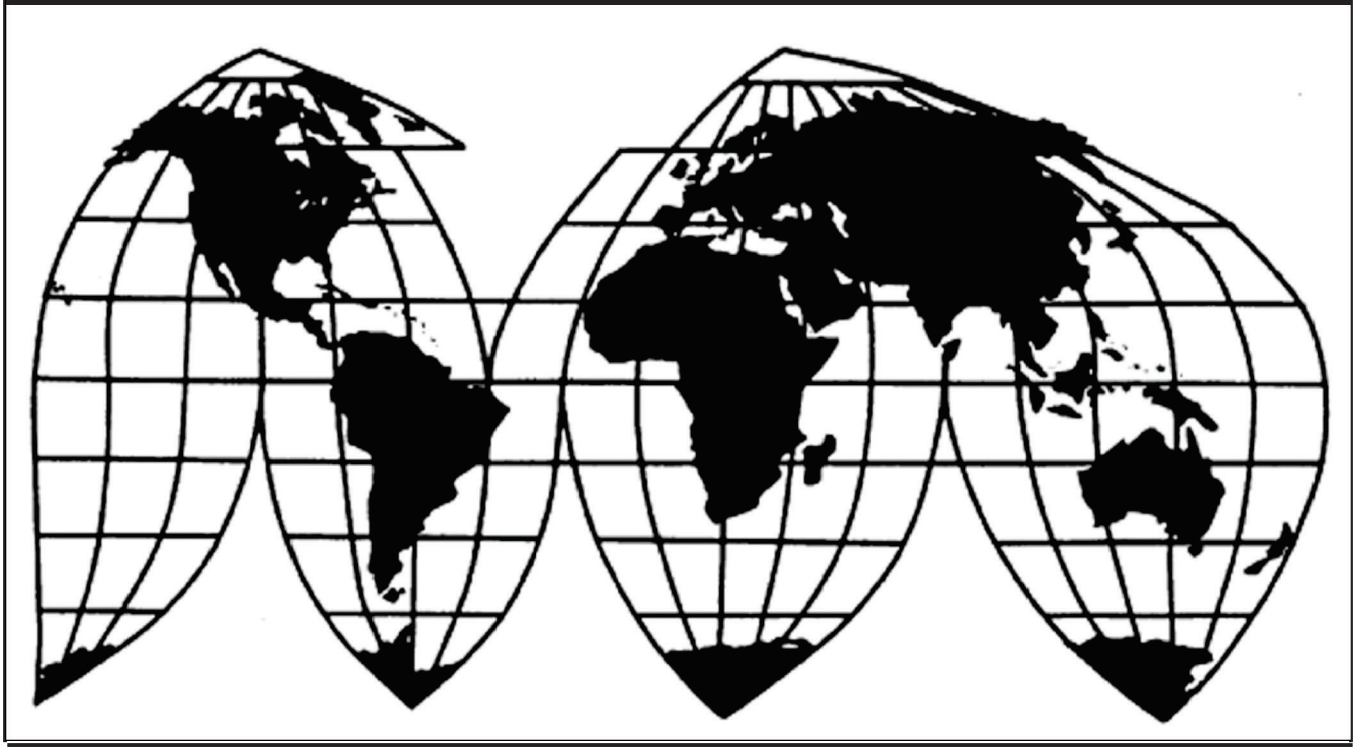
In the Matter of

CERTAIN MOBILE ELECTRONIC DEVICES AND RADIO FREQUENCY AND PROCESSING COMPONENTS THEREOF

Investigation No. 337-TA-1065

Publication 4981 **September 2019**

U.S. International Trade Commission



Washington, DC 20436

U.S. International Trade Commission

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Address all communications to
Secretary to the Commission
United States International Trade Commission
Washington, DC 20436

U.S. International Trade Commission

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UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C.

In The Matter of **CERTAIN MOBILE ELECTRONIC DEVICES AND RADIO FREQUENCY AND PROCESSING COMPONENTS THEREOF**	Investigation No. 337-TA-1065

NOTICE OF THE COMMISSION'S FINAL DETERMINATION FINDING NO VIOLATION OF SECTION 337; TERMINATION OF THE INVESTIGATION

AGENCY: U.S. International Trade Commission.

ACTION: Notice.

SUMMARY: Notice is hereby given that the U.S. International Trade Commission (the "Commission") has determined that no violation of 19 U.S.C. 1337, as amended ("Section 337"), has been proven in the above-captioned investigation and accordingly no remedial orders shall be issued, which renders moot any issues of remedy, the public interest, or bonding. The investigation is terminated.

FOR FURTHER INFORMATION CONTACT: Carl P. Bretscher, Office of the General Counsel, U.S. International Trade Commission, 500 E Street, SW, Washington, DC 20436, telephone (202) 205-2382. Copies of non-confidential documents filed in connection with this investigation are or will be available for inspection during official business hours (8:45 a.m. to 5:15 p.m.) in the Office of the Secretary, U.S. International Trade Commission, 500 E Street, SW, Washington, DC 20436, telephone (202) 205-2000. General information concerning the Commission may also be obtained by accessing its Internet server (*https://www.usitc.gov*). The public record for this investigation may be viewed on the Commission's Electronic Docket Information System ("EDIS") (*https://edis.usitc.gov*). Hearing-impaired persons are advised that information on this matter can be obtained by contacting the Commission's TDD terminal, telephone (202) 205-1810.

SUPPLEMENTARY INFORMATION: On August 14, 2017, the Commission instituted this investigation based on a Complaint and amendment thereto filed by Qualcomm Incorporated of San Diego, California ("Qualcomm"). 82 FR 37899 (Aug. 14, 2017). The Complaint alleged that 19 U.S.C. 1337, as amended ("Section 337"), has been violated by way of importation into the United States, sale for importation, or sale within the United States after importation of certain mobile electronic devices and radio frequency and processing components thereof that infringe one or more claims of U.S. Patent No. 9,535,490 ("the '490 patent"), U.S. Patent No. 8,698,558 ("the '558 patent"), U.S. Patent No. 8,633,936 ("the '936 patent"), U.S. Patent No. 8,838,949 ("the '949 patent"), U.S. Patent No. 9,608,675 ("the '675 patent"), and U.S. Patent No. 8,487,658 ("the '658 patent"). The notice of investigation named Apple Inc. of Cupertino,

California ("Apple") as Respondent. The Commission also named the Office of Unfair Import Investigations ("OUII") as a party.

The Commission, following Qualcomm's motions, partially terminated the investigation with respect to the following claims and patents: all asserted claims of the '658, '949, and '675 patents; claims 1, 20-24, 26, 38, 67, and 68 of the '936 patent; claims 1, 6, and 8-20 of the '558 patent; and claims 1-6, 8, 10, and 16-17 of the '490 patent. Comm'n Notice (July 17, 2018) (*aff'g* Order No. 43); Comm'n Notice (May 23, 2018) (*aff'g* Order No. 37); Comm'n Notice (May 9, 2018) (amending notice of investigation); Comm'n Notice (Apr. 6, 2018) (*aff'g* Order No. 34); Comm'n Notice (Mar. 22, 2018) (*aff'g* Order No. 24); Comm'n Notice (Sept. 20, 2017) (*aff'g* Order No. 6). The only claims that remain at issue in this investigation are claim 31 of the '490 patent, claim 7 of the '558 patent, and claims 19, 25, and 27 of the '936 patent.

The ALJ held an evidentiary hearing from June 19-27, 2018. On September 28, 2018, the ALJ issued a combined initial determination ("ID") on violation issues and recommended determination ("RD") on remedy, the public interest, and bonding in this investigation. The ID found a violation of Section 337 due to infringement of the '490 patent. ID at 197. The ID found no infringement and hence no violation of Section 337 with respect to the '558 patent or the '936 patent. *Id.* The ID found that Qualcomm satisfied the technical and economic prongs of the domestic industry requirement with respect to the '490 patent, but did not satisfy the technical prong with respect to the '558 patent or the '936 patent. *Id.* The ID also found that it was not shown by clear and convincing evidence that any asserted claim was invalid. *Id.* The ALJ further recommended that no limited exclusion order or cease-and-desist order be issued in this investigation due to their prospective effects on competitive conditions in the United States, national security, and other public interest concerns. RD at 199-200. The ALJ recommended that bond be set at zero-percent of entered value during the Presidential review period, if any. *Id.* at 201.

Apple and Qualcomm filed their respective petitions for review on October 15, 2018. The parties, including OUII, filed their respective responses to the petitions on October 23, 2018. The parties also filed their submissions on the public interest on October 31, 2018. Intel Corporation, an interested third party, submitted its comments on the public interest on November 8, 2018.

On December 18, 2018, the Commission determined to review the final ID in part with respect to certain findings regarding the '490 patent. 83 FR 64875 (Dec. 18, 2018). The Commission determined to review the ID's construction of the term "hold" and its findings on infringement and the technical prong of domestic industry to the extent they may be affected by that claim construction. *Id.* at 64876. The Commission further determined to review the ID's findings as to whether claim 31 of the '490 patent is invalid as obvious. *Id.* at 64876-77. The Commission determined not to review any of the ID's findings with respect to the '558 patent, the '936 patent, or the economic prong of the domestic industry requirement. *Id.* at 64876.

In the same notice, the Commission asked the parties to brief issues of remedy, the public interest, and bonding. *Id.* at 64877. The Commission also invited members of the public and interested government agencies to comment on the RD's findings on the public interest, remedy, and bonding. *Id.* The Commission received a number of public interest statements from third

parties, including but not limited to Intel Corporation; ACT/The App Association; the American Antitrust Institute; the American Conservative Union; Americans for Limited Government; the Club for Growth; the Computer and Communications Industry Association; Conservatives for Property Rights; Frances Brevets; Frontiers of Freedom; Innovation Alliance; Inventors Digest; IP Europe; Public Knowledge and Open Markets (a joint submission); R Street Institute, the Electronic Frontier Foundation, Engine Advocacy, and Lincoln Network (a joint submission), *et al.*; RED Technologies; TiVo; certain members of the U.S. Senate and the U.S. House of Representatives; Hon. Paul Michel, former Chief Judge, U.S. Court of Appeals for the Federal Circuit; and various professors of law or economics.

On March 19, 2019, while Commission review was ongoing, the parties informed the Commission of a jury verdict in a parallel lawsuit in the U.S. District Court for the Southern District of California, *Qualcomm Inc. v. Apple Inc.*, Case No. 3:17-cv-01375 (S.D. Cal.). *See* Letter of D. Okun to D. Johanson, Chairman, U.S. International Trade Commission of March 19, 2019 ("Qualcomm Letter"); Respondent Apple Inc.'s Request for Leave to Submit a Supplemental Response to Question D of the Commission's Questions on the Public Interest ("Apple Request"). The jury found that the accused Apple iPhones infringe three Qualcomm patents. Qualcomm Letter at 1-2. Two of those three patents, the '490 and '936 patents, are also part of this investigation. *Id.* The jury was not asked to determine, nor did it determine, whether any claim of the '490, '936, or '949 patents is invalid as obvious. *Id.*

In view of the jury's verdict and damages award, Apple requested leave to supplement its response to the Commission's Question D on public interest, as set forth in the Commission's notice of partial review. *See* 83 FR at 64877. Qualcomm filed an opposition to Apple's request. The Commission has determined to grant Apple's request for the limited purpose of supplementing the record with respect to the jury's verdict. Neither Apple's nor Qualcomm's submissions affect the outcome of this investigation or any issue decided by the Commission.

On review of the submissions from the parties and the public, the prior art, the ID, and the evidence of record, the Commission has determined: (1) the term "hold" in claim 31 of the '490 patent means "to prevent data from traveling across the bus, or to store, buffer, or accumulate data"; and (2) Apple has shown by clear and convincing evidence that claim 31 of the '490 patent is invalid as obvious over U.S. Patent No. 9,329,671 (Heinrich) in combination with U.S. Patent No. 8,160,000 (Balasubramanian), which reflects knowledge in the art.

The Commission previously declined to review, and therefore adopted, the ID's finding that there is no infringement of either of the other two patents asserted in this investigation, the '558 patent or the '936 patent. 83 FR at 64876. Accordingly, the Commission has concluded that Complainant has not shown a violation of Section 337 and no remedial orders shall be issued, which renders moot any issues of remedy, the public interest, or bonding.

The authority for the Commission's determination is contained in Section 337 of the Tariff Act of 1930, as amended (19 U.S.C. 1337), and in part 210 of the Commission's Rules of Practice and Procedure (19 CFR part 210).

By order of the Commission.

Lisa R. Barton
Secretary to the Commission

Issued: March 26, 2019

CERTAIN MOBILE ELECTRONIC DEVICES AND RADIO FREQUENCY AND PROCESSING COMPONENTS THEREOF **Inv. No. 337-TA-1065**

PUBLIC CERTIFICATE OF SERVICE

I, Lisa R. Barton, hereby certify that the attached **NOTICE** has been served upon the following parties as indicated, on **March 26, 2019**.

Lisa R. Barton, Secretary
U.S. International Trade Commission
500 E Street, SW, Room 112
Washington, DC 20436

On Behalf of Complainants Qualcomm Incorporated:

S. Alex Lasher, II, Esq.
QUINNN EMANUEL URQUHART & SULLIVAN LLP
1300 I Street NW, Suite 900
Washington, DC 20005

☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other:_____

On Behalf of Respondent Apple Inc.:

Lauren A. Degnan
FISH & RICHARDSON P.C.
1000 Maine Avenue, SW
Suite 1000
Washington, DC 20024

☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other:_____

PUBLIC VERSION

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C.

In The Matter Of CERTAIN MOBILE ELECTRONIC DEVICES AND RADIO FREQUENCY AND PROCESSING COMPONENTS THEREOF	Investigation No. 337-TA-1065

COMMISSION OPINION

I. INTRODUCTION

This investigation is before the Commission for a final determination on the issues under review, whether there is a violation of 19 U.S.C. § 1337, as amended ("Section 337"), and, as appropriate, remedy, the public interest, and bonding. *See* Comm'n Determination to Review In Part a Final Initial Determination Finding a Violation of Section 337, 83 *Fed. Reg.* 64875 (Dec. 18, 2018). For the reasons set forth below, the Commission has determined the following:

(1) With respect to claim 31 of U.S. Patent No. 9,535,490 ("the '490 patent"), the Commission has determined to modify the presiding administrative law judge's ("ALJ's") construction of the claim term "hold" to mean "to prevent data from traveling across the bus or to store, buffer, or accumulate data." *See* Initial Determination and Recommended Determination ("ID" and "RD," respectively[1]) at 74-75 (Sept. 28, 2018). The modified construction more accurately denotes the plain and ordinary meaning of the term as used in the context of the '490 patent.

(2) The Commission has determined to reverse the ID's finding that claim 31 of the '490 patent is not invalid as obvious and finds that Apple has presented clear and convincing evidence that claim 31 is obvious over U.S. Patent No. 9,329,671 ("Heinrich") in combination with U.S. Patent No. 8,160,000 ("Balasubramanian"), where Balasubramanian reflects the knowledge in the art. The Commission further finds that the alleged long-felt but unmet need for saving power in mobile devices lacks a sufficient nexus to the claimed invention and is insufficient to outweigh the evidence of its *prima facie* obviousness. *See* ID at 87-96.

[1] Specifically, "ID" refers to those portions directed to background and violation issues (pp. 1-114, 197-98), and "RD" refers to those portions directed to the public interest, remedy, and bonding (pp. 114-197, 198-201).

The Commission previously determined not to review, and therefore adopted, the ID's finding that there is no infringement of the other two patents asserted in this investigation, U.S. Patent Nos. 8,698,558 ("the '558 patent") and 8,633,936 ("the '936 patent"). 83 *Fed. Reg.* at 64876. Accordingly, the Commission has concluded that Complainant has not shown a violation of Section 337 and that no remedial orders shall be issued, which renders moot any issues of remedy, the public interest, or bonding.

II. PROCEDURAL HISTORY

The Commission instituted the present investigation on August 14, 2017, on a complaint filed by Qualcomm Incorporated ("Qualcomm") of San Diego, California. 82 *Fed. Reg.* 37899 (Aug. 14, 2017). The complaint accused Apple, Inc. ("Apple") of Cupertino, California, of violating Section 337 by importing into the United States, selling for importation, or selling in the United States after importation certain mobile electronic devices and components thereof that allegedly infringe the asserted claims of the '490 patent, '558 patent, and '936 patents.[2] The Office of Unfair Import Investigations ("OUII") was also named a party to this investigation.

The accused products include Apple's iPhone 7, iPhone 7 Plus, iPhone 8, iPhone 8 Plus, and iPhone X smart phones that use certain baseband processor chipsets supplied by Intel Corporation ("Intel"), a third party to this investigation. ID at 72-73. Each Apple application processor is connected to an Intel baseband processor by a peripheral component interconnect express ("PCIe") bus. *Id.*

[2] Qualcomm originally asserted three other patents but later voluntarily withdrew them from the investigation: U.S. Patent Nos. 8,838,949 ("the '949 patent"), 9,608,675, and 8,487,658. 83 *Fed. Reg.* 64875, 6476 (Dec. 18, 2018) (discussing *inter alia* Comm'n Notice (May 23, 2018), Comm'n Notice (Sept. 20, 2017)). Those patents are no longer at issue in this investigation.

On January 24, 2018, the ALJ held a *Markman* hearing to resolve the parties' arguments on the disputed claim terms. On March 5, 2018, the ALJ issued Order No. 28, which construed ten terms from four of the asserted patents but not the '490 patent.

The ALJ held an evidentiary hearing from June 15, 2018, to June 26, 2018. By that time, Qualcomm had withdrawn certain patents and claims, leaving just claim 31 of the '490 patent, claim 7 of the '558 patent, and claims 19, 25, and 27 of the '936 patent. ID at 3. On September 29, 2018, the ALJ issued a combined initial determination and recommended determination. The ID found that Apple infringes asserted claim 31 of the '490 patent, but does not infringe any claim of the '558 or '936 patents. *Id.* at 197. The ID found that Qualcomm satisfies the technical prong of the domestic industry requirement with respect to the '490 patent but not the '558 or '936 patents. *Id.* The ID further found that Qualcomm satisfies the economic prong of domestic industry with respect to all three patents. *Id.* The ID did not find any of the asserted claims invalid. *Id.*

The ID concluded that Apple is violating Section 337 in the importation, sale for importation, or sale in the United States after importation of mobile electronic devices that infringe claim 31 of the '490 patent. *Id.* at 197-98. Despite finding a violation of Section 337, the ID recommended that the Commission decline to issue a limited exclusion order or cease and desist order because it found that public interest concerns, particularly competitive conditions in the United States and national security, weighed against issuing any such remedy. RD at 198-200. The RD found that excluding Apple iPhones using Intel baseband processor chipsets would likely force Intel to exit the market for supplying 4G and next-generation 5G baseband technologies, leaving Qualcomm as the sole U.S. supplier for baseband processor chipsets in these critical technological areas. *See generally id.* at 114-97. The RD also recommended

setting the bond at zero percent of entered value during the period of Presidential review because Qualcomm does not sell products that directly compete with the accused Apple smart phones. *Id.* at 201.

The Commission determined to review the ID in part with respect to certain violation issues affecting claim construction, infringement, and invalidity of the '490 patent. 83 *Fed. Reg.* at 64876-77. The Commission determined not to review, and thereby adopted, the ID's findings of no infringement and hence no Section 337 violation with respect to the '558 and '936 patents. *Id.* at 64876. The Commission also asked the parties, interested members of the public, and interested government agencies to address the RD and issues relating to remedy, public interest, and bonding in the event the Commission were to find a violation of Section 337. *Id.* at 64877.

The parties filed their initial responses to the Commission's questions on review on February 7, 2019.[3] On the same date, third-party Intel Corporation filed its own response to the Commission's questions on remedy and the public interest.[4] On February 14, 2019, the parties filed their respective replies to the opposing parties' submissions.[5] The Commission also received numerous submissions from the public both in support of and in opposition to the RD's

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[3] *See* Complainant Qualcomm Incorporated's Written Submission Pursuant to the Commission's December 12, 2018, Notice ("Qualcomm's Resp."); Respondent Apple Inc.'s Written Submission Regarding the Commission's Questions on the Issues Under Review, and on Remedy, Bonding, and the Public Interest ("Apple's Resp."); Brief of the Office of Unfair Import Investigations on Issues Under Review and on Remedy, the Public Interest, and Bonding ("OUII's Resp.").

[4] *See* Statement in Response to the Commission's Notice of Determination to Review in Part a Final Determination Finding a Violation of Section 337.

[5] *See* Complainant Qualcomm Incorporated's Reply Submission Pursuant to the Commission's December 12, 2018 Notice ("Qualcomm's Reply"); Respondent Apple Incorporated's Reply Submission Regarding the Commission's Questions Under Review and on Remedy, the Public Interest, and Bonding ("Apple's Reply"); Reply Brief of the Office of Unfair Import Investigations on Issues Under Review and on Remedy, the Public Interest and Bonding ("OUII's Reply").

recommendation that the public interest outweighs issuance of any remedial orders in the event a violation is found.

On March 19, 2019, while Commission review was ongoing, the parties informed the Commission of a jury verdict in a parallel lawsuit in the U.S. District Court for the Southern District of California, *Qualcomm Inc. v. Apple Inc.*, Case No. 3:17-cv-01375 (S.D. Cal.).[6] *See* Letter of D. Okun to D. Johanson, Chairman, U.S. International Trade Commission of March 19, 2019 ("Qualcomm Letter"); Respondent Apple Inc.'s Request for Leave to Submit a Supplemental Response to Question D of the Commission's Questions on the Public Interest ("Apple Request"). The jury found that the accused Apple iPhones infringe three Qualcomm patents. Qualcomm Letter at 1-2. Two of those three patents, the '490 and '936 patents, are also part of this investigation, as noted above. *Id.* Qualcomm originally asserted the third patent, the '949 patent, in this investigation but later withdrew it. *See* fn. 1, *supra.* The jury was not asked to determine, nor did it determine, whether any claim of the '490, '936, or '949 patents is invalid as obvious. Qualcomm Letter at 2.

In view of the jury's verdict and damages award, Apple requested leave to supplement its response to the Commission's Question D on public interest, as set forth in the Commission's notice of partial review. *See* 83 *Fed. Reg.* 64875, 64877 (Dec. 18, 2018). Qualcomm filed an opposition to Apple's request.[7] The Commission has determined to grant Apple's request for the limited purpose of supplementing the record with respect to the jury's verdict. Apple's

[6] Qualcomm filed its complaint in the Southern District of California on July 6, 2017, one day before it filed its Section 337 complaint in the Commission. Qualcomm Letter at 1-2. Apple did not exercise its rights under 28 U.S.C. § 1659 to stay the parallel district court litigation. *Id.*

[7] Complainant Qualcomm Incorporated's Reply to Respondent Apple Inc.'s Request for Leave to Submit a Supplemental Response to Question D of the Commission's Questions on the Public Interest (March 21, 2019).

submission does not affect the outcome of this investigation or any issue decided by the Commission, for the reasons set forth below.

III. THE '490 PATENT

The '490 patent is directed to techniques for power saving in smart phones, tablets, and other mobile devices as well as larger networked systems. '490 patent at 1:20-35, 6:1-9, 6:33-43, Figs. 1A-1C. As shown in Figures 1C and 2 of the '490 patent, below, a mobile device includes a mobile device modem ("MDM") for communicating with a data network. *Id.* at 6:58-63, 7:19-21, 7:47-52.[8] The MDM includes a modem processor (44), which receives and processes data from the network for transmission to the application processor (34), and further receives and processes data received from the application processor for uploading to the network. *Id.* at 6:58-63, 7:37-52. The modem processor and application processor exchange data via an interconnectivity data bus (36). *Id.* at 6:60-65, 7:14-15, Figs. 1C, 2. Data transmitted from the network to the modem processor is referred to as "downlink data." *See, e.g., id.* at 8:20-23, 9:66-10:4, 10:36-38, 10:46-50, Fig. 1C. Data transmitted from the application processor to the modem processor for transmission to the network is referred to as "uplink data." *See, e.g., id.*

[8] The '490 patent states that the invention is not limited to any particular wireless transmission protocol. *See* '490 patent at 7:50-60.

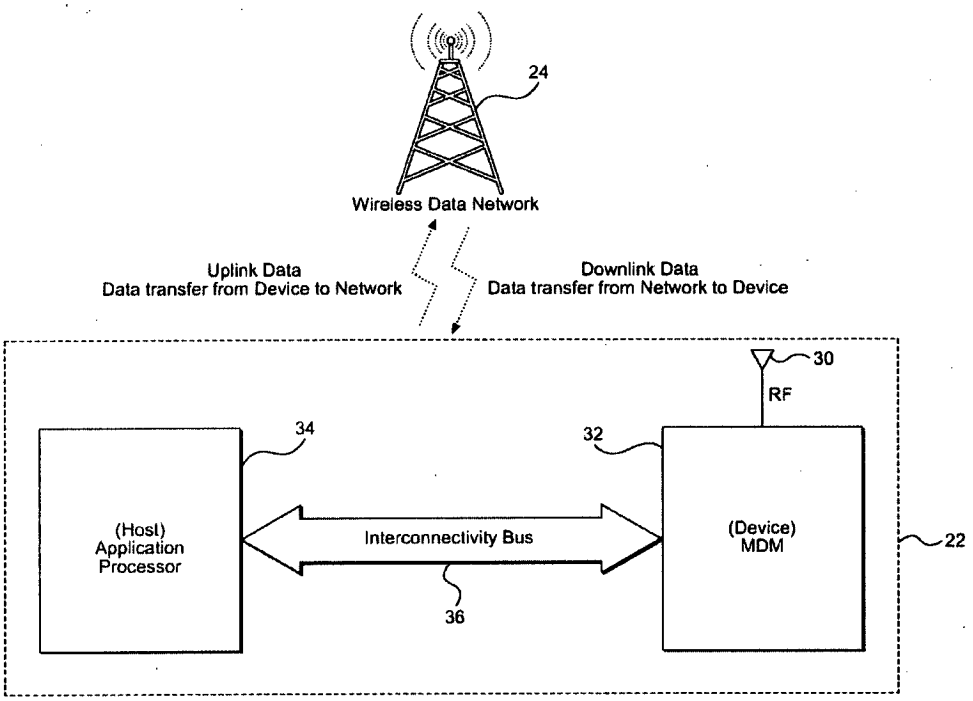

24
Wireless Data Network
Uplink Data
Data transfer from Device to Network
Downlink Data
Data transfer from Network to Device
30
RF
34
32
(Host)
Application
Processor
Interconnectivity Bus
(Device)
MDM
22
36

FIG. 1C

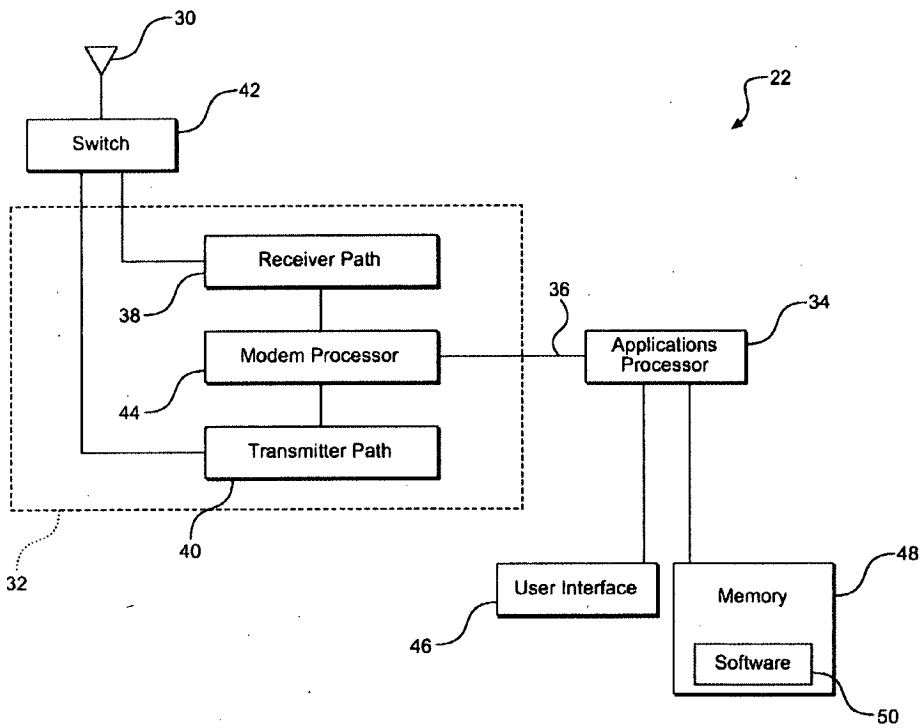

30
42
Switch
22
Receiver Path
38
36
34
Modem Processor
Applications
Processor
44
Transmitter Path
40
32
User Interface
Memory
48
46
Software
50

FIG. 2

The '490 patent teaches that as processing and transmission speeds of mobile devices have increased, mobile devices have required faster interconnectivity buses (36), such as the aforementioned PCIe buses or later generations of universal serial buses ("USB"). *Id.* at 1:52-56, 6:66-7:3. Faster buses require more power, however, which tends to reduce battery life. *Id.* at 1:56-60. As shown in Figure 3, below, each time the modem and application processors exchange data across the bus, relatively large amounts of power are required to transition the bus from a low-power sleep state to a high-power active state for transmission, after which the bus drops back to the low-power sleep state. *Id.* at 8:6-31, Fig. 1C. If the bus drops back to its sleep state before the next transmission, power must be expended again to transition the bus back up to its active state. *Id.* at 8:27-34. As transmission and processing speeds in mobile devices have increased, the bus interconnecting the modem and application processors may transition between power states thousands of times per second, which consumes substantial amounts of power and reduces battery life. *Id.* at 8:34-40, Fig. 3.

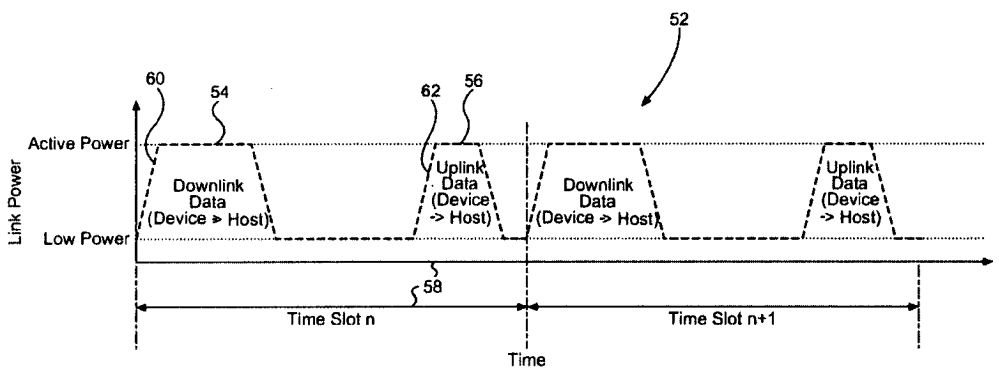


FIG. 3

The '490 patent teaches that power can be saved and battery life extended by aggregating transmissions of downlink and uplink data across the bus, which reduces the number of times the bus transitions between low and high power states. *See, e.g., id.* at 1:64-2:15, 5:17-35, 8:41-56,

9:29-40, 11:54-63, Figs. 5, 7. In Figure 5, below, the previously separate transmissions of downlink and uplink data in Figure 3 have been temporarily stored and then synchronized to form a single data transmission during each time interval, so that the bus transitions from a low power state to a high power state only once, not twice, per time interval. *Id.* at 10:36-45. Synchronizing data transmissions in this manner saves power by avoiding the second transition from a low power state to a high power state. *Id.* at 2:12-14, 5:32-35, 10:36-45.

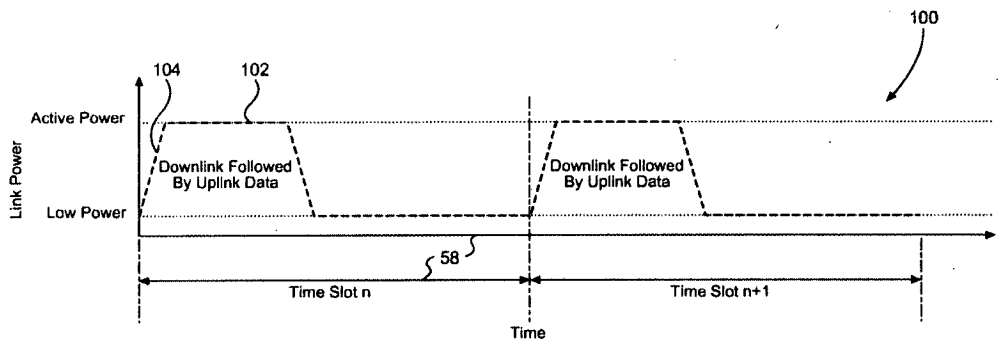


FIG. 5

To accomplish this goal, the '490 patent teaches that the modem processor temporarily stores and accumulates downlink data on one side of the bus, while the application processor accumulates uplink data on the other side of the bus. *See, e.g., id.* at 1:64-22, 2:48-3:6, 4:30-42, 5:17-35, 9:21-40. In some embodiments, the modem processor transmits its stored downlink data to the application processor upon expiration of a modem timer (or "downlink timer"), which may operate alone or in conjunction with an application timer (or "uplink timer"). *Id.* After the modem processor transmits its stored downlink data to the application processor, the modem processor may "pull" stored uplink data from the application processor, so that the downlink and uplink data are transmitted during a single active state of the bus. *Id.* at 4:30-42, 9:66-10:4.

Claim 31, the only asserted claim of the '490 patent and the only claim under review, is set forth below, with claim terms of interest identified by underlined italics:

> 31. A mobile terminal comprising:
>
> a modem timer;
>
> a modem processor, the modem processor configured to *hold* modem processor to application processor data [*i.e.*, downlink data] until expiration of the modem timer;
>
> an application processor;
>
> an interconnectivity bus communicatively coupling the application processor to the modem processor; and
>
> the application processor configured to *hold* application processor to modem processor data [*i.e.*, uplink data] until the modem processor *pulls* data from the application processor *after transmission* of the modem processor to application processor [downlink] data,
>
> wherein the modem processor is further configured [to] *pull* data from the application processor *after transmission* of the modem processor to application processor [downlink] data and before the interconnectivity bus transitions from an active power state to a low power state.

'490 patent at 21:4-21 (emphasis added). For the sake of convenience, and consistent with the patent specification, the term "modem processor to application processor data" will be referred to as "downlink data," and "application processor to modem processor data" will be referred to as "uplink data." *See, e.g., id.* at 8:20-23, 9:66-10:4, 10:36-38, 10:46-50, Figs. 1C, 3, 5.

The parties did not ask the ALJ to construe, nor did he *sua sponte* construe, any terms from the '490 patent in the *Markman* order. ID at 72. Because the parties' claims and defenses presented tacit claim construction issues, the ID construed three terms – "hold," "processor," and "after" – as a predicate to the ID's infringement analysis. The ID's constructions follow:

- ***"Hold."*** Claim 31 states that each processor is "configured to hold" certain data until there is a certain triggering event (*e.g.*, expiration of a modem timer). The ID

construed "hold" to mean "to prevent data from traveling across the bus." ID at 74-75. The ID's construction is under review, as discussed below.

- ***"Processor."*** The ID construed "processor" to refer to "the system components responsible for logic processing, and does not require that all such components reside on the same chip or package." ID at 76-77. Under this construction, a "processor" may include memory devices that are external ("off-chip") to the processor chipset. *See id.*
- ***"After transmission."*** The ID construed "after transmission" to mean "waiting until the downlink transmission has started before starting the uplink transmission. The entirety of the downlink data need not have been transmitted before starting the uplink transmission." ID at 80-82. Once the modem processor begins to transmit downlink data across the bus to the application processor, transmissions of uplink and downlink data between the two processors across the bus may proceed simultaneously. *Id.*

A fourth term – "pull" – will be of interest as a predicate to the obviousness analysis later in this opinion. The parties did not ask the ALJ to construe, nor did he *sua sponte* construe, the term "pull" in either the *Markman* opinion or the ID. The Commission's understanding of the term comports with its usage in the '490 patent, the ID, and the evidence of record, as discussed in Part IV(B)(4)(a)(v) of this opinion, *infra*.

IV. ISSUES UNDER REVIEW

A. Construction Of The Claim Term "Hold"

1. Applicable Claim Construction Law

Section 337 prohibits, *inter alia*, "the importation into the United States, the sale for importation, or the sale within the United States after importation . . . of articles that infringe a valid and enforceable United States patent . . . ." 19 U.S.C. § 1337(a)(1)(B). Infringement is

found where an accused product or process practices each and every limitation of a patent claim, either literally or under the doctrine of equivalents. *Cross Medical Products, Inc. v. Medtronic Sofamor Danek, Inc.*, 424 F.3d 1293, 1310-11 (Fed. Cir. 2005). The first step of an infringement analysis is to construe, or interpret, the disputed terms in the asserted patent claims. *SafeTCare Mfg., Inc. v. Tele-Made, Inc.*, 497 F.3d 1262, 1268 (Fed. Cir. 2007) (citing *Cybor Corp. v. FAS Techns., Inc.*, 138 F.3d 1448, 1454 (Fed. Cir. 1998) (*en banc*)). The second step is to compare the properly construed claim to the allegedly infringing product or process. *Id.*

Claim terms are normally construed according to their ordinary and customary meaning in the art, "which is 'the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention.'" *Continental Circuits LLC v. Intel Corp.*, 915 F.3d 788, 796 (Fed. Cir. 2019) (quoting *Phillips v. AWH*, 415 F.3d 1303, 1312-13 (Fed. Cir. 2005) (*en banc*)). The Federal Circuit has explained:

> In some cases, the ordinary meaning of claim language as understood by a person of skill in the art may be readily apparent even to lay judges, and claim construction in such cases involves little more than the application of the widely accepted meaning of commonly understood words. *See Brown v. 3M*, 265 F.3d 1349, 1352 (Fed. Cir. 2001) (holding that the claims did "not require elaborate interpretation"). In such circumstances, general purpose dictionaries may be helpful.

Phillips, 415 F.3d at 1314. Where a claim term has a specialized meaning, however, it is necessary to determine what a person skilled in the art would have understood the disputed claim language to mean. *Id.*

The Commission should look primarily to intrinsic sources, *i.e.*, the language of the claims themselves, the remainder of the specification (of which the claims are a part), and the patent's prosecution history, to determine the meaning of a claim term and whether the inventor

used it in an idiosyncratic manner. *Id.*; *Continental Circuits*, 915 F.3d at 796. The Federal Circuit has described the roles of the claims and specification as follows:

> From this list of sources, "the claims themselves provide substantial guidance as to the meaning of particular claim terms." [*Phillips*, 415 F.3d at 1314]. However, the claims "do not stand alone." *Id.* at 1315. They are part of "'a fully integrated written instrument,' consisting principally of a specification that concludes with the claims," and must therefore "be read in view of the specification." *Id.* (quoting *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 978-79 (Fed. Cir. 1995) [, *aff'd*, 517 U.S. 370 (1996)]). Accordingly, the specification "is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term." *Id.* (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)).

Continental Circuits, 915 F.3d at 796. The specification may also indicate whether the inventor intended to give a special meaning to a claim term that differs from its original meaning or to disclaim or disavow some measure of claim scope. *Id.* (discussing *Phillips*, 415 F.3d at 1316). As a general rule, embodiments or examples in the specification may shed light on the meaning of claim terms, but they should not be read into the claims as limitations where they are not necessary. *See id.* at 797-98.

The Commission should also consider the patent's prosecution history, where it is in evidence, as it provides contemporaneous evidence as to how the inventor and the U.S. Patent and Trademark Office ("PTO") understood the term. *Id.* at 796. The prosecution history, however, generally lacks the clarity of the specification and is often less useful for claim construction purposes because it reflects an ongoing negotiation between the inventor and the PTO rather than the final product of that negotiation. *Id.*

In addition to this body of intrinsic evidence, the Commission may look to extrinsic evidence, such as expert and inventor testimony, dictionaries, learned treatises, and other evidence external to the patent and its prosecution history, to discern the scope and meaning of a claim term. *Id.* at 799. Extrinsic evidence may also be useful in understanding relevant

scientific principles, the meaning of technical terms, and the state of the art. *Id.* at 796. Extrinsic evidence, however, is generally regarded as less reliable than intrinsic evidence and cannot be used to override the meaning of claim terms provided by the intrinsic evidence. *Id.* at 799. "The construction that stays true to the claim language and most naturally aligns with the patent's description of the invention will be, in the end, the correct construction." *Phillips*, 415 F.3d at 1316 (quotes omitted).

2. The ID

The ALJ found that a person of ordinary skill in the art would have "a Master's degree in Electrical Engineering, Computer Engineering, or Computer Science plus at least two years of relevant experience with multi-processor systems, or a Bachelor's degree in one of those fields plus at least four years of relevant experience." ID at 72, citing Order No. 28 (*Markman* Order) at 7-9 (March 5, 2018). The *Markman* Order further stated that "'[r]elevant experience,' in the context of the asserted patents, refers to experience with mobile device architecture as well as . . . multi-processor systems." *Id.* at 8-9. No party is contesting this description of the education and experience of a person of ordinary skill in the art.

Claim 31 of the '490 patent states that the modem and application processors are each "configured to hold" downlink or uplink data, respectively, until there is a certain triggering event, such as the expiration of a modem timer or transmission of downlink data, respectively. '490 patent at 21:6-8, 12-14. The ID construed "hold" to mean "to prevent data from traveling across the bus." ID at 74-75. The ID found this construction is supported by the specification, which uses "'hold' as a synonym for 'accumulate.'" *Id.* at 75 (citing, *e.g.*, '490 patent at 2:12-15, 5:32-35).

In so holding, the ID rejected Apple's construction of "hold" to mean "to store, buffer, or accumulate data" because Apple had argued that the data must be stored in a memory integral to the processor. *Id.* The ID then noted that "[n]othing in the specification teaches that a specific type of storage must be used to practice the invention." *Id.*; *see also id.* at 76-77 (construing "processor" without limitation as to where the storage medium is located). The ID also found that Apple's construction would exclude a preferred embodiment. *Id.* at 75.

3. Commission Analysis

The Commission determined to review the ID's construction of "hold," and asked the parties to consider whether the term could cover both constructions proposed by the parties. *See* 83 *Fed. Reg.* at 64876. Qualcomm argued that construing "hold" to mean "prevent . . . *and* store, buffer, or accumulate" may be acceptable, but construing it to mean "prevent . . . *or* store . . . ." would make it ambiguous, as it could be read to mean the data did not need to be stored on one side of the bus until the appropriate triggering event. Apple, on the other hand, argued that regardless of whether "hold" is construed to mean "prevent" and/or "store," it should be interpreted to mean the data must be stored internally in the processor.[9] OUII supported the ID's "prevent" construction and stated that a construction that includes both meanings, while not necessarily wrong, was unnecessary, as it would not resolve the issues in dispute.

Having reviewed the parties' submissions, the ID, and the evidence of record, the Commission has determined to modify the construction of "hold" to mean "prevent data from traveling across the bus or to store, buffer, or accumulate data." This modified construction naturally aligns with the ordinary meaning of "hold," which may mean either to "prevent" (*e.g.*,

[9] Apple argues it would avoid infringement under its proposed construction, as the Intel modem processors use external DRAM memory, [ ].

to "hold" a door open to prevent it from closing) or to store, buffer, or accumulate (*e.g.*, to "hold" water in a container). The Commission finds its construction is also consistent with the specification, which often describes data as being "held by" or "held at" a particular processor.[10] *See, e.g.*, '490 patent at 2:12-15 ("holding or accumulating the data at a source processor"), Abstract, 2:4-6, 5:23-26 ("data held by" a processor), 2:50-52, 2:56-62 (each processor is "configured to hold" certain data), 4:26-29 ("The method further comprises holding [downlink] data at the modem processor . . . "), 5:32-35 ("By holding or accumulating the data at a source processor . . ."), 9:29-32, 9:59-63, 11:3-6, 13:6-12 (data "held at" a processor). "Held by" could refer to either "prevent" or "store," whereas "held at" is more consistent with "store" or "accumulate," without requiring any additional step to stop data from being transmitted across the bus. *See, e.g., id.* at 2:12-15, 4:26-29, 5:32-35, 9:29-32, 9:59-63, 11:3-6, 13:6-12.

Further, construing "hold" as "prevent . . . *or* store . . . " does not introduce any ambiguity as to whether data must be stored until the appropriate triggering event, as Qualcomm argued. Claim 31 expressly states that the modem processor and application processor are each configured to "hold" (*i.e.*, store or prevent transmission of) certain data "*until* expiration of the modem timer" or "*until* the modem processor pulls data from the application processor . . . ," respectively. '490 patent at 21:6-8, 12-14 (emphasis added). As for Apple's argument that "hold" should be construed to require that data be stored internally in the processor, this position has already been considered and rejected as part of the construction of the term "processor," as discussed above. *See* ID at 76-77. The Commission has already determined not to review, and has thereby adopted, the ID's construction of that term. *See* 83 *Fed. Reg.* at 64876.

[10] Neither the parties nor the ID identified any remarks or amendments from the prosecution history of the '490 patent that are relevant to construction of the term "hold."

For the reasons given above, the Commission construes "hold" to mean to "prevent data from traveling across the bus or to store, buffer, or accumulate data." Given that this construction is relatively broader than the ID's construction, modifying the construction of "hold" in this manner does not upset the ID's infringement and the technical prong determinations. *See* ID at 77-87. Accordingly, the Commission adopts the ID's findings that Apple infringes claim 31 and Qualcomm practices that claim, if that claim is valid. *See id.*

B. Whether Claim 31 Of The '490 Patent Is Invalid As Obvious

1. Applicable Obviousness Law

A patent claim is invalid "if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains." 35 U.S.C. § 103 (post-America Invents Act). Obviousness is a question of law that is based on underlying facts and must be proven by clear and convincing evidence. *Intercontinental Great Brands LLC v. Kellogg North America Co.*, 869 F.3d 1336, 1343-44 (Fed. Cir. 2017) (affirming summary judgment of obviousness).

The underlying factual inquiries for obviousness, known as the *Graham* factors, include: (1) the scope and content of the prior art; (2) differences between the prior art and the claimed invention; (3) the level of ordinary skill in the pertinent art (the field of the invention); and (4) any relevant objective evidence of nonobviousness, such as commercial success of the invention, long-felt but unmet need, industry praise, or copying. *ZUP, LLC v. Nash Mfg., Inc.*, 896 F.3d 1365, 1371, 1374 (Fed. Cir. 2018), *cert. denied*, No. 18-823, 2019 WL 659872 (U.S. Feb. 19, 2019) (citing *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966)). A party challenging validity must also show that a person skilled in the art had a motivation to combine the pieces of

prior art in the way that was eventually claimed in the patent at issue, and that such a skilled artisan would have had a reasonable expectation of success in doing so. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421, 427 (2007)); *Intercontinental Great Brands*, 869 F.3d at 1343.

Accordingly, an obviousness analysis, unlike anticipation, is not limited to "the express and inherent teachings of a single prior art reference," but "reaches beyond the prior art reference and takes into account other considerations such as the level of ordinary skill in the art and any objective indicia of nonobviousness." *Vivint, Inc. v. Alarm.com, Inc.*, 741 Fed. Appx. 786, 791-92 (Fed. Cir. July 26, 2018) (unpublished) (citing *Cohesive Techns., Inc. v. Waters Corp.*, 543 F.3d 1351, 1364 (Fed. Cir. 2008)). Obviousness jurisprudence directs the Commission to employ an "expansive and flexible approach" when reviewing the evidence of record rather than limiting itself to a "rigid approach . . . based on disclosures of individual prior-art references[.]" *Intercontinental Great Brands*, 869 F.3d at 1344 (citing *inter alia KSR*, 550 U.S. at 415, 419-22). The Federal Circuit has described these considerations as follows:

> "In *KSR,* the Supreme Court criticized a rigid approach to determining obviousness based on the disclosures of individual prior-art references, with little recourse to the knowledge, creativity, and common sense that an ordinarily skilled artisan would have brought to bear when considering combinations or modifications." [*Randall Mfg. v. Rea*, 733 F.3d 1355, 1362 (Fed. Cir. 2013)]. "[T]he Court required an analysis that reads the prior art in context, taking account of 'demands known to the design community,' 'the background knowledge possessed by a person having ordinary skill in the art,' and 'the inferences and creative steps that a person of ordinary skill in the art would employ.'" *Id.* (quoting *KSR*, 550 U.S. at 418, 127 S. Ct. 1727). A "court must ask whether the [claimed] improvement is more than the predictable use" – a "predictable variation" – "of prior art elements according to their established functions," considering whether more is involved than "the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement." *KSR*, 550 U.S. at 417, 127 S. Ct. 1727. "[I]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill." *Id.* at 417, 127 S. Ct. 1727. The court should consider a range of real-world facts to determine "whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *Id.* at

> 418, 127 S. Ct. 1727; *see id.* ("[I]t can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does."). "One of the ways in which a patent's subject matter can be proved obvious is by noting that there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims." *Id.* at 419-20, 127 S. Ct. 1727.

Intercontinental Great Brands, 869 F.3d at 1344.

A motivation to combine prior art may be found, for example, "[w]hen there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, [the invention] is likely the product not of innovation but of ordinary skill and common sense," and "the fact that a combination was obvious to try might show it was obvious under § 103." *KSR*, 550 U.S. at 421. "A motivation to combine may be found explicitly or implicitly in market forces; design incentives; the interrelated teachings of multiple patents; any need or problem known in the field of endeavor at the time of invention and addressed by the patent; and the background knowledge, creativity, and common sense of the person of ordinary skill." *RealTime Data, LLC v. Iancu*, 912 F.3d 1368, 1373-74 (Fed. Cir. 2019) (quotes omitted) (citing *ZUP*, 896 F.3d at 1371).

When a patent is challenged for obviousness, the patentee may present objective evidence (also called secondary considerations) of nonobviousness, such as a long-felt but unmet need for the invention, its commercial success, failure of others, unexpected results, or copying. *See ZUP*, 896 F.3d at 1374. When objective evidence of nonobviousness is presented, it must be considered with all other *Graham* factors before making a determination of obviousness. *Apple Inc. v. Int'l Trade Comm'n*, 725 F.3d 1356, 1365 (Fed. Cir. 2013); *Transocean Offshore Deepwater Drilling, Inc. v. Maersk Drilling USA, Inc.*, 699 F.3d 1340, 1348-49 (Fed. Cir. 2012). This is because "evidence of secondary considerations may often be the most probative and

cogent evidence in the record," as it may "establish that an invention appearing to have been obvious in light of the prior art was not." *Transocean*, 699 F.3d at 1349.

Yet even when objective indicia are present and given "fair weight," they do not always "dislodge" a determination that a claim was obvious. *Intercontinental Great Brands*, 869 F.3d at 1346 (citing *inter alia KSR*, 550 U.S. at 426). "[W]here a claimed invention represents no more than the predictable use of prior art elements according to established functions, as here, evidence of secondary indicia are frequently deemed inadequate to establish non-obviousness." *Ohio Willow Wood Co. v. Alps S., LLC*, 735 F.3d 1333, 1344 (Fed. Cir. 2013). Evidence of secondary considerations of nonobviousness is relevant only if the patentee demonstrates a nexus between the alleged secondary considerations and the merits of the invention. *Bosch Automotive Service Solutions, LLC v. Matal*, 878 F.3d 1027, 1038 (Fed. Cir. 2017); *In re Huai-Hung Kao*, 639 F.3d 1057, 1068 (Fed. Cir. 2011) (when secondary considerations "actually result from something other than what is both claimed and novel in the claim, there is no nexus to the merits of the claimed invention"). Also, when the differences between the prior art and the claimed invention are minimal, courts have found the alleged long-felt need was not unsolved. *ZUP*, 896 F.3d at 1374 ("[w]here the differences between the prior art and the claimed invention are as minimal as they are here, however, it cannot be said that any long-felt need was unsolved." (quotes omitted)). Consequently, "a strong showing of obviousness may stand even in the face of considerable evidence of secondary considerations." *Id.* (quotes omitted).

2. <u>The Prior Art at Issue</u>

a. <u>Heinrich (U.S. Patent No. 9,329,671)</u>

The Heinrich patent (RX-1146) is directed to saving power and extending battery life in cell phones, tablets, and other mobile devices by scheduling certain interprocessor

communications ("IPC") to coincide with the awake state of at least one of the processors, such as the application processor in the preferred embodiment. Heinrich at Abstract, 1:11-23, 1:40-42, 1:54-2:54, 4:6-15, 4:21-23, 5:18-39. "IPC activities" refer to communications between the modem and application processors (and thus across the IPC bus), which can convey various types of information, such as control information, data, logging information, or file system information, spread across several communication channels. *Id.* at 1:40-53, 4:65-5:17; Hr'g Tr. (Baker) at 1387:13-16 (Dr. Jacob Baker was an expert witness for Qualcomm).

Figure 1 of Heinrich, reproduced below, depicts a basic, well-known architecture of a cell phone or mobile device, comprising a baseband (or modem) processor and application processor interconnected by an IPC bus. Heinrich at 1:23-45, 4:18-50; Hr'g Tr. (Baker) at 1385:18-1386:1. The modem processor exchanges data with a radio network and transmits such data via the IPC bus to the application processor for further processing. *Id.* at 1:24-39, 4:30-36. The application processor runs various applications and, as necessary, transmits data via the IPC bus to the modem processor for transmission to the network. *Id.* at 1:24-39, 4:36-43.

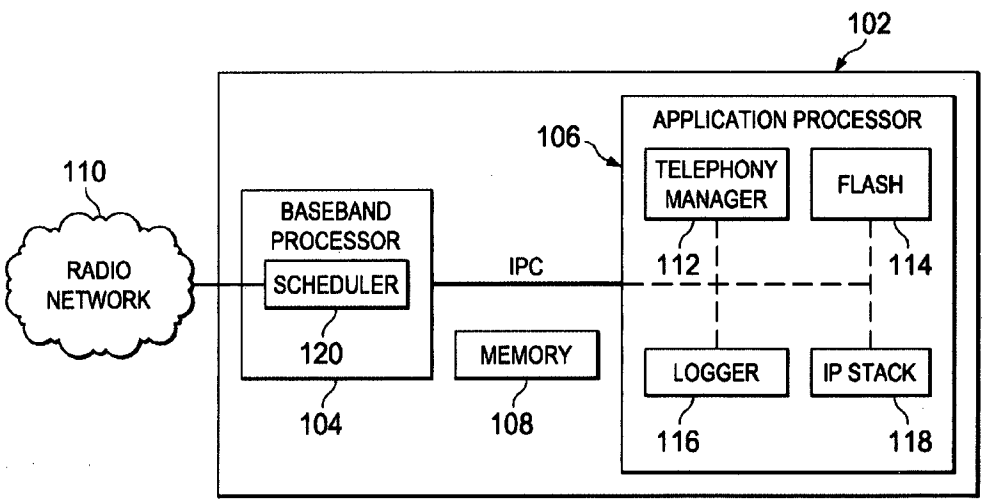


FIG. 1

Heinrich teaches that each processor may operate in a plurality of modes, including an awake mode and a sleep mode. *Id.* at 1:54-55, 5:18-19. For example, when an application processor is in an "awake mode," it can process IPC activities it receives from the modem processor. *Id.* at 1:54-57, 5:19-22. When an application processor is in a sleep mode, it cannot store or process IPC activities, but it consumes less power. *Id.* at 1:58-62, 5:22-26. When no IPC activities are being communicated between the processors (*i.e.*, across the bus), the application processor may be configured to operate in a sleep mode to save power. *Id.* at 1:62-65, 5:27-30. Whenever a quantum of data is transmitted over the bus from the modem processor, the application processor must be woken up (if it is not awake already) to process the transmitted data. *Id.* at 1:65-2:5, 5:30-37. According to Heinrich, a processor may consume 50 times more power when it is awake than asleep, so power usage can be reduced by minimizing the number of times a processor must be woken up to receive and process data. *Id.* at 2:5-8, 5:37-39.

"[O]verall power consumption associated with IPC activities," Heinrich further explains, "is dominated by latency [*i.e.*, the time required for a processor to exit or enter its sleep state], not by the actual processing of information sent over the IPC." *Id.* at 3:29-33, 4:12-15; Hr'g Tr. (Baker) at 1404:12-1405:14. For example, even though an application processor may require only a few milliseconds to process a certain quantum of data, the application processor may be awake for total period of about two seconds due to the latencies, or delays, in changing power states. *Id.* at 3:32-34, 5:57-6:35, Fig. 2. The amount of current the processor uses may soar, from about 5 mA (milliamps) to 200 mA, during the time the processor is awake. *Id.* at 6:23-41. As a result, substantial power is consumed if the processor is frequently woken from its sleep mode to process incoming data and then allowed to reenter its sleep mode before the next

quantum of data arrives, due to the long delays and substantial increase in current use between the time a processor is woken up and the time it returns to a sleep mode. *Id.* at 7:1-7.

Heinrich teaches that the magnitude of the latency a processor needs to exit or enter its sleep mode depends in part on the latency of the IPC bus. *Id.* at 3:32-45, 4:44-50, 6:11-17. For example, if logging information is sent every second over a USB bus, which has a latency of about one second before it reenters its sleep mode, then the USB bus would remain in its active mode. *Id.* at 3:37-40, 11:35-40. As a result, the application processor would not have the time to reenter its sleep mode after processing the logging information before it received the next piece of logging information in the next IPC activity. *Id.* at 11:40-45. Delaying and aggregating non-real-time-sensitive IPC activities, including logging information, enables the application processor to enter a sleep mode and thereby reduces its power consumption. *Id.* at 11:45-52.

In light of the latencies, Heinrich teaches that power can be saved by aggregating and synchronizing data transmissions across the IPC bus to coincide with the awake state of the receiving processor (typically the application processor). *Id.* at 2:12-54, 8:21-49, 11:45-52. For example, Heinrich teaches that the modem processor can identify which of a plurality of IPC activities are not sensitive to real-time processing,[11] store and aggregate the non-real-time-sensitive IPC activities, and then transmit the IPC activities as a group during a single awake state of the application processor. *Id.* at 2:20-33, 2:42-54, 3:1-11, 8:21-36. When the application processor is awake, it will process and transmit any uplink data to the modem processor during the same active state. *See id.* at 2:12-20, 2:33-42, 1:54-57, 3:50-4:5. In this manner, power

[11] Real-time-sensitive data is transmitted immediately and not held. *Id.* at 8:16-20.

consumption by the application processor is reduced by lowering the number of times that the processor enters and exits its sleep mode.[12] *Id.* at 4:6-15, 7:16-19, 7:34-64, 8:37-55.

Although most of the embodiments in Heinrich describe the modem processor as the storing and sending processor and the application processor as the receiving processor, Heinrich teaches that the same power-saving technique can be used when the application processor is the sending processor and the modem processor is the receiving processor. *Id.* at 12:47-59. In the latter case, non-real-time-sensitive IPC activities may be stored on the application processor and sent as a group the modem processor. *Id.* Heinrich also suggests that IPC activities may be scheduled "in both directions between the processors," but it does not provide details on that kind of operation. *See id.* at 7:19-21.

Heinrich teaches that the identification and scheduling of non-real-time-sensitive IPC activities are controlled by one or more schedulers. *Id.* at 7:8-27, 7:65-8:32, Figs. 1, 3. In the preferred embodiment in Figure 1, *supra*, the scheduler is a software or hardware module on the modem processor that controls IPC transmissions from the modem processor to the application processor to reduce the number of times the application processor enters and exits a sleep state. *Id.* at 7:8-18, 21-23, 12:47-49, Fig. 1. IPC activities from the application processor to the modem processor may be controlled by a separate scheduler on the application processor or by the same scheduler on the modem processor, according to Heinrich. *Id.* at 7:19-27, 12:52-64. As noted above, Heinrich also state that "the [same] scheduler 120 may control the scheduling of

[12] Heinrich teaches that delaying and storing IPC activities in this manner has the added benefit of allowing IPC activities to be updated and redundancies removed before they are transmitted to the application processor. This may reduce the overall number of IPC activities that are transmitted to the processor, which further reduces power consumption. Heinrich at 10:44-67.

IPC activities in both directions between the processors 104 and 106," but it does not provide details on that kind of operation. *Id.* at 7:19-21, Fig. 1.

Heinrich also teaches that a scheduler may associate each stored IPC activity with a "lazy timer," which will fire either by a given deadline or when a determination has been made that the application processor is awake. *Id.* at 9:1-11, 22-29. When one lazy timer fires, all timers fire at the same time, so that all IPC activities stored on the modem processor are transmitted to the application processor during the same active state. *Id.* at 9:11-21.

Heinrich discloses a variety of methods by which the scheduler can determine when the application processor (or other receiving processor) is awake. In one example, the scheduler may rely on power state changes in the IPC interface (bus) to determine when the application processor is awake. *Id.* at 9:50-67; RX-7C (Yalamanchili WS) at Q/A 28, 429, 437 (an interface is another term for bus).[13] By delaying, aggregating, and transmitting IPC data when the application processor is awake, Heinrich reduces the number of times the application processor must be woken up, which reduces the length of time it spends in an active state (by reducing unnecessary latency periods), thereby saving power and extending battery life in a cell phone or other mobile device. *Id.* at 4:6-15, 7:16-19, 7:34-64, 8:21-55, 11:45-52.

[13] RX-7C is the Direct Testimony Witness Statement of Sudhakar Yalamanchili, Ph.D. *See* Order No. 1 (Ground Rules) (Aug. 22, 2017) (Ground Rule 14.3 discusses witness statements). Dr. Yalamanchili was an expert witness for Apple.

b. **Balasubramanian (U.S. Patent No. 8,160,000)**

The Balasubramanian patent (RX-106) discloses techniques to save power and extend battery life in a cell phone, tablet, or other mobile device by storing and aggregating data packets while the device or component thereof (*e.g.*, a transceiver) is in a "suspended" (or sleep) state, and then transmitting the stored data packets during a single "wake" (or active) state of the device or component. Balasubramanian at Abstract, 1:27-39, 1:52-2:2, 2:55-67, 4:24-29, 5:47-61, 7:4-19, 14:49-63. Figure 1, below, depicts the basic architecture of a preferred embodiment in Balasubramanian:

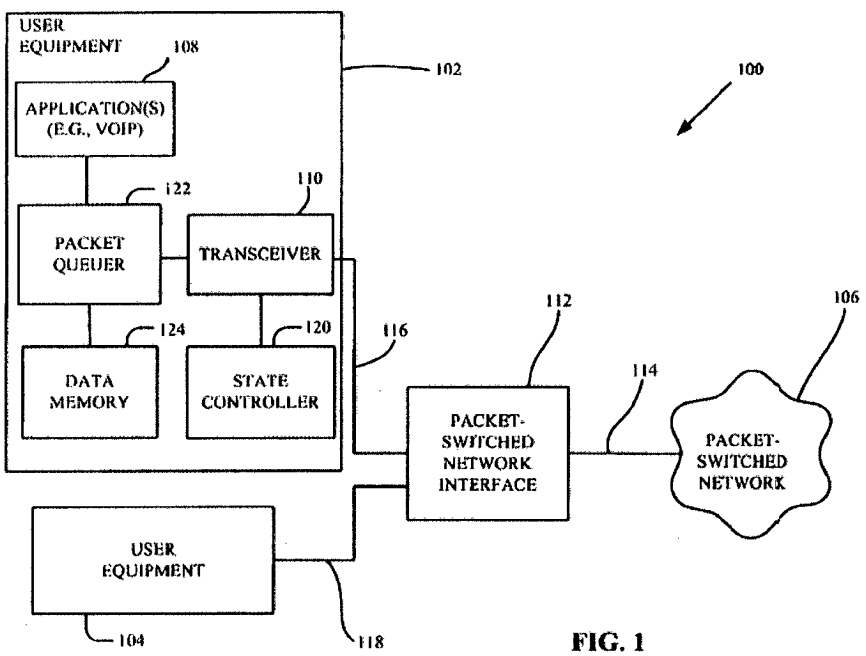


FIG. 1

Balasubramanian explains that power savings are achievable because transceivers or other components are subject to a "delay period," or "lag time" (or "latency" in Heinrich). *Id.* at 14:54-63. A transceiver, for example, may be awake for only about 5-10 milliseconds out of a 60 millisecond delay period. *Id.* "Waking" the transceiver less often to transmit or receive data not only reduces the number of times it must transition between active and sleep states, but it

also avoids the extended "lag time" associated with turning the transceiver on and off each time. This means the transceiver can spend longer periods of time asleep, when it consumes much less power, than it would if it were woken up every 10 or 20 milliseconds to receive or transmit a new packet of data. *Id.* at 5:47-61, 14:49-67.

In a preferred embodiment, Balasubramanian teaches that to reduce the number of times the transceiver must be woken up, packets of data are "queued" (*i.e.*, buffered or stored) on the cell phone or a network access point, or both, while the transceiver is in a sleep state. *Id.* at 1:53-2:2, 2:55-59, 5:47-51, 5:62-6:10. "Queuing of packets may comprise, for example, simply storing the packets in some manner and/or referencing where the packet information was stored when it was generated, copied or moved." *Id.* at 6:43-46. Packets may be queued "for configurable amount of time," for example, or by a "configurable number of packets." *Id.* at 1:67-2:2, 2:55-67, 6:47-53, 9:4-9. In the former case, "once the configurable amount of time has elapsed," as determined by a timer for example, the transceiver will transition from a sleep state to a wake state to transmit and/or receive the queued data packets as a group during a single wake state.. *Id.* at 2:55-69, 5:51-54, 6:1-10, 6:55-67, 9:29-36.

Balasubramanian also teaches that once the transceiver is awake and transmits stored data to the network, the network interface may send any queued downlink data in close succession to the transceiver during the same wake state, using receipt of the uplink data to trigger transmission of any stored downlink packets. *See, e.g., id.* at 6:5-15, 6:55-7:8. "Alternatively, the transceiver [] may send a message to the network interface [] requesting transmission of all queued packets" after the transceiver has transmitted data to the interface. *Id.* at 7:8-13; *see also id.* at 6:15-19 ("Conversely, in response to a request from the transceiver [] or some other indication, the network interface [] may send any of its queued downlink packets to the

transceiver [] in close succession over the communication link []"). Also, the network interface may transmit stored downlink data first, followed by transmission of stored uplink data from the transceiver. *See id.* at 6:5-15, Fig. 2. After the data transmissions have been completed, the transceiver may transition back to its sleep state to conserve power. *Id.* at 7:14-19.

The wake and sleep states of the transceiver or other components are controlled by a state controller. *Id.* at 5:10-46, 8:41-9:3. For example, the data transmitting components may be put into a power saving mode while the data receiving components are kept in an active mode so that downlink traffic from the network is not lost. *Id.* at 5:4-9. Alternatively, both the transmit and receive components of the mobile device may be placed in a "power save mode" at designated time periods, or they may be independently transitioned between active and power save modes to save power, depending on the application. *Id.* at 4:63-5:9.

3. The ID

The ID found that Apple failed to prove by clear and convincing evidence that claim 31 of the '490 patent is invalid as obvious over Heinrich in combination with Balasubramanian. ID at 87. Although Heinrich discloses delaying and grouping non-real-time sensitive IPC activities in at least one processor to save power, the ID found that Heinrich does not disclose synchronizing data transmissions in both directions across a bus, as required by claim 31. *Id.* at 89-90. The ID also found that Heinrich does not teach that the modem processor "pulls" data from the application processor after the modem processor has pushed its stored downlink data to the application processor. *Id.* Heinrich, the ID found, also does not disclose exchanging stored downlink and uplink data between the processors "before the interconnectivity bus transitions from an active power state to a low power state," as required by claim 31. *Id.*

The ID similarly found that even though Balasubramanian teaches that power can be saved by grouping and transmitting data packets to and from a transceiver during a single wake state, "Balasubramanian is not directed to inter-processor communications within a mobile device terminal and thus does not disclose any of the claim 31 limitations." *Id.* at 90. The ID also found that Balasubramanian "instructs away against delaying data or using reduced power states at the modem-to-application processor level" because those components, unlike the transceiver, remain awake and active. *Id.* (citing Balasubramanian at 5:16-29, Figs. 9-10). The ID also found that Balasubramanian does not disclose a transmission scheme "wherein a component will 'pull data' from a remote location only 'after transmission' of its source data." *Id.* at 91 (citing Balasubramanian at 7:4-11). Balasubramanian also does not teach that the wired or wireless WiFi link between the transceiver or network interface experiences any reduced or low power states, according to the ID. *Id.* at 90-91.

The ID also found that Apple failed to prove by clear and convincing evidence that a person skilled in the art would have been motivated to combine Heinrich with Balasubramanian to produce the claimed invention. *Id.* at 91-92. Heinrich, the ID explained, saves power by grouping and delaying certain non-real-time-sensitive IPC activities in order to keep the remote processor (*e.g.*, the application processor) in a low power state as long as possible, whereas Balasubramanian saves power by turning off the radio transceiver or mobile device when they are not sending or receiving data to or from the network. *Id.* at 92. Neither reference teaches that power can be saved by minimizing the number of power state transitions experienced by the bus connecting the two processors. *Id.*

Moreover, the ID found that Heinrich and Balasubramanian cannot be combined because their power goals differ from each other and that of the '490 patent. *Id.* at 92-93. Heinrich,

according to the ID, is directed to saving power by avoiding unnecessary latencies in the processor, not the bus. *Id.* The ID also found that Heinrich and Balasubramanian "are in different, dissimilar fields" of IPC and voice over Internet protocols ("VoIP"), respectively. *Id.* Neither reference teaches that IPC techniques are applicable to VoIP or *vice versa*, the ID found. *Id.* The ID further concluded that a person skilled in the art would not have been motivated to modify Heinrich's "push-only system" to "pushes . . . coupled with pulls" because it would have increased demands on the application processor and risked the "significant" power savings that Heinrich purportedly achieved. *Id.* at 93-94.

The ID then turned to Qualcomm's evidence of secondary considerations of nonobviousness. ID at 94-96. The ID found that Qualcomm has shown "a long-standing need in the art for technologies that provide power savings and improve the battery life for mobile devices," which was met by purportedly "significant device power savings" of approximately 8-10% achieved by the invention of the '490 patent. *Id.* at 95. This evidence, the ID concluded, supported a finding of nonobviousness. *Id.* at 95-96. The ID, however, found insufficient evidence to support Qualcomm's claims of commercial success, industry praise, licensing, copying, or a nexus connecting those alleged benefits to the invention. *Id.* at 94-95.

4. Commission Analysis

The Commission determined to review the ID's finding that claim 31 was not obvious over Heinrich in combination with Balasubramanian. 83 *Fed. Reg.* at 64876-77. The parties do not dispute that Heinrich and Balasubramanian are prior art with respect to the '490 patent or the level of ordinary skill in the art.[14] *See* RX-7C (Yalamanchili WS) at Q/A 24, 304-06, 320-22. Their disputes focus instead on the differences between the prior art and the claimed invention,

[14] *See* ID at 72 (citing Order No. 28 (*Markman* Order) at 7-9), discussed at p. 15, *supra.*

the motivation to combine those references, secondary considerations of nonobviousness, and whether, in light of these factors, claim 31 is invalid as obvious. Having reviewed the prior art, the parties' submissions, the ID, and other evidence of record, the Commission has concluded that Apple has proven by clear and convincing evidence that claim 31 of the '490 patent is invalid as obvious over Heinrich in combination with Balasubramanian, where Balasubramanian reflects the knowledge in the art.

a. Differences Between the Prior Art and Claim 31

i. A modem processor, an application processor, a bus interconnecting the two processors, and a modem timer

Claim 31 requires, *inter alia*, the following hardware components: "A mobile terminal comprising: a modem timer; a modem processor . . . ; an application processor; [and] an interconnectivity bus communicatively coupling the application processor to the modem processor . . . ." *See* '490 patent at 21:4-11. The '490 patent does not claim to have invented any new type of processor, bus, or timer or any new operation of any such component. RX-7C (Yalamanchili WS) at Q/A 30-35, 37-38, 42-43, 50-51, 65-66, 73; Hr'g Tr. (Krishna) at 660:1-662:1, 663:17-669:13.[15]

All of these components are expressly disclosed in Heinrich and arranged in the same manner in which they are disclosed and claimed in the '490 patent. *See* Heinrich at 1:29-45, 3:32-43, 4:23-50, Fig. 1 *to* '490 patent at 7:4-18, Fig. 2; Hr'g Tr. (Baker) at 1385:10-1386:19. Heinrich refers to communications between the two processors across the bus as "IPC activities." *Id.* at 1:40-51, 4:65-5:17. Although Balasubramanian does not explicitly disclose a modem processor, application processor, or bus, Balasubramanian, like Heinrich, is expressly directed to

[15] Dr. Murali Krishna was one of Qualcomm's fact witnesses.

saving power and extending battery life in smart phones, cell phones, and other mobile devices. Balasubramanian at 2:55-59, 4:24-29, Fig. 1. Balasubramanian also teaches that a mobile device, such as a cell phone, may include multiple processors to perform the functions of "generating [data] packets," "queuing and assembling packets," or "transmitting and receiving packets." Balasubramanian at 17:39-48, 18:21-36, Fig. 10.

Heinrich also teaches that the scheduler in the modem processor may associate each stored IPC activity with a "lazy timer," which will fire either by a given deadline or when a determination is made that the application processor is awake. *Id.* at 9:1-11, 22-29. A processor may have multiple lazy timers. When one lazy timer fires, all timers fire at the same time, so that all stored IPC activities are transmitted across the bus to the application processor during the same awake mode. *Id.* at 9:11-21. Persons skilled in the art also knew of countdown timers, and that two processors could be controlled by either a single timer or separate timers. RX-7C (Yalamanchili WS) at Q/A 63-64. Balasubramanian, for example, teaches that data may be held for a "configurable amount [of] time," which may be measured by a "timer." Balasubramanian at 9:4-9. The '490 patent does not claim to have invented a new kind of timer. RX-7C (Yalamanchili WS) at Q/A 65-66.

ii. Completing interprocessor data transmissions "before the interconnectivity bus transitions from an active power state to a low power state"

This element, which appears at the end of claim 31, expresses the crux of the invention – to save power by exchanging data stored by the modem and application processors "before the interconnectivity bus transitions from an active power state to a low power state." '490 patent at 21:20-21. The ID found that Heinrich does not expressly teach this limitation or the coordinated push and pull of data transmissions across the bus (discussed later in this opinion). ID at 89-90.

While the Commission does not disagree with the ID's findings about these two aspects of Heinrich, the ID erred by adhering too strictly to what Heinrich may "expressly teach or disclose" (ID at 89-90), in contravention of *Cohesive Techns.*, 543 F.3d at 1364 (obviousness is not limited to the express or inherent teachings of a prior art reference). Obviousness demands a "more expansive and flexible approach," *KSR,* 550 U.S. at 415, 419-22, one that takes into consideration the "knowledge, creativity, and common sense that an ordinarily skilled artisan would have brought to bear when considering combinations or modifications," as well "demands known to the design community . . . and the inferences and creative steps a person of ordinary skill in the art would employ." *Intercontinental Great Brands*, 869 F.3d at 1344 (discussing *inter alia KSR, supra*).

As a result, the ID missed the broader principles that a person of ordinary skill in the art would extract from Heinrich. *See, e.g.*, RX-7C (Yalamanchili WS) at Q/A 433 (testifying that "Because Heinrich and Balasubramanian are directed to similar fields and describe similar architectures and similar techniques, a person of ordinary skill in the art would have looked at and considered combining the different features of the power saving schemes in each of Heinrich and Balasubramanian into the same system."). Even though Heinrich and Balasubramanian do not speak directly to saving power consumed by the bus, Heinrich emphasizes the importance of latencies and teaches that the latency period of a processor is related to the latency of the bus with which it interfaces. Heinrich at 3:29-45, 4:44-50, 6:11-17; RX-7C (Yalamanchili WS) at Q/A 419-422, 426; *see also* Balasubramanian at 14:49-63 (discussing "lag time associated with turning the transceiver on and off" and reducing "power consumption associated with some of the lag time"). Heinrich teaches, for example, that a Universal Serial Bus ("USB") interface typically requires at least one second of idle time before switching from an active to inactive

state, whereas a faster High-Speed Synchronous Interface ("HSI") may exhibit shorter latencies of the order of hundreds of milliseconds (or tenths of a second). Heinrich at 3:37-43, 6:11-17. Persons skilled in the art also knew before the '490 patent that buses have active and inactive states, that a bus must be in an active state to transmit data between processors, and that transitioning a bus from an inactive (low power) state to an active (high power) state requires power. RX-7C (Yalamanchili WS) at Q/A 44-51. The '490 patent does not claim to have invented new bus states or new ways to transition between bus states, nor does it claim to have invented the concept of storing data in a processor while a bus is in an inactive state, all of which were already known in the art. *Id.* at Q/A 50, 52, 73; Hr'g Tr. (Krishna) at 662:2-669:13.

Also, even though the functions and latencies of buses and processors differ, a person skilled in the art would have been motivated by the same design needs and market incentives to save power in mobile devices that motivated the inventions in Heinrich and Balasubramanian. *See KSR*, 550 U.S. at 421; *ZUP*, 896 F.3d at 1371. These same incentives would have motivated a person skilled in the art to try to save power in other components of the system as well. *See* RX-7C (Yalamanchili WS) at Q/A 428-33, 450. An obvious candidate would have been the bus interconnecting the two processors because a bus, like a processor or transceiver, is subject to latencies and requires power to transition from an inactive state to an active state. *Id.* at Q/A 44-51, 419. Qualcomm acknowledges that a bus must be active to transmit data in either direction, so data transmissions between the processors will coincide with the bus's active state. *See* Qualcomm's Resp. at 18. Heinrich even teaches that a scheduler on the modem processor can determine when the application processor is awake by detecting changes in the power state of the bus. Heinrich at 9:50-67; RX-7C (Yalamanchili WS) at Q/A 318, 421, 430-31, 437. Thus, modifying Heinrich to aggregate and transmit data to coincide with the active state of the bus,

instead of the application processor, would have involved the "application of a known [power-saving] technique to a piece of prior art ready for the improvement," and would have fallen within the "knowledge, creativity, and common sense" of a person skilled in the art. *KSR*, 550 U.S. at 417; *Intercontinental Great Brands*, 869 F.3d at 1344; RX-7C (Yalamanchili WS) at Q/A 432-37.

A person skilled in the art would also have found that applying Heinrich's power-saving technique to the bus constitutes a predictable use or variation of known components that would yield predictable results with a reasonable likelihood of success. *See KSR*, 550 U.S. at 417-18; *Intercontinental Great Brands*, 869 F.3d at 1344; RX-7C (Yalamanchili WS) at Q/A 444-50. Heinrich teaches that a processor must perform a variety of operations, including receiving and processing data from multiple sources, distinguishing between real-time-sensitive and non-real-time-sensitive data, and treating each category of data differently for storage and transmission purposes. The bus, in contrast, only transmits data between the two processors and does not segregate or distinguish between the different types of data being transmitted. *See* Heinrich at 1:40-43, Fig. 1; RX-7C (Yalamanchili WS) at Q/A 28. Coordinating transmissions between the modem and application processor to substantially reduce the number of times the application processor is woken up would also reduce the number of times the bus is woken up as well, resulting in power savings in both the processor and the bus.[16] *See, e.g.,* Heinrich at 2:11-33, 3:29-43; *see also* RX-7C (Yalamanchili WS) at Q/A at 45-48, 310-11. A person skilled in the art

[16] Heinrich also discloses a scenario in which a logging buffer accumulates more than two minutes worth of data. "In the best case, during these two minutes the IPC will have been used for some other purpose (text messaging, screen state notification, . . .) and the logging data will be flushed 'for free.'" Heinrich at 14:41-46. This passage suggests that the logging data was "flushed" (transmitted) with the other data during the same active state of the IPC bus, so that additional power was not required to turn on the bus (*i.e.*, "for free"). *See id.* If so, Heinrich discloses saving power by grouping and transmitting data during the same active state of the bus.

would have found modifying or applying Heinrich's basic concepts to the bus to be predictable, likely to be successful, and obvious. *See* RX-7C (Yalamanchili WS) at Q/A 444, 447, 450.

Balasubramanian discloses a similar power-saving technique that involves synchronizing data transmissions to coincide with the active state of a transceiver. While Balasubramanian does not expressly disclose saving power across the bus between two processors, a transceiver is conceptually analogous to a bus in that they both serve as bidirectional conduits for data transmissions; they both interact with a modem processor or a similar processor for receiving and transmitting data (*see, e.g.*, Balasubramanian, Figs. 1, 10); and they both experience active states, inactive states, and latencies. RX-7C (Yalamanchili WS) at Q/A 335, 426, 444. Balasubramanian's technique of exploiting latency to transmit data during a single awake state of the transceiver, taken with Heinrich, would have further motivated a person skilled in the art to try to apply a similar power-saving method to the bus and to have a reasonable expectation of success in doing so. *See id.* at Q/A 437, 439-41, 447, 450.

For these reasons, the Commission finds a person skilled in the art would have found it obvious to modify the power-saving technique disclosed in Heinrich in combination with Balasubramanian, which represents knowledge in the art, and apply it to the bus, and would have had a reasonable expectation of successfully transmitting data in both directions during a single active state of the bus. The question whether a person skilled in the art would have found it obvious to push downlink data from the modem processor and then "pull" uplink data from the application processor, as recited in claim 31, is addressed later in this opinion.

iii. A "modem processor configured to hold [downlink] data until expiration of the modem timer"

As disclosed in Heinrich and known in the art, a modem processor in a cell phone or other mobile device receives and processes data from the network and transmits this "downlink"

data to the application processor, as needed. Heinrich at 1:29-35, 2:18-23, 4:30-36, Fig. 1. Heinrich also teaches that the modem processor will store and accumulate ("hold") non-real-time-sensitive data relating to IPC activities for later transmission to the application processor. Heinrich at 2:42-54, 8:7-49, Fig. 3; Hr'g Tr. (Baker) at 1386:9-12. The '490 patent does not claim to have invented the concept of having a processor hold data intended for another processor for some defined period of time. RX-7C (Yalamanchili WS) at Q/A 62-66, 73.

In the preferred embodiment, Heinrich teaches that the storage of downlink data on the modem processor and its transmission to the application processor is controlled by a "scheduler" on the modem processor. Heinrich at 7:8-9, 7:14-16, 7:21-27, 12:47-52. The scheduler, Heinrich explains, associates each stored IPC activity with a lazy timer, which will fire either at the expiration of a preset deadline or when a determination has been made that the application processor is awake. *Id.* at 9:1-11, 22-26. When one registered lazy timer fires, all of the registered lazy timers fire at the same time. *Id.* at 9:11-14. The firing of the lazy timers causes the modem processor to transmit all of its stored non-real-time-sensitive IPC data to the application processor. *Id.* at 9:11-17. Thus, Heinrich discloses a modem processor that is configured to store and aggregate, or "hold," downlink data until the expiration of a "modem timer." RX-7C (Yalamanchili WS) at Q/A 356-57.

To the extent it may be found that Heinrich does not disclose this limitation, OUII argues the '490 patent could be practiced using a countdown timer, which was already known in the art. OUII's Resp. at 18; *see also* RX-7C (Yalamanchili WS) at Q/A 62-66. Balasubramanian, for example, teaches that data packets may be generated in a cell phone and stored for "a configurable period of time" (*e.g.*, using a timer) until the transceiver is awake and can receive and transmit the data packets. Balasubramanian at 6:29-31, 6:40-49, 17:39-47, Figs. 1, 2, 10;

Hr'g Tr. (Baker) at 1390:6-14. Heinrich also teaches that the lazy timer in a scheduler may fire by a given deadline, similar to a countdown timer, if it has not previously received a signal that the application processor is awake. *See* Heinrich at 9:1-9. Using a modem timer or countdown timer to trigger the transmission of data stored in a modem processor was thus either known in the art or a "predictable variation" or "predictable use of prior art elements according to their established functions" that would "yield predictable results." *See KSR*, 550 U.S. at 416-17; *Intercontinental Great Foods*, 869 F.3d at 1344; RX-7C (Yalamanchili WS) at Q/A 62-66.

iv. An "application processor configured to hold [uplink] data"

Heinrich teaches multiple embodiments of the invention. In the preferred embodiment, the modem processor is the processor that initially stores, accumulates, and transmits non-real-time-sensitive downlink data to the application processor, which is the receiving processor. Heinrich at 12:47-52. Heinrich also teaches that these roles may be reversed – the application processor may be the processor that initially stores, accumulates, and transmits uplink data to the modem processor, which is the receiving processor. *Id.* at 12:52-59. In the latter embodiment, the scheduler may implement the same scheduling techniques described above, but it is configured to control transmissions of non-real-time-sensitive IPC data from the application processor to the modem processor. *Id.* Heinrich further teaches that the scheduler that schedules transmission of IPC data from the application processor to the modem processor may be located on the modem processor. *Id.* at 12:59-64; *see also id.* at 7:19-27. Heinrich thus teaches that the application processor may store, or "hold," uplink data for later transmission to the modem processor using a scheduler located on the modem processor. *Id.* at 7:14-23, 12:47-64.

Heinrich also teaches that the application processor may operate with a flash memory to manage or retrieve data; handle a variety of "multimedia features" on the mobile device, such as

the telephony applications, GPS function, and other applications; and transmit such data to the modem processor. *See id.* at 1:27-39, 4:26-43, 4:51-64, Fig. 1. A person skilled in the art also would have known that processors can store and process data for later transmission. *See* RX-7C (Yalamanchili WS) at Q/A 37-38, 52-56, 59. The ID acknowledged that Heinrich teaches that delaying and grouping non-real-time-sensitive IPC data can be done at either or both processors, although it found that Heinrich does not teach how to synchronize data transmissions in both directions. ID at 89-90. The Commission finds that in light of these teachings and knowledge in the art, a person skilled in the art would have known or found it obvious that an application processor, like the modem processor, could store and accumulate "uplink data" for later transmission to the modem processor via the bus.[17] *See* RX-7C (Yalamanchili WS) at Q/A 37-38, 52-56, 59, 383-87.

Qualcomm argues that Heinrich does not disclose how both processors can store data at the same time, as required by claim 31. When the application processor is asleep, Qualcomm contends, it cannot accumulate or process data, but when it is awake, the application processor will transmit all of its uplink data to the modem processor without storing it. *See* Qualcomm's Resp. at 13-14. In claim 31, in contrast, both processors must be awake to store and transmit data, a scenario that cannot occur in the disclosed Heinrich system, Qualcomm argues. *Id.* at 20.

The Commission, while aware of the differences between Heinrich and the '490 patent, finds that Qualcomm, like the ID, is reading Heinrich too narrowly for obviousness purposes. *See KSR*, 550 U.S. at 416-18 ("the analysis need not seek out precise teachings directed to the

[17] Balasubramanian, while not explicitly disclosing an application processor, teaches that a processor that runs applications and generates data packets, or that queues and assembles such packets for transmission to the network, may operate in conjunction with a "data memory for storing packets." Balasubramanian at 4:30-42, 6:29-39, 17:39-48, Figs. 1, 2, 10.

specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ"); *Cohesive Techns.*, 543 F.3d at 1364 (unlike anticipation, obviousness is not bound by the express or inherent teachings of a single prior art reference). Heinrich, as explained above, teaches that the modem processor and application processor (or perhaps both) may store their respective data until such time as they are triggered to transmit such data across the IPC bus to the other processor. Heinrich at 12:47-64. Qualcomm's expert, Dr. Baker, testified that the application processor in Heinrich can hold uplink data for later transmission to the modem processor. Hr'g Tr. (Baker) at 1386:13-16, 1417:7-9.

To the extent there is a dispute as to whether both processors can store data at the same time (*see id.*), this is a function of the specific embodiment in Heinrich, in which one processor is expected to accumulate data while the other processor is in a sleep state. But Heinrich itself invites a person of ordinary skill in the art to consider storing data on both processors, and even using the same scheduler on the modem processor to control the storage and transmission of data by both processors. Heinrich at 7:16-21, 12:59-64. The Commission thus finds that even though Heinrich itself does not expressly disclose such a procedure, the temporary storage of data on both processors suggested by Heinrich itself lies within the knowledge, creativity, and common sense of a person skilled in the art. *See Intercontinental Great Brands*, 869 F.3d at 1344; RX-7C (Yalamanchili WS) at Q/A 37, 52-56, 59, 383-86, 390.

Temporarily storing data on both processors is also suggested by the nature of the bus, as known in the art and taught in Heinrich. A person skilled in the art, as explained earlier, would have found it obvious at least to try saving power by coordinating data transmissions to coincide with a single active state of the bus. This goal would necessarily and predictably lead to

temporarily storing and accumulating data in both processors, because the bus is active when either processor is transmitting data to the other processor, and it can enter a sleep state only when neither processor is transmitting data across the bus to the other processor. *See* RX-7C (Yalamanchili WS) at Q/A 44-47, 52-53; Hr'g Tr. (Krishna) at 698:18-699:20 (discussing full-duplex buses). Thus, a person skilled in the art would have found modifying Heinrich to temporarily store data on the application and modem processors represented a predictable use or variation of components already known in the art and using them "according to their established functions." *See KSR*, 550 U.S. at 417-18.

v. "until the modem processor pulls data from the application processor after transmission of the [downlink] data" and "wherein the modem processor is configured [to] pull data from the application processor after transmission of the [downlink] data"

These two elements of claim 31 impose two related limitations on the modem processor. First, the modem processor must transmit (*i.e.*, push) its stored downlink data across the bus to the application processor upon expiration of the modem timer. RX-7C (Yalamanchili WS) at Q/A 67, 69 (explaining that a processor pushes data when it "serves as the source of the data [and] initiates a transmission, or sending, of the data to another component"). Second, the modem processor, "after transmission" of its stored downlink data[18], must "pull" any stored uplink data from the application processor before the bus transitions back to a low power state. *See id.* at Q/A 68-69 (explaining that a processor "pulls" data when the processor receives data in

[18] As noted earlier in the claim construction section, "after transmission" means "waiting until the downlink transmission has started before starting the uplink transmission. The entirety of the downlink data need not have been transmitted before starting the uplink transmission." ID at 80-82. Thus, once the modem processor begins to transmit downlink data to the application processor (upon expiration of the modem timer), interprocessor transmissions of uplink and downlink data may proceed in both directions across the bus simultaneously, without waiting for completion of the initial transmission of downlink data from the modem processor. *Id.*

response to a request it made for that data). A "pull" means the receiving processor (the modem processor in claim 31) requests or initiates the transfer of data from a remote source (the application processor). *Id.* This understanding is consistent with the plain meaning of "pull" and its usage in the '490 patent.[19]

With respect to the first step, Heinrich describes the modem processor transmitting stored data to the application processor at the expiration of a modem timer. Heinrich at 4:6-15, 8:7-49, 9:1-29, Fig. 3; RX-7C (Yalamanchili WS) at Q/A 356-59. The dispute, then, is over whether it would have been obvious for the modem processor to "pull" stored data from the application processor after pushing its own stored data to the application processor and doing so before the bus transitions back to its inactive state. The ID found that claim 31 is not obvious because neither Heinrich nor Balasubramanian expressly disclose a push followed by a pull, or a coordinated transmission of stored data in both directions before the bus transitions back to an inactive state. ID at 89-90. While it may be true that Heinrich and Balasubramanian do not expressly disclose a combined push/pull in the context of interprocessor communications, the Commission finds the ID erred once again in adhering too strictly to the express teachings of the references, without taking into consideration the more flexible approach of obviousness. *See*

[19] *See* '490 patent at 4:38-42 ("The application processor is configured to hold [uplink] data until the modem processor *pulls* data from the application processor after transmission of the [downlink] data."), 9:66-10:4 ("As an alternative, the modem processor 44 may continue to *pull* the uplink data 56 from the application processor 34 until it detects no further downlink data 54 activity. That is, the modem processor 44 may intersperse pulling the uplink data 56 while receiving the downlink data 54," discussing Fig. 4); 16:14-18, 23-26 (" . . . then the application processor 34 updates the internal data structure/context array with uplink data packet information that the device can *pull* and update write pointers accordingly . . . "), 16:34-38 ("Likewise, once a timer has expired, data can be *pulled* or pushed across the interconnectivity bus 36 based on polling [reading], setting doorbell registers, or other technique."). Qualcomm contends that all examples of a "pull" in the '490 patent use DMA ("direct memory access"). Qualcomm's Resp. at 29; Hr'g Tr. (Leucht-Roth) at 733:6-13 (Intel's fact witness, on DMA). Qualcomm, however, does not claim the '490 patent invented DMA, nor did it request a limiting construction of "pull."

Intercontinental Great Brands, 869 F.3d at 1344 (explaining that an obviousness analysis requires "read[ing] the prior art in context, taking account of 'demands known to the design community,' 'the background knowledge possessed by a person having ordinary skill in the art,' and 'the inferences and creative steps that a person of ordinary skill in the art would employ'" (quoting *KSR*)); *Cohesive Techns.*, 543 F.3d at 1364 (obviousness is not limited to the express or inherent teachings of the prior art).

The '490 patent does not claim to have invented a new way to push or pull data, as these techniques were already known in the art. RX-7C (Yalamanchili WS) at Q/A 70-73. Heinrich teaches that, when the modem processor transmits stored data to the application processor, the application processor will transmit, or push, data to the modem processor during the same active state. *Id.*; *see* Heinrich at 9:1-29, 9:41-49. Heinrich also teaches that a scheduler on the modem processor can remotely instruct the application processor to transmit its stored data across the bus to the modem processor. *See* Heinrich at 12:47-64. Thus, at a minimum Heinrich teaches that the modem processor can push data to or "pull" data from the application processor.

Qualcomm argues that for the modem processor to "pull" data from the application processor, the modem processor must have information to locate such data. Qualcomm's Resp. at 22-23. But Qualcomm's argument on this point is that neither Heinrich nor Balasubramanian expressly discloses this function. Qualcomm does not argue that designing an interprocessor system to "pull" data from one processor to the other was beyond the knowledge, creativity, or common sense of a person skilled in the art. *See id.* As noted earlier, the ID defined a person skilled in the art as having two to four years of experience in multi-processor systems, plus a Master's degree or Bachelor's degree, respectively, in electrical engineering, computer engineering, or computer science. ID at 72. Interprocessor communications, which are a

backbone functionality of cell phones, predated not only the '490 patent but Heinrich as well.[20] Heinrich at 1:24-39. Persons skilled in the art of multiprocessor communications would have known how to perform a "pull" function, including using addressing information, as the '490 patent does not claim to have invented a new way to pull or push data. RX-7C (Yalamanchili WS) at Q/A at 70-73.

The remaining dispute is whether a person skilled in the art would have found it obvious that the modem processor could push *and then* pull stored data from the application processor while the bus is still in its active state. To the extent it may be argued that Heinrich does not disclose a data "push" followed by a "pull," Balasubramanian teaches this basic concept when it states that a transceiver may transmit its own stored data to the network interface and then "send a message to the network interface [] requesting transmission of all queued [stored] packets." Balasubramanian at 6:11-19, 6:43-49, 6:55-7:11; RX-7C (Yalamanchili WS) at Q/A 400-408. Even though Balasubramanian is not specifically directed to interprocessor communications or DMA, Balasubramanian shows that a person skilled in the art knew conceptually that a component (*e.g.*, a transceiver) can push stored data, and then locate and "pull" data from a remote location; in other words, the basic sequencing of these commands was not invented in the '490 patent. RX-7C (Yalamanchili WS) at Q/A 397-98, 401-08, 417, 428. Balasubramanian, like Heinrich, is also directed to methods of saving power in cell phones and mobile devices by

[20] Apple, for example, released its first iPhone in June 2007, over five years before the application for the Heinrich patent was filed (January 2013) and six years before the first provision application that eventually led to the '490 patent was filed (December 2013). *See* AT&T, *A Timeline of Apple iPhone Launches*, https://www.attexperience.com/blog/a-timeline-of-apple-iphone-launches/ (last visited March 26, 2019). Balasubramanian filed a provisional application in June 2006 and a complete patent application in October 2006. Balasubramanian, cover. PCIe buses, referenced in the '490 patent, were developed in the early 2000s, and PCIe standards date back to at least 2007. RX-7C (Yalamanchili WS) at Q/A 30.

coordinating data transmissions, and involves similar device architectures, components, functions, and techniques. *Id.* at Q/A 432-33. A person skilled in the art would have found Balasubramanian's teachings relevant at a conceptual level because it was known that a processor, like a transceiver, can temporarily store, push, or pull data and experiences similar active states, inactive states, and latencies. *See id.* at Q/A 399, 409, 414, 417, 426-27.

Obviousness, moreover, is not limited to literally "combining" Balasubramanian's description of pushing and pulling data by a transceiver with Heinrich's IPC embodiment in some "rigid" or mechanical sense. *See KSR*, 550 U.S. at 415-17, 419-22 (rejecting "rigid" approach to analyzing prior art for obviousness); *Cohesive Techns.*, 543 F.3d at 1364 (obviousness is not limited to express or inherent teachings of a reference); *Intercontinental Great Brands*, 869 F.3d at 1344 (discussing the flexible approach of obviousness). The Commission, as explained before, finds it would have been obvious for a person skilled in the art to try to adapt Heinrich's power-saving technique to the bus, given that a bus exhibits active/inactive states and latency like a processor; it transmits data only between the modem and application processors; its active state coincides with those of the processors when they are exchanging data; and it may enter an inactive state only when the processors are not transmitting data. Coordinating data transmissions to coincide with the bus's active state means that data must be temporarily stored and aggregated at both processors, not just one, and that transmissions from both processors must be coordinated to coincide with the bus's active state to minimize transitions. *See* RX-7C (Yalamanchili WS) at Q/A 44-52, 418-22; Hr'g Tr. (Krishna) at 698:18-699:20 (discussing full-duplex buses).

In this context, then, there are only "a finite number of identified, predictable solutions" for addressing the design need to coordinate data transmissions from both processors to coincide

with an active state of the bus. *See KSR*, 550 U.S. at 420-21. First, each processor could "push" its data across the bus to the other processor. Second, each processor could "pull" data from the other processor. Third, one processor (*e.g.*, the modem processor) could push its own stored data to the other processor, and then pull stored data from that processor (or *vice versa*). RX-7C (Yalamanchili WS) at Q/A 70-72. All three combinations were known in the art, and the '490 patent does not claim to have invented a new way to push or pull data. *Id.* Heinrich, as discussed earlier, discloses the first combination (push/push); it says little or nothing of the second combination (pull/pull); and it suggests but does not expressly describe the third combination (push/pull). *See, e.g.,* Heinrich at 7:14-27, 12:47-13:2 (". . . in other examples, IPC activities may be communicated as described above between any two (or more) processors on the computer system"). Balasubramanian teaches that a transceiver can push stored data to the network and then pull stored data from the network. RX-7C (Yalamanchili WS) at Q/A 323, 405-08 (discussing Balasubramanian at 6:63-7:11), 428. In light of the teachings of Heinrich and knowledge in the art, a person skilled in the art would have found it obvious to try the third option (push/pull) and would have had a reasonable likelihood of success, given that the bus and processors are being used in a "predictable" manner "according to the[ir] established functions," and these modifications involve "known options within [the] technical grasp" of a person skilled in the art. *See* 550 U.S. at 418, 420-21; *Intercontinental Great Brands*, 869 F.3d at 1344.

For these reasons, Qualcomm's argument that Heinrich cannot teach a synchronized push/pull of data in both directions lacks merit. Qualcomm's argument assumes that the modem and application processors cannot perform in any manner other than what is expressly described in Heinrich. This is not correct. As noted earlier, a person skilled in the art would have known that processors in a mobile device can temporarily store data, that they can push or pull such data

to or from another processor, and that they do not have to segregate non-real-time-sensitive data from real-time-sensitive data for storage or transmission purposes as described in Heinrich. *See* Balasubramanian at 5:62-6:19, 6:40-47, 6:55-7:13, Fig. 2 ("queuing" means storing, and does not segregate different data types for storage or transmission purposes); RX-7C (Yalamanchili WS) at Q/A 323. Heinrich itself, moreover, invites persons skilled in the art to consider different ways of coordinating transmissions between the processors. *See* Heinrich at 7:14-27, 12:45-64. Qualcomm also erroneously assumes that a person skilled in the art, on reading Heinrich, must continue to focus on saving power *in the processors*, when the real question is whether a person skilled in the art would have found it obvious to apply Heinrich's power-saving technique *to the bus* using a coordinated push/pull transmission technique as recited in claim 31. For the reasons given above, the Commission finds a person skilled in the art would have been motivated to modify Heinrich in this manner. *See* RX-7C (Yalamanchili WS) at Q/A 427, 434-36, 447.

For the foregoing reasons, the Commission finds that Apple has proven by clear and convincing evidence that a person skilled in the art would have found it obvious to modify the power-saving technique in Heinrich using knowledge in the art, as represented by Balasubramanian, and apply it to the bus in the manner recited in claim 31 of the '490 patent.

b. Motivation to Modify Heinrich With Teachings From Balasubramanian, As Reflective Of Knowledge in the Art

In addition to the discussion above, *see* Parts IV(B)(4)(a)(ii) and (IV)(B)(4)(a)(v), *supra*, the Commission finds that a person skilled in the art would have had a strong motivation to modify Heinrich or combine it with Balasubramanian, which reflects knowledge in the art. As Heinrich explains, there have been ongoing design needs and market pressures to save power and extend battery life in cell phones and mobile devices as their processing power and capabilities have continued to increase. Heinrich at 1:11-2:8; *see also* Balasubramanian at 1:27-45, 4:24-29.

The trade-off between increasing processing power and saving power even influenced the basic architecture of a cell phone, which comprises a separate modem processor and application processor interconnected by an IPC bus, as recited in claim 31. Heinrich at 1:24-45.

Heinrich and Balasubramanian are both explicitly directed to the goal of saving power in cell phones, mobile devices, and other computing systems. RX-7C (Yalamanchili WS) at Q/A 432-36, 447. Both references disclose similar power-saving techniques, which include at least temporarily storing and aggregating data in a processor or other component, transmitting that data as a group to a receiving processor or transceiver (or other component), and receiving data during a single active state of that receiving component, thereby reducing the number of times that component must transition between active and active modes. *See, e.g.,* Heinrich at 2:20-33, 2:42-54,4:6-15, 7:16-27, 8:21-55, 11:45-52; Balasubramanian at 1:52-2:2, 2:23-27, 2:50-63; 5:47-61, 6:55-58, 14:49-63. Both Heinrich and Balasubramanian also recognize that reducing the number of power state transitions reduces the amount of time that a processor, bus, or transceiver spends in its awake state due to the latencies, or delays, associated with transitioning from an awake state to a sleep state. *See, e.g.,* Heinrich at 3:29-31, 4:12-15, 5:57-6:41, Fig. 2; Balasubramanian at 14:49-63. "A motivation to combine may be found explicitly or implicitly in market forces; design incentives; the interrelated teachings of multiple patents; any need or problem known in the field of endeavor at the time of invention and addressed by the patent; and the background knowledge, creativity, and common sense of the person of ordinary skill." *RealTime Data*, 912 F.3d at 1373-74 (internal quotes omitted) (citing *ZUP*, 896 F.3d at 1371).

The Commission appreciates the differences between Heinrich and Balasubramanian (*e.g.*, saving power in a processor vs. a transceiver, IPC vs. network interfaces) and that Balasubramanian does not expressly disclose the basic architecture of a cell phone or mobile

device. Nonetheless, the Commission does not find these differences to be as compelling as the ID found. *See* ID at 91-94. The fact that Balasubramanian does not expressly disclose the architecture of a cell phone does not erase knowledge of that architecture, its components, and their basic operations from the prior art, particularly when they are expressly disclosed in Heinrich. Likewise, the fact that Heinrich and Balasubramanian are directed to somewhat different power-saving goals does not negate the conceptual similarities in their techniques described above. To a person skilled in the art, the application of similar concepts in somewhat different contexts does not necessarily discourage their combination and application in another context. Rather, it shows that those concepts were known in the art and that their application would have been predictable, reliable, reasonable, likely to lead to successful results, and within the level of ordinary skill in the art. *See* RX-7C (Yalamanchili WS) at Q/A 447-50.

Moreover, obviousness does not require rigidly applying Heinrich's power-saving technique for processors to the network disclosed in Balasubramanian, nor does it require rigidly applying Balasubramanian's power-saving technique to interprocessor communications, as the ID found. *See* ID at 93. Balasubramanian makes clear conceptually what was suggested in Heinrich or already known in the art, namely, that a coordinated "push/pull" of data between two components that coincides with an active state of a component can save power. *See* RX-7C (Yalamanchili WS) at Q/A 70-72, 431-436, 439-41, 447. For the reasons given above, the Commission finds those modifications were suggested by Heinrich itself or known in the art, yielded predictable and likely successful results, and fell within the scope of a skilled artisan's knowledge (as represented by Balasubramanian), creativity, and common sense.

The Commission also finds that the purportedly substantial power-saving results reported by Heinrich do not weigh against a finding of obviousness. *See* ID at 93-94.[21] The testing data disclosed by Heinrich and discussed by the ID are limited to two case studies and a table. ID at 93 (discussing Heinrich at 4:6-12). Neither the ID nor Qualcomm claims that Heinrich's power-saving technique is practical, reliable, or adaptable to any actual cell phones or other mobile devices, that its alleged power savings have been exhibited in any real-life applications (other than two limited case studies), or that its technique is somehow necessary or praiseworthy for any actual cell phone design or application. *See id.*; RX-7C (Yalamanchili WS) at Q/A 459-65. In the absence of any such evidence, there is no reason to assume that a person skilled in the art would have felt compelled to limit Heinrich's power-saving concepts to processors or to restrict their application or modification to methods that would have preserved the processor power savings Heinrich reported. In fact, if Heinrich's power-saving technique was not actually implemented in any actual cell phones or mobile devices, then persons skilled in the art would have been motivated to continue searching for new ways to save power and extend battery life in such devices. This search would have included modifying Heinrich's concepts to save power consumed by the bus that interconnects two processors rather than focusing on one processor, for the reasons given above. *See* RX-7C (Yalamanchili WS) at Q/A 44-51, 435-39.

[21] The ID did not explicitly categorize the "outstanding" results as "unexpected results." *See In re Soni*, 54 F.3d 746, 750 (Fed. Cir. 1995) (explaining, "One way for a patent applicant to rebut a *prima facie* case of obviousness is to make a showing of 'unexpected results,' *i.e.*, to show that the claimed invention exhibits some superior property or advantage that a person of ordinary skill in the relevant art would have found surprising or unexpected. The basic principle behind this rule is straightforward – that which would have been surprising to a person of ordinary skill in a particular art would not have been obvious."). Rather, the ID discussed the results in its motivation-to-combine analysis and in connection with Qualcomm's long-felt need argument. *See* ID at 93-94, 95-96.

For all these reasons, the Commission finds that there is clear and convincing evidence that a person of ordinary skill in the art would have been motivated to modify Heinrich's power-saving technique to apply it to the bus interconnecting two processors in a manner recited by claim 31 of the '490 patent. Such modifications were suggested by Heinrich or fell within the knowledge and creative steps that a person of ordinary skill in the art would employ when designing multiprocessor systems, as represented by the application of similar power-saving and data synchronization concepts in Balasubramanian.

c. Secondary Considerations of Nonobviousness

The ID noted that Qualcomm argued that secondary considerations of long-felt but unmet need, commercial success, industry praise, licensing, and copying show that claim 31 of the '490 patent was not obvious. ID at 94. With the exception of long-felt but unmet need, discussed below, the ID found Qualcomm's evidence of secondary considerations to be "unpersuasive," primarily because of its failure to demonstrate a nexus between the claimed invention and the alleged secondary consideration. *Id.* For example, the ID found that Qualcomm's evidence of industry praise and licensing were tied to marketing statements and multiple Qualcomm patents, respectively, and not to the invention of claim 31. *Id.* [

] *See id.* at 94-95.

Qualcomm did not petition for review of the ID's findings with respect to commercial success, industry praise, licensing, or copying, and has thus abandoned any arguments as to those issues, pursuant to Commission Rule 210.43(b)(2). In the absence of sufficient evidence of a

nexus and in view of the evidence of record, the Commission finds no reason *sua sponte* to review, reverse, or remand the ID's findings on these issues, and accordingly adopts such findings as its own. *See Bosch Automotive Service Solutions*, 878 F.3d at 1036-38 (evidence of secondary considerations of nonobviousness is relevant only if the patentee demonstrates a nexus between the alleged secondary considerations and the merits of the invention).

With regard to long-felt need, however, the ID observed that Heinrich describes "a long-standing need in the art for technologies that provide power savings and improve battery life for mobile devices." ID at 95 (citing Heinrich at 1:11-23). That need, the ID found, was met by the invention of the '490 patent, which purportedly achieved "significant device power savings" of approximately 8-10%, according to Qualcomm's witness Mr. Krishna. *Id.* at 95-96 (citing Hr'g Tr. (Krishna) at 716:19-717:2).

The Commission has determined that the ID's long-felt need finding contains clear errors of fact and law. "Long-felt but unmet need is analyzed as of the date of an articulated identified problem and evidence of efforts to solve that problem." *Perfect Web Techns., Inc. v. InfoUSA, Inc.*, 587 F.3d 1324, 1332-33 (Fed. Cir 2009) (quoting *Texas Instruments v. U.S. Int'l Trade Comm'n*, 988 F.2d 1165, 1178 (Fed. Cir. 1993). But the ID identifies only a general need to save power and extend battery life in cell phones and mobile devices, not an "articulated identified problem," such as conserving power used by the bus. *See* ID at 95-96; RX-7C (Yalamanchili WS) at Q/A 457-59. Nor did the ID provide any evidence as to when this "articulated identified problem" first arose, how long this need was felt, or that it was not being met through other means. *See Perfect Web*, 587 F.3d at 1332-33. The record contains multiple proposed solutions to this general need to save power, such as Heinrich's power-saving technique for processors, Balasubramanian's technique for saving power in transceivers, and the dual-processor

architecture of a cell phone itself, not to mention improvements in other components or applications. *See id.* at Q/A 458. Thus, while the need to save power and extend battery life has been and remains an ongoing goal, the invention itself does not represent a solution to an "articulated identified problem" that was unmet or unsolved prior to the '490 patent.

As for the ID's reliance on Mr. Krishna's reported power savings of 8-10%, these findings refer to the "modem power budget" and not to entire "device power savings," as reported in the ID.[22] ID at 95-96; Qualcomm's Resp. at 32. Moreover, Mr. Krishna observed those power savings in a laboratory setting but presented no evidence as to whether or how much the invention of the '490 patent resolved power issues in real-world applications, or whether it affected industry practices, marketing, consumer purchases, or the like. RX-7C (Yalamanchili WS) at Q/A 455-56 (noting lack of nexus between the invention and alleged sales of commercial products, consumer purchasing decisions, advertisements, etc.); *Perfect Web*, 587 F.3d at 1332-33 (alleged long-felt but unmet need was insufficient to raise genuine issue of material fact because the patentee's bare assertion that the invention "improved efficiency" was unsupported by any data that the invention actually affected marketing costs, time, consumer practices, etc.).

Long-felt but unmet need, moreover, is only one factor, "and will not always dislodge a determination of obviousness based on analysis of the prior art." *KSR*, 550 U.S. at 426. For the reasons given earlier, the differences between Heinrich (with Balasubramanian, representing knowledge in the art) and the invention of claim 31 were relatively minor. When the differences between the prior art and the claimed invention are minimal, as they are here, it cannot be said the alleged long-felt need was unsolved. *ZUP*, 896 F.3d at 1374. Moreover, the motivations and

[22] *See* Hr'g Tr. (Leucht-Roth) at 751:22-752:11 [

].

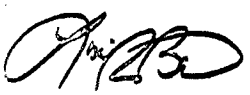
modifications needed to apply Heinrich (with Balasubramanian or knowledge in the art) to the bus were predictable variations that fell within the knowledge, common sense, inferences, and creativity of a person of ordinary skill in the art. Where the claimed invention is "no more than the predictable use of prior art elements according to established functions, evidence of secondary indicia are frequently deemed inadequate to establish nonobviousness." *Intercontinental Great Brands*, 869 F.3d at 1347 (quotes omitted). Also, because obviousness is ultimately a legal determination, "a strong showing of obviousness" may remain standing "even in the face of considerable evidence of secondary considerations" (which are not present here). *ZUP*, 896 F.3d at 1374 (quotes omitted).

V. CONCLUSION

For the foregoing reasons, the Commission has determined that: (1) the term "hold" in claim 31 means "to prevent data from traveling across the bus or to store, buffer, or accumulate data," and (2) Apple has shown, through clear and convincing evidence, that claim 31 is invalid as obvious over Heinrich in combination with Balasubramanian, which reflects knowledge in the art. The Commission also grants Apple's request for leave to supplement its response to the Commission's Question D on the public interest for the limited purpose of supplementing the record regarding the jury verdict in the parallel district court proceeding.

The Commission previously declined to review, and therefore adopted, the ID's finding there is no infringement of the other two patents asserted in this investigation, the '558 patent" or the '936 patent. 83 *Fed. Reg.* at 64876. Accordingly, the Commission has concluded that Qualcomm has not shown a violation of Section 337 and that no remedial orders shall be issued, which renders any moot issues of remedy, the public interest, or bonding.

By order of the Commission.



Lisa R. Barton

Secretary to the Commission

Issued: April 5, 2019

CERTAIN MOBILE ELECTRONIC DEVICES AND RADIO FREQUENCY AND PROCESSING COMPONENTS THEREOF **Inv. No. 337-TA-1065**

PUBLIC CERTIFICATE OF SERVICE

I, Lisa R. Barton, hereby certify that the attached **COMMISSION OPINION** has been served upon the following parties as indicated, on **April 5, 2019**.

Lisa R. Barton, Secretary
U.S. International Trade Commission
500 E Street, SW, Room 112
Washington, DC 20436

On Behalf of Complainants Qualcomm Incorporated:

S. Alex Lasher, II, Esq.
QUINNN EMANUEL URQUHART & SULLIVAN LLP
1300 I Street NW, Suite 900
Washington, DC 20005

☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other:_____

On Behalf of Respondent Apple Inc.:

Lauren A. Degnan
FISH & RICHARDSON P.C.
1000 Maine Avenue, SW
Suite 1000
Washington, DC 20024

☐ Via Hand Delivery
☒ Via Express Delivery
☐ Via First Class Mail
☐ Other:_____

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C.

In The Matter of **CERTAIN MOBILE ELECTRONIC DEVICES AND RADIO FREQUENCY AND PROCESSING COMPONENTS THEREOF**	**Investigation No. 337-TA-1065**

NOTICE OF A COMMISSION DETERMINATION TO REVIEW IN PART A FINAL INITIAL DETERMINATION FINDING A VIOLATION OF SECTION 337; SCHEDULE FOR FILING WRITTEN SUBMISSIONS ON THE ISSUES UNDER REVIEW AND ON REMEDY, PUBLIC INTEREST, AND BONDING; AND EXTENSION OF THE TARGET DATE

AGENCY: U.S. International Trade Commission.

ACTION: Notice.

SUMMARY: Notice is hereby given that the U.S. International Trade Commission (the "Commission") has determined to review in part the final initial determination ("ID") of the administrative law judge ("ALJ"), which was issued on September 28, 2018. The Commission has determined to extend the target date for completion of the investigation to February 19, 2019.

FOR FURTHER INFORMATION CONTACT: Carl P. Bretscher, Office of the General Counsel, U.S. International Trade Commission, 500 E Street, SW, Washington, DC 20436, telephone (202) 205-2382. Copies of non-confidential documents filed in connection with this investigation are or will be available for inspection during official business hours (8:45 a.m. to 5:15 p.m.) in the Office of the Secretary, U.S. International Trade Commission, 500 E Street, SW, Washington, DC 20436, telephone (202) 205-2000. General information concerning the Commission may also be obtained by accessing its Internet server (*https://www.usitc.gov*). The public record for this investigation may be viewed on the Commission's Electronic Docket Information System ("EDIS") (*https://edis.usitc.gov*). Hearing-impaired persons are advised that information on this matter can be obtained by contacting the Commission's TDD terminal, telephone (202) 205-1810.

SUPPLEMENTARY INFORMATION: On August 14, 2017, the Commission instituted this investigation based on a Complaint and amendment thereto filed by Qualcomm Incorporated of San Diego, California ("Qualcomm"). 82 FR 37899 (Aug. 14, 2017). The notice of investigation named Apple Inc. of Cupertino, California ("Apple") as Respondent. The Complaint alleged violations of Section 337 of the Tariff Act of 1930, as amended (19 U.S.C. 1337), by reason of the importation into the United States, sale for importation, or sale within the United States after importation of certain mobile electronic devices and radio frequency and processing components thereof that infringe one or more claims of U.S. Patent No. 9,535,490

("the '490 patent"), U.S. Patent No. 8,698,558 ("the '558 patent"), U.S. Patent No. 8,633,936 ("the '936 patent"), U.S. Patent No. 8,838,949 ("the '949 patent"), U.S. Patent No. 9,608,675 ("the '675 patent"), and U.S. Patent No. 8,487,658 ("the '658 patent"). The Office of Unfair Import Investigations ("OUII") is also a party to this investigation.

The following claims were voluntarily terminated during the course of this investigation: all asserted claims of the '658 patent, '949 patent, and '675 patent; claims 1, 20-24, 26, 38, 67, and 68 of the '936 patent; claims 1, 6, and 8-20 of the '558 patent; and claims 1-6, 8, 10, and 16-17 of the '490 patent. Comm'n Notice (July 17, 2018) (*aff'g* Order No. 43); Comm'n Notice (May 23, 2018) (*aff'g* Order No. 37); Comm'n Notice (Apr. 6, 2018) (*aff'g* Order No. 34); Comm'n Notice (Mar. 22, 2018) (*aff'g* Order No. 24); Comm'n Notice (Sept. 20, 2017) (*aff'g* Order No. 6). The only claims still at issue are claim 31 of the '490 patent, claim 7 of the '558 patent, and claims 19, 25, and 27 of the '936 patent.

The presiding administrative law judge ("ALJ") originally set a target date for completion of this investigation within 17 months, *i.e.*, by January 14, 2019. Comm'n Notice (Sept. 11, 2017) (*aff'g* Order No. 3). The Commission subsequently agreed to extend the target date to January 28, 2019. Comm'n Notice (Sept. 26, 2018) (*aff'g* Order No. 44). The Commission also extended the date for determining whether to review the subject ID to December 12, 2018. Comm'n Notice (Nov. 9, 2018).

The ALJ held an evidentiary hearing from June 19-27, 2018. On September 28, 2018, the ALJ issued his final initial determination in this investigation. The ALJ found a violation of Section 337 due to infringement of the '490 patent. ID at 197. The ALJ found no infringement and hence no violation of Section 337 with respect to the '558 patent or '936 patent. *Id.* The ALJ found that Qualcomm satisfied the technical and economic prongs of the domestic industry requirement with respect to the '490 patent, but did not satisfy the technical prong with respect to the '558 patent or '936 patent. *Id.* The ALJ also found that it was not shown by clear and convincing evidence that any asserted claim was invalid. *Id.* The ALJ further recommended that no limited exclusion order or cease-and-desist order be issued in this investigation due to their prospective effects on competitive conditions in the United States, national security, and other public interest concerns. *Id.* at 199-200. The ALJ recommended that bond be set at zero-percent of entered value during the Presidential review period, if any. *Id.* at 201.

Apple and Qualcomm filed their respective petitions for review on October 15, 2018. The parties, including OUII, filed their respective responses to the petitions on October 23, 2018. The Commission has also received a number of public interest statements from third parties, including Intel Corporation; ACT/The App Association; the American Antitrust Institute; the American Conservative Union; Americans for Limited Government; the Computer and Communications Industry Association; Conservatives for Property Rights; Frances Brevets (a patent sovereign fund); Frontiers of Freedom; Innovation Alliance; Inventors Digest; IP Europe; Public Knowledge and Open Markets (a joint submission); RED Technologies; R Street Institute, the Electronic Frontier Foundation, Engine Advocacy, and Lincoln Network (a joint submission), *et al*.

Having reviewed the record in this investigation, including the ALJ's orders and final ID, as well as the parties' petitions and responses thereto, the Commission has determined to review the final ID in part, as follows.

As to the '490 patent, the Commission has determined to review the ALJ's construction of the term "hold" and his findings on infringement and the technical prong of domestic industry to the extent they may be affected by that claim construction. The Commission has further determined to review the ALJ's findings as to whether claim 31 of the '490 patent is obvious.

The Commission has determined not to review any of the ALJ's findings with respect to the '558 patent or the '936 patent.

The Commission has also determined not to review the ALJ's findings with respect to the economic prong of the domestic industry requirement.

The parties are asked to provide additional briefing on the following issues regarding the '490 patent, with appropriate reference to the applicable law and the existing evidentiary record. For each argument presented, the parties' submissions should set forth whether and/or how that argument was presented and preserved in the proceedings before the ALJ, in conformity with the ALJ's Ground Rules (Order No. 2), with citations to the record:

A. With regard to the '490 patent, please explain the plain and ordinary meaning of the term "hold" in the context of claim 31 of this patent. In particular, explain whether the ordinary meaning of "hold" can mean both "to store, buffer, or accumulate" data and "to prevent data from traveling across the bus," or whether "hold" must be limited to one construction or the other.

B. Assuming "hold" could be interpreted to mean "to store, buffer, or accumulate" data and "to prevent data from traveling across the bus," as set forth in Question (A), explain whether that construction would affect the ALJ's findings on infringement or the technical prong of domestic industry, and if so, how.

C. Assuming "hold" could be interpreted to mean "to store, buffer, or accumulate" data and "to prevent data from traveling across the bus," as set forth in Question (A), explain whether that construction would affect the ALJ's analysis of either the Heinrich patent (U.S. Patent No. 9,329,671) or the Balasubramanian patent (U.S. Patent No. 8,160,000) or his findings on obviousness, and if so, how.

D. The Heinrich patent, *supra*, explains that a scheduler may be implemented either through software or hardware to control interprocessor communications in both directions across a bus. *See* Heinrich at 4:44-50, 7:8-21, 8:1-5. Heinrich further teaches that the scheduler can monitor the active state of the receiving processor by monitoring the active state of the IPC bus. *See id.* at 9:50-62. Explain whether the active state of the bus connecting the two processors in Heinrich coincides with or is otherwise related to the active state(s) of the processor(s) receiving the transmission across the bus. If so, explain whether monitoring the active state of the receiving processor (by monitoring the bus) and timing data transmissions to

coincide with the active state of the receiving processor(s) will directly, indirectly, or inherently cause the transmissions to coincide with the active state of the bus.

E. Based on your answer to Question (D), explain whether Heinrich's technique of grouping and scheduling transmissions to minimize the number of times a receiving processor switches between its active and sleep states will also minimize the number of times the bus switches between its active and sleep states.

F. Taking into consideration the ALJ's construction of "after transmission," explain whether a scheduler that monitors the active states of both processors (*i.e.*, the application and baseband processors) and controls transmissions in both directions across the bus to coincide with the active state of each receiving processor will, in the course of its operation, directly, indirectly, or inherently "pull" uplink data from the application processor after the scheduler has initiated transmission of downlink data from the modem processor, as in claim 31.

G. Explain whether the scheduler and/or lazy timers in Heinrich may comprise a "modem timer" and perform the functions of a modem processor in claim 31.

H. Explain whether the Balasubramanian patent includes any disclosures or teachings relevant to Questions D-G for purposes of analyzing obviousness.

I. Explain whether there is a long-felt but unmet need for the invention of the '490 patent, focusing particularly on evidence of a nexus between the invention and this secondary consideration of non-obviousness.

The parties are requested to brief only the discrete issues identified above, with reference to the applicable law and evidentiary record. The parties are not to brief any other issues on review, which have already been adequately presented in the parties' previous filings.

In connection with the final disposition of this investigation, the Commission may issue: (1) an exclusion order that could result in the exclusion of the subject articles from entry into the United States, and/or (2) a cease-and-desist order that could result in the respondent being required to cease and desist from engaging in unfair acts in the importation and sale of such articles. Accordingly, the Commission is interested in receiving written submissions that address the form of remedy, if any, that should be ordered. If a party seeks exclusion of an article from entry into the United States for purposes other than entry for consumption, the party should so indicate and provide information establishing that activities involving other types of entry either are adversely affecting it or likely to do so. For background, see *Certain Devices for Connecting Computers via Telephone Lines*, Inv. No. 337-TA-360, USITC Pub. No. 2843 (December 1994) (Commission Opinion).

If the Commission contemplates some form of remedy, it must consider the effects of that remedy upon the public interest. The factors the Commission will consider include the effect that an exclusion order and/or cease-and-desist order would have on: (1) the public health and welfare; (2) competitive conditions in the U.S. economy; (3) U.S. production of articles that are like or directly competitive with those that are subject to investigation; and (4) U.S. consumers.

The Commission is therefore interested in receiving written submissions that address the aforementioned public interest factors in the context of this investigation.

Accordingly, the Commission is interested in receiving responses to the following questions. For the purpose of preparing their responses, the parties should assume that a violation of Section 337 has been found with respect to claim 31 of the '490 patent only. No other patent or patent claim has been found to be infringed.

A. Assuming the Commission were to affirm the ALJ's finding that only claim 31 of '490 patent is infringed and not invalid, explain the likelihood that Apple or Intel could design around the claimed invention to avoid infringement and, if so, approximately how long it would take to implement such a design-around in Apple's accused products (if known).

B. Explain whether and to what extent Intel supplies the same chipsets used in the accused Apple iPhones to any other U.S. merchant for use in any other products that are made, used, or sold in the United States or imported into the United States.

C. Explain whether the "carve-outs" proposed by the Office of Unfair Import Investigations would be practicable, feasible, and would effectively balance enforcement of Qualcomm's '490 patent rights against the interest of avoiding Intel's exit from the relevant market for premium baseband chipsets.

D. Explain whether delaying implementation of a limited exclusion order or cease-and-desist order for a fixed period of time (*e.g.*, six months or one year) would effectively balance enforcement of Qualcomm's patent rights against the adverse consequences alleged by the parties with respect to industry competition, monopolization, the alleged exit of Apple's chipset supplier from the market for 5G technology, and other concerns. If not, explain whether any other "carve-out" or limitation in a remedial order can accomplish this objective.

E. Explain whether national security concerns may be taken into consideration for the purpose of evaluating the public interest and, if so, whether and how such national security concerns would be implicated if a limited exclusion order were to issue covering products that infringe claim 31 of the '490 patent.

If the Commission orders some form of remedy, the U.S. Trade Representative, as delegated by the President, has 60 days to approve or disapprove the Commission's action. *See* Presidential Memorandum of July 21, 2005. 70 *Fed. Reg*. 43251 (July 26, 2005). During this period, the subject articles would be entitled to enter the United States under bond, in an amount determined by the Commission and prescribed by the Secretary of the Treasury. The Commission is therefore interested in receiving submissions concerning the amount of the bond that should be imposed if a remedy is ordered.

The Commission has determined to extend the target date for completion of this investigation to February 19, 2019.

WRITTEN SUBMISSIONS: The parties to this investigation are requested to file written submissions on the issues identified in this Notice. Parties to the investigation, interested government agencies, and any other interested parties are also encouraged to file written submissions on the issues of remedy, the public interest, and bonding. Such submissions should address the recommended determination by the ALJ on remedy and bonding. Complainant and OUII are requested to submit proposed remedial orders for the Commission's consideration. Complainant is also requested to state the date that the patents expire and the HTSUS numbers under which the accused products are imported. Complainant is further requested to supply the names of known importers of the Respondent's products at issue in this investigation. The written submissions and proposed remedial orders must be filed no later than the close of business on January 3, 2019. Reply submissions must be filed no later than the close of business on January 10, 2019. Opening submissions are limited to 60 pages. Reply submissions are limited to 40 pages. Such submissions should address the ALJ's recommended determination on remedy and bonding. No further submissions on any of these issues will be permitted unless otherwise ordered by the Commission.

Persons filing written submissions must file the original document electronically on or before the deadlines stated above and submit eight (8) true paper copies to the Office of the Secretary by noon the next day, pursuant to section 201.4(f) of the Commission's Rule of Practice and Procedure (19 CFR 210.4(f)). Submissions should refer to the investigation number ("Inv. No. 337-TA-1065") in a prominent place on the cover page and/or first page. (*See* Handbook for Electronic Filing Procedures, https://www.usitc.gov/documents/handbook_on_filing_procedures.pdf). Persons with questions regarding filing should contact the Secretary (202-205-2000).

Any person desiring to submit a document to the Commission in confidence must request confidential treatment. All such requests should be directed to the Secretary to the Commission and include a full statement of the reasons why the Commission should grant such treatment. *See* 19 CFR 201.6. Documents for which confidential treatment by the Commission is properly sought will be treated accordingly. All information, including confidential business information and documents for which confidential treatment is properly sought, submitted to the Commission for purposes of this Investigation may be disclosed to and used: (i) by the Commission, its employees and Offices, and contract personnel (a) for developing or maintaining the records of this or a related proceeding, or (b) in internal investigations, audits, reviews, and evaluations relating to the programs, personnel, and operations of the Commission including under 5 U.S.C. Appendix 3; or (ii) by U.S. government employees and contract personnel[1] solely for cybersecurity purposes. All non-confidential written submissions will be available for public inspection at the Office of the Secretary and on EDIS.

The authority for the Commission's determination is contained in Section 337 of the Tariff Act of 1930, as amended (19 U.S.C. 1337), and in part 210 of the Commission's Rules of Practice and Procedure (19 CFR part 210).

[1] All contract personnel will sign appropriate nondisclosure agreements.

By order of the Commission.

Lisa R. Barton
Secretary to the Commission

Issued: December 12, 2018

CERTAIN MOBILE ELECTRONIC DEVICES AND RADIO FREQUENCY AND PROCESSING COMPONENTS THEREOF **Inv. No. 337-TA-1065**

PUBLIC CERTIFICATE OF SERVICE

I, Lisa R. Barton, hereby certify that the attached **NOTICE** has been served upon the following parties as indicated, on **December 12, 2018**.

Lisa R. Barton, Secretary
U.S. International Trade Commission
500 E Street, SW, Room 112
Washington, DC 20436

On Behalf of Complainants Qualcomm Incorporated:

S. Alex Lasher, II, Esq.
QUINNN EMANUEL URQUHART & SULLIVAN LLP
1300 I Street NW, Suite 900
Washington, DC 20005

☐ Via Hand Delivery
☐ Via Express Delivery
☒ Via First Class Mail
☐ Other:_____

On Behalf of Respondent Apple Inc.:

Lauren A. Degnan
FISH & RICHARDSON P.C.
1000 Maine Avenue, SW
Suite 1000
Washington, DC 20024

☐ Via Hand Delivery
☐ Via Express Delivery
☒ Via First Class Mail
☐ Other:_____

PUBLIC VERSION

UNITED STATES INTERNATIONAL TRADE COMMISSION
WASHINGTON, D.C. 20436

In the Matter of **CERTAIN MOBILE ELECTRONIC DEVICES AND RADIO FREQUENCY AND PROCESSING COMPONENTS THEREOF**	**Investigation No. 337-TA-1065**

INITIAL DETERMINATION AND RECOMMENDED DETERMINATION

Administrative Law Judge Thomas B. Pender

Pursuant to the notice of investigation, 82 Fed. Reg. 37899 (Aug. 14, 2017), this is the initial determination on violation and recommended determination on remedy and bonding in *Certain Mobile Electronic Devices and Radio Frequency and Processing Components Thereof*, United States International Trade Commission Investigation No. 337-TA-1065.

It is held that a violation of section 337 of the Tariff Act, as amended, has occurred in the importation into the United States, the sale for importation, or the sale within the United States after importation, of certain mobile electronic devices and radio frequency and processing components thereof, with respect to asserted claim 31 of U.S. Patent No. 9,535,490.

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The following abbreviations may be used in this Initial Determination:

4G	Fourth Generation Cellular Standard
5G	Fifth Generation Cellular Standard
AIR	Apple Intermediate Representation
ALU	Arithmetic Logic Unit
CDX	Complainant's Demonstrative Exhibit
CFIUS	Committee on Foreign Investment in the United States
CIB	Complainant's Initial Post-Hearing Brief
CPX	Complainant's Physical Exhibit
CRPB	Complainant's Reply Post-Hearing Brief
CRSB	Complainant's Responsive Post-Hearing Brief
CX	Complainant's Exhibit
Dep.	Deposition
DMA	Direct Memory Access
EDIS	Electronic Document Imaging System
ESL	Execution State Load
ET	Envelope Tracking
GPU	Graphics Processing Unit
HSA	Hybrid Switching Amplifier
IoT	Internet of Things
IPC	Interprocessor Communication
ISA	Instruction Set Architecture
JDX	Joint Demonstrative Exhibit

JPX	Joint Physical Exhibit
JX	Joint Exhibit
LTE	Long Term Evolution, a Fourth Generation (4G) Wireless Standard
MTP	Mobile Test Platform
NMOS	N-Channel Metal Oxide Semiconductor
OEM	Original Equipment Manufacturer
PA	Power Amplifier
PHB	Post-Hearing Brief
PMOS	P-Channel Metal Oxide Semiconductor
PTO	U.S. Patent and Trademark Office
QCES	Qualcomm's Corporate Engineering Services
R&D	Research and Development
RDX	Respondent's Demonstrative Exhibit
RIB	Respondent's Initial Post-Hearing Brief
RF	Radio Frequency
RPX	Respondent's Physical Exhibit
RRPB	Respondent's Reply Post-Hearing Brief
RRSB	Respondent's Responsive Post-Hearing Brief
RWS	Rebuttal Witness Statement
RX	Respondent's Exhibit
SDX	Staff's Demonstrative Exhibit
SEP	Standard-Essential Patent
SIB	Staff's Initial Post-Hearing Brief

SoC	System on Chip
SSO	Standard Setting Organization
SPX	Staff's Physical Exhibit
SRAM	Static Random Access Memory
SRPB	Staff's Reply Post-Hearing Brief
SRSB	Staff's Responsive Post-Hearing Brief
SX	Staff's Exhibit
Tr.	Transcript
VoIP	Voice Over IP
WS	Witness Statement

I. Background

A. Institution of the Investigation

By publication of a notice in the *Federal Register* on August 14, 2017, pursuant to subsection (b) of section 337 of the Tariff Act of 1930, as amended, the Commission instituted this investigation to determine:

> [W]hether there is a violation of subsection (a)(1)(B) of section 337 in the importation into the United States, the sale for importation, or the sale within the United States after importation of certain mobile electronic devices and radio frequency and processing components thereof by reason of infringement of one or more of claims [1, 10–27], 29, 38, 49, 55–60, 67, and 68 of the '936 patent [U.S. Patent No. 8,633,936]; claims 1 and 6–20 of the '558 patent [U.S. Patent No. 8,698,558] ; claims 9, 10, 12, 14, and 20–22 of the '658 patent [U.S. Patent No. 8,487,658]; claims 1–8, 10–14, 16, 20, and 22 of the '949 patent [U.S. Patent No. 8,838,949]; claims 1–6, 8, 10, 16, 17, and 31 of the '490 patent [U.S. Patent No. 9,535,490]; and claims 1–3 and 7–14 of the '675 patent [U.S. Patent No. 9,608,675]; and whether an industry in the United States exists as required by subsection (a)(2) of section 337.

82 Fed. Reg. 37899 (Aug. 14, 2017); 83 Fed. Reg. 21307 (May 9, 2018).

The Commission also ordered, pursuant to Commission Rule 210.50(b)(1), 19 CFR § 210.50(b)(1):

> [T]he presiding Administrative Law Judge shall take evidence or other information and hear arguments from the parties or other interested persons with respect to the public interest in this investigation, as appropriate, and provide the Commission with findings of fact and a recommended determination on this issue, which shall be limited to the statutory public interest factors set forth in 19 U.S.C. 1337(d)(1), (f)(1), (g)(1).

82 Fed. Reg. 37899 (Aug. 14, 2017).

The Commission named as complainant Qualcomm Incorporated ("Qualcomm") of San Diego, California. The Commission named as respondent Apple Inc. ("Apple") of Cupertino, California. The Office of Unfair Import Investigations ("Staff" or "OUII") was also named as a party to the investigation. *Id.*

B. Procedural History

The target date for completion of this investigation was set at 17 months, *i.e.*, January 14, 2019. Order No. 3 (Aug. 22, 2017), *aff'd*, Comm'n Notice of Non-Review (Sept. 11, 2017).

Qualcomm moved to terminate the investigation in part as to U.S. Patent No. 8,487,658. The motion was granted in an initial determination. Order No. 6 (Aug. 30, 2017), *aff'd*, Comm'n Notice of Non-Review (Sept. 19, 2017).

Qualcomm moved to terminate the investigation in part as to claims 9 and 10 of U.S. Patent No. 8,698,558. The motion was granted in an initial determination. Order No. 24 (Feb. 20, 2017), *aff'd*, Comm'n Notice of Non-Review (Mar. 22, 2018).

Qualcomm moved to terminate the investigation in part with respect to the following claims: claims 10-18, 29, 49, and 55-60 of U.S. Patent No. 8,633,936; claims 8, 11, 12, and 14 of U.S. Patent No. 8,698,558; claim 16 of U.S. Patent No. 8,838,949; claim 10 of U.S. Patent No. 9,535,490; and claim 2 of U.S. Patent No. 9,608,675. The motion was granted in an initial determination. Order No. 34 (Mar. 19, 2018), *aff'd*, Comm'n Notice of Non-Review (Apr. 6, 2018).

Qualcomm moved to terminate the investigation in part with respect to the following claims: claims 1, 20, 24, 26, 38, and 67-68 of U.S. Patent No. 8,633,936; claims 1, 13, 17, and 20 of U.S. Patent No. 8,698,558; claims 1-6, 8, and 16-17 of U.S. Patent No. 9,535,490; and all asserted claims of U.S. Patent No. 8,838,949 and U.S. Patent No. 9,608,675. The motion was granted in an initial determination. Order No. 37 (Apr. 26, 2018), *aff'd*, Comm'n Notice of Non-Review (May 23, 2018).

A prehearing conference was held on June 15, 2018, and the evidentiary hearing began immediately thereafter. The hearing ended on June 26, 2018. *See* Prehearing Tr. 1-146; Hearing

Tr. 1-1683. The parties were ordered to file initial post-hearing briefs of not more than 100 pages in length, responsive briefs of not more than 75 pages in length, and reply briefs of not more than 30 pages in length. Hearing Tr. 1515.

Qualcomm moved to terminate the investigation in part with respect to the following claims: claims 21, 22, and 23 of U.S. Patent No. 8,633,936 and claims 6, 15, 16, 18, and 19 of U.S. Patent No. 8,698,558. The motion was granted in an initial determination. Order No. 43 (June 21, 2018), *aff'd*, Comm'n Notice of Non-Review (July 17, 2018).[1]

The target date for this investigation was extended by two weeks until January 28, 2019. Order No. 44 (Sept. 5, 2018), *aff'd*, Comm'n Notice of Non-Review (Sept. 26, 2018). This initial determination is therefore due on September 28, 2018. *Id.*

C. The Private Parties

Qualcomm is a publicly-traded corporation organized and existing under the laws of the State of Delaware, with its principal place of business located at 5775 Morehouse Drive, San Diego, California 92121. CX-0014C (Kerr WS) at Q17; CX-4736. Founded in 1985, Qualcomm focuses on communications and has grown into a multinational corporation with over 18,000 employees in the U.S. and 224 locations worldwide. CX-0014C (Kerr WS) at Q17-18; CX-4736.0005-16.

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[1] Qualcomm continues to assert the following claims:

Patent No.	Asserted Claims
8,633,936	19, 25, 27
8,698,558	7
9,535,490	31

Apple is a corporation existing under the laws of the State of California, with a principal place of business in Cupertino, California. Apple designs, manufactures, and markets personal and tablet computers, mobile communication devices, and portable digital music and video players and sells a variety of related software, services, peripherals, and networking solutions. *See* Apple's Resp. to Compl. ¶¶ 8-9.

D. Ownership of the Asserted Patents

The asserted patents have each been assigned to Qualcomm, and the assignments have been recorded with the United States Patent and Trademark Office. JX-0001 ('558 Patent); JX-0017 (same); JX-0003 ('490 Patent); JX-0018 (same); JX-0005 ('936 Patent); JX-0016 (same).

II. Jurisdiction and Importation

No party has contested the Commission's personal jurisdiction over it, and all parties appeared at the evidentiary hearing and presented evidence. I find that the Commission has personal jurisdiction over all parties.

No party has contested the Commission's *in rem* jurisdiction over the accused products. Indeed, Qualcomm and Apple have stipulated that Apple has imported into the United States products accused in this investigation, namely the iPhone 7, iPhone 7 Plus, iPhone 8, iPhone 8 Plus, and iPhone X. JX-0013C. Accordingly, I find that the Commission has *in rem* jurisdiction over the products accused of infringing the asserted patents and that the importation requirement of section 337 has been satisfied.

No party has contested the Commission's jurisdiction over the subject matter of this investigation. As indicated in the Commission's notice of investigation, discussed above, this investigation involves the importation of products that allegedly infringe U.S. patents in a

manner that violates section 337 of the Tariff Act, as amended. Accordingly, I find that the Commission has subject matter jurisdiction over this investigation.

III. The '558 Patent

Asserted U.S. Patent No. 8,698,558 ("the '558 Patent") is titled, "Low-Voltage Power-Efficient Envelope Tracker." JX-0001. The '558 Patent issued on April 15, 2014, and the named inventors are Leonard K. Mathe, Thomas Domenick Marra, and Todd R. Sutton. *Id.*

Qualcomm asserts dependent claim 7 of the '558 Patent, which depends from independent claim 6. The relevant claims read as follows:

> 6. An apparatus for wireless communication, comprising:
>
> a power amplifier operative to receive and amplify an input radio frequency (RF) signal and provide an output RF signal; and
>
> a supply generator operative to receive an envelope signal and a first supply voltage, to generate a boosted supply voltage having a higher voltage than the first supply voltage, and to generate a second supply voltage for the power amplifier based on the envelope signal and the boosted supply voltage, wherein the supply generator incorporates an operational amplifier (op-amp) operative to receive the envelope signal and provide an amplified signal, a driver operative to receive the amplified signal and provide a first control signal and a second control signal, a P-channel metal oxide semiconductor (PMOS) transistor having a gate receiving a first control signal, a source receiving the boosted supply voltage or the first supply voltage, and a drain providing the second supply voltage, and an N-channel metal oxide semiconductor (NMOS) transistor having a gate receiving the second control signal, a drain providing the second supply voltage, and a source coupled to circuit ground.
>
> 7. The apparatus of claim 6, wherein the supply generator is operative to generate the second supply voltage based on the envelope signal and either the boosted supply voltage or the first supply voltage.

JX-0001 at 11:42-67.

A. Claim Construction

The following terms of the '558 Patent were previously construed in a *Markman* order:

- "based on" – plain and ordinary meaning
- "current sense amplifier" – construed to mean "amplifier that produces a voltage from a current"
- "envelope signal" – construed to mean "signal indicative of the upper boundary of the output RF signal"

Order No. 28, at 9-14 (Mar. 5, 2018).

A person of ordinary skill in the art was defined as having a Master's degree in Electrical Engineering, Computer Engineering, or Computer Science plus at least two years of relevant experience with transmission and power circuitry for radio frequency devices, or a Bachelor's degree in one of those fields plus at least four years of relevant experience. *Id.* at 8.

B. Infringement

1. General Principles of Law[2]

Under 35 U.S.C. §271(a), direct infringement consists of making, using, offering to sell, or selling a patented invention without consent of the patent owner. The complainant in a section 337 investigation bears the burden of proving infringement of the asserted patent claims by a "preponderance of the evidence." *Certain Flooring Products*, Inv. No. 337-TA-443, Comm'n Notice of Final Determination of No Violation of Section 337, 2002 WL 448690, at *59, (Mar. 22, 2002); *Enercon GmbH v. Int'l Trade Comm'n*, 151 F.3d 1376 (Fed. Cir. 1998).

Literal infringement of a claim occurs when every limitation recited in the claim appears in the accused device, *i.e.*, when the properly construed claim reads on the accused device

[2] The legal principles set forth in this section apply equally to the infringement analysis of the other patents asserted in this investigation.

exactly.[3] *Amhil Enters., Ltd. v. Wawa, Inc.*, 81 F.3d 1554, 1562 (Fed. Cir. 1996); *Southwall Tech. v. Cardinal IG Co.*, 54 F.3d 1570, 1575 (Fed Cir. 1995).

If the accused product does not literally infringe the patent claim, infringement might be found under the doctrine of equivalents. "Under this doctrine, a product or process that does not literally infringe upon the express terms of a patent claim may nonetheless be found to infringe if there is 'equivalence' between the elements of the accused product or process and the claimed elements of the patented invention." *Warner-Jenkinson Co., Inc. v. Hilton Davis Chemical Co.*, 520 U.S. 17, 21 (1997) (citing *Graver Tank & Mfg. Co. v. Linde Air Products Co.*, 339 U.S. 605, 609 (1950)). "The determination of equivalence should be applied as an objective inquiry on an element-by-element basis."[4] *Id.* at 40.

"An element in the accused product is equivalent to a claim limitation if the differences between the two are insubstantial. The analysis focuses on whether the element in the accused device 'performs substantially the same function in substantially the same way to obtain the same result' as the claim limitation." *AquaTex Indus. v. Techniche Solutions*, 419 F.3d 1374, 1382 (Fed. Cir. 2005) (quoting *Graver Tank*, 339 U.S. at 608); *accord Absolute Software*, 659 F.3d at 1139-40.[5]

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[3] Each patent claim element or limitation is considered material and essential. *London v. Carson Pirie Scott & Co.*, 946 F.2d 1534, 1538 (Fed. Cir. 1991). If an accused device lacks a limitation of an independent claim, the device cannot infringe a dependent claim. *See Wahpeton Canvas Co. v. Frontier, Inc.*, 870 F.2d 1546, 1552 n.9 (Fed. Cir. 1989).

[4] "Infringement, whether literal or under the doctrine of equivalents, is a question of fact." *Absolute Software, Inc. v. Stealth Signal, Inc.*, 659 F.3d 1121, 1130 (Fed. Cir. 2011).

[5] "The known interchangeability of substitutes for an element of a patent is one of the express objective factors noted by *Graver Tank* as bearing upon whether the accused device is substantially the same as the patented invention. Independent experimentation by the alleged infringer would not always reflect upon the objective question whether a person skilled in the art

Prosecution history estoppel can prevent a patentee from relying on the doctrine of equivalents when the patentee relinquished subject matter during the prosecution of the patent, either by amendment or argument. *AquaTex*, 419 F.3d at 1382. In particular, "[t]he doctrine of prosecution history estoppel limits the doctrine of equivalents when an applicant makes a narrowing amendment for purposes of patentability, or clearly and unmistakably surrenders subject matter by arguments made to an examiner." *Id.* (quoting *Salazar v. Procter & Gamble Co.*, 414 F.3d 1342, 1344 (Fed. Cir. 2005)).

2. The '558 Accused Products

The products accused of infringing claim 7 of the '558 Patent are the iPhone 7, iPhone 7 Plus, iPhone 8, iPhone 8 Plus, and iPhone X products that include Intel modems (the "'558 Accused Products"). *See* CX-0013C (Kelley WS) at Q238. The evidence shows that the iPhone 7 and iPhone 7 Plus products include a Qorvo 81003 envelope tracker module, an Avago AFEM-8050 power amplifier, and an Intel PNB 5750 RF transceiver (also known as the SMARTi 5 transceiver). *See* CX-0013C (Kelley WS) at Q240-241; CX-2702C.2-3; CX-2469C.23. The evidence also shows that the iPhone 8, iPhone 8 Plus, and iPhone X products include a Qorvo 81004 envelope tracker module, an Avago AFEM-8056 power amplifier, and an Intel PMB 5757 RF transceiver (also known as the SMARTi 6T transceiver). *See* CX-0013C (Kelley WS) at Q241; CX-2702C.2-3.

For purposes of the '558 infringement analysis, Qualcomm's expert Dr. Kelley analyzed the iPhone 7 as representative of all '558 Accused Products. CX-0013C (Kelley WS) at Q242-244. Apple has represented that there are no relevant differences between the '558

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would have known of the interchangeability between two elements, but in many cases it would likely be probative of such knowledge." *Warner-Jenkinson*, 520 U.S. at 36.

Accused Products with respect to the infringement analysis. CX-4747C; *see* CX-0013C (Kelley WS) at Q244. Accordingly, the discussion below will focus on the representative iPhone 7 product. *See also* CX-0013C (Kelley WS) at Q245-249 (discussing relevant similarities and differences between the Accused Products).

3. Claim 6

The record evidence shows that the '558 Accused Products do not practice all limitations of independent claim 6 of the '558 Patent, from which asserted claim 7 depends.

a. An apparatus for wireless communication, comprising: a power amplifier operative to receive and amplify an input radio frequency (RF) signal and provide an output RF signal; and

The products accused of infringing claim 7 of the '558 Patent are the iPhone 7, iPhone 7 Plus, iPhone 8, iPhone 8 Plus, and iPhone X products. No party disputes that the '558 Accused Products comprise apparatuses for wireless communication. *See* RRSB at 3-18; SRSB at 2-13.

Qualcomm's expert Dr. Kelley provided undisputed testimony showing that the '558 Accused Products contain RF power amplifiers, including the Avago AFEM-8050 (for the iPhone 7 and iPhone 7 Plus) and Avago AFEM-8056 (for the iPhone 8, iPhone 8 Plus, and iPhone X), operative to receive and amplify an input RF signal and provide and output RF signal. CX-0013C (Kelley WS) at Q262-263; CX-2469C.23; CX-2702C.2-3; *see also* CX-0013C at Q245 (introducing relevant exhibits), Q259-61 (same).

b. a supply generator operative to receive an envelope signal and a first supply voltage, to generate a boosted supply voltage having a higher voltage than the first supply voltage, and to generate a second supply voltage for the power amplifier based on the envelope signal and the boosted supply voltage,

The undisputed evidence shows that the '558 Accused Products comprise a supply generator operative to receive a differential envelope signal, [ ]. CX-0013C

(Kelley WS) at Q264-267; CX-3888C.2; CX-2456C; CX-2457C; CX-2469C.23-24; CX-2489C.31, 36. The supply generator also contains a boost converter, [ ], operative to receive a first supply voltage. CX-0013C (Kelley WS) at Q268-269; CX-2489C.64; CX-3888C.2; CX-3886C.4. The supply voltage output by the [ ], can be a boosted supply voltage having a higher voltage than the first supply voltage. CX-0013C (Kelley WS) at Q270-272; CX-3883C.5; CX-906C.51. The envelope amplifier is also operative to generate a second supply voltage, [ ], for the power amplifier based on the envelope signal, [ ], and the boosted supply voltage, [ ]. CX-0013C (Kelley WS) at Q273-274; CX-3888C.2.

c. wherein the supply generator incorporates an operational amplifier (op-amp) operative to receive the envelope signal and provide an amplified signal,

The undisputed evidence shows that the '558 Accused Products include an op-amp operative to receive the envelope signal, [ ], and provide an amplified signal, [ ]. CX-0013C (Kelley WS) at Q275-276; CX-3888C.2; CX-2490C; CX-3885C.6; *see also* CX-4601 (Kay Dep. Tr.) at 78:15-21.

d. a driver operative to receive the amplified signal and provide a first control signal and a second control signal,

The undisputed evidence shows that the '558 Accused Products incorporate a driver labeled "OTA" as shown in the ParAmp design review document. CX-0013C (Kelley WS) at Q277; CX-3885C.6. [

].

CX-0013C (Kelley WS) at Q278-280; CX-3888C.2; CX-2490C. In the next level schematic drawing (which is labeled ParAmp_opamp_r12), [ ]

[ ]. CX-0013C (Kelley WS) at Q281; CX-3874C.2. [

] *Id.*

e. a P-channel metal oxide semiconductor (PMOS) transistor having a gate receiving a first control signal, a source receiving the boosted supply voltage or the first supply voltage, and a drain providing the second supply voltage, and

The undisputed evidence shows that the Qorvo ALPeS II chip contains [

] and not a single PMOS transistor as recited in claim 6. CX-0013C (Kelley WS) at Q284. The parties disagree as to whether or not this [ ] [ ] satisfies the claim limitation. *See* CIB at 2-11; RRSB at 9-16; SRSB at 4-9, 11-13.

Apple's expert Dr. Apsel provided clear and credible testimony regarding the operation of the [

]. RX-1602C (Apsel WS) at Q101-102 (referring to RDX-15.24-27C); *see also* RX-1600C (Kay WS)[6] at Q22-29; RX-461C. [

]. RX-1602C (Apsel WS) at Q106; RDX-15.26. [

]. RX-1602C (Apsel WS) at Q105, Q107 (referring to RDX-15.27); RX-461C. [ ]

[6] Michael Kay is a Qorvo employee who testified regarding the functionality of the accused Qorvo chips.

[

]. RX-1602 (Apsel WS) at Q111.

Qualcomm argues that [ ] literally satisfies the structural requirements for the PMOS transistor limitation. *See, e.g.*, CIB at 3 ("[T]he only disputed issue is whether [ ] 'provides' the second supply voltage."). Yet, the record evidence shows that [

].

[

] and this difference is illustrated by the testimony of Mr. Michael Kay of Qorvo, as well as in demonstrative exhibit RDX-27C. *See* Hearing Tr. (Kay) at 140:8-20; Hearing Tr. (Kay) at 139:-5-16 [

].

Demonstrative exhibit RDX-27C, reproduced above, [

].

See Hearing Tr. (Kay) at 141:7-142:15. [

]. Hearing Tr. (Kay) at 141:3-6. As shown by RDX-27C and the testimony of Mr. Kay,

[ ]. *See* Hearing Tr. (Kay) at 139:-5-16 [

] *see also* RX-1602C (Apsel WS) at Q109-111; Hearing Tr. (Apsel) at 936:5-12.

[

].

[

]. RX-1602C

(Apsel WS) at Q111. [

] Hearing Tr. (Kay) at 139:5-16 [

] RX-1602 (Apsel WS) at Q111. [

] *See* Hearing Tr. (Kay) at 141:19-142:20

[

]

In support of its literal infringement case, Qualcomm argues that the '558 Patent disclosure supports the argument that the structure and role of the [ ] in producing and providing the claimed second supply voltage can be ignored. *See, e.g.*, CIB at 7-10. For example, Qualcomm relies on the patent's disclosure of current sensor (164), depicted in Figures 3 and 5 of the '558 Patent, to argue that the claims allow the supply voltage to be changed by intervening downstream elements in the signal pathway leading to the RF amplifier. *See* JX-001 ('558 Patent) at Figs. 3, 5; CIB at 8-9. Qualcomm also points to the patent's disclosure of PMOS transistors 318 and 320, which are used to selectively provide the first and boosted supply voltages to the source of the PMOS transistor (314) on the envelope amplifier (which is, at its drain, responsible for producing the envelope-tracking supply voltage). See JX-001 ('558 Patent) at 4:42-57, 9:8-17, Figs. 3, 5; CIB at 9-10.

Nevertheless, although the output of the envelope amplifier disclosed in the '558 Patent crosses the current sensor (164) before reaching the power amplifier, Qualcomm has failed to show that the intervening current sensor element (164) would be expected to have any significant effect on the voltage produced and provided by the envelope amplifier. *See* Hearing Tr. (Apsel) at 929:16-931:6 ("Q: And so just to be perfectly clear on this point, is the voltage on E the same or different than the voltage at node A? A: It's the same."); JX-001 ('558 Patent) at Figs. 3, 5. Likewise, it has not been shown that the disclosed PMOS 318 and 320 transistors act as anything other than simple on/off switches, without altering or changing the voltages passing through them to any significant degree. Thus, nothing in the patent specification supports Qualcomm's argument that the drain of the [ ] does not have to provide the claimed second supply voltage, or that the [ ] can satisfy the claim limitation even if its output is fundamentally changed by a subsequent downstream element into a different supply voltage.

I therefore find that the Accused Products do not satisfy the PMOS transistor limitation of claim 6 because the [ ] does not have the claimed "drain providing the second supply voltage." Moreover, [ ] does not satisfy the claim limitation because it does not have "a source receiving the boosted supply voltage or the first supply voltage." For this reason, there can be no infringement of independent claim 6 or dependent claim 7, which depends from claim 6.

f. an N-channel metal oxide semiconductor (NMOS) transistor having a gate receiving the second control signal, a drain providing the second supply voltage, and a source coupled to circuit ground.

The undisputed evidence shows that the Qorvo ALPeS II chip contains [ ] and not a single NMOS transistor as recited in claim 6. CX-0013C (Kelley WS) at Q294. The parties' infringement arguments with respect to the [ ] are largely the same as their arguments with respect to the [ ] *See, e.g.*, CIB at 4.

For reasons similar to those discussed above regarding the cascoded PMOS transistors, I find that the [ ] do not satisfy the NMOS transistor limitation of claim 6. In particular, Apple's expert Dr. Apsel provided clear and credible testimony regarding the operation of the [ ] The [ ] RX-1602C (Apsel WS) at Q137 [ ] Q138-146.

Qualcomm argues that the [ ] by itself literally satisfies the structural requirements for the claimed NMOS transistor. *See, e.g.*, CIB at 4 ("[T]he only dispute is whether the 'drain' of the [ ] 'provides' the second supply voltage."). Yet, the record evidence shows that the [ ] in the '558 Accused Products is not the claimed "second supply voltage," which is instead [ ] For example, as shown in demonstrative exhibit RDