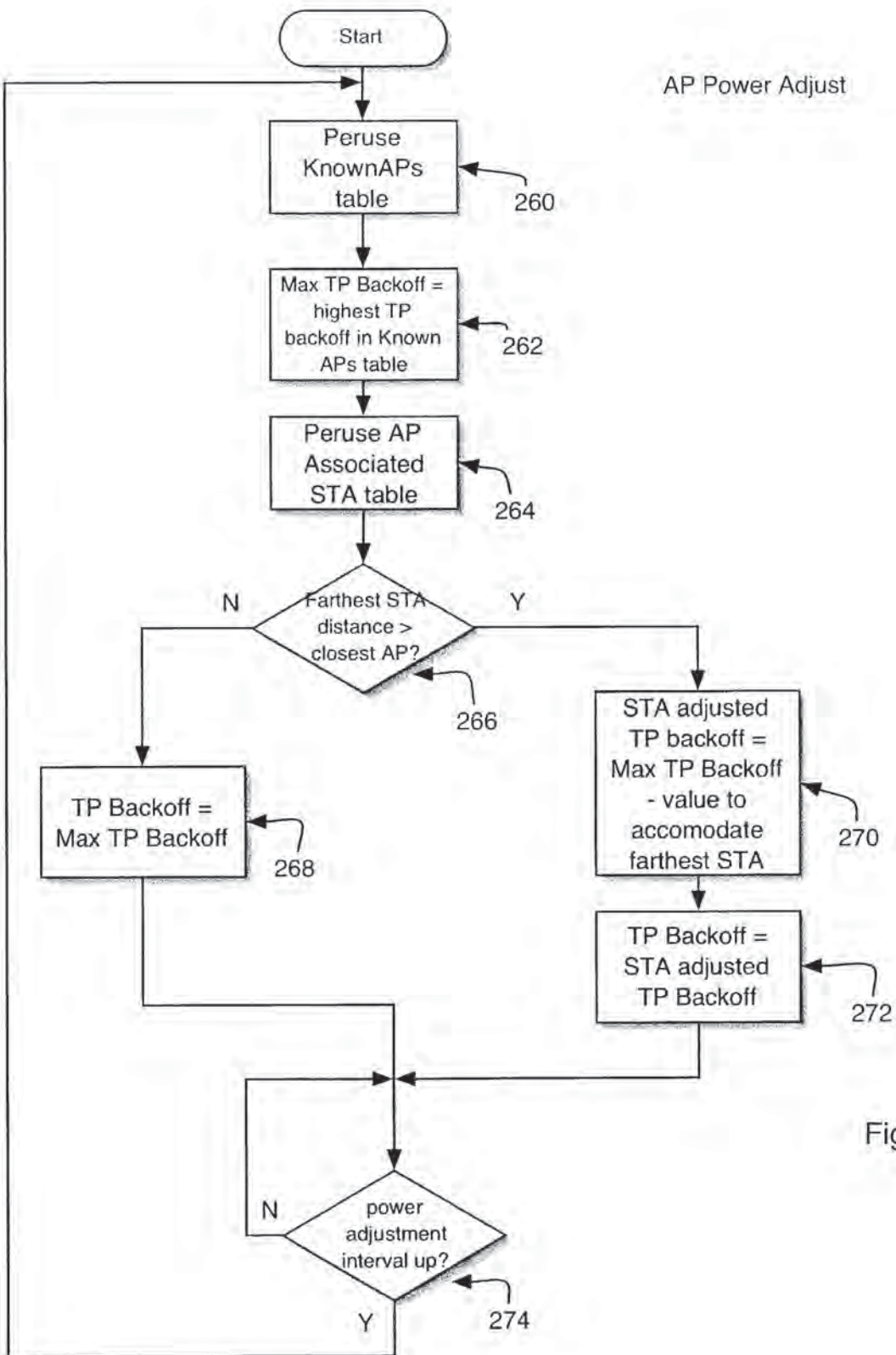


Fig. 17

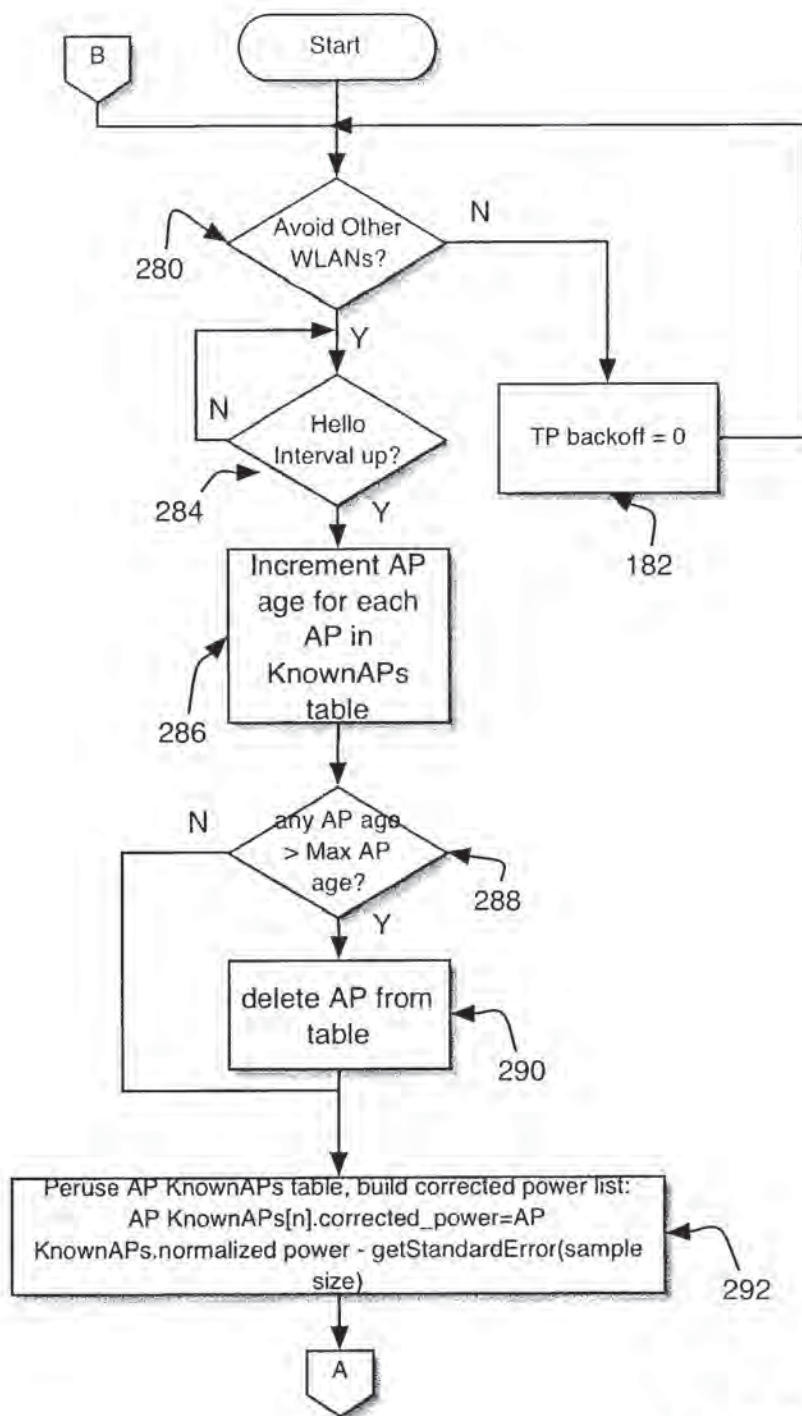


Fig. 18A

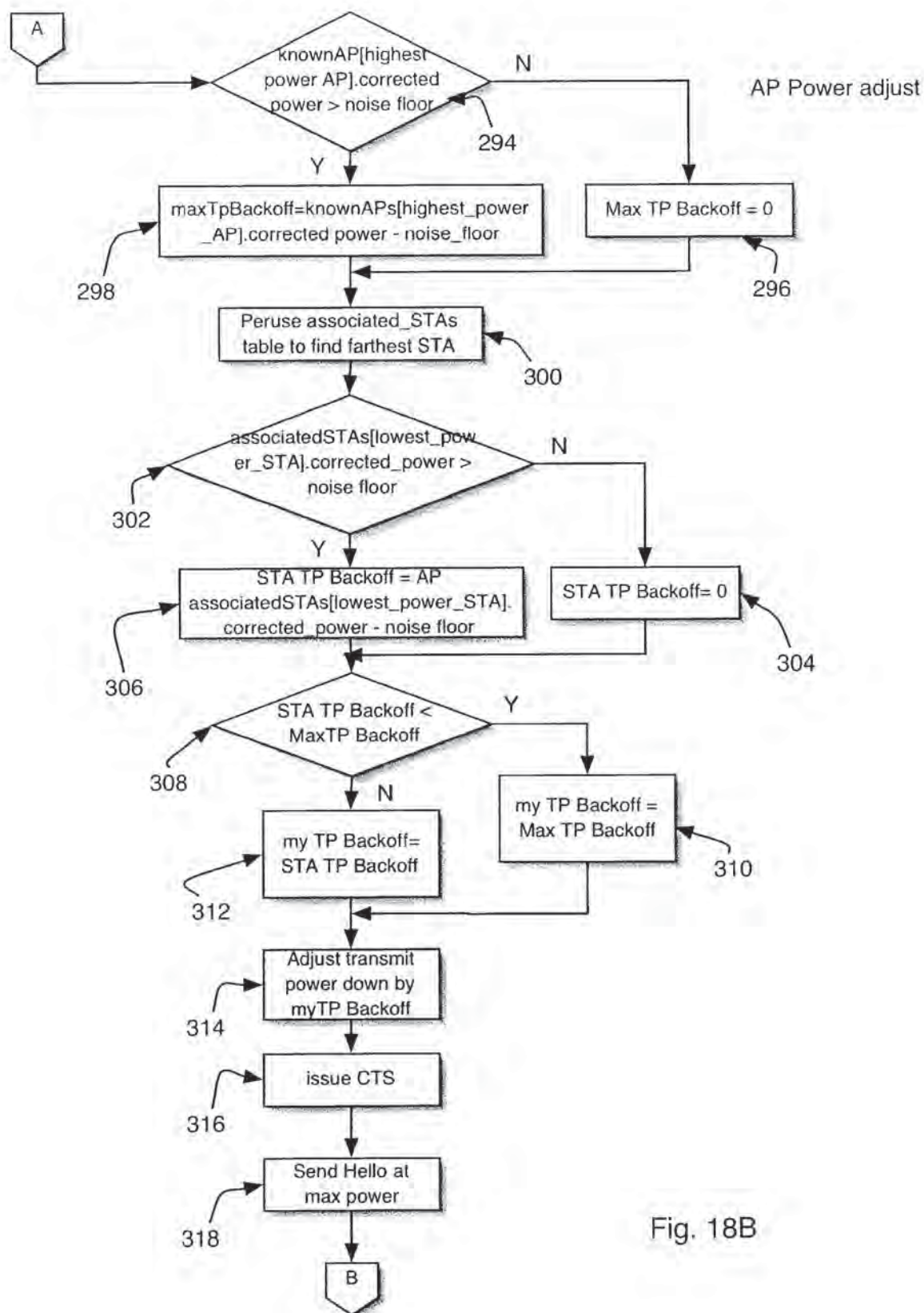


Fig. 18B

Number of Samples	Calculated Standard Error (+/- dB)	Rounded Standard Error (+/- dB)
2	38.6	39
4	22.3	22
8	14.6	15
16	9.94	10
32	6.9	7
64	4.9	5
128	3.4	3
256	2.3	2
512	1.7	2
1024	.8<dB<1.7	1
2000	.8	1
2048	0<dB<.8	1

Table I

Standard error for 99% confidence on received power values averaged over number of samples for standard deviation = 15 dB.

Fig. 19

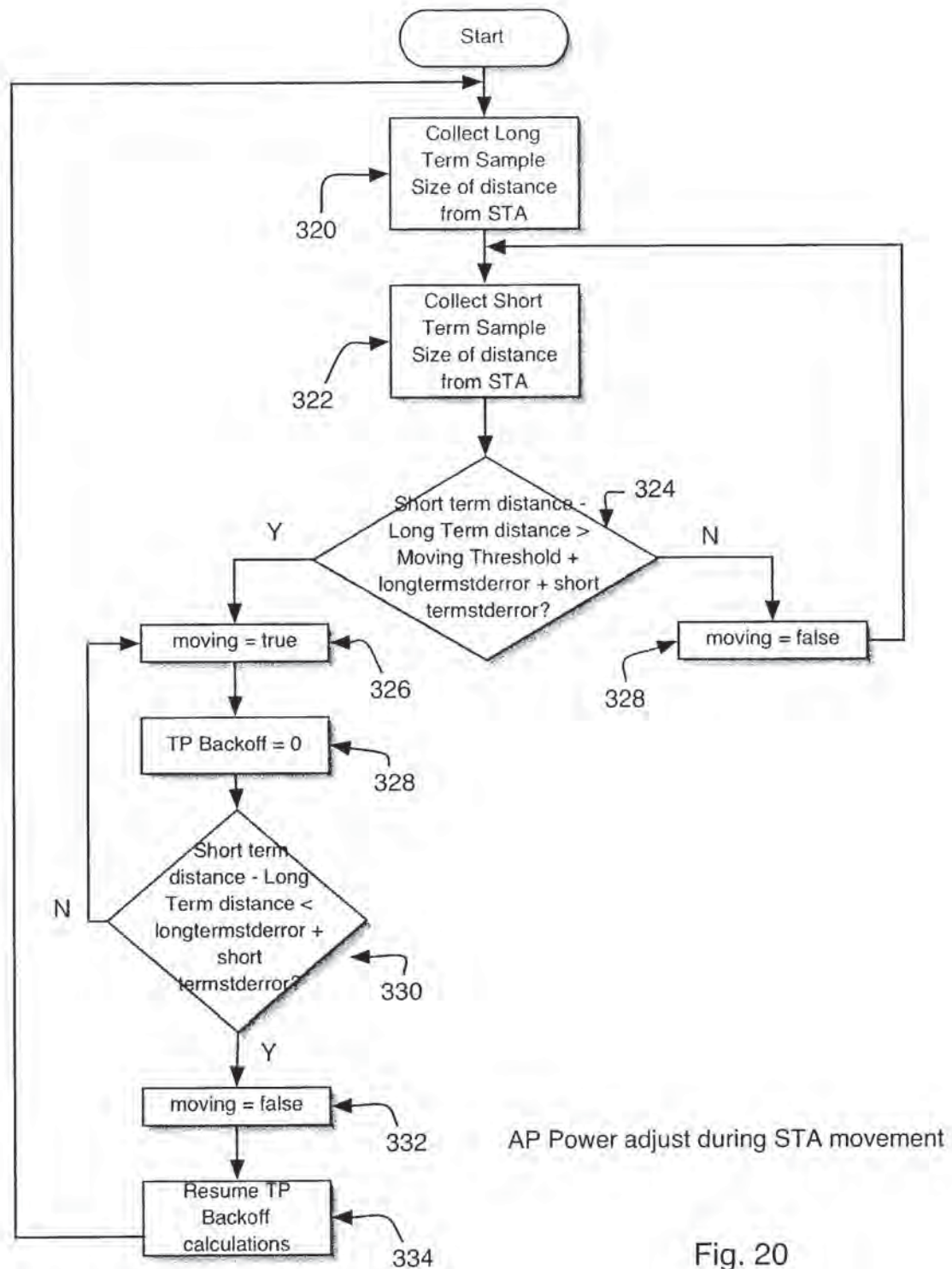


Fig. 20

AP Auction

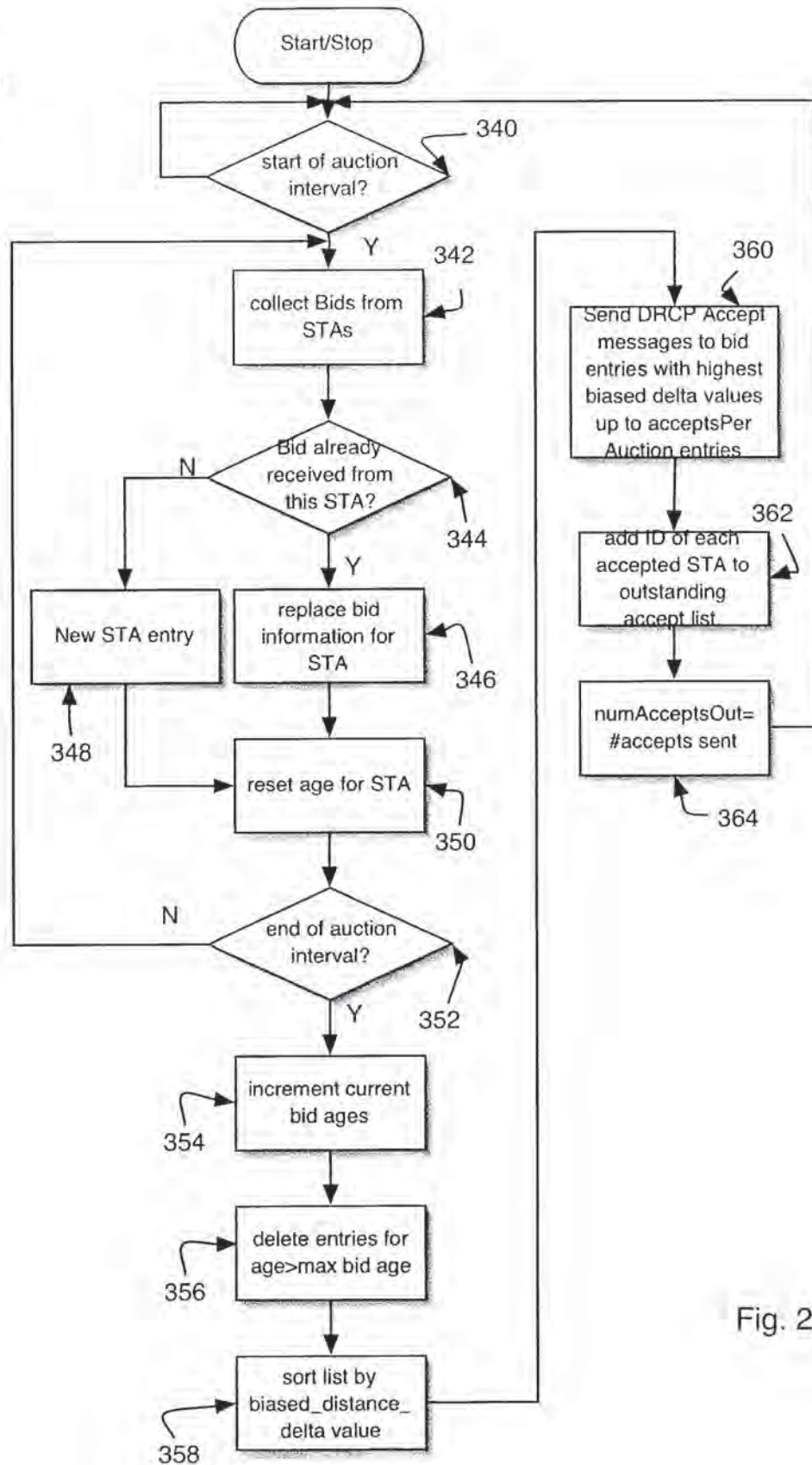


Fig. 21

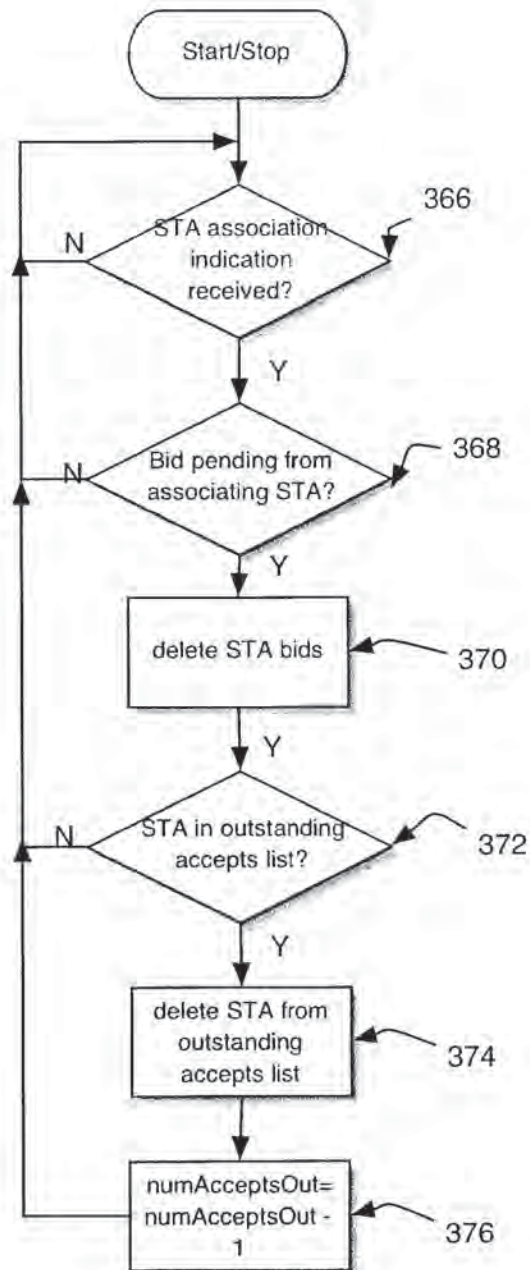


Fig. 22

STA Initialization

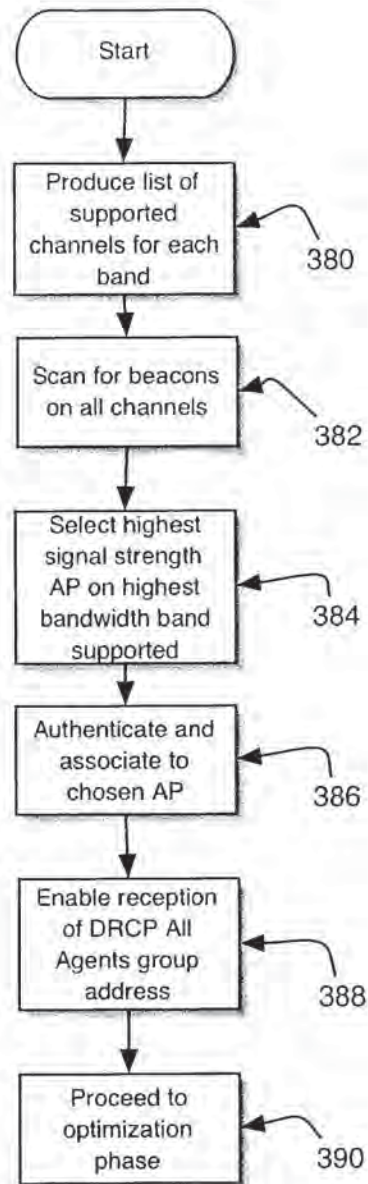


Fig. 23

STA Canvassing

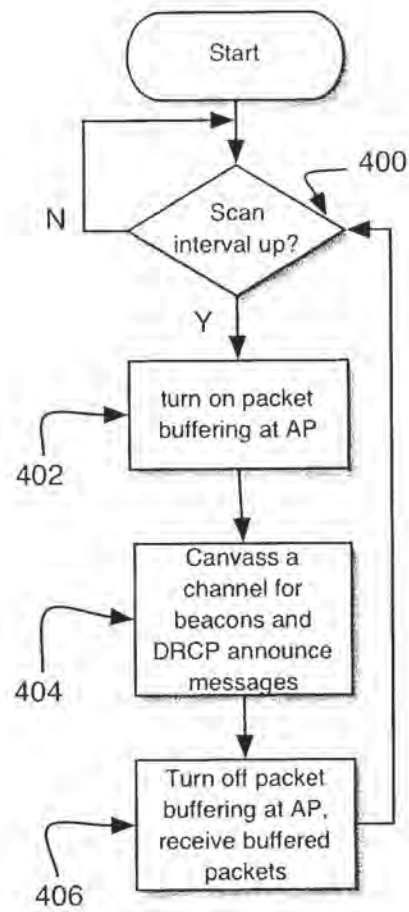


Fig. 24

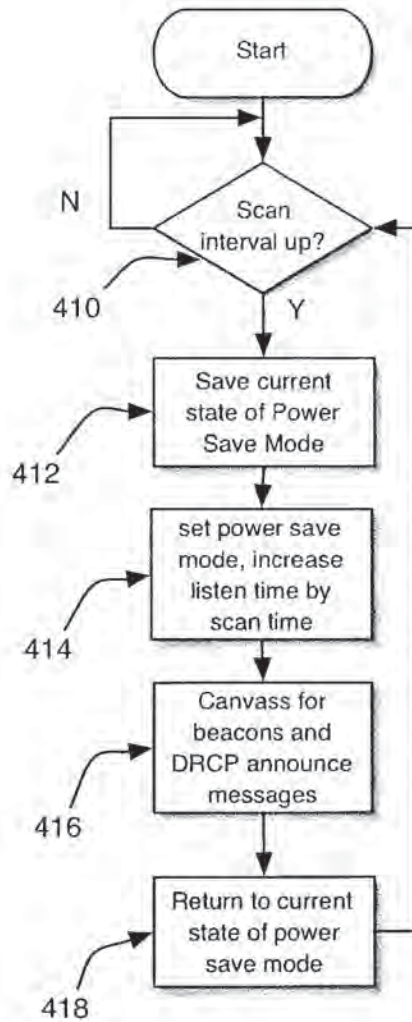


Fig. 25

430 →

AP_ID	Channel ID	age	Load Factor	TP Backoff	Max Power	distance_sample_s	distance	my_Load Factor	biased distance	corrected distance
AP[1]	3	2	2	<list>	<list>	10	avg	2	2	2
AP[2]	7	3	3	<list>	<list>	7		3	3	3
...	5	...	...	...	...	...	...	...	...	...
AP[MAX_AP]	2	1	1	<list>	<list>	13		1	1	1

STA Known APs Table

Fig. 26

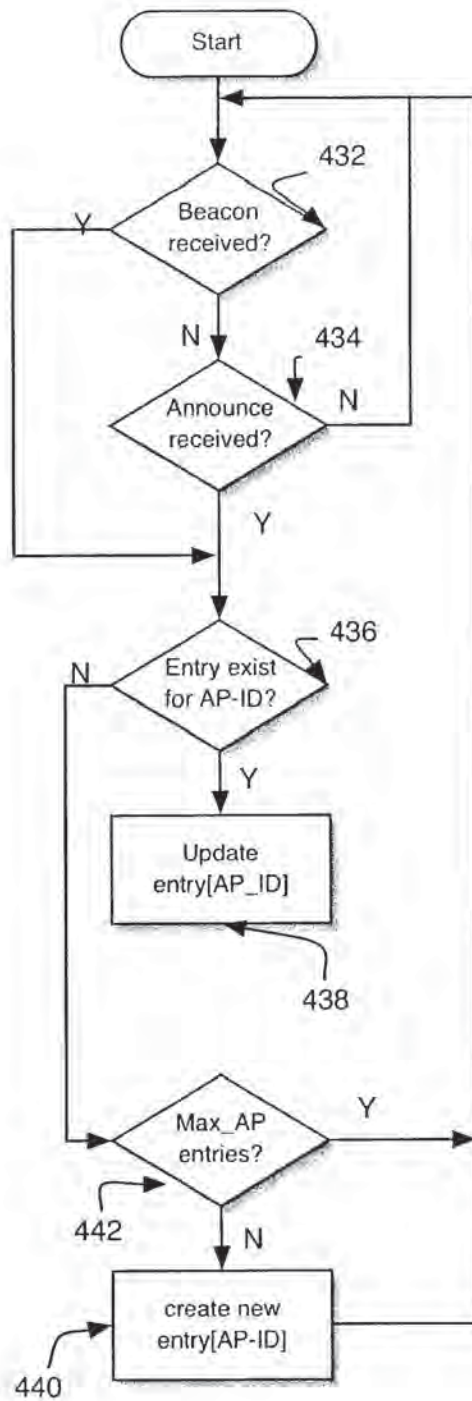


Fig. 27

STA Power Adjustment

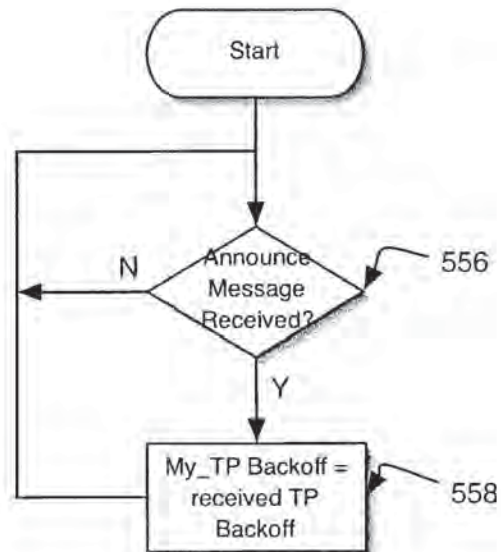


Fig. 28

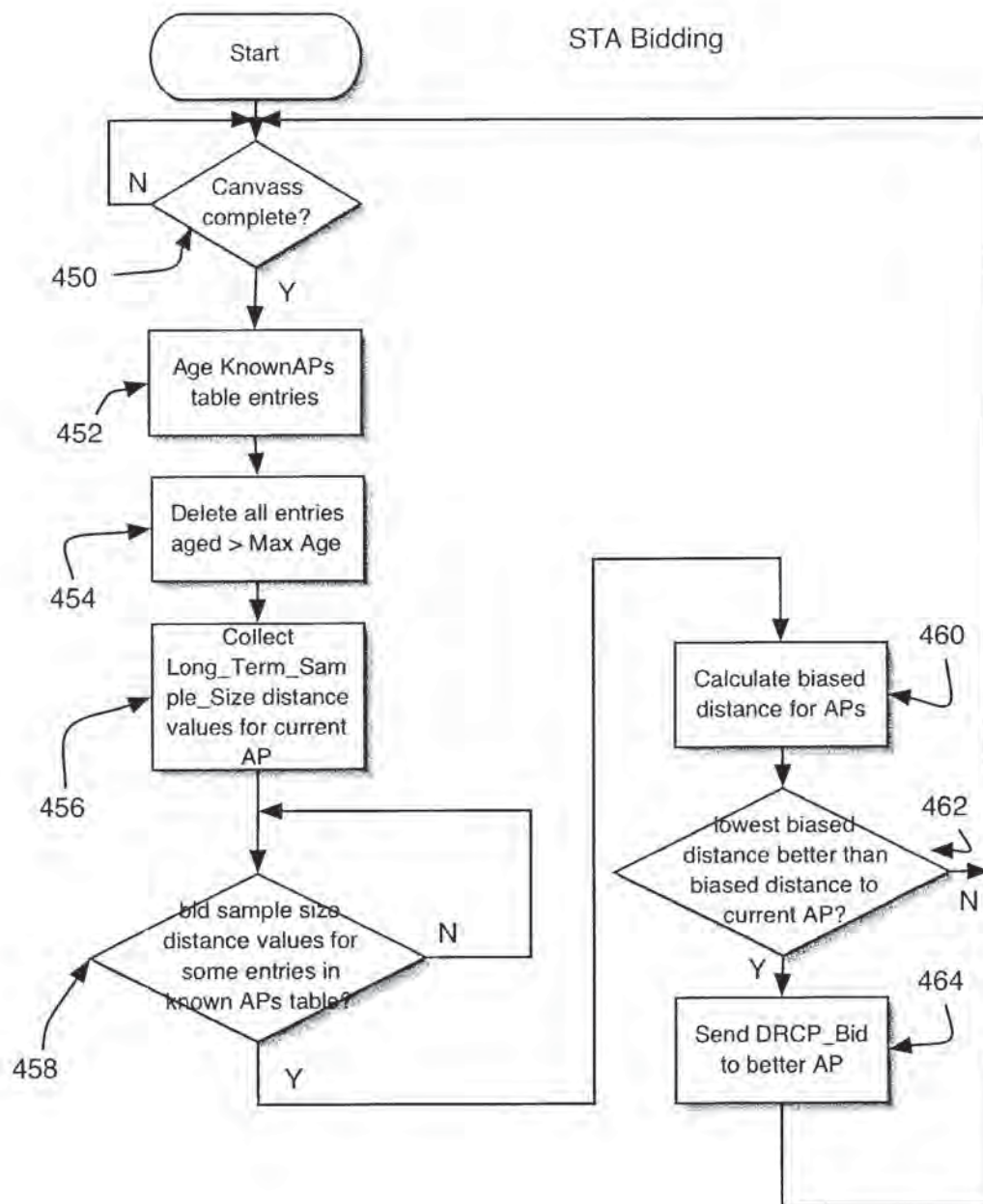


Fig. 29

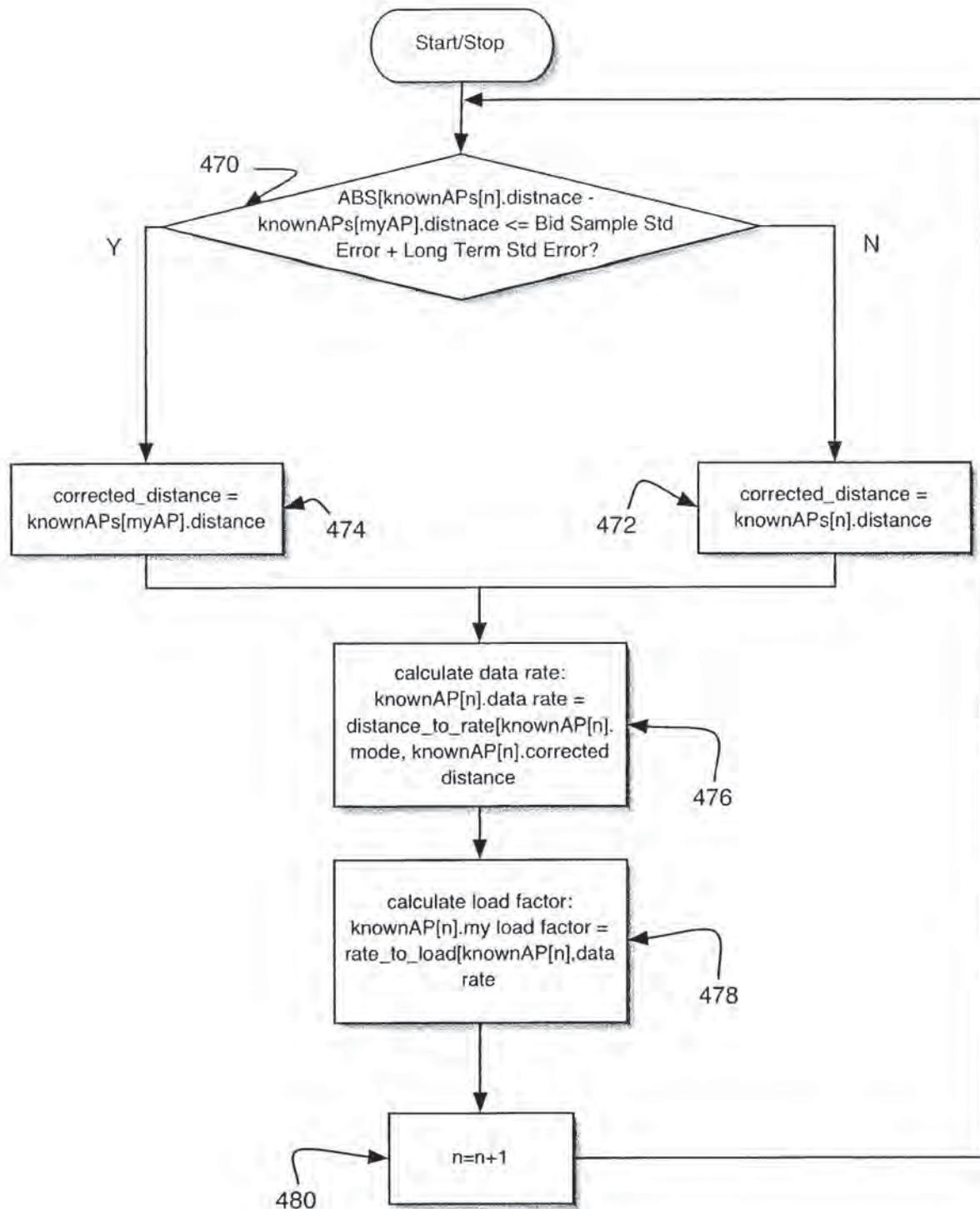


Fig. 30

Distance in Banzais	802.11a, g Mb/s	802.11b Mb/s
0-68	54	11
69-72	48	11
73-76	36	11
77-80	24	11
81-83	18	11
84-85	12	5.5
86	9	5.5
87	9	2
88	6	2
89	2	2
90-91	2	1
92-94	1	0
95-97	.5	0

Table II
Distance_to_Rate Table, 802.11

Fig. 31

Data Rate	Load Factor
108	4
72	6
54	8
48	9
36	12
24	18
18	24
11	39
9	48
6	72
5.5	79
2	216
1	432
.5	864
0	65,535

Table III

Rate_to_Load table for 802.11

Fig. 32

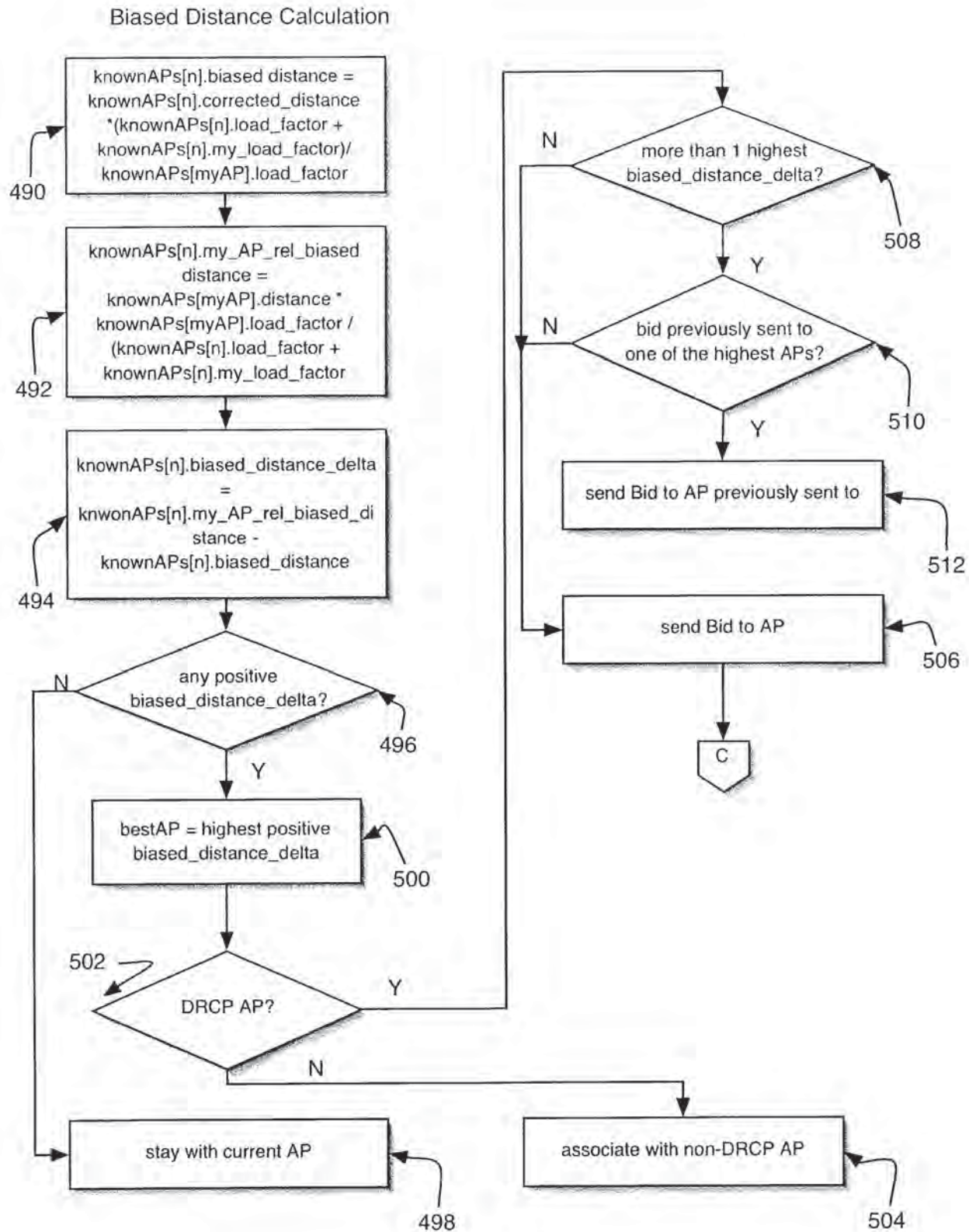


Fig. 33A

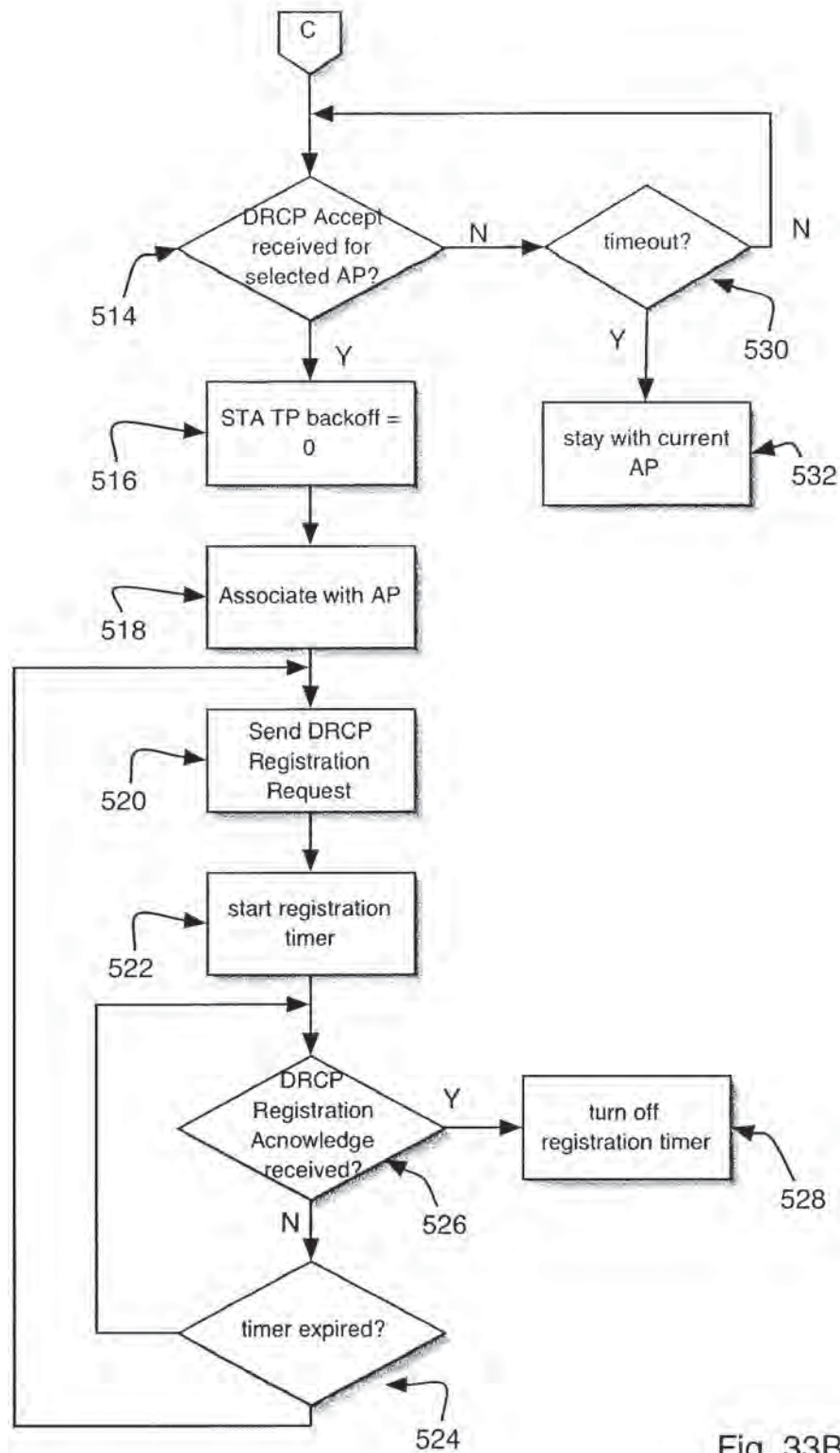


Fig. 33B

STA movement detection

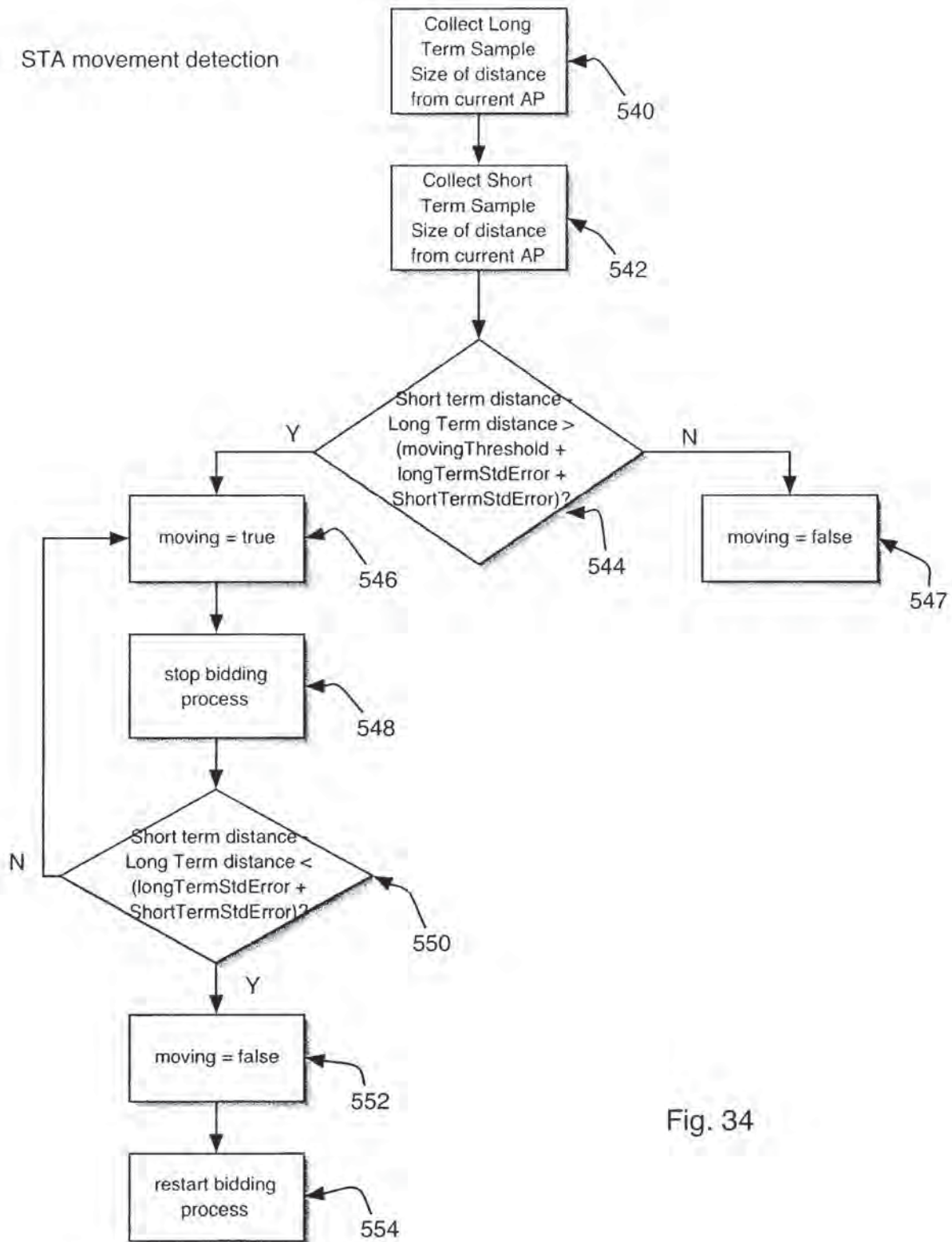


Fig. 34

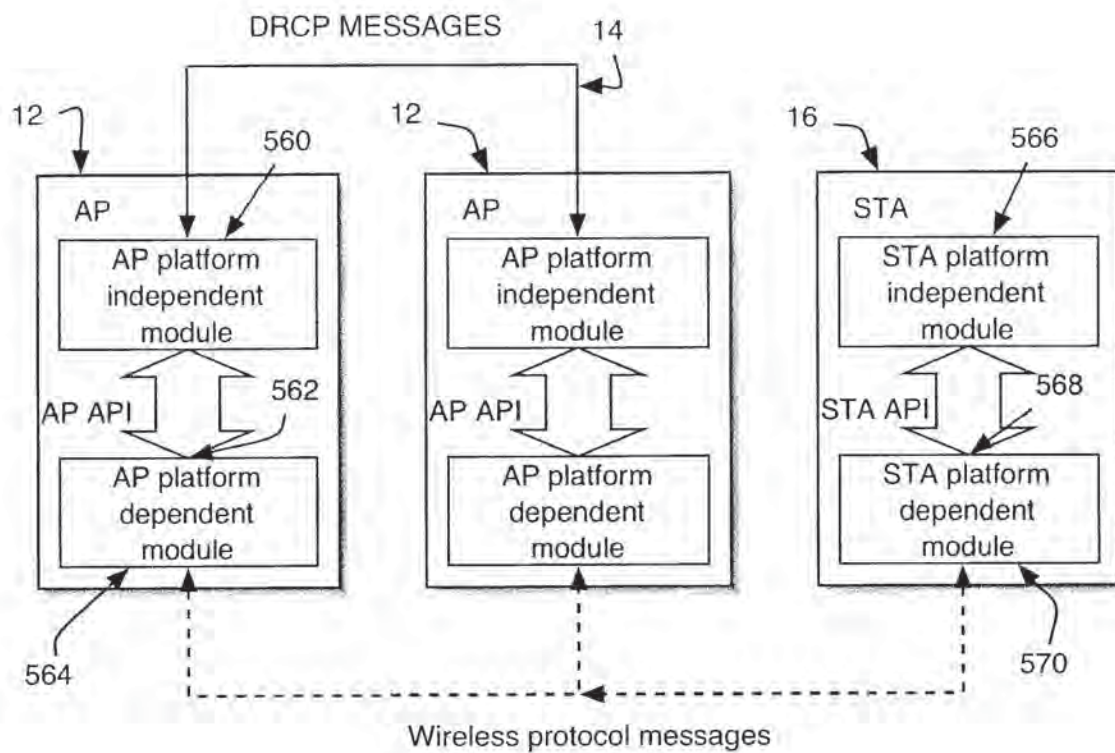


Fig. 35

802.11 AP DRCP Architecture

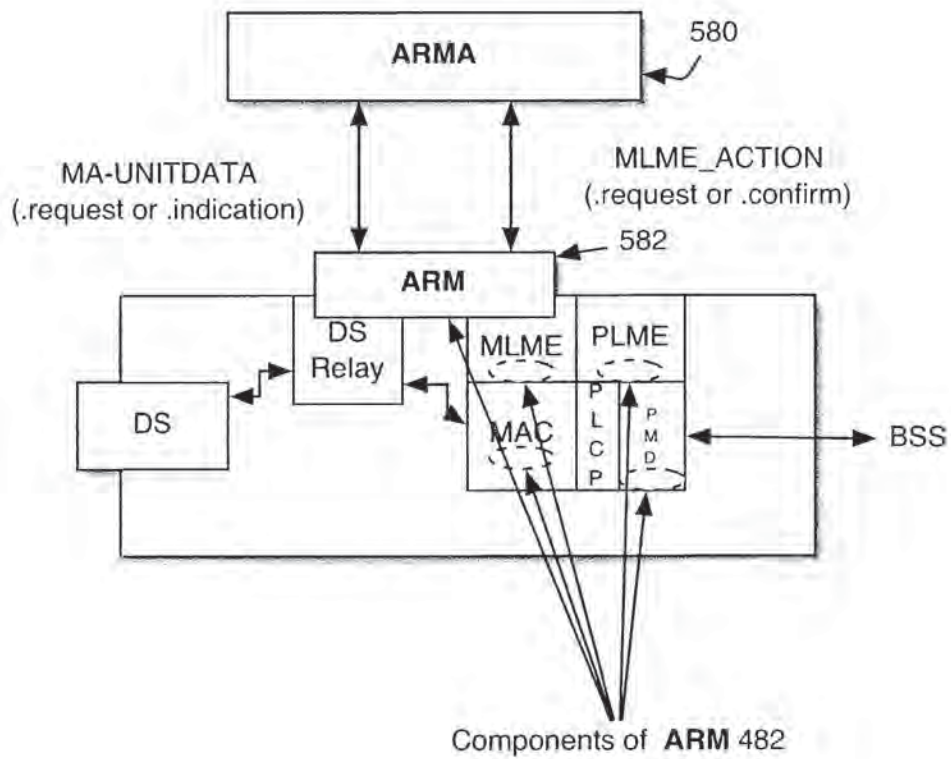


Fig. 36

802.11 STA DRCP Architecture

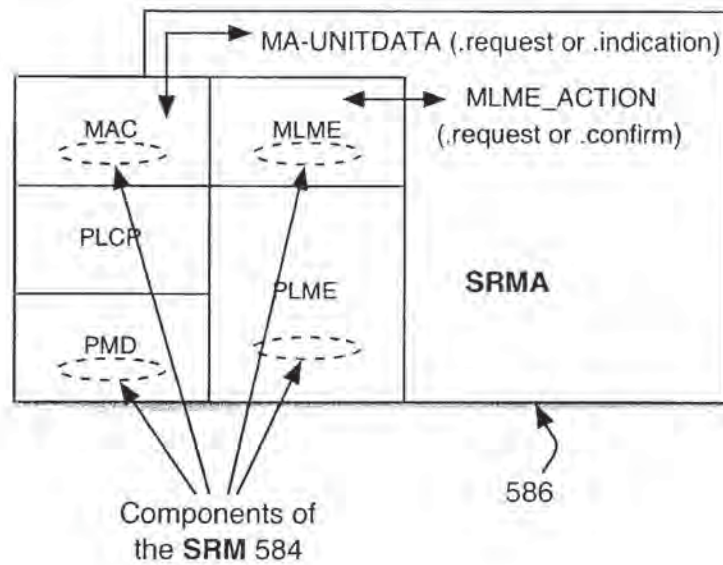


Fig. 37

Encoding of DRCP Message in an 802.11 Management Frame of Subtype Beacon

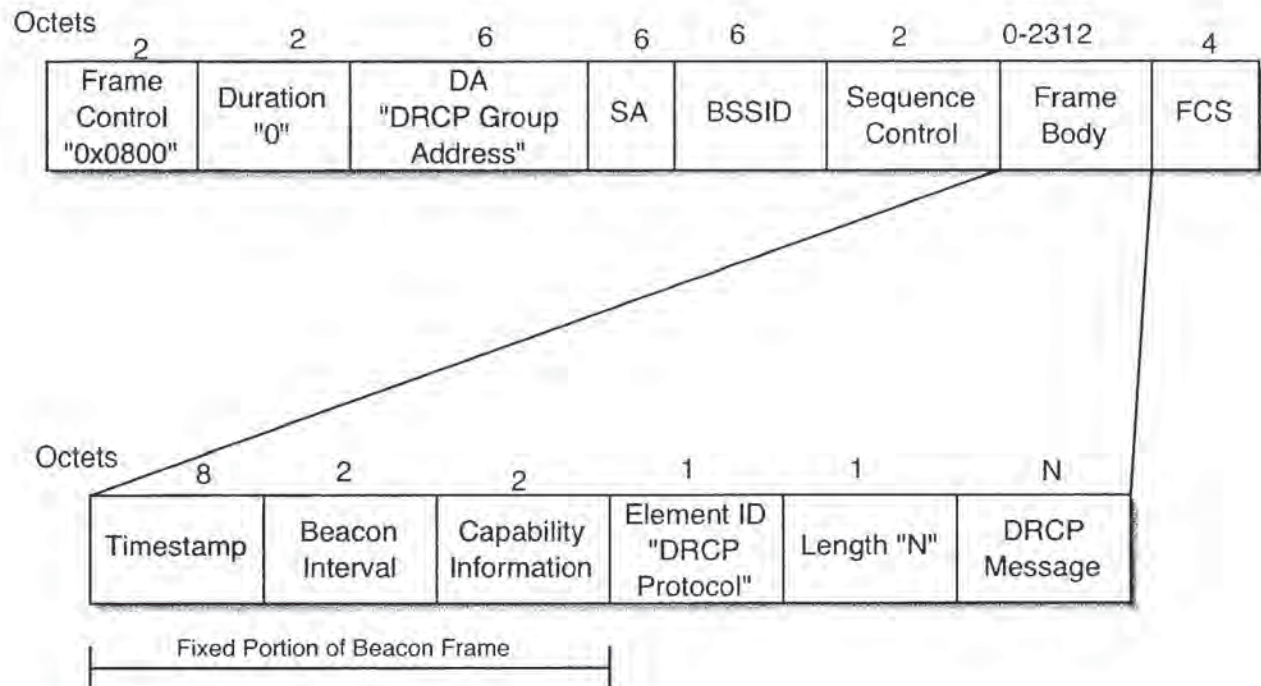


Fig. 38

Encoding of DRCP Message in an 802.11 Data Frame

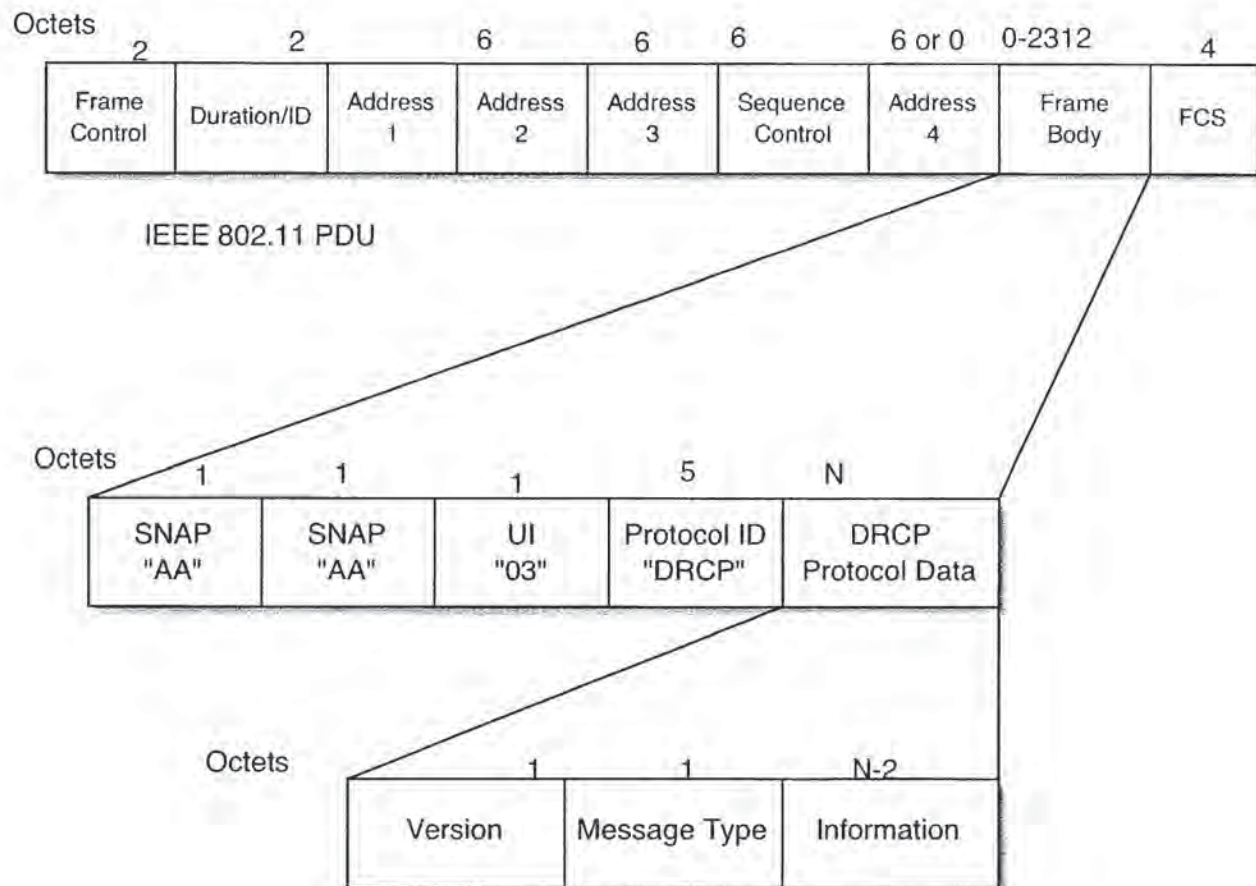


Fig. 39

Message Type	Usage	Data Rate	Max Power
DRCP Preclaim	Used by ARMAs in the channel selection process	Lowest Datarate	Max Power
DRCP Claim	Used by ARMAs in the channel selection process	Lowest Datarate	Max Power
DRCP Announce	Used by ARMAs to announce their presence to SRMAs and other ARMAs.	Lowest Datarate	Max Power
DRCP Bid	Used by SRMAs to bid for slots on ARMAs	STA Datarate	Max Power - TP Backoff
DRCP Accept	Used by ARMAs to signal to SRMAs permission to associate	STA Datarate	Max Power - TP Backoff
DRCP Registration Request	Used by STAs to tell ARMAs they will associate	STA Datarate	Max Power - TP Backoff
DRCP Registration Acknowledge	Used by ARMAs to tell STA it received registration request	STA Datarate	Max Power - TP Backoff

Fig. 40

Name	Size	Description
Type	1	Message type. Values: 1 = DRCP Claim 2 = DRCP Announce 3 = DRCP Preclaim 4 = DRCP Bid 5 = DRCP Accept 6 = DRCP Registration Request 7 = DRCP Registration Acknowledge
Channel ID	1	Indicates the channel of the originating station
AP-ID	6	The MAC Address of the AP in which the transmitting ARMA is instantiated
SSID	32	The Service Set ID (SSID) of the AP in which the transmitting ARMA is instantiated. This value is also referred to as the "Network Name".
Load Factor	2	The sum of the loads of the ATAs currently associated to the transmitting AP.
TP Backoff	2	Transmit power backoff value in use by the transmitting AP.
Max Power	2	Maximum pwer output, in dBm, of the transmitting AP's radio.
Biased Distance Delta	4	The difference between the biased distance from the transmitting STA to its current AP and the destination AP.
STA ID	6	The MAC address of the STA in which the transmitting SRMA is instantiated.
STA Assoc AP ID	6	The MAC address of the AP to which the transmitting STA is currently associated.
Bid AP ID	6	The MAC address of the AP to which the transmitting STA is bidding.
Accepted STA ID	6	The MAC address of the STA that the sending AP is accepting.
STA Reported AP ID	6	The MAC address of the AP that was identified in the last Bid message as the accepted STA's associated AP.
Max TP Backoff	2	Max dB's backoff capable of an AP
Adjacency Vector Sum	2	Sum of received power levels from all APs heard during scanning and preclaiming.

Fig. 41

Byte Address

0	Version	Type	Flags	Channel ID
4	AP ID (MSBs)			
8	AP ID (LSBs)		Max Backoff Max power	

DRCP Preclaim Message

Fig. 42

Byte Address

0	Version	Type	Flags	Channel ID
4	AP ID (MSBs)			
8	AP ID (LSBs)		Max Backoff Max Power	
12	Adjacency Vector Sum		Reserved	

DRCP Claim Message

Fig. 43

Byte Address

0	Version	Type	Flags	Channel ID
4	AP ID (MSBs)			
8	AP ID (LSBs)		Max Backoff Max Power	
12	TP Backoff Reserved		Load Factor	

DRCP Announce Message

Fig. 44

Byte Address

0	Version	Type	Flags	Channel ID
4	Biased Distance Delta			
8	STA ID (MSBs)			
12	STA ID (LSBs)		STA Assoc AP ID (MSBs)	
16	STA Assoc AP ID (LSBs)			
20	Bid AP ID (MSBs)			
24	Bid AP (LSBs)		Reserved	

DRCP Bid Message

Fig. 45

Byte Address

0	Version	Type	Flags	Channel ID
4	AP ID (MSBs)			
8	AP ID (LSBs)		Accepted STA ID (MSBs)	
12	Accepted STA ID (LSBs)			
16	STA Reported AP ID (MSBs)			
20	STA Reported AP ID (LSBs)		Reserved	

DRCP Accept Message

Fig. 46

Byte Address

0	Version	Type	Flags	Channel ID
4	AP ID (MSBs)			
8	AP ID (LSBs)		Accepted STA ID (MSBs)	
12	Accepted STA ID (LSBs)			

DRCP Registration Request Message

Fig. 47

Byte Address

0	Version	Type	Flags	Channel ID
4	AP ID (MSBs)			
8	AP ID (LSBs)		Accepted STA ID (MSBs)	
12	Accepted STA ID (LSBs)			

DRCP Registration Acknowledge Message

Fig. 48

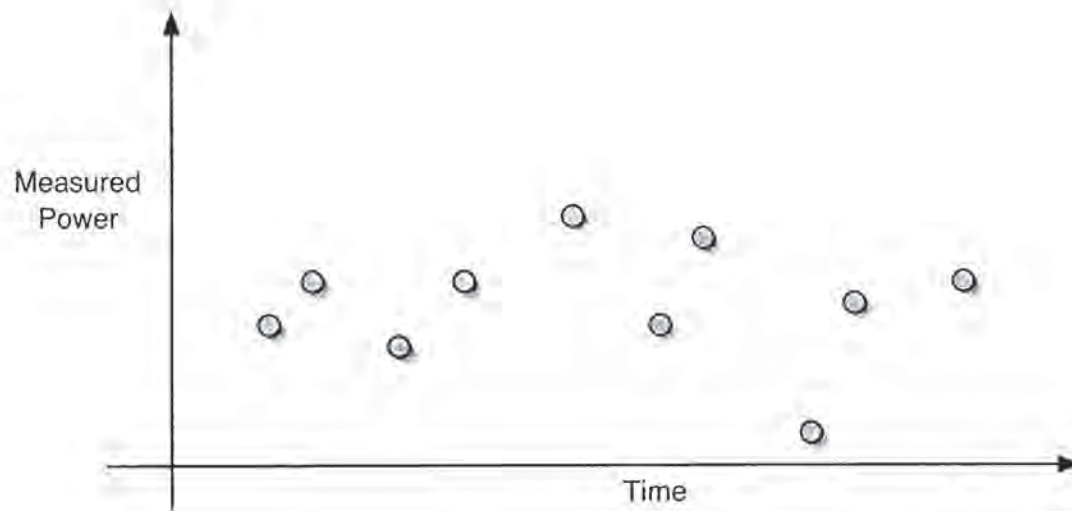


Fig. 49

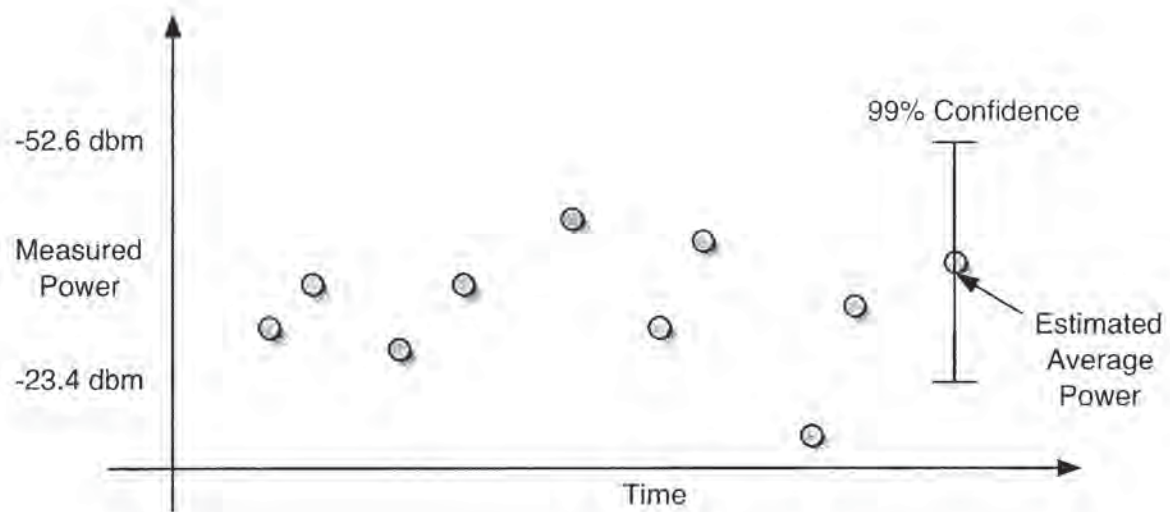


Fig. 50

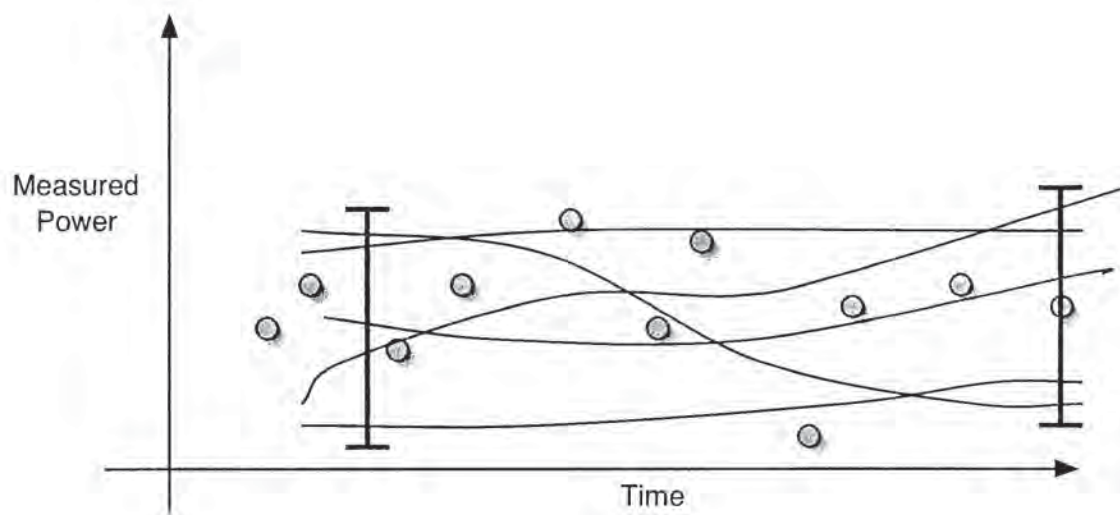


Fig. 51

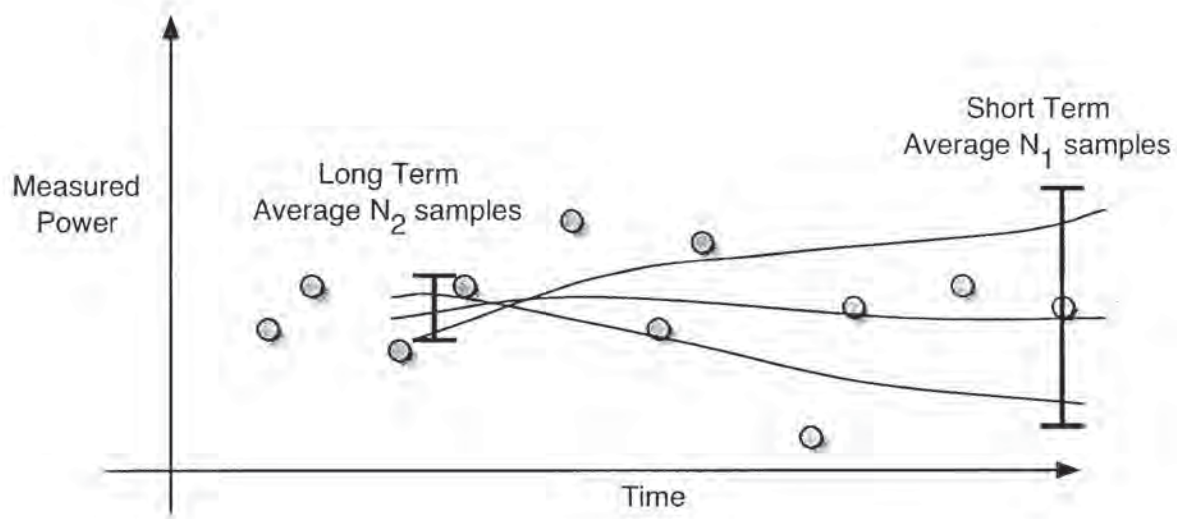


Fig. 52

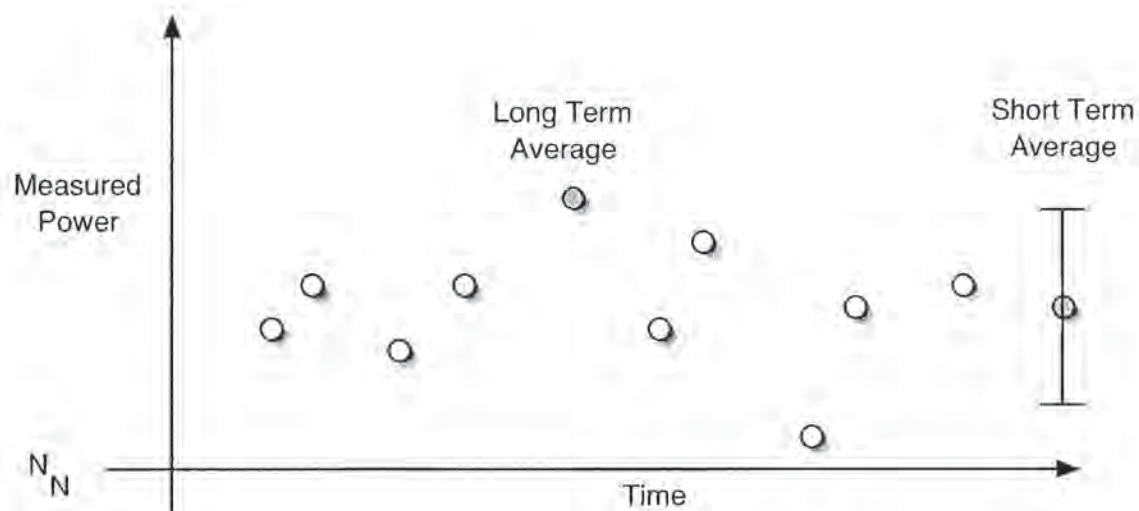


Fig. 53

Sample Time Duration	# Power Samples (N2)	Upper 99% Confidence Interval	Lower 99% Confidence Interval
1 sec	20	-29.1 dbm	-46.9 dbm
10 sec	200	-35.3 dbm	-40.7 dbm
100 sec	2000	-37.2 dbm	-38.3 dbm
1000 sec	20,000	-37.7 dbm	-38.3 dbm

Fig. 54

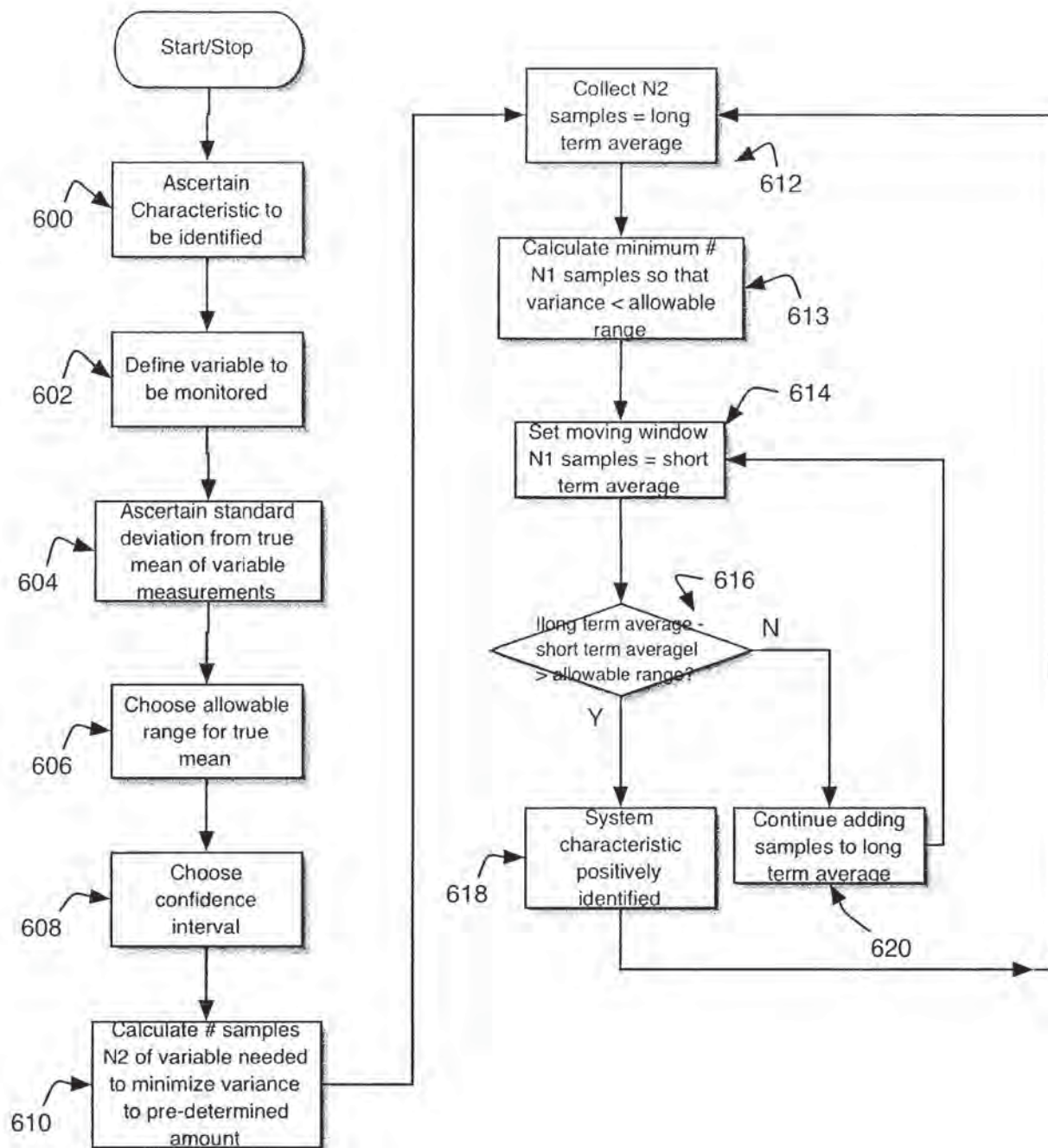


Fig. 55

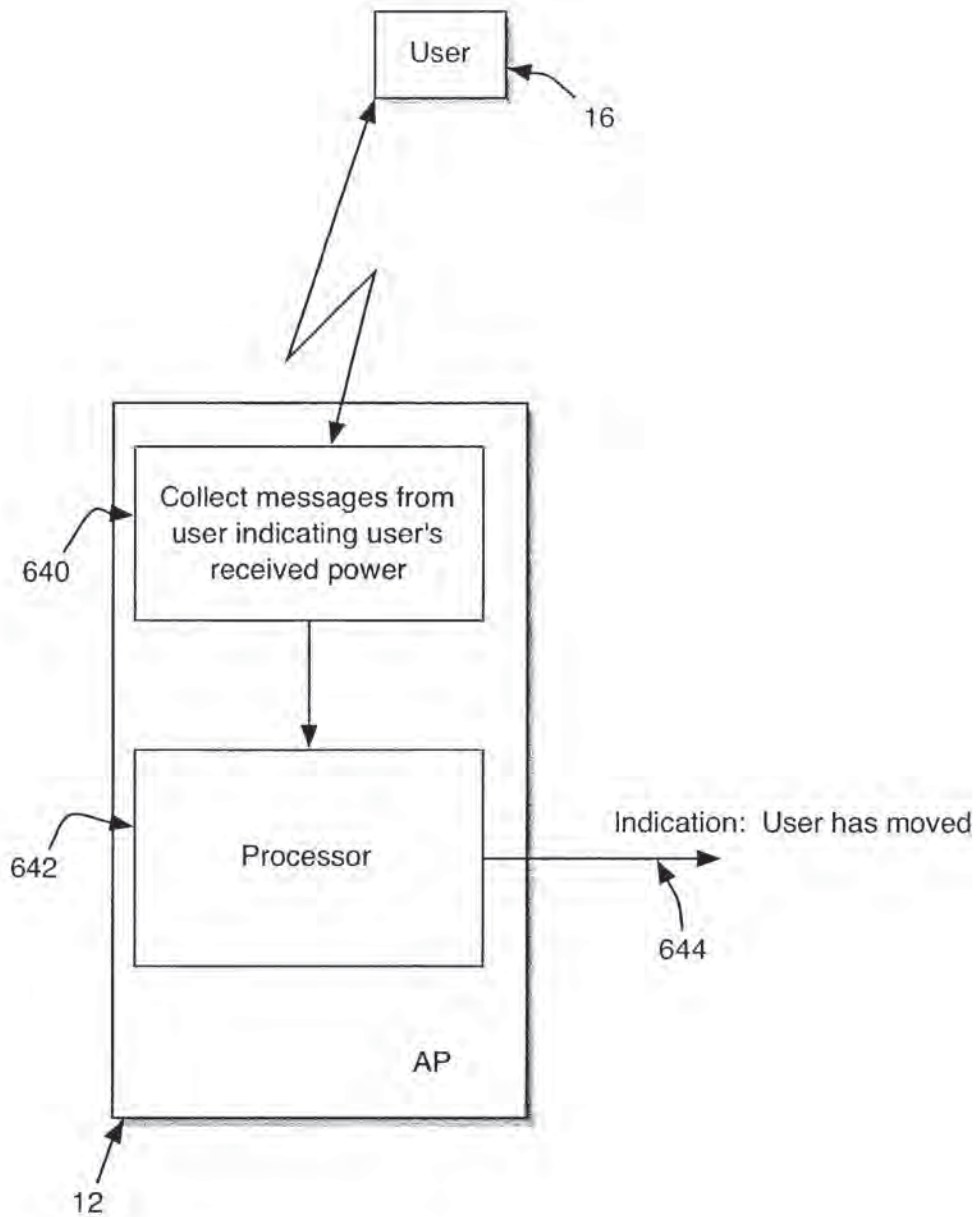


Fig. 56

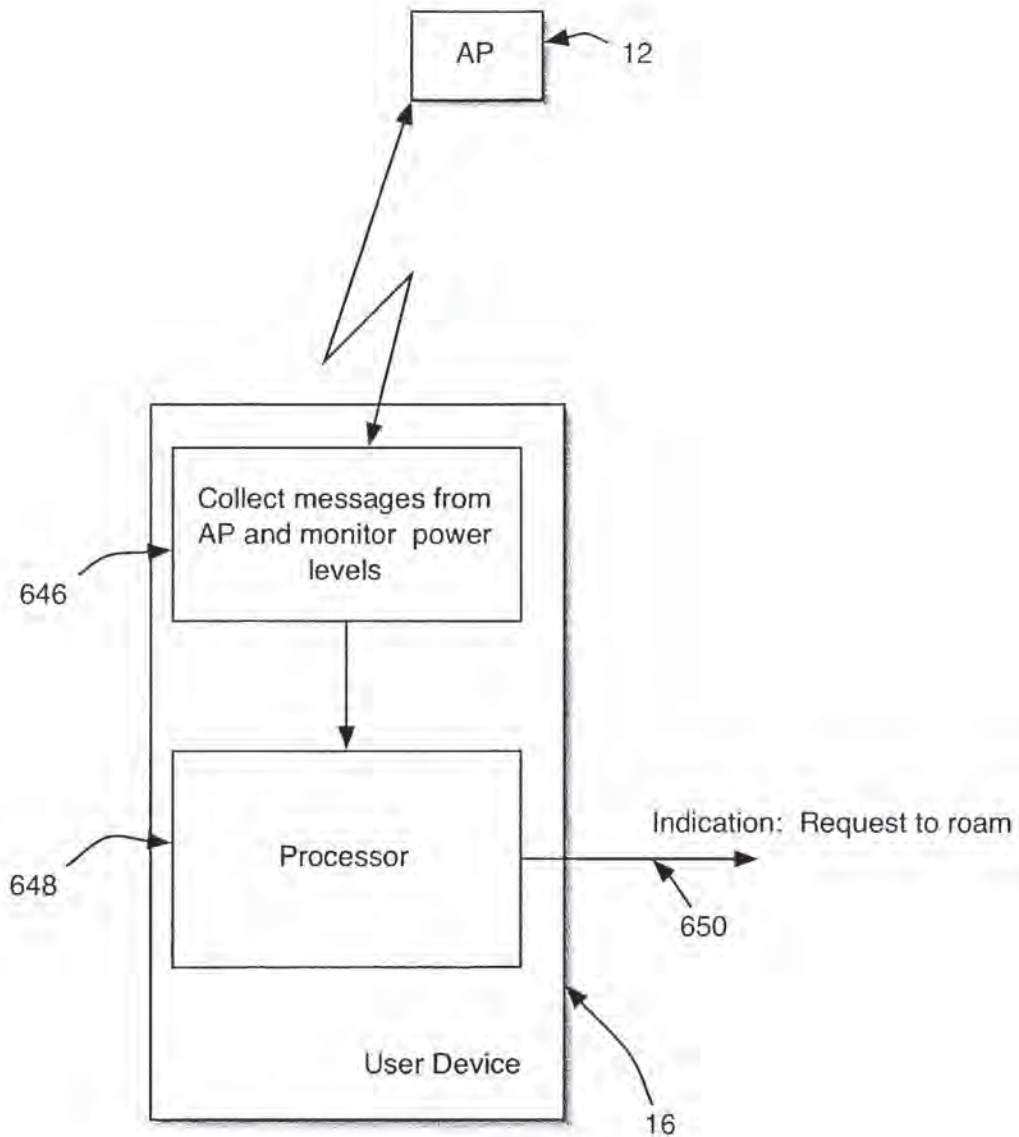


Fig. 57

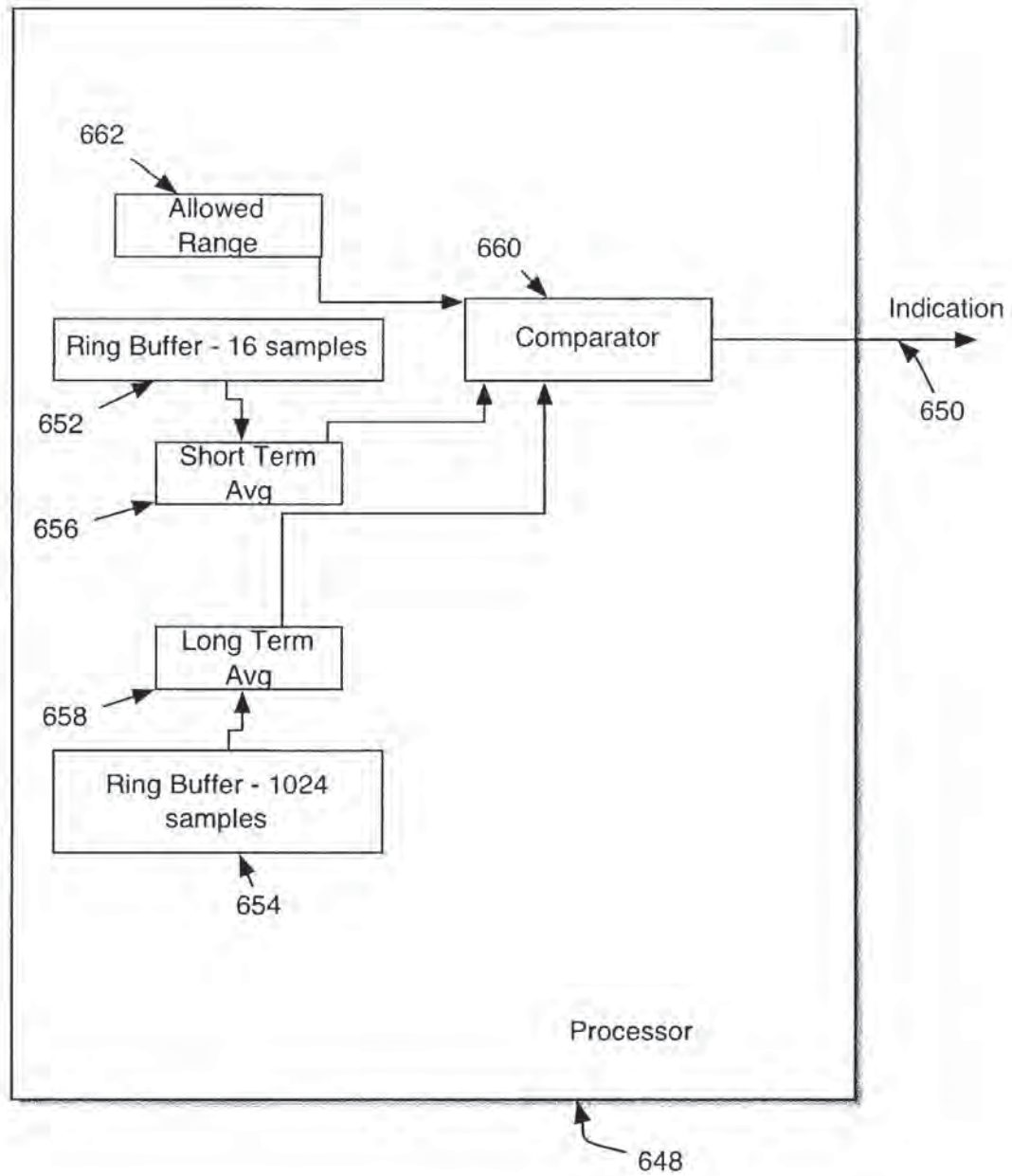


Fig. 58

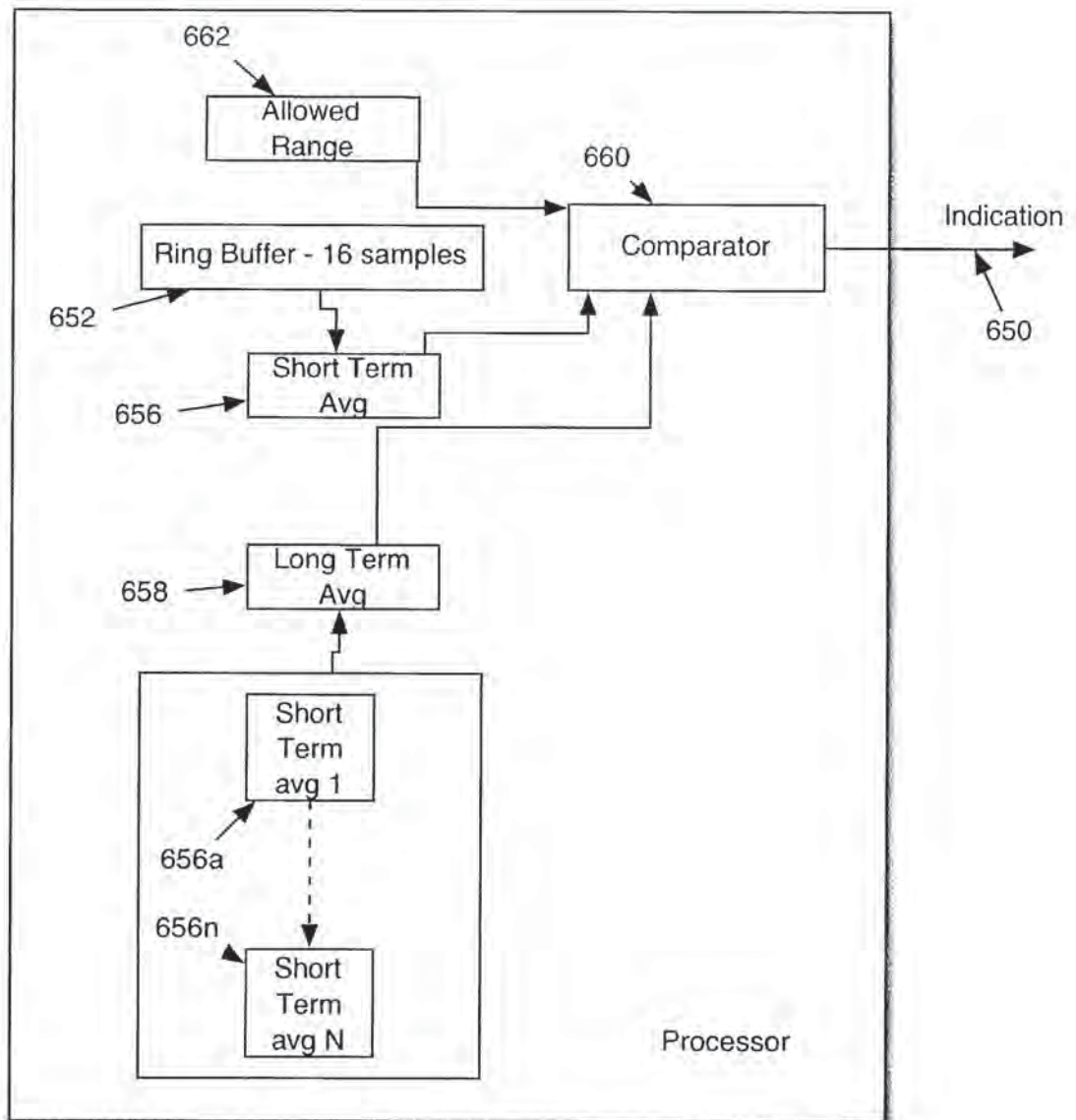


Fig. 59

Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		Program for Adjusting Channel Interference Between Access Points in a Wireless Network		
First Named Inventor/Applicant Name:		Floyd Backes		
Filer:		Holmes W. Anderson/Christine Morrisette		
Attorney Docket Number:		160-126		
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Utility application filing	1011	1	330	330
Utility Search Fee	1111	1	540	540
Utility Examination Fee	1311	1	220	220
Pages:				
Utility Appl Size fee per 50 sheets >100	1081	1	270	270
Claims:				
Miscellaneous-Filing:				
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1360

Electronic Acknowledgement Receipt	
EFS ID:	7925203
Application Number:	12827021
International Application Number:	
Confirmation Number:	4411
Title of Invention:	Program for Adjusting Channel Interference Between Access Points in a Wireless Network
First Named Inventor/Applicant Name:	Floyd Backes
Customer Number:	34845
Filer:	Holmes W. Anderson/Christine Morrisette
Filer Authorized By:	Holmes W. Anderson
Attorney Docket Number:	160-126
Receipt Date:	30-JUN-2010
Filing Date:	
Time Stamp:	13:37:54
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$1360
RAM confirmation Number	22970
Deposit Account	504416
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	Transmittal of New Application	UtilityTransmittalForContinuation.pdf	99813 69401311e03c289925d987d81d418f4bdc0226c	no	1
Warnings:					
Information:					
2	Power of Attorney	PowerOfAttorneyAndStatement.pdf	37317 11111560020c1b000000050f00e985b781a7a75	no	1
Warnings:					
Information:					
3	Oath or Declaration filed	Declaration.pdf	134268 c2c87938b6a75d075ada9bb31b95326d13db99b	no	3
Warnings:					
Information:					
4		Application.pdf	459018 46c3d30067ac21bba01cc73440a5a152a2e35820	yes	94
	Multipart Description/PDF files in .zip description				
	Document Description	Start		End	
	Specification	1		92	
	Claims	93		93	
	Abstract	94		94	
Warnings:					
Information:					
5	Drawings-only black and white line drawings	Drawings.pdf	1251069 66e722a11880e78be2803c3100041c398d4198e3	no	62
Warnings:					
Information:					
6	Fee Worksheet (PTO-875)	fee-info.pdf	36619 7879ba052102680a6c5b64119733323f1772d	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			2018104		

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.

DATE: 06/30/10

Approved for use through 7/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 12/827,021	
APPLICATION AS FILED – PART I						
(Column 1)		(Column 2)		SMALL ENTITY		OR
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	330
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A		N/A	540
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A		N/A	220
TOTAL CLAIMS (37 CFR 1.16(i))	1	minus 20 =	x\$26		x\$52	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1	minus 3 = *	x\$110		x\$220	
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$270 (\$135 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR					270
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))			195		390	
			TOTAL		TOTAL	1360
* If the difference in column 1 is less than zero, enter "0" in column 2.						
APPLICATION AS AMENDED – PART II						
(Column 1)		(Column 2)		SMALL ENTITY		OR
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)
Total (37 CFR 1.16(i))	*	Minus **	=	X =		X =
Independent (37 CFR 1.16(h))	*	Minus ***	=	X =		X =
Application Size Fee (37 CFR 1.16(s))						
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))				N/A		N/A
				TOTAL ADD'T FEE		TOTAL ADD'T FEE
(Column 1)		(Column 2)		SMALL ENTITY		OR
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)
Total (37 CFR 1.16(i))	*	Minus **	=	X =		X =
Independent (37 CFR 1.16(h))	*	Minus ***	=	X =		X =
Application Size Fee (37 CFR 1.16(s))						
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))				N/A		N/A
				TOTAL ADD'T FEE		TOTAL ADD'T 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.						

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.

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



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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
12/827,021	06/30/2010	2617	1360	160-126	1	1

CONFIRMATION NO. 4411

FILING RECEIPT



0000000042537162

34845
Anderson Gorecki & Manaras LLP
33 NAGOG PARK
ACTON, MA 01720

Date Mailed: 07/14/2010

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)

Floyd Backes, Sharon, NH;
Gary Vacon, East Falmouth, MA;
Paul Callahan, Carlisle, MA;
William Hawe, Hollis, NH;
Roger Durand, Amherst, NH;

Power of Attorney: The patent practitioners associated with Customer Number 34845

Domestic Priority data as claimed by applicant

This application is a CON of 10/781,137 02/18/2004
which claims benefit of 60/449,602 02/24/2003
and claims benefit of 60/466,448 04/29/2003
and claims benefit of 60/472,320 05/21/2003
and claims benefit of 60/472,239 05/21/2003

Foreign Applications

If Required, Foreign Filing License Granted: 07/13/2010

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/827,021**

Projected Publication Date: 10/21/2010

Non-Publication Request: No

Early Publication Request: No

page 1 of 3

Title

Program for Adjusting Channel Interference Between Access Points in a Wireless Network

Preliminary Class

370

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.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

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page 2 of 3

set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/827,021	06/30/2010	Floyd Backes	160-126

34845
Anderson Gorecki & Manaras LLP
33 NAGOG PARK
ACTON, MA 01720

CONFIRMATION NO. 4411
POA ACCEPTANCE LETTER



OC000000042537193

Date Mailed: 07/14/2010

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/30/2010.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/ccetin/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/827,021	06/30/2010	Floyd Backes	160-126	4411
34845	7596	10/01/2010		
Anderson Gorecki & Manaras LLP 33 NAGOG PARK ACTON, MA 01720			EXAMINER BEAMER, TEMICA M	
			ART UNIT 2617	PAPER NUMBER
			NOTIFICATION DATE 10/01/2010	DELIVERY MODE 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):

handerson@smmalaw.com
officeadmin@smmalaw.com
cmorrisette@smmalaw.com

Office Action Summary	Application No. 12/827,021	Applicant(s) BACKES ET AL.	
	Examiner TEMICA M. BEAMER	Art Unit 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 6/30/2010.

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 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 is/are rejected.

7) ☐ Claim(s) _____ 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 _____ 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: _____	6) ☐ Other: _____

Double Patenting

1. 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).

2. Claim 1 is rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of U.S. Patent No. 7,774,013. Although the conflicting claims are not identical, they are not patentably distinct from each other because both inventions are drawn to a computer program product recorded on a computer-readable medium for a first access point capable of communicating in a wireless communications network via a RF channel.

Conclusion

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to TEMICA M. BEAMER whose telephone number is (571)272-7797. The examiner can normally be reached on Monday-Thursday (alternate Fridays) 9:00am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lester Kincaid can be reached on (571) 272-7922. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2617

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.

/Temica M. Beamer/
Primary Examiner, Art Unit 2617



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 United States Patent and Trademark Office
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BIB DATA SHEET

CONFIRMATION NO. 4411

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.		
12/827,021	06/30/2010	455	2617	160-126		
APPLICANTS Floyd Backes, Sharon, NH; Gary Vacon, East Falmouth, MA; Paul Callahan, Carlisle, MA; William Hawe, Hollis, NH; Roger Durand, Amherst, NH;						
** CONTINUING DATA ***** This application is a CON of 10/781,137 02/18/2004 PAT 7,774,013 which claims benefit of 60/449,602 02/24/2003 and claims benefit of 60/466,448 04/29/2003 and claims benefit of 60/472,320 05/21/2003 and claims benefit of 60/472,239 05/21/2003						
** FOREIGN APPLICATIONS *****						
** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 07/13/2010						
Foreign Priority claimed ☐ Yes ☒ No 35 USC 119(a-d) conditions met ☐ Yes ☒ No Verified and Acknowledged <u>/TEMICA M BEAMER/</u> Examiner's Signature		☐ Met after Allowance Initials	STATE OR COUNTRY NH	SHEETS DRAWINGS 62	TOTAL CLAIMS 1	INDEPENDENT CLAIMS 1
ADDRESS Anderson Gorecki & Manaras LLP 33 NAGOG PARK ACTON, MA 01720 UNITED STATES						
TITLE Program for Adjusting Channel Interference Between Access Points in a Wireless Network						
FILING FEE RECEIVED 1360	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		

<i>Index of Claims</i> 	Application/Control No. 12827021	Applicant(s)/Patent Under Reexamination BACKES ET AL.
	Examiner TEMICA M BEAMER	Art Unit 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	09/27/2010					
	1	✓					

Search Notes 	Application/Control No. 12827021	Applicant(s)/Patent Under Reexamination BACKES ET AL.
	Examiner TEMICA M BEAMER	Art Unit 2617

SEARCHED			
Class	Subclass	Date	Examiner
455	67.11, 67.13, 434, 446, 447, 522	9/27/2010	TMB

SEARCH NOTES		
Search Notes	Date	Examiner
WEST search	9/27/2010	TMB

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

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Anderson Gorecki & Manaras LLP
33 NAGOG PARK
ACTON, MA 01720



**Courtesy Reminder for
Application Serial No: 12/827,021**

Attorney Docket No: 160-126

Customer Number: 34845

Date of Electronic Notification: 10/01/2010

This is a courtesy reminder that new correspondence is available for this application. The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

An email notification regarding the correspondence was sent to the following email address(es) associated with your customer number:

handerson@smmalaw.com

officeadmin@smmalaw.com

cmorrisette@smmalaw.com

Please verify that these email addresses are correct.

To view your correspondence online or update your email addresses, please visit us anytime at <https://spportal.uspto.gov/secure/myportal/privatepair>. If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov or call 1-866-217-9197.



UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/827,021	06/30/2010	Floyd Backes	160-126

CONFIRMATION NO. 4411
PUBLICATION NOTICE

34845
Anderson Gorecki & Manaras LLP
33 NAGOG PARK
ACTON, MA 01720



0000000044115699

Title:Program for Adjusting Channel Interference Between Access Points in a Wireless Network

Publication No.US-2010-0267414-A1

Publication Date:10/21/2010

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publicly available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <http://pair.uspto.gov/>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Backes	
Application No.: 12/827,021	Group Art Unit: 2617
Filed: 06/30/201	Examiner: Beamer
Title: Program for Adjusting Channel Interference Between Access Points in a Wireless Network	Confirmation No.: 4411
Attorney Docket No.: 160-126	
Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450	

RESPONSE UNDER 37 CFR 1.111

Dear Sir:

In response to the Office Action of October 1, 2010, please amend this application as follows:

In the claims:

1. (currently amended) A computer program product recorded on a computer-readable medium ~~for a first access point capable of communicating in a wireless communications network via a radio frequency channel~~, comprising:

logic for detecting that a first access point is using a radio frequency channel;

logic for detecting that a second access point is also using the radio frequency channel,

the detecting logic including:

logic for receiving messages from the second access point; and

logic for maintaining indications of the transmit power levels of other access points including the second access point; and

logic, responsive to the indications of the transmit power levels of other access points maintained by the detecting logic, for instructing the first access point to adjust ~~adjusting~~ transmit power to decrease interference with the second access point detected to be using the radio frequency channel; wherein the ~~detecting logic and the reducing transmit power logic are executed by the first access point~~ adjusts transmit power as instructed.

REMARKS

Claim 1 is pending in this application. The claim was rejected for double-patenting and is currently amended to overcome that rejection. Reconsideration is therefore respectfully requested.

Respectfully Submitted,

February 1, 2011
Date

/Holmes W. Anderson/
Holmes W. Anderson, Reg. No. 37,272
Attorney/Agent for Applicant(s)
Anderson Gorecki & Manaras LLP
33 Nagog Park
Acton, MA 01720
(978) 264-4001

Docket No. 160-126
Dd: 01/01/2011

Electronic Acknowledgement Receipt	
EFS ID:	9351171
Application Number:	12827021
International Application Number:	
Confirmation Number:	4411
Title of Invention:	Program for Adjusting Channel Interference Between Access Points in a Wireless Network
First Named Inventor/Applicant Name:	Floyd Backes
Customer Number:	34845
Filer:	Holmes W. Anderson
Filer Authorized By:	
Attorney Docket Number:	160-126
Receipt Date:	01-FEB-2011
Filing Date:	30-JUN-2010
Time Stamp:	12:20:44
Application Type:	Utility under 35 USC 111(a)

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	Amendment/Req. Reconsideration-After Non-Final Reject	amn160126.pdf	54952 15176593b05680661a389b69628f1d3977 1810	no	3
Warnings:					
Information:					

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.

Electronic Patent Application Fee Transmittal				
Application Number:		12827021		
Filing Date:		30-Jun-2010		
Title of Invention:		Program for Adjusting Channel Interference Between Access Points in a Wireless Network		
First Named Inventor/Applicant Name:		Floyd Backes		
Filer:		Holmes W. Anderson		
Attorney Docket Number:		160-126		
Filed as Large Entity				
Utility under 35 USC 111(a) 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:				
Extension - 1 month with \$0 paid	1251	1	130	130

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				130

Electronic Acknowledgement Receipt	
EFS ID:	9351506
Application Number:	12827021
International Application Number:	
Confirmation Number:	4411
Title of Invention:	Program for Adjusting Channel Interference Between Access Points in a Wireless Network
First Named Inventor/Applicant Name:	Floyd Backes
Customer Number:	34845
Filer:	Holmes W. Anderson
Filer Authorized By:	
Attorney Docket Number:	160-126
Receipt Date:	01-FEB-2011
Filing Date:	30-JUN-2010
Time Stamp:	12:48:01
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$130
RAM confirmation Number	10269
Deposit Account	504416
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 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

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	Fee Worksheet (PTO-875)	fee-info.pdf	29989 0a56dbd62eb8860a72b61d4f6fa7ccca9981ea	no	2

Warnings:

Information:

Total Files Size (in bytes): 29989

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New Applications Under 35 U.S.C. 111

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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.

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.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 12/827,021		Filing Date 06/30/2010		☐ 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 (\$)	RATE (\$)	FEE (\$)	RATE (\$)	FEE (\$)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A		N/A		N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	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		N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 = *	*	X \$ =		X \$ =		X \$ =		X \$ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 = *	*	X \$ =		X \$ =		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										
(Column 1)			(Column 2)		SMALL ENTITY			OR OTHER THAN SMALL ENTITY		
AMENDMENT	02/01/2011	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)	ADDITIONAL FEE (\$)
Total (37 CFR 1.16(i))	+ 1	Minus	** 20	=	X \$ =		OR X \$ =		X \$ =	
Independent (37 CFR 1.16(h))	+ 1	Minus	*** 3	=	X \$ =		OR X \$ =		X \$ =	
☐ Application Size Fee (37 CFR 1.16(s))										
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
					TOTAL ADD'L FEE		OR TOTAL ADD'L FEE			
(Column 1)			(Column 2)		SMALL ENTITY			OR OTHER THAN SMALL ENTITY		
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)	ADDITIONAL FEE (\$)
Total (37 CFR 1.16(i))	+	Minus	**	=	X \$ =		OR X \$ =		X \$ =	
Independent (37 CFR 1.16(h))	+	Minus	***	=	X \$ =		OR X \$ =		X \$ =	
☐ Application Size Fee (37 CFR 1.16(s))										
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
					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:
/ELMIRA HALL/

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.

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



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/827,021	06/30/2010	Floyd Backes	160-126	4411
34845 7596 02/23/2011 Anderson Gorecki & Manaras LLP 33 NAGOG PARK ACTON, MA 01720			EXAMINER BEAMER, TEMICA M	
			ART UNIT 2617	PAPER NUMBER
			NOTIFICATION DATE 02/22/2011	DELIVERY MODE 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):

handerson@smmalaw.com
officeadmin@smmalaw.com
cmorrisette@smmalaw.com

Office Action Summary	Application No.	Applicant(s)	
	12/827,021	BACKES ET AL.	
	Examiner	Art Unit	
	TEMICA M. BEAMER	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 February 2011.
 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 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 is/are rejected.
 7) ☐ Claim(s) _____ 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 _____ 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) |
| 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date: _____ |
| 3) ☐ Information Disclosure Statement(s) (PTO/SB/08) | 5) ☐ Notice of Informal Patent Application |
| Paper No(s)/Mail Date: _____ | 6) ☐ Other: _____ |

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 2/2/2011 have been fully considered but they are not persuasive. Applicant states that amendment overcomes the Double Patenting rejection. The examiner, however, disagrees. The claim language in both inventions discloses logic for determining that first and second access points are using a radio frequency channel. Therefore, the rejection is maintained and set forth below.

Double Patenting

2. 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).

3. Claim 1 is rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of U.S. Patent No. 7,774,013. Although the conflicting claims are not identical, they are not patentably distinct from each other because both inventions are drawn to a computer program product recorded on a computer-readable medium for a first access point capable of communicating in a wireless communications network via a RF channel.

Conclusion

2. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to TEMICA M. BEAMER whose telephone number is (571)272-7797. The examiner can normally be reached on Monday-Thursday (alternate Fridays) 9:00am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lester Kincaid can be reached on (571) 272-7922. 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.

/Temica M. Beamer/
Primary Examiner, Art Unit 2617

<i>Index of Claims</i> 	Application/Control No. 12827021	Applicant(s)/Patent Under Reexamination BACKES ET AL.
	Examiner TEMICA M BEAMER	Art Unit 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	09/27/2010	02/14/2011				
	1	✓	✓				

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.

**TERMINAL DISCLAIMER TO OBIVATE A DOUBLE PATENTING
REJECTION OVER A "PRIOR" PATENT**

Docket Number (Optional)
160-126

In re Application of: Floyd Buckles

Application No.: 12/827,621

Filed: 06/30/2010

For: Program for Adjusting Channel Interference Between Access Points in a Wireless Network

The owner, Autocall Laboratories, 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. 7,774,013, 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 renewed; 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 are 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. 37,272

Holmes W. Anderson
Signature

April 12, 2011
Date

Holmes W. Anderson
Typed or printed name

878-264-4001
Telephone Number

- ☒ Terminal disclaimer fee under 37 CFR 1.20(d) included.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2638.

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner). Form PTO/SB/26 may be used for making this certification. See MPEP § 324.

This collection of information is required by 37 CFR 1.321. 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 1.11 and 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.

If you need assistance in completing the form, call 1-800-PTO-6196 and select option 2.

Electronic Patent Application Fee Transmittal				
Application Number:		12827021		
Filing Date:		30-Jun-2010		
Title of Invention:		Program for Adjusting Channel Interference Between Access Points in a Wireless Network		
First Named Inventor/Applicant Name:		Floyd Backes		
Filer:		Holmes W. Anderson/Christine Morrisette		
Attorney Docket Number:		160-126		
Filed as Large Entity				
Utility under 35 USC 111(a) 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:	9858373
Application Number:	12827021
International Application Number:	
Confirmation Number:	4411
Title of Invention:	Program for Adjusting Channel Interference Between Access Points in a Wireless Network
First Named Inventor/Applicant Name:	Floyd Backes
Customer Number:	34845
Filer:	Holmes W. Anderson/Christine Morrisette
Filer Authorized By:	Holmes W. Anderson
Attorney Docket Number:	160-126
Receipt Date:	12-APR-2011
Filing Date:	30-JUN-2010
Time Stamp:	10:34:26
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$ 140
RAM confirmation Number	8144
Deposit Account	504416
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	Terminal Disclaimer Filed	TerminalDisclaimer.pdf	453537	no	1
			5A096A0086C292619967A8080416762A C971		

Warnings:**Information:**

2	Fee Worksheet (PTO-875)	fee-info.pdf	29977	no	2
			69976D7A4d1f3D08c2b744e0bde03b6A 9B54d		

Warnings:**Information:**

Total Files Size (in bytes):	483514
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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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Backes	
Application No.: 12/827,021	Group Art Unit: 2617
Filed: 06/30/201	Examiner: Beamer
Title: Program for Adjusting Channel Interference Between Access Points in a Wireless Network	Confirmation No.: 4411
Attorney Docket No.: 160-126	
Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450	

RESPONSE

Dear Sir:

Please enter this response to the Final Office Action of February 22, 2011.

In the claims:

1. (previously presented) A computer program product recorded on a computer-readable medium, comprising:

logic for detecting that a first access point is using a radio frequency channel;

logic for detecting that a second access point is also using the radio frequency channel,

the detecting logic including:

logic for receiving messages from the second access point; and

logic for maintaining indications of the transmit power levels of other access points including the second access point; and

logic, responsive to the indications of the transmit power levels of other access points maintained by the detecting logic, for instructing the first access point to adjust transmit power to decrease interference with the second access point detected to be using the radio frequency channel; wherein the first access point adjusts transmit power as instructed.

REMARKS

Claim 1 is pending in this application and was rejected for double-patenting. A terminal disclaimer was filed on April 12, 2011 to overcome that rejection. A notice of allowance is therefore respectfully requested.

Respectfully Submitted,

April 14, 2011
Date

/Holmes W. Anderson/
Holmes W. Anderson, Reg. No. 37,272
Attorney/Agent for Applicant(s)
Anderson Gorecki & Manaras LLP
33 Nagog Park
Acton, MA 01720
(978) 264-4001

Docket No. 160-126
Dd: 05/22/2011

Electronic Acknowledgement Receipt	
EFS ID:	9880639
Application Number:	12827021
International Application Number:	
Confirmation Number:	4411
Title of Invention:	Program for Adjusting Channel Interference Between Access Points in a Wireless Network
First Named Inventor/Applicant Name:	Floyd Backes
Customer Number:	34845
Filer:	Holmes W. Anderson/Christine Morrisette
Filer Authorized By:	Holmes W. Anderson
Attorney Docket Number:	160-126
Receipt Date:	14-APR-2011
Filing Date:	30-JUN-2010
Time Stamp:	14:36:00
Application Type:	Utility under 35 USC 111(a)

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		Amendment.pdf	54578 f0ec1354480003119166091805c775b60305d001	yes	3

Multipart Description/PDF files in .zip description		
Document Description	Start	End
Amendment After Final	1	1
Claims	2	2
Applicant Arguments/Remarks Made in an Amendment	3	3

Warnings:

Information:

Total Files Size (in bytes):	54578
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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.

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.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 12/827,021		Filing Date 06/30/2010		☐ 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), (l), 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												
(Column 1)			(Column 2)		SMALL ENTITY			OR OTHER THAN SMALL ENTITY				
AMENDMENT	04/14/2011	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)				RATE (\$)	ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	+ 1	Minus	** 20	= 0	X \$ =		OR			X \$52=	0
	Independent (37 CFR 1.16(h))	+ 1	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))											
						TOTAL ADD'L FEE			TOTAL ADD'L FEE			
								0				
AMENDMENT	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	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))											
						TOTAL ADD'L FEE			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:
/LAWANDA MILTON/

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.

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

Application Number 	Application/Control No. 12/827,021	Applicant(s)/Patent under Reexamination BACKES ET AL.	
Document Code - DISQ		Internal Document – DO NOT MAIL	

TERMINAL DISCLAIMER	☒ APPROVED	☐ DISAPPROVED
Date Filed : 4/12/11	This patent is subject to a Terminal Disclaimer	

Approved/Disapproved by:
jean proctor

U.S. Patent and Trademark Office



UNITED STATES PATENT AND TRADEMARK OFFICE

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

34845 7590 05/17/2011
Anderson Gorecki & Manaras LLP
33 NAGOG PARK
ACTON, MA 01720

EXAMINER	
BEAMER, TEMICA M	
ART UNIT	PAPER NUMBER
2617	

DATE MAILED: 05/17/2011

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/827,021	06/30/2010	Floyd Backes	160-126	411

TITLE OF INVENTION: PROGRAM FOR ADJUSTING CHANNEL INTERFERENCE BETWEEN ACCESS POINTS IN A WIRELESS NETWORK

APPL. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1510	\$300	50	\$1810	08/17/2011

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.

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)

34845 7590 05/17/2011
Anderson Gorecki & Manaras LLP
33 NAGOG PARK
ACTON, MA 01720

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.
12/827,021	06/30/2010	Floyd Backes	160-126	4411

TITLE OF INVENTION: PROGRAM FOR ADJUSTING CHANNEL INTERFERENCE BETWEEN ACCESS POINTS IN A WIRELESS NETWORK

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	08/17/2011

EXAMINER	ART UNIT	CLASS-SUBCLASS
BEAMER, TEMICA M	2617	455-418000

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, 1 _____
 (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. 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.

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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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.
12/827,021	06/30/2010	Floyd Backes	160-126	4411
34845 7590 05/17/2011 Anderson Gorecki & Manaras LLP 33 NAGOG PARK ACTON, MA 01720			EXAMINER BEAMER, TEMICA M	
			ART UNIT 2617	PAPER NUMBER

DATE MAILED: 05/17/2011

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 0 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 0 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)	
	12/827,021	BACKES ET AL.	
	Examiner	Art Unit	
	TEMICA M. BEAMER	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 amendment filed 4/14/2011.

2. ☒ The allowed claim(s) is/are 1.

3. ☐ 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.

4. ☐ 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.

5. ☐ 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).

6. ☐ 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 Draftsperson's Patent Drawing Review (PTO-948) 3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____ 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 _____
---	--

/TEMICA M. BEAMER/ Primary Examiner, Art Unit 2617	
---	--

OK TO ENTER: /T.B./

05/08/2011

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Backes	
Application No.: 12/827,021	Group Art Unit: 2617
Filed: 06/30/201	Examiner: Beamer
Title: Program for Adjusting Channel Interference Between Access Points in a Wireless Network	Confirmation No.: 4411
Attorney Docket No.: 160-126	
Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450	

RESPONSE

Dear Sir:

Please enter this response to the Final Office Action of February 22, 2011.

<i>Index of Claims</i> 	Application/Control No. 12827021	Applicant(s)/Patent Under Reexamination BACKES ET AL.
	Examiner TEMICA M BEAMER	Art Unit 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	09/27/2010	02/14/2011	05/09/2011					
1	1	✓	✓	=					

Search Notes 	Application/Control No. 12827021	Applicant(s)/Patent Under Reexamination BACKES ET AL.
	Examiner TEMICA M BEAMER	Art Unit 2617

SEARCHED			
Class	Subclass	Date	Examiner
455	67.11, 67.13, 434, 446, 447, 522	9/27/2010	TMB
	updated search	5/8/2011	TMB

SEARCH NOTES			
Search Notes		Date	Examiner
WEST search		9/27/2010	TMB
WEST search		5/8/2011	TMB

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner
455	522, 67.11, 67.13, 434	5/8/2011	TMB
	PGPUB text search	5/8/2011	TMB

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Issue Classification 	Application/Control No. 12827021	Applicant(s)/Patent Under Reexamination BACKES ET AL.
	Examiner TEMICA M BEAMER	Art Unit 2617

ORIGINAL						INTERNATIONAL CLASSIFICATION												
CLASS			SUBCLASS			CLAIMED					NON-CLAIMED							
455			522			H	0	4	B	7 / 00 (2006.01.01)								
CROSS REFERENCE(S)																		
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)																	
455	67.11	67.13	434															

☒	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	Final	Original
1	1																

NONE		Total Claims Allowed:	
		1	
(Assistant Examiner)	(Date)	O.G. Print Claim(s)	O.G. Print Figure
/TEMICA M BEAMER/ Primary Examiner, Art Unit 2617	5/9/2011	1	2
(Primary Examiner)	(Date)		

WEST Search History for Application 12827021

Creation Date: 2011050900:13

Interference Searches

Query	DB	Op.	Plur.	Thes.	Date
(logic and detect \$ 3 and power and access and point and adjust \$ 3 and frequency).clm.	PGPB	OR	YES		05-08-2011
((logic and detect \$ 3 and power and access and point and adjust \$ 3 and frequency).clm.) and (level and transmit).clm.	PGPB	OR	YES		05-08-2011

Prior Art Searches

Query	DB	Op.	Plur.	Thes.	Date
7653407.pn.	PGPB, USPT	OR	YES		05-08-2011
5345598.pn.	PGPB, USPT	OR	YES		05-08-2011
455/\$.ccls. or 370/\$.ccls.	PGPB, USPT	OR	YES		05-08-2011
frequency with reuse same (adjust\$3 or increas\$3) near5 power	PGPB, USPT	OR	YES		05-08-2011
(455/\$.ccls. or 370/\$.ccls.) and (frequency with reuse same (adjust\$3 or increas\$3) near5 power)	PGPB, USPT	OR	YES		05-08-2011
detect\$3 and (455/\$.ccls. or 370/\$.ccls. and frequency with reuse same (adjust\$3 or increas\$3) near5 power)	PGPB, USPT	OR	YES		05-08-2011
(base or access) adj station and (detect\$3 and 455/\$.ccls. or 370/\$.ccls. and frequency with reuse same (adjust\$3 or increas\$3) near5 power)	PGPB, USPT	OR	YES		05-08-2011
"same" near4 (frequency or channel) same power	PGPB, USPT	OR	YES		05-08-2011
(455/\$.ccls. or 370/\$.ccls. and frequency with reuse same (adjust\$3 or increas\$3) near5 power) and ("same" near4 (frequency or channel) same power)	PGPB, USPT	OR	YES		05-08-2011
table and (455/\$.ccls. or 370/\$.ccls. and frequency with reuse same (adjust\$3 or increas\$3) near5 power and "same" near4 (frequency or channel) same power)	PGPB, USPT	OR	YES		05-08-2011

power near6 table and (455/\$.ccls. or 370/\$.ccls. and frequency with reuse same (adjust\$3 or increas\$3) near5 power and "same" near4 (frequency or channel) same power)	PGPB, USPT	OR	YES		05-08-2011
802.11	PGPB, USPT	OR	YES		05-08-2011
(802.11) and (frequency with reuse same (adjust\$3 or increas\$3) near5 power)	PGPB, USPT	OR	YES		05-08-2011
(455/522).ccls.	PGPB, USPT	OR	YES		05-08-2011
(reduc\$3 or decreas\$3) near5 power same detect\$3 near5 interference2	PGPB, USPT	OR	YES		05-08-2011
(reduc\$3 or decreas\$3) near5 power same detect\$3 near5 interference	PGPB, USPT	OR	YES		05-08-2011
((455/522).ccls.) and ((reduc\$3 or decreas\$3) near5 power same detect\$3 near5 interference)	PGPB, USPT	OR	YES		05-08-2011
base adj station and ((455/522).ccls. and (reduc\$3 or decreas\$3) near5 power same detect\$3 near5 interference)	PGPB, USPT	OR	YES		05-08-2011
5345598.pn.	PGPB, USPT	OR	YES		05-08-2011
5574982.pn.	PGPB, USPT	OR	YES		05-08-2011
power near6 backoff	PGPB, USPT	OR	YES		05-08-2011
((455/522).ccls.) and (power near6 backoff)	PGPB, USPT	OR	YES		05-08-2011
inform\$3 near5 base adj station same power and ((455/522).ccls.)	PGPB, USPT	OR	YES		05-08-2011
inform\$3 near5 base adj station with power and ((455/522).ccls.)	PGPB, USPT	OR	YES		05-08-2011
backoff and (inform\$3 near5 base adj station with power and (455/522).ccls.)	PGPB, USPT	OR	YES		05-08-2011
(frequency or channel) near8 reuse same interference	PGPB, USPT	OR	YES		05-08-2011
(455/522).ccls. and ((frequency or channel) near8 reuse same interference)	PGPB, USPT	OR	YES		05-08-2011
((access adj point) or (base adj station)) and ((455/522).ccls. and (frequency or channel) near8 reuse	PGPB, USPT	OR	YES		05-08-2011

same interference)					
((access adj point) or (base adj station)) near10 power and ((455/522).ccls. and (frequency or channel) near8 reuse same interference)	PGPB, USPT	OR	YES		05-08-2011
power near8 (decreas\$3 or reduc\$3) and (((access adj point) or (base adj station)) near10 power and (455/522).ccls. and (frequency or channel) near8 reuse same interference)	PGPB, USPT	OR	YES		05-08-2011
power near8 (decreas\$3 or reduc\$3 or increas\$3 or adjust\$3) same ((base adj station or access adj station)) and ((455/522).ccls. and (frequency or channel) near8 reuse same interference)	PGPB, USPT	OR	YES		05-08-2011
(reduc\$3 or decreas\$3) near8 interference and (power near8 (decreas\$3 or reduc\$3 or increas\$3 or adjust\$3) same ((base adj station or access adj station)) and (455/522).ccls. and (frequency or channel) near8 reuse same interference)	PGPB, USPT	OR	YES		05-08-2011
detect\$3 near8 (interference or co-channel adj interference) same adjust\$3 with power same base adj station	PGPB, USPT	OR	YES		05-08-2011
detect\$3 near8 co-channel adj interference same base adj station and power near8 adjust\$3	PGPB, USPT	OR	YES		05-08-2011
detect\$3 near8 co-channel adj interference same base adj station and power near8 adjust\$3	PGPB, USPT	OR	YES		05-08-2011
co-channel adj interference	PGPB, USPT	OR	YES		05-08-2011
co-channel adj interference near10 base adj station	PGPB, USPT	OR	YES		05-08-2011
adjust\$5 near7 power same interference and (co-channel adj interference near10 base adj station)	PGPB, USPT	OR	YES		05-08-2011
detect\$3 near10 co-channel adj interference same power near5 (decreas\$3 or reduc\$3 or adjust\$5) and ((base or access) adj station)	PGPB, USPT	OR	YES		05-08-2011
detect\$3 near10 co-channel adj interference same base adj station	PGPB, USPT	OR	YES		05-08-2011
power and (detect\$3 near10 co-channel adj interference same base adj station)	PGPB, USPT	OR	YES		05-08-2011
7774013.pn.	PGPB, USPT	OR	YES		05-08-2011

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Backes	
Serial No.: 12/827,021	Group Art Unit: 2617
Filed: 06/30/021	Examiner: Beamer
Title: Program for Adjusting Channel Interference Between Access Points in a Wireless Network	
Attorney Docket No.: 160-126	

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT

Dear Sir:

This Information Disclosure Statement is submitted:

- ☐ under 37 CFR 1.97(b), or
(Within three months of filing national application; or date of entry of international application; or before mailing date of first office action on the merits; whichever occurs last)
- ☐ under 37 CFR 1.97(c) together with either a:
☐ Statement under 37 CFR 1.97(e), or
☐ a \$180.00 fee under 37 CFR 1.17(p), or
(After the CFR 1.97(b) time period, but before final action or notice of allowance, whichever occurs first)
- ☒ under 37 CFR 1.97(d) together with a:
☒ Statement under 37 CFR 1.97(e), and
☒ a \$180.00 fee set forth in 37 CFR 1.17(p).
(Filed after final action or notice of allowance, whichever occurs first, but before payment of the issue fee)
- ☒ Applicant(s) submit herewith Form PTO 1449-Information Disclosure Citation together with copies, of patents, publications or other information of which applicant(s) are aware, which applicant(s) believe(s) may be material to the examination of this application and for which there may be a duty to disclose in accordance with 37 CFR 1.56.

The relevance of the attached references is that they are associated with litigation of another patent of the assignee. Applicant submits that the above references taken alone or in combination neither anticipate nor render obvious the present invention. Consideration of the foregoing in relation to this application is respectfully requested.

It is requested that the information disclosed herein be made of record in this application.

Respectfully submitted,

I hereby certify that this correspondence is being electronically filed with the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below

Date of Deposit: June 7, 2011

Typed Name: Christine Morrisette

Signature: /Christine Morrisette/

/Holmes W. Anderson/

Holmes W. Anderson

Attorney/Agent for Applicant(s)

Reg. No. 37,272

Date: June 7, 2011

Telephone No.: 978-264-4001

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Backes	
Serial No.: 12/827,021	Examiner: Beamer
Filing Date: 06/30/2010	Group Art Unit: 2617
Title: Program for Adjusting Channel Interference Between Access Points in a Wireless Network	
Attorney Docket No.: 160-126	

COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, VA 22313-1450

STATEMENT UNDER 37 CFR 1.97(e)

Sir:

The undersigned hereby certifies that either:

- () Each item of information contained in the Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application, not more than three months prior to the filing of the statement, or
- (X) 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 undersigned, after making reasonable inquiry, was known to an individual designated in 37 CFR 1.56 (c) more than three months prior to the filing of the Information Disclosure Statement.

Respectfully submitted,

I hereby certify that this correspondence is being electronically filed with the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below

Date of Deposit: June 7, 2011

Typed Name: Christine Morrisette

Signature: /Christine Morrisette/

/Holmes W. Anderson/

Holmes W. Anderson
Attorney/Agent for Applicant(s)
Reg. No. 37,272

Date: June 7, 2011

Telephone No.: 978-264-4001

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

AUTOCELL LABORATORIES, INC.,	)	
	)	
Plaintiff,	)	
	)	
v.	)	Civ. No. 08-760-SLR
	)	
CISCO SYSTEMS INC.,	)	
	)	
Defendant.	)	

John G. Day, Esquire, Tiffany Geyer Lydon, Esquire and Caroline Hong, Esquire of Ashby & Geddes, Wilmington, Delaware. Counsel for Plaintiff. Of Counsel: Edward A Pennington, Esquire and Chadwick A Jackson, Esquire of Hanify & King PC, Washington, D.C., John D. Hanify, Esquire and Christopher M. Morrison, Esquire of Hanify & King PC, Boston, MA.

Jack B. Blumenfeld, Esquire, Karen Jacobs Loudon, Esquire and Thomas C. Grimm, Esquire, of Morris, Nichols, Arsht & Tunnell LLP, Wilmington, Delaware. Counsel for Defendant. Of Counsel: Greg Stone, Esquire, Ted Dane, Esquire, Garth Vincent, Esquire and Kevin Goldman, Esquire of Munger Tolles & Olson, LLP, Los Angeles, CA.

MEMORANDUM OPINION

Dated: January 5, 2011
Wilmington, Delaware


ROBINSON, District Judge

I. INTRODUCTION

Plaintiff Autocell Laboratories, Inc ("plaintiff") owns several patents directed to systems and methods for managing wireless networks. On October 8, 2008, plaintiff commenced this patent infringement action against defendant Cisco Systems, Inc. ("defendant"), alleging that multiple products sold by defendant infringe U.S. Patent Nos. 7,127,275 ("the '275 patent"), 7,149,539 ("the '539 patent") and 7,369,858 ("the '858 patent"). (D.I. 1) Defendant has asserted various affirmative defenses and counterclaims in response to plaintiff's complaint, including noninfringement and invalidity of the patents in suit. (D.I. 8) Fact discovery completed in April 2010. On June 23, 2010, pursuant to the parties' stipulation, the court dismissed with prejudice plaintiff's claims relating to both the '275 and the '539 patents, and to claims 3 and 4 of the '858 patent. (D.I. 132)

The parties have proffered meanings for the disputed claim limitations and move for summary judgment. Plaintiff seeks summary judgment of infringement, and defendant seeks summary judgment of invalidity and noninfringement of the '858 patent. (D.I. 155; D.I. 156; D.I. 158; D.I. 162; D.I. 165) The court has jurisdiction pursuant to 28 U.S.C. §§ 1331 and 1338. For the reasons that follow, the court grants defendant's motion for noninfringement, and denies all other motions.

II. BACKGROUND

A. The Parties And The Technology At Issue

Plaintiff develops methods for managing wireless networking traffic and reducing radio frequency interference to enhance the quality of the signal in a wireless network.

(D.I. 159 at 1-2) Wireless networks allow computers and other related devices to communicate with each other without the need to be physically connected. (D.I. 143, ex 2a at ¶ 7) A wireless network generally consists of two devices: an access point and a client ("station"). (*Id.* at ¶ 9) The access point is a wireless communications-capable device that connects the wireless stations together, and with a wired network. (*Id.*) A station varies in nature and can take the form of wireless laptops, telephones, and printers. (*Id.* at ¶ 11) Because of their portability, stations may switch from access point to access point as they move to different locations within a wireless network. (*Id.*) Due to the fluid nature of a wireless network, it is sometimes advantageous for wireless networking devices to lower their transmit power in order to control the range of transmissions, reduce interference with other wireless devices, or reduce power consumption. (*Id.* at ¶ 10) The technology at issue concerns a method for automatically adjusting the transmit power level of a wireless networking station in response to the lowering of the transmit power level of the access point with which the station is associated. (D.I. 159 at 5)

Defendant manufactures and sells wireless networking equipment, including access points and stations that incorporate technology allowing a station to reduce its transmit power level in response to the reduction in transmit power from an associated access point. (D.I. 159 at 7-8) Defendant also creates wireless networking standards that ensure interoperability of third party systems with its products. (*Id.* at n.6)

B. The '858 Patent

The '858 patent claims a method for automatically adjusting the transmit power

level of a wireless networking station in response to the lowering of the transmit power level of the access point with which the station is associated. ('858 patent, col. 42:54-63) The '858 patent was filed on August 26, 2004 and issued on May 6, 2008. Plaintiff alleges that defendant's products infringe claims 1 and 2 of the '858 patent. (D.I. 156 at 10)

Claim 1 is the only independent claim asserted:

A method for use by a station capable of communicating via an access point in a wireless communications network via a radio frequency channel, comprising the steps of:

receiving a message from the access point, the message containing information indicative of an amount by which to attenuate transmit power, wherein the information is a transmit backoff level that indicates how far the access point's power has been reduced; and
adjusting transmit power by the indicated amount in response to the information in the message.

(Col. 42:54-63)

Claim 2 further limits claim one:

The method of claim 1 wherein the step of adjusting transmit power reduces the station's transmit power relative to maximum transmit power by the transmit back off level received in the message.

(Col. 42:64-67)

C. The Accused Products

There are two kinds of access points that are made and sold by defendant. The first is "unified," meaning that the access points require a separate controller which is used by a network administrator to manage and configure their settings. (D.I. 166 at 2) In contrast, "autonomous" access points can have their settings directly set by a network administrator via a computer interface. (*Id.*)

1. Allegedly infringing technology

Regardless of whether the access point is unified or autonomous, one of two different technologies are used for lowering the transmit power of a station that is associated with it. The first, Dynamic Transmit Power Control ("DTPC"), "is a new [method] that allows the access point to broadcast its transmit power. [Associated stations] can use this information to automatically configure themselves to that power while associated with that access point. In this manner, both devices transmit at the same level." (D.I. 161, ex. F at CA00056538)

The second, Transmit Power Control technology ("TPC"), provides the capability for an access point to tell an associated station to set itself to a particular transmit power. (D.I. 159 at 6) In TPC, the power value with which the station is instructed to set itself is independent of the transmit power settings of the access point. (*Id.*)

No matter the technology used, the access point instructs an associated station to set its transmit power level to a certain value by sending a wireless message to the station. This message is known as Information Element 150 ("I.E. 150"). (*Id.*) I.E. 150 is a hexadecimal value that corresponds to a transmission power in dBm.¹ (D.I. 161, ex. L at ¶ 52)

The route taken to arrive at I.E. 150's value differs slightly depending on whether the access point is unified or autonomous. If the access point is autonomous, the system administrator directly sets a decibel value in the access point's settings that

¹dBm is a unit of measurement known as decibels per milliwatt, and is commonly used to describe radio transmit power. (D.I. 143, ex 2a at ¶ 19)

corresponds to the configured maximum of the access point's transmit power.² (*Id.* at ¶ 60) This value is then sent in I.E. 150 to associated stations. (*Id.*) If the access point is unified, the network administrator sets an integer value in the controller,³ which is then converted by the access point into a corresponding transmit power value in dBm, and sent in I.E. 150 to associated stations.⁴ (D.I. 159 at 9) Only a transmit power value in dBm is sent to the associated station, not the integer value that the controller sent to the access point. (*Id.* at 10)

III. STANDARD OF REVIEW

A court shall grant summary judgment only if "the pleadings, depositions, answers to interrogatories, and admissions on file, together with the affidavits, if any, show that there is no genuine issue as to any material fact and that the moving party is entitled to judgment as a matter of law." Fed. R. Civ. P. 56(c). The moving party bears the burden of proving that no genuine issue of material fact exists. *See Matsushita Elec. Indus. Co. v. Zenith Radio Corp.*, 475 U.S. 574, 586 n.10 (1986). "Facts that could alter the outcome are 'material,' and disputes are 'genuine' if evidence exists from

² The "configured maximum" transmit power level is set either by a system administrator or I.E. 150. However, the actual transmission value may be lower because the access point's actual transmit power is constrained by regulatory and hardware limitations. (*Id.* at ¶ 59) In contrast, the "hardware maximum" transmit power level is the maximum theoretical power level at which the device is capable of transmitting.

³ The integer value of 1 represents the highest transmit power. As the integer values go up (2, 3, 4, etc.), the access point's corresponding broadcast power values go down. (D.I. 159 at 9) Plaintiff refers to these integers as "Power Levels." (*Id.*)

⁴ Once again, this value represents the upper limit to the access point's transmit power. Its actual power may be constrained by regulatory and hardware limitations. (D.I. 182 at 9)

which a rational person could conclude that the position of the person with the burden of proof on the disputed issue is correct." *Horowitz v. Fed. Kemper Life Assurance Co.*, 57 F.3d 300, 302 n.1 (3d Cir. 1995) (internal citations omitted). If the moving party has demonstrated an absence of material fact, the nonmoving party then "must come forward with 'specific facts showing that there is a genuine issue for trial.'" *Matsushita*, 475 U.S. at 587 (quoting Fed. R. Civ. P. 56(e)). The court will "view the underlying facts and all reasonable inferences therefrom in the light most favorable to the party opposing the motion." *Pa. Coal Ass'n v. Babbitt*, 63 F.3d 231, 236 (3d Cir. 1995). The mere existence of some evidence in support of the nonmoving party, however, will not be sufficient for denial of a motion for summary judgment; there must be enough evidence to enable a jury reasonably to find for the nonmoving party on that issue. See *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 249 (1986). If the nonmoving party fails to make a sufficient showing on an essential element of its case with respect to which it has the burden of proof, the moving party is entitled to judgment as a matter of law. See *Celotex Corp. v. Catrett*, 477 U.S. 317, 322 (1986).

IV. DISCUSSION

A. Infringement

1. Standard

A patent is infringed when a person "without authority makes, uses or sells any patented invention, within the United States . . . during the term of the patent." 35 U.S.C. § 271(a). A two-step analysis is employed in making an infringement determination. *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 976 (Fed. Cir.

1995). First, the court must construe the asserted claims to ascertain their meaning and scope. *Id.* Construction of the claims is a question of law subject to de novo review. See *Cybor Corp. v. FAS Techs.*, 138 F.3d 1448, 1454 (Fed. Cir. 1998). The trier of fact must then compare the properly construed claims with the accused infringing product. *Markman*, 52 F.3d at 976. This second step is a question of fact. See *Bai v. L & L Wings, Inc.*, 160 F.3d 1350, 1353 (Fed. Cir. 1998).

"Direct infringement requires a party to perform or use each and every step or element of a claimed method or product." *BMC Res., Inc. v. Paymentech, L.P.*, 498 F.3d 1373, 1378 (Fed. Cir. 2007). "If any claim limitation is absent from the accused device, there is no literal infringement as a matter of law." *Bayer AG v. Elan Pharm. Research Corp.*, 212 F.3d 1241, 1247 (Fed. Cir. 2000). If an accused product does not infringe an independent claim, it also does not infringe any claim depending thereon. See *Wahpeton Canvas Co. v. Frontier, Inc.*, 870 F.2d 1546, 1553 (Fed. Cir. 1989). The patent owner has the burden of proving infringement and must meet its burden by a preponderance of the evidence. *SmithKline Diagnostics, Inc. v. Helena Lab. Corp.*, 859 F.2d 878, 889 (Fed. Cir. 1988) (citations omitted).

2. Analysis

a. "Access point"

The court interprets an access point to be a wireless communications-capable device, or a wireless communications-capable device and its controller, that connects wireless stations with each other and with a wired network. Defendant argues that the controller is a physically separate device in a unified network, and that it should not be

considered a part of the access point. (D.I. 143 at 11) In support of its argument, defendant reasons that, because the patent did not mention a controller, it was not contemplated by the claims. (*Id.*) Defendant does not cite its own expert in support of its argument. Instead, defendant cites wi-fiplanet.com, a website that contains an article written by plaintiff's expert, James T. Geier ("Geier"), wherein Geier explains the difference between "thick" and "thin" access points.⁵ (*Id.*, ex. 10 at 1-2) Defendant alleges that this article demonstrates that the term "access point" "does not include other devices such as . . . controllers that may interface with the [access point] but which do not themselves communicate wirelessly with the wireless stations." (D.I. 143 at 11) The court disagrees that this article supports defendant's contention. Rather, the article simply explains the differences between "thick" and "thin" access points just as was done earlier in this opinion. (*Id.*, ex. 10 at 1-2) The article does not say that a person of skill in the art would consider a controller to be separate from the access point, nor does it discuss the meaning of the term "access point" as used in the '858 patent. (*Id.*)

In contrast, Geier's deposition testimony directly contradicts defendant's argument. During his deposition, Geier opined that one of ordinary skill in the art would understand that the combination of two devices, the access point and the controller, come together to form the functional access point. (D.I. 141, ex. H at 34:24-35:15) As defendant admits, controllers perform "[t]raditional roles of access points, such as association or authentication of wireless clients." (*Id.*, ex. G at CA00020564) Because

⁵ From the website's explanation, "thick" and "thin" access points correspond to autonomous and unified access points as defined by the parties.

much of the functionality of the access point is dependant on the controller, the court finds that the combination of defendant's access points and controllers forms an "access point" within the meaning of the claim limitation.

b. "Information indicative of an amount by which to attenuate transmit power"

The court construes this limitation to mean information indicating the amount by which the station is to reduce its power. As with various limitations at issue, the focus of the parties' dispute has been whether instructing the station to broadcast at 15 dBm (i.e., setting the power) is the same as instructing the station to lower transmission power by 5 dBm, (i.e., attenuating the power) where the station was previously broadcasting at 20 dBm. (D.I. 143 at 12) The prosecution history of the '858 patent supports the court's conclusion that setting the station's transmit power is not the same as attenuating the station's transmit power. Consistent with this conclusion, in an appeal brief explaining an amendment to claim 1 of the '858 patent, plaintiff wrote: "According to the method, the station is responsive to a message indicative of an amount by which to **attenuate** transmit power. In other words, the access point does not instruct the station '[to **set**] transmit at power x,' but rather '**reduce** transmit power by x.'" (D.I. 142, ex. B at ACE00665578-79) (emphasis added)⁶

Defendant's unified and autonomous access points send a transmit value to associated stations via I.E 150. (D.I. 159 at 6) This value comes in the form of a dBm

⁶ Plaintiff further wrote "when an access point signals a power attenuation of X dB in accordance with the present invention, the station learns (1) the amount by which the it should **reduce** its own transmit power." (D.I. 142, ex. B at ACE00665581) (emphasis added)

measurement that represents the maximum configured transmit power of the station. (D.I. 161, ex. L at ¶ 52) It is not an amount by which the station should attenuate power, but the transmit power level itself.⁷ This is exactly the type of message that plaintiff disclaimed during prosecution and cannot claim now. *Felix v. Am. Honda Motor Co., Inc.*, 562 F.3d 1167 1181-82 (Fed. Cir. 2009). Because defendant's products directly set stations' maximum transmit power value, its products do not infringe the asserted claims of the '858 patent as a matter of law.⁸

c. "Transmit backoff level that indicates how far the access point's power has been reduced"

The court construes this limitation to mean data representing the amount by

⁷ Plaintiff attempts to argue the inverse, by claiming that the stations "do not set themselves to the value in I.E. 150, but instead use the value . . . to discern how far an [access point's] transmit power is backed off from maximum and the amount by which the station is to attenuate its transmit power." (D.I. 184 at 13) (emphasis in original) In support of its argument, plaintiff relies on testing performed by defendant's expert, Dr. Vincent Poor ("Poor"). When Poor tested one of defendant's stations that had been configured to a transmission power level of 14 dBm by I.E. 150, he measured a reading that fluctuated between 11-14 dBm. (D.I. 184 at 13) Plaintiff argues that, because the station's transmit power did not hold steady at 14 dBm, it was reducing its power by an indicated amount, and not setting it to a specific amount. (*Id.*) This argument is unpersuasive as the station's operation complies with defendant's explanation that I.E. 150 sets the station's configured maximum transmit power. (D.I. 166 at 11) Plaintiff does not cite an expert's opinion to explain how directly setting a configured maximum transmit power at 14 dBm is the same as attenuating the power from a hardware maximum of 20 dBm. If defendant's products had attenuated their transmit power level by the amount specified in I.E. 150, they would instead transmit at 6 dbm since 20 dBm hardware maximum - I.E. 150 value of 14 dBm = 6 dBm. (D.I. 166 at 11-12)

⁸ Plaintiff also argues that defendant induces infringement by specifying interoperability standards with its products. (D.I. 159 at 16) Because defendant's products do not infringe the asserted claims of the '858 patent, its standards for interoperability with said products do not infringe either. Therefore, plaintiff's infringement by inducement arguments fail as well. The court further notes that plaintiff does not assert a doctrine of equivalents theory in its motion for summary judgment, nor is one cited in its expert report.

which the access point's transmit power has been reduced from maximum. (Col. 8:66-9:2, 13:6-8)

Defendant argues that prosecution history estoppel requires that the transmit power backoff level be referenced from the access point's maximum transmit power. (D.I. 143 at 17) During prosecution of the '858 patent, plaintiff explained that, "[a]s described in the specification at page 19 and supporting claims 2 and 3, 'the [transmit power] [b]ackoff value indicates **how far from maximum power** the sending [access point's] radio has been turned down.'" (D.I. 142, ex. B at ACE00665579) (emphasis added) See also *id.* at ACE00665583 ("as stated in the specification, the [transmit power] [b]ackoff value indicates how far from maximum power the sending access point's radio has been turned down."). Plaintiff counters that the doctrine of claim differentiation prevents such a construction as it would render claim 2 of the '858 patent superfluous.⁹ (D.I. 151 at 13)

"The doctrine of claim differentiation create[s] a presumption that each claim in a patent has a different scope." *Bradford Co. v. Conteyor N. Am., Inc.*, 603 F.3d 1262 1271 (Fed. Cir. 2010) (citing *Comark Commc'ns v. Harris Corp.*, 156 F.3d 1182, 1186 (Fed. Cir. 1998)). However, "the presumption created by the doctrine of claim differentiation is 'not a hard and fast rule and will be overcome by a contrary construction dictated by the written description or prosecution history.'" *Regents of Univ. Of Cal. v. Dakocytomation Cal., Inc.*, 517 F.3d 1364, 1375 (Fed. Cir. 2008) (citing

⁹ This argument also fails because plaintiff later contends that "maximum transmit power" as used in claim 2 refers to the power of the station, not the access point. (D.I. 141 at 15) Therefore, under this construction, claim 2 would not be rendered superfluous.

N. Am. Vaccine, Inc. v. Am. Cyanamid Co., 7 F.3d 1361, 1369 (Fed. Cir. 2005)). Here, the '858 patent's prosecution history overcomes the presumption found in the doctrine of claim differentiation. Plaintiff's statement during prosecution clearly and unambiguously limited the transmit power backoff to an attenuated value based on the maximum transmit power of the access point.

Similar to the limitation found in section IV(A)(2)(b) *supra*, this limitation requires information about how much an access point's transmit power has been reduced, not the value of its current transmit power.¹⁰ Because defendant's I.E. 150 message does not specify the amount by which the access point's transmit power level has been reduced, but instead specifies its current maximum transmit power levels, defendant's products do not literally infringe the asserted claims of the '858 patent as a matter of law.

d. "Adjusting transmit power by the indicated amount"

The court construes this limitation to require reducing the station's transmit power by the amount by which the access point's power has been reduced. (Col. 13:6-12) This construction comports with Geier's opinion as to what one of ordinary skill in the art would understand the limitation to mean. (D.I. 141, ex. H at 110:20-112:13)

Consistent with this court's construction of the other claim limitations, the "indicated amount" is the "transmit backoff level" which indicates both an amount by

¹⁰ Once again, the '858 patent's prosecution history support the court's conclusion. In an attempt to distinguish the '858 patent from U.S. Patent Pub. No. 2004/0057507 ("Rotstein"), plaintiff wrote: "One distinction between Rotstein and the claimed invention is that Rotstein's AP sends data representing the power level at which the [access point] has been **set**, rather than the magnitude of power **attenuation**." (D.I. 142, ex. B at ACE00665581) (emphasis added)

which the station is to attenuate transmit power, and how far the access point's power has been reduced from the hardware maximum. (D.I. 193 at 7) Once again, defendant's products do not reduce their transmit power by the amount indicated in I.E. 150; instead, they set their configured maximum transmit power to said amount. Because of this set to/reduce by dichotomy, defendant's products do not infringe the asserted claims of the '858 patent as a matter of law.

B. Invalidity

1. Anticipation

a. Standard

The standard of proof to establish the invalidity of a patent is "clear and convincing evidence." *Golden Blount, Inc. v. Robert H. Peterson Co.*, 365 F.3d 1054, 1058 (Fed. Cir. 2004). In conjunction with this burden, the Federal Circuit has explained that,

[w]hen no prior art other than that which was considered by the PTO examiner is relied on by the attacker, he has the added burden of overcoming the deference that is due to a qualified government agency presumed to have properly done its job, which includes one or more examiners who are assumed to have some expertise in interpreting the references and to be familiar from their work with the level of skill in the art and whose duty it is to issue only valid patents.

PowerOasis, Inc. v. T-Mobile USA, Inc., 522 F.3d 1299, 1304 (Fed. Cir. 2008) (quoting *Am. Hoist & Derrick Co. v. Sowa & Sons*, 725 F.2d 1350, 1359 (Fed. Cir. 1984)).

An anticipation inquiry involves two steps. First, the court must construe the claims of the patent in suit as a matter of law. See *Key Pharms. v. Hercon Labs. Corp.*, 161 F.3d 709, 714 (Fed. Cir. 1998). Second, the finder of fact must compare the

construed claims against the prior art. *See id.*

Proving a patent invalid by anticipation "requires that the four corners of a single, prior art document describe every element of the claimed invention, either expressly or inherently, such that a person of ordinary skill in the art could practice the invention without undue experimentation." *Advanced Display Sys. Inc. v. Kent State Univ.*, 212 F.3d 1272, 1282 (Fed. Cir. 2000) (citations omitted). The Federal Circuit has stated that "[t]here must be no difference between the claimed invention and the referenced disclosure, as viewed by a person of ordinary skill in the field of the invention." *Scripps Clinic & Research Found. v. Genentech, Inc.*, 927 F.2d 1565, 1576 (Fed. Cir. 1991). The elements of the prior art must be arranged or combined in the same manner as in the claim at issue, but the reference need not satisfy an ipsissimis verbis test. *In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. Mar. 26, 2009) (citations omitted). "In determining whether a patented invention is [explicitly] anticipated, the claims are read in the context of the patent specification in which they arise and in which the invention is described." *Glaverbel Societe Anonyme v. Northlake Mktg. & Supply, Inc.*, 45 F.3d 1550, 1554 (Fed. Cir. 1995). The prosecution history and the prior art may be consulted "[i]f needed to impart clarity or avoid ambiguity" in ascertaining whether the invention is novel or was previously known in the art. *Id.* (internal citations omitted).

b. Discussion

All of defendant's arguments in support of its motions for invalidity are based exclusively on plaintiff's claim construction. (D.I. 188 at 17, 21, 29) Because the court declined to follow plaintiff's construction in the majority of instances, defendant's briefs

are no longer relevant, and its motions for invalidity are denied.

V. CONCLUSION

For the reasons stated above, defendant's products do not infringe the asserted claims of the '858 patent under the court's claim construction. Therefore defendant's motion for summary judgment of noninfringement is granted, plaintiff's motion for summary judgment of infringement is denied, and defendant's motions for summary judgment of invalidity are denied.

An appropriate order shall issue.

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

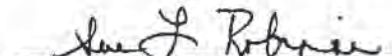
AUTOCELL LABORATORIES, INC.,	)	
	)	
Plaintiff,	)	
	)	
v.	)	Civ. No. 08-760-SLR
	)	
CISCO SYSTEMS INC.,	)	
	)	
Defendant.	)	

ORDER

At Wilmington this 5th day of January 2011, consistent with the memorandum opinion issued this same date;

IT IS ORDERED that:

1. Cisco's motion for summary judgment of noninfringement (D.I. 165) of the '858 patent is granted.
2. Cisco's motions for summary judgment of invalidity (D.I. 156; D.I. 158; D.I. 162) of the '858 patent are denied.
3. Autocell's motion for summary judgment of infringement (D.I. 155) of the '858 patent is denied.


United States District Judge

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

AUTOCELL LABORATORIES, INC.,	)	
	)	
Plaintiff,	)	
	)	
v.	)	C.A. No. 08-760 (SLR)
	)	
CISCO SYSTEMS, INC.,	)	
	)	
Defendant.	)	

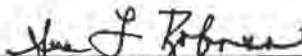
JUDGMENT

In accordance with the Court's January 5, 2011 Memorandum Opinion and Order,
and the January ~~4~~^{18, 2011} Stipulation and Order for Entry of Final Judgment,

IT IS ORDERED AND ADJUDGED

1. That defendant Cisco Systems, Inc. ("Cisco") has not infringed and is not infringing claims 1 and 2 of U.S. Patent 7,369,858;
2. That plaintiff Autocell Laboratories, Inc. take nothing and that its Complaint be dismissed on the merits; and
3. That Cisco recover its costs.

Dated: January ~~4~~^{3/16/11}, 2011


UNITED STATES DISTRICT JUDGE

Electronic Patent Application Fee Transmittal				
Application Number:		12827021		
Filing Date:		30-Jun-2010		
Title of Invention:		PROGRAM FOR ADJUSTING CHANNEL INTERFERENCE BETWEEN ACCESS POINTS IN A WIRELESS NETWORK		
First Named Inventor/Applicant Name:		Floyd Backes		
Filer:		Holmes W. Anderson/Christine Morrisette		
Attorney Docket Number:		160-126		
Filed as Large Entity				
Utility under 35 USC 111(a) 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:	10248567
Application Number:	12827021
International Application Number:	
Confirmation Number:	4411
Title of Invention:	PROGRAM FOR ADJUSTING CHANNEL INTERFERENCE BETWEEN ACCESS POINTS IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Floyd Backes
Customer Number:	34845
Filer:	Holmes W. Anderson/Christine Morrisette
Filer Authorized By:	Holmes W. Anderson
Attorney Docket Number:	160-126
Receipt Date:	07-JUN-2011
Filing Date:	30-JUN-2010
Time Stamp:	13:29:43
Application Type:	Utility under 35 USC 111(a)

Payment information:

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Payment Type	Deposit Account
Payment was successfully received in RAM	\$180
RAM confirmation Number	10579
Deposit Account	504416
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File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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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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 Commissioner for Patents
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 Alexandria, Virginia 22313-1450
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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 (Please Use Block 1 for any change of address)

34845 7390 05/17/2011
 Anderson Gorecki & Manaras LLP
 33 NAOOG PARK
 ACTON, MA 01720

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 transmittal.

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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.

Christine Morrisette (Depositor's name)
 Christine Morrisette (Signature)
 June 21, 2011 (Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/627,021	06/30/2010	Floyd Backer	160-126	4411

TITLE OF INVENTION: PROGRAM FOR ADJUSTING CHANNEL INTERFERENCE BETWEEN ACCESS POINTS IN A WIRELESS NETWORK

APPL. TYPE	SMALL ENTITY	ISSUE FEE DOL	PUBLICATION FEE DOL	PREV. PAID ISSUE FEE	TOTAL FEE DOL	DATE DUE
nonprovisional	NO	\$4510	\$300	\$0	\$4810	08/17/2011

EXAMINER	ART UNIT	CLASS/SUBCLASS
BEAMER, YIMICA M	2617	455-418000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.503).

- ☐ Change of correspondence address (for 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 OK, 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. Anderson Gorecki
 2. & Manaras LLP
 3.

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

PLEASE NOTE: Unless an assignee is identified below, an 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

AUTOCELL LABORATORIES INC.

(B) RESIDENCE (CITY and STATE OR COUNTRY)

Acton, MA

USA

Please check the appropriate assigner category (a 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 resupply 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 504976 (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

Holmes W. Anderson

Date June 21, 2011

Typed or printed name Holmes W. Anderson

Registration No. 37,272

This collection of information is required by 37 CFR 1.911. The information is required to obtain or retain a benefit by the public who 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 person is required to respond to a collection of information unless it displays a valid OMB control number.

Electronic Patent Application Fee Transmittal

Application Number:	12827021			
Filing Date:	30-Jun-2010			
Title of Invention:	PROGRAM FOR ADJUSTING CHANNEL INTERFERENCE BETWEEN ACCESS POINTS IN A WIRELESS NETWORK			
First Named Inventor/Applicant Name:	Floyd Backes			
Filer:	Holmes W. Anderson/Christine Morrisette			
Attorney Docket Number:	160-126			
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
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Pages:				
Claims:				
Miscellaneous-Filing:				
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Patent-Appeals-and-Interference:				
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International Application Number:	
Confirmation Number:	4411
Title of Invention:	PROGRAM FOR ADJUSTING CHANNEL INTERFERENCE BETWEEN ACCESS POINTS IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Floyd Backes
Customer Number:	34845
Filer:	Holmes W. Anderson/Christine Morrisette
Filer Authorized By:	Holmes W. Anderson
Attorney Docket Number:	160-126
Receipt Date:	21-JUN-2011
Filing Date:	30-JUN-2010
Time Stamp:	15:03:05
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$1810
RAM confirmation Number	1509
Deposit Account	504416
Authorized User	
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File Listing:

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Warnings:**Information:**

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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.

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Substitute for form 1449B/PTO				Complete if Known Application Number 12/827,021 Filing Date 06/30/2010 First Named Inventor Backes Group Art Unit 2617 Examiner Name Beamer Attorney Docket Number 160-126	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(use as many sheets as necessary)</i>					
Sheet	1	of	1		

[illegible]

Examiner Signature	/Temica Beamer/	Date Considered	08/02/2011
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹Applicant's unique citation designation number (optional). ²Applicant is to place a check mark here if English language Translation is attached.

Burden Hour Statement: This form is estimated to take 2.0 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, Washington, DC 20231. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO:** Assistant Commissioner for Patents, Washington, DC 20231



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/827,021	06/30/2010	Floyd Backes	160-126	4411
34845	7596	08/10/2011		
Anderson Gorecki & Manaras LLP 33 NAGOG PARK ACTON, MA 01720			EXAMINER BEAMER, TEMICA M	
			ART UNIT 2617	PAPER NUMBER
			NOTIFICATION DATE 08/10/2011	DELIVERY MODE 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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officeadmin@smmalaw.com
cmorrisette@smmalaw.com



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P.O. Box 1450
Alexandria, Virginia 22313-1450

APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
12/827,021	30 June, 2010	BACKES ET AL.	160-126

Anderson Gorecki & Manaras LLP 33 NAGOG PARK ACTON, MA 01720	EXAMINER	
	TEMICA M. BEAMER	
	ART UNIT	PAPER
	2617	20110802

DATE MAILED:

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Commissioner for Patents

The IDS filed 6/7/2011 has been initialed/signed.

/TEMICA M. BEAMER/
Primary Examiner, Art Unit 2617

PTO-90G (Rev.04-03)



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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/827,021	09/20/2011	8023991	160-126	411

34845 7590 08/31/2011
Anderson Gorecki & Manaras LLP
33 NAGOG PARK
ACTON, MA 01720

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 0 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):

Floyd Backes, Sharon, NH;
Gary Vacon, East Falmouth, MA;
Paul Callahan, Carlisle, MA;
William Hawe, Hollis, NH;
Roger Durand, Amherst, NH;

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re U.S. Application Nos:

10/810,083	10/780,594	10/781,157	10/781,476
11/113,672	10/780,595	10/781,159	10/781,520
11/145,712	10/780,775	10/781,191	10/781,525
10/855,208	10/780,798	10/781,192	10/781,526
11/159,955	10/780,800	10/781,214	10/781,535
10/807,484	10/780,804	10/781,219	10/781,536
10/855,669	10/780,817	10/781,222	10/782,457
10/673,636	10/780,818	10/781,228	10/806,785
10/855,263	10/780,836	10/781,250	10/807,477
10/855,671	10/780,840	10/781,252	10/855,675
11/165,007	10/780,841	10/781,259	11/279,317
11/159,481	10/780,842	10/781,284	11/285,514
11/054,221	10/780,844	10/781,288	11/258,612
11/103,403	10/781,013	10/781,308	12/556,079
11/103,408	10/781,121	10/781,309	12/827,021
11/551,412	10/781,136	10/781,361	12/437,085
10/992,050	10/781,137	10/781,458	11/682,912
10/780,593	10/781,147	10/781,474	10/937,550
11/866,445	11/625,982		

Customer No.: 30678

Revocation and Power of Attorney

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

All previous powers of attorney and authorizations of agent are hereby revoked, and the undersigned hereby appoints the attorneys and agents of Connolly Bove Lodge & Hutz LLP associated with U.S. Patent and Trademark Office ("PTO") Customer Number 30678 to prosecute these applications and any U.S., foreign, or international applications under the Patent Cooperation Treaty based on them and to transact all business in the PTO connected therewith, and to receive all communications from the PTO, including the patent documents. Further

4769497

Application Nos.: 10/810,083 et al.

details about each application are found in the Appendix to this paper. The authority under this Power of Attorney of each person listed under the aforementioned PTO Customer Number shall automatically terminate and be revoked upon such person ceasing to be associated with Connolly Bove Lodge & Hutz LLP.

Designation of Correspondence Address

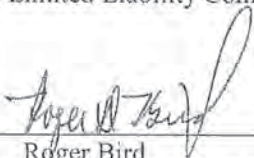
Please associate these applications with PTO Customer Number 30678 and send all notices, official letters, documents, communications, and other correspondence regarding these applications to the address:

Connolly Bove Lodge & Hutz LLP
1875 Eye Street NW, Suite 1100
Washington, DC 20006

or to the address currently associated with PTO Customer Number 30678. Please also record the respective Attorney Docket Numbers in the attached appendix in any applicable databases.

Certificate Under 37 C.F.R. § 3.73(b)

Piccata Fund Limited Liability Company is the assignee of the entire right, title, and interest in these patents and applications by virtue of the chains of assignment shown in the attached Appendix, which are recorded in the records of the PTO. To the best of the undersigned's knowledge and belief, the titles are in the name of said assignee. The undersigned, whose title is supplied below, is empowered to sign this certificate on behalf of Piccata Fund Limited Liability Company.

Signed:  Date: 5/30/12
Name: Roger Bird
Title: Authorized Person Piccata Fund Limited Liability Company

APPENDIX: DETAILS OF LISTED APPLICATIONS

Application No.	10/810,083
Confirmation No.	8218
Patent No.	N/A
Filing Date	3/26/2004
First Named Inventor	Laura Bridge
Title	System And Method For Access Point/Probe Conversion
Attorney Docket No.	27592-01400-US
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015780/Frame 0637; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 028067/Frame 0959.

Application No.	11/113,672
Confirmation No.	8467
Patent No.	7,813,370
Filing Date	4/25/2005
First Named Inventor	Roger Durand
Title	Facilitating Wireless Spectrum Migration
Attorney Docket No.	27592-01401-US
Chain of Title	Assignment from Inventors to Autocell Laboratories, Inc., recorded at Reel 016511/Frame 0463; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	11/145,712
Confirmation No.	3737
Patent No.	7,773,944
Filing Date	6/6/2005
First Named Inventor	Thomas Gulick
Title	RF Domains
Attorney Docket No.	27592-01402-US
Chain of Title	Assignment from Inventors to Autocell Laboratories, Inc., recorded at Reel 016670/Frame 0545; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel

	027852/Frame 0201.
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Application No.	10/855,208
Confirmation No.	9543
Patent No.	7,283,848
Filing Date	5/27/2004
First Named Inventor	Roger Pfister
Title	System And Method For Generating Display Objects Representing Areas Of Coverage, Available Bandwidth And Channel Selection For Wireless Devices In A Wireless Communication Network
Attorney Docket No.	27592-01397-US
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015801/Frame 0481; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027582/Frame 0201.

Application No.	11/159,955
Confirmation No.	4633
Patent No.	7,505,434
Filing Date	6/23/2005
First Named Inventor	Floyd J. Backes
Title	VLAN Tagging In WLANS
Attorney Docket No.	27592-01378-US
Chain of Title	Assignment from Inventors to Autocell Laboratories, Inc., recorded at Reel 016729/Frame 0167; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027582/Frame 0201.

Application No.	10/807,484
Confirmation No.	3044
Patent No.	7,684,783
Filing Date	3/23/2004
First Named Inventor	Gary Vacon
Title	System And Method For Authenticating Devices In A Wireless Network
Attorney Docket No.	27592-01376-US
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at

	Reel 015135/Frame 0702; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.
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Application No.	10/855,669
Confirmation No.	9640
Patent No.	7,043,277
Filing Date	5/27/2004
First Named Inventor	Roger Pfister
Title	Automatically Populated Display Regions For Discovered Access Points And Stations In A User Interface Representing A Wireless Communication Network Deployed In A Physical Environment
Attorney Docket No.	27592-01390-US
Chain of Title	Assignment from Inventors to Propagate Networks, Inc., recorded at Reel 015364/Frame 0652; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/673,636
Confirmation No.	1124
Patent No.	7,606,573
Filing Date	9/29/2003
First Named Inventor	Gary Vacon
Title	Wireless Switched Network
Attorney Docket No.	27592-01391-US
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 014762/Frame 0106, and Reel 015159/Frame 0738; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/855,263
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Confirmation No.	8222
Patent No.	7,660,263
Filing Date	5/27/2004
First Named Inventor	Roger Pfister
Title	Graphical Representations Of Associations Between Devices In A Wireless Communication Network Indicating Available Throughput And Channel Selection
Attorney Docket No.	27592-01392-US
Chain of Title	Assignment from Inventors to Propagate Networks, Inc., recorded at Reel 015243/Frame 0055; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/855,671
Confirmation No.	8659
Patent No.	7,774,028
Filing Date	5/27/2004
First Named Inventor	Roger Pfister
Title	System And Method For Stateful Representation Of Wireless Network Devices In A User Interface To A Wireless Communication Environment Planning And Management System
Attorney Docket No.	27592-01393-US
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015372/Frame 0132; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	11/165,007
Confirmation No.	4553
Patent No.	7,636,550
Filing Date	6/23/2005
First Named Inventor	Michael Yuen
Title	System And Method For Determining Channel Quality In A Wireless Network
Attorney Docket No.	27592-01394-US
Chain of Title	Assignment from Inventor to Autocell Laboratories, Inc., recorded at

	Reel 016729/Frame 0207; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.
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Application No.	11/159,481
Confirmation No.	2008
Patent No.	7,633,901
Filing Date	6/23/2005
First Named Inventor	Michael Yuen
Title	Co-Channel Congestion Method And Apparatus
Attorney Docket No.	27592-01395-US
Chain of Title	Assignment from Inventors to Autocell Laboratories, Inc., recorded at Reel 016725/Frame 0712; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027582/Frame 0201.

Application No.	11/054,221
Confirmation No.	8948
Patent No.	7,505,751
Filing Date	2/9/2005
First Named Inventor	Floyd Backes
Title	Wireless Mesh Architecture
Attorney Docket No.	27592-01396-US
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 016270/Frame 0484; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201

Application No.	11/103,403
Confirmation No.	8699
Patent No.	N/A
Filing Date	4/11/2005
First Named Inventor	Michael Yuen
Title	Backup Channel Selection In Wireless LANs
Attorney Docket No.	27592-01397-US5
Chain of Title	Assignment from Inventors to Autocell Laboratories, Inc., recorded at Reel 016472/Frame 0881; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc.,

Application Nos.: 10/810,083 et al.

	recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 028067/Frame 0959.
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Application No.	11/103,408
Confirmation No.	7584
Patent No.	N/A
Filing Date	4/11/2005
First Named Inventor	Roger Durand
Title	Remedial Actions For Interference in Wireless LANs
Attorney Docket No.	27592-01397-US
Chain of Title	Assignment from Inventors to Autocell Laboratories, Inc., recorded at Reel 016466/Frame 0449; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 028067/Frame 0959.

Application No.	11/551,412
Confirmation No.	1284
Patent No.	7,986,956
Filing Date	10/20/2006
First Named Inventor	Laura Bridge
Title	Supporting Mobile Voice Clients In A WLAN
Attorney Docket No.	27592-01398-US
Chain of Title	Assignment from Inventors to Autocell Laboratories, Inc., recorded at Reel 018722/Frame 0486; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/992,050
Confirmation No.	9123
Patent No.	7,965,686
Filing Date	11/18/2004
First Named Inventor	Laura Bridge
Title	Selecting A Wireless Access Point When Load Information Is Not Provided By All Access Points
Attorney Docket No.	27592-01399-US
Chain of Title	Assignment from Inventors to Propagate Networks, Inc., recorded at Reel 016015/Frame 0532; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories,

	Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.
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Application No.	10/780,593
Confirmation No.	3377
Patent No.	7,206,297
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Method For Associating Access Points With Stations Using Bid Techniques
Attorney Docket No.	27592-01403-US1
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 014994/Frame 0297; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/780,594
Confirmation No.	3370
Patent No.	7,366,504
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Program For Associating Access Points With Stations Using Bid Techniques
Attorney Docket No.	27592-01403-US2
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 014994/Frame 0282; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/780,595
Confirmation No.	3366
Patent No.	7,236,471
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Program For Associating Access Points With Stations In A Wireless Network
Attorney Docket No.	27592-01380-US
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 014994/Frame 0292; change of name from Propagate Networks,

	Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.
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Application No.	10/780,775
Confirmation No.	2754
Patent No.	7,295,537
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Method for Self-Adjusting Power at a Wireless Station to Reduce Inter-Channel Interference
Attorney Docket No.	27592-01380-US1
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015006/Frame 0921; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/780,798
Confirmation No.	1518
Patent No.	7,623,862
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Distributed Protocol For Use In A Wireless Network
Attorney Docket No.	27592-01403-US3
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015001/Frame 0056; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/780,800
Confirmation No.	1516
Patent No.	7,221,943

Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Wireless Station Protocol Program
Attorney Docket No.	27592-01403-US4
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015003/Frame 0859; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/780,804
Confirmation No.	1521
Patent No.	7,248,574
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Apparatus for Selecting an Optimum Access Point in a Wireless Network
Attorney Docket No.	27592-01403-US5
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015003/Frame 0246; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/780,817
Confirmation No.	1490
Patent No.	N/A
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Program for Distributed Channel Selection, Power Adjustment and Load Balancing Decisions in a Wireless Network
Attorney Docket No.	27592-01381-US
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015005/Frame 0256; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel

	027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 028067/Frame 0959.
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Application No.	10/780,818
Confirmation No.	1488
Patent No.	7,366,537
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Wireless Network Apparatus and System
Attorney Docket No.	27592-01380-US2
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015005/Frame 0292; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/780,836
Confirmation No.	3744
Patent No.	7,158,787
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Wireless Sation Protocol Method
Attorney Docket No.	27592-01403-US6
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015034/Frame 0896; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/780,840
Confirmation No.	2505
Patent No.	N/A
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Wireless Access Point Protocol Logic
Attorney Docket No.	27592-01380-US3
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015009/Frame 0251; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent

	for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 028067/Frame 0959.
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Application No.	10/780,841
Confirmation No.	2503
Patent No.	7,167,696
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Method for Scanning Radio Frequency Channels
Attorney Docket No.	27592-01403-US8
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015009/Frame 0268; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/780,842
Confirmation No.	5483
Patent No.	7,274,930
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Distance Determination Program For Use By Devices In A Wireless Network
Attorney Docket No.	27592-01403-US9
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015009/Frame 0562; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/780,844
Confirmation No.	2514
Patent No.	7,149,519
Filing Date	2/18/2004
First Named Inventor	Floyd Backes

Title	Transmission Channel Selection Method
Attorney Docket No.	27592-01380-US4
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015005/Frame 0416; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/781,013
Confirmation No.	2425
Patent No.	7,155,169
Filing Date	2/18/2004
First Named Inventor	William Hawe
Title	Program For Ascertaining A Dynamic Attribute Of A System
Attorney Docket No.	27592-01380-US5
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015009/Frame 0249; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/781,121
Confirmation No.	1979
Patent No.	7,502,347
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Program For Selecting An Optimum Access Point In A Wireless Network
Attorney Docket No.	27592-01403-US11
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015005/Frame 0599; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/781,136
Confirmation No.	3350
Patent No.	7,366,169
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Apparatus For Scanning Radio Frequency Channels
Attorney Docket No.	27592-01403-US
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 014993/Frame 0808; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/781,137
Confirmation No.	3361
Patent No.	7,774,013
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Program For Adjusting Channel Interference Between Access Points In A Wireless Network
Attorney Docket No.	27592-01380-US6
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 014995/Frame 0426; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/781,147
Confirmation No.	6054
Patent No.	7,146,166
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Transmission Channel Selection Program
Attorney Docket No.	27592-01380-US7
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015023/Frame 0136; change of name from Propagate Networks,

	Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.
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Application No.	10/781,157
Confirmation No.	6049
Patent No.	N/A
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Method For Selecting An Optimum Access Point In A Wireless Network
Attorney Docket No.	27592-01403-US12
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015012/Frame 0897; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 028067/Frame 0959.

Application No.	10/781,159
Confirmation No.	6025
Patent No.	7,215,973
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Apparatus For Adjusting Channel Interference Between Access Points In A Wireless Network
Attorney Docket No.	27592-01380-US8
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015012/Frame 0904; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/781,191
Confirmation No.	1762

Patent No.	7,653,407
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Program For Adjusting Channel Interference Between Devices In A Wireless Network
Attorney Docket No.	27592-01380-US9
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 014999/Frame 0403; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/781,192
Confirmation No.	1760
Patent No.	7,167,708
Filing Date	02/18/2004
First Named Inventor	Floyd Backes
Title	Wireless Channel Selection Apparatus Including Scanning Logic
Attorney Docket No.	27592-01380-US10
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 014999/Frame 0398; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/781,214
Confirmation No.	1930
Patent No.	7,505,441
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Method For Selecting An Optimum Access Point In A Wireless Network On A Common Channel
Attorney Docket No.	27592-01403-US13
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015006/Frame 0966; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent

Application Nos.: 10/810,083 et al.

	for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.
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Application No.	10/781,219
Confirmation No.	1936
Patent No.	7,369,858
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Apparatus for Self-Adjusting Power at a Wireless Station to Reduce Inter-Channel Interference
Attorney Docket No.	27592-01380-US12
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015006/Frame 0929; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/781,222
Confirmation No.	2127
Patent No.	7,047,015
Filing Date	02/18/2004
First Named Inventor	William Hawe
Title	Method for Ascertaining a Dynamic Attribute of a System
Attorney Docket No.	27592-01380-US13
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015006/Frame 0919; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/781,228
Confirmation No.	2371
Patent No.	7,274,945
Filing Date	2/18/2004
First Named Inventor	Floyd Backes

Title	Transmission Channel Selection Apparatus
Attorney Docket No.	27592-01380-US14
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015009/Frame 0335; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/781,250
Confirmation No.	3137
Patent No.	7,307,976
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Program for Selection an Optimum Access Point in a Wireless Network on a Common Channel
Attorney Docket No.	27592-01403-US14
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015005/Frame 0879; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/781,252
Confirmation No.	3154
Patent No.	7,149,478
Filing Date	2/18/2004
First Named Inventor	William Hawe
Title	Apparatus for Ascertaining A Dynamic Attribute of a System
Attorney Docket No.	27592-01380-US15
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 014994/Frame 0747; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/781,259
Confirmation No.	3147
Patent No.	7,116,979
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Wireless Channel Selection Method and System Using Scanning for Identifying Access Point
Attorney Docket No.	27592-01380-US16
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015007/Frame 0524; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/781,284
Confirmation No.	2061
Patent No.	7,307,972
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Apparatus for Selecting an Optimum Access Point in a Wireless Network on a Common Channel
Attorney Docket No.	27592-01403-US15
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015006/Frame 0934; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/781,288
Confirmation No.	3344
Patent No.	7,200,395
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Wireless Station Protocol Apparatus
Attorney Docket No.	27592-01403-US16
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at

	Reel 015005/Frame 0901; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.
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Application No.	10/781,308
Confirmation No.	4838
Patent No.	N/A
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Wireless Network Architecture
Attorney Docket No.	27592-01380-US17
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015011/Frame 0347; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 028067/Frame 0959.

Application No.	10/781,309
Confirmation No.	4854
Patent No.	7,149,520
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Wireless Channel Selection Program
Attorney Docket No.	27592-01380-US18
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015010/Frame 0746; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/781,361
Confirmation No.	2771
Patent No.	7,076,220

Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Program for Scanning Radio Frequency Channels
Attorney Docket No.	27592-01403-US17
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015006/Frame 0912; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/781,458
Confirmation No.	1742
Patent No.	7,656,839
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Apparatus for Associating Access Points with Stations in a Wireless Network
Attorney Docket No.	27592-01380-US19
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 014999/Frame 0381; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/781,474
Confirmation No.	3134
Patent No.	7,221,954
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Method for Adjusting Channel Interference Between Access Point in a Wireless Network
Attorney Docket No.	27592-01380-US20
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 014994/Frame 0633; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel

	027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.
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Application No.	10/781,476
Confirmation No.	3160
Patent No.	N/A
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Wireless Network Architecture Comprising Platform Dependent and Platform Independent Characteristics
Attorney Docket No.	27592-01380-US21
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 014993/Frame 0796; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 028067/Frame 0959.

Application No.	10/781,520
Confirmation No.	2922
Patent No.	7,263,369
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Distance Determination Method for Use by Devices in a Wireless Network
Attorney Docket No.	27592-01403-US18
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 014993/Frame 0781; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 028067/Frame 0959.

Application No.	10/781,525
Confirmation No.	2448
Patent No.	7,215,661
Filing Date	2/18/2004
First Named Inventor	Floyd Backes

Title	Method for Associating Access Points with Stations in a Wireless Network
Attorney Docket No.	27592-01380-US22
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015009/Frame 0271; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/781,526
Confirmation No.	2447
Patent No.	7,346,321
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Apparatus for Associating Access Points with Stations Using Bid Techniques
Attorney Docket No.	27592-01403-US19
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015009/Frame 0315; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/781,535
Confirmation No.	2454
Patent No.	7,228,149
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Method for Adjusting Channel Interference Between Devices in a Wireless Network
Attorney Docket No.	27592-01380-US23
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015006/Frame 0909; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to

	Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.
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Application No.	10/781,536
Confirmation No.	2456
Patent No.	7,149,539
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Program for Self-Adjusting Power at a Wireless Station to Reduce Inter-Channel Interference
Attorney Docket No.	27592-01380-US24
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015009/Frame 0282; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/782,457
Confirmation No.	5172
Patent No.	7,248,882
Filing Date	2/18/2004
First Named Inventor	Floyd Backes
Title	Distance Determination Apparatus for use by Devices in a Wireless Network
Attorney Docket No.	27592-01403-US20
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015010/Frame 00355; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 028067/Frame 0959.

Application No.	10/806,785
Confirmation No.	2376
Patent No.	N/A
Filing Date	3/23/2004
First Named Inventor	Gary Vacon
Title	System and Method for Key Generation

Application Nos.: 10/810,083 et al.

Attorney Docket No.	27592-01422-US
Chain of Title	Assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/807,477
Confirmation No.	3054
Patent No.	N/A
Filing Date	3/23/2004
First Named Inventor	Gary Vacon
Title	System And Method For Securing Transmissions In A Wireless Network
Attorney Docket No.	27592-01424-US
Chain of Title	Assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	10/855,675
Confirmation No.	8656
Patent No.	N/A
Filing Date	5/27/2004
First Named Inventor	Roger Pfister
Title	Architecture For A Wireless Communication Environment Planning And Management System
Attorney Docket No.	27592-01425-US
Chain of Title	Assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	11/279,317
Confirmation No.	7944
Patent No.	7,636,576
Filing Date	4/11/2006
First Named Inventor	Roger Pfister
Title	System And Method For Determining And Representing One Or More Potential Physical Locations Of A Newly Detected Wireless Network Device
Attorney Docket No.	27592-01377-US1
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 028068/Frame 0258; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 028070/Frame 0486; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	11/285,514
Confirmation No.	9232
Patent No.	7,127,275
Filing Date	11/22/2005

First Named Inventor	Roger Pfister
Title	Automatically Populated Display Regions For Discovered Access Points And Astations In A User Interface Representing A Wireless Communication Network Deployed In A Physical Environment
Attorney Docket No.	27592-01390-US1
Chain of Title	Assignment from Inventors to Autocell Laboratories, Inc., recorded at Reel 017359/Frame 0271 (correction to recordation cover sheet recorded at Reel 028070/Frame 0291); change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 028070/Frame 0486; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	11/258,612
Confirmation No.	1453
Patent No.	N/A
Filing Date	10/25/2005
First Named Inventor	Gary Vacon
Title	Wireless Switch Network
Attorney Docket No.	27592-01391-US1
Chain of Title	Assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	12/556,079
Confirmation No.	1850
Patent No.	7,970,408
Filing Date	9/9/2009
First Named Inventor	Gary Vacon
Title	Wirless Switched Network
Attorney Docket No.	27592-01391-US2
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 028068/Frame 0330; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 028070/Frame 0486; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	12/827,021
Confirmation No.	4411
Patent No.	8,023,991
Filing Date	6/30/2010
First Named Inventor	Floyd Backes
Title	Program For Adjusting Channel Interference Between Access Points In A Wireless Network
Attorney Docket No.	27592-01380-US27
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at

	Reel 028068/Frame 0403; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 028070/Frame 0486; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.
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Application No.	12/437,085
Confirmation No.	6798
Patent No.	7,890,131
Filing Date	5/7/2009
First Named Inventor	Floyd Backes
Title	Program For Adjusting Channel Interference Between Devices In A Wireless Network
Attorney Docket No.	27592-01380-US28
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 028068/Frame 0419; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 028070/Frame 0486; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	11/682,912
Confirmation No.	9927
Patent No.	N/A
Filing Date	3/7/2007
First Named Inventor	Floyd Backes
Title	Wireless Network Architecture
Attorney Docket No.	27592-01380-US29
Chain of Title	Assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 028067/Frame 0959.

Application No.	10/937,550
Confirmation No.	2500
Patent No.	7,085,588
Filing Date	9/9/2004
First Named Inventor	Roger Pfister
Title	System And Method For Determining And Representing One Or More Potential Physical Locations Of A Newly Detected Wireless Network Device
Attorney Docket No.	27592-01377-US
Chain of Title	Assignment from Inventor to Propagate Networks, Inc., recorded at Reel 015801/Frame 0604; change of name from Propagate Networks, Inc., to Autocell Laboratories, Inc., recorded at Reel 015743/Frame 0534; release of security agreement by Albert A. Holman, III (agent for lenders) to Autocell Laboratories, Inc., recorded at Reel 017382/Frame 0502, Reel 027781/Frame 0447, and Reel 027851/Frame 0628; assignment from Autocell Laboratories, Inc., to

	Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.
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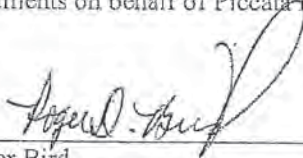
Application No.	11/866,445
Confirmation No.	7152
Patent No.	7,869,822
Filing Date	10/3/2007
First Named Inventor	Floyd Backes
Title	Wireless Network Apparatus And System Field Of The Invention
Attorney Docket No.	27592-01380-US25
Chain of Title	Assignment from Inventors to Autocell Laboratories, Inc., recorded at Reel 027766/Frame 0966; assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	11/625,982
Confirmation No.	9393
Patent No.	N/A
Filing Date	1/23/2007
First Named Inventor	Roger Pfister
Title	Automatically Populated Display Regions For Discovered Access Points And Stations In A User Interface Representing A Wireless Communication Network Deployed In A Physical Environment
Attorney Docket No.	27592-01390-US2
Chain of Title	Assignment from Autocell Laboratories, Inc., to Piccata Fund Limited Liability Company, recorded at Reel 027852/Frame 0201.

Application No.	
Confirmation No.	
Patent No.	
Filing Date	
First Named Inventor	
Title	
Attorney Docket No.	
Chain of Title	

DECLARATION REGARDING AUTHORITY TO SIGN
ON BEHALF OF A LEGAL ENTITY
37 C.F.R. 3.73(b)(2)(i)

I, Roger Bird (whose title is supplied below), hereby declare that I am authorized to sign documents on behalf of Piccata Fund Limited Liability Company.



Roger Bird

Authorized Person for Piccata Fund Limited Liability Company

5/9/12

Date

Electronic Acknowledgement Receipt	
EFS ID:	12912122
Application Number:	12827021
International Application Number:	
Confirmation Number:	4411
Title of Invention:	PROGRAM FOR ADJUSTING CHANNEL INTERFERENCE BETWEEN ACCESS POINTS IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Floyd Backes
Customer Number:	34845
Filer:	Burton A. Amernick/Valerie Williams
Filer Authorized By:	Burton A. Amernick
Attorney Docket Number:	160-126
Receipt Date:	01-JUN-2012
Filing Date:	30-JUN-2010
Time Stamp:	12:44:33
Application Type:	Utility under 35 USC 111(a)

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	Power of Attorney	AutocellRevocation_PoA_Pt2_Signed.pdf	8138423 cc33547e0e080740f95a716d0bab7dfe2re0437	no	31
Warnings:					
Information:					

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

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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/827,021	06/30/2010	Floyd Backes	160-126

34845
Anderson Gorecki & Manaras LLP
33 NAGOG PARK
ACTON, MA 01720

CONFIRMATION NO. 4411
POWER OF ATTORNEY NOTICE



OC000000054660281*

Date Mailed: 06/07/2012

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/01/2012.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

/snguyen/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/827,021	06/30/2010	Floyd Backes	27592-01380-US27

CONFIRMATION NO. 4411
POA ACCEPTANCE LETTER

30678
CONNOLLY BOVE LODGE & HUTZ LLP
1875 EYE STREET, N.W.
SUITE 1100
WASHINGTON, DC 20006



Date Mailed: 06/07/2012

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/01/2012.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/snguyen/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

☒ Practitioners associated with the Customer Number:

00570

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

☒ The address associated with Customer Number:

00570

OR

☐ Firm or Individual Name

Address

City

State

Zip

Country

Telephone

Email

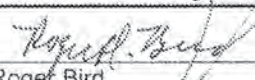
Assignee Name and Address:

Piccata Fund Limited Liability Company
2711 Centerville Road
Suite 400
Wilmington, DE 19808

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

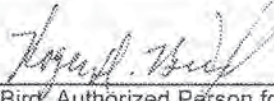
Signature		Date	11/25/14
Name	Roger Bird	Telephone	
Title	Authorized Person for Piccata Fund Limited Liability Company		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. 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. 422 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 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.

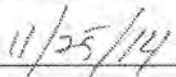
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2

DECLARATION REGARDING AUTHORITY TO SIGN ON BEHALF OF A LEGAL ENTITY
(37 C.F.R. 3.73(b)(2)(i))

I, Roger Bird (whose title is supplied below), hereby declare that I am authorized to sign on behalf of Piccata Fund Limited Liability Company.



Roger Bird, Authorized Person for Piccata Fund Limited Liability Company



Date

Electronic Acknowledgement Receipt	
EFS ID:	21247570
Application Number:	12827021
International Application Number:	
Confirmation Number:	4411
Title of Invention:	PROGRAM FOR ADJUSTING CHANNEL INTERFERENCE BETWEEN ACCESS POINTS IN A WIRELESS NETWORK
First Named Inventor/Applicant Name:	Floyd Backes
Customer Number:	30678
Filer:	Jeffrey W. Gluck/Denise Porreca
Filer Authorized By:	Jeffrey W. Gluck
Attorney Docket Number:	27592-01380-US27
Receipt Date:	21-JAN-2015
Filing Date:	30-JUN-2010
Time Stamp:	09:05:41
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Assignee showing of ownership per 37 CFR 3.73.	STATEMENT_UNDER_PRE_AIA_SECTION_373b_OR_POST_AIA_373c.PDF	451313 815d003d9388c79590088c508f50113c0945201	no	1

Warnings:

Information:

2	Power of Attorney	Autocell_US_POA_SB80_and_Declaration_to_Sign_Panitch_signed.PDF	1104167 810Jh0X3C9H12544r91dcxb80f230da2744 a63037	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			1555480		
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. <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.					

STATEMENT UNDER PRE AIA SECTION 3.73(b) OR POST AIA 3.73(c)Piccata Fund Limited Liability CompanyApplication No./Patent No.: 8,023,991 Filed/Issue Date: September 20, 2011Titled: PROGRAM FOR ADJUSTING CHANNEL INTERFERENCE BETWEEN ACCESS POINTS IN A WIRELESS NETWORKPiccata Fund Limited Liability Company, aLimited Liability Company

(Name of Assignee)

(Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

1. ☒ the assignee of the entire right, title, and interest in;
2. ☐ an assignee of less than the entire right, title, and interest in
(The extent (by percentage) of its ownership interest is _____ %); or
3. ☐ the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made) the patent application/patent identified above, by virtue of either:
- A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy therefore is attached.

OR

- B. ☒ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: Backes et al. To: Propagate Networks Inc.
The document was recorded in the United States Patent and Trademark Office at
Reel 028068, Frame 0403, or for which a copy thereof is attached.
2. From: Propagate Networks Inc. To: Autocell Laboratories, Inc.
The document was recorded in the United States Patent and Trademark Office at
Reel 028070, Frame 0486, or for which a copy thereof is attached.
3. From: Autocell Laboratories, Inc. To: Piccata Fund Limited Liability Company
The document was recorded in the United States Patent and Trademark Office at
Reel 027852, Frame 0201, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).☐ As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Jeffrey W. Gluck/

Signature

January 15, 2015

Date

Jeffrey W. Gluck, Ph.D.

Printed or Typed Name

Attorney for Assignee

Title

JWG/ah



UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/827,021	06/30/2010	Floyd Backes	27592-01380-US27

CONFIRMATION NO. 4411

POWER OF ATTORNEY NOTICE



OC000000073078036

30678
NOVAK DRUCE CONNOLLY BOVE + QUIGG LLP
(DC OFFICE)
1875 EYE STREET, N.W.
SUITE 1100
WASHINGTON, DC 20006

Date Mailed: 01/29/2015

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 01/21/2015.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

/s/entchit/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/827,021	06/30/2010	Floyd Backes	27592-01380-US27

CONFIRMATION NO. 4411

POA ACCEPTANCE LETTER

570
PANITCH SCHWARZE BELISARIO & NADEL LLP
ONE COMMERCE SQUARE
2005 MARKET STREET, SUITE 2200
PHILADELPHIA, PA 19103



Date Mailed: 01/29/2015

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 01/21/2015.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/sleutcht/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101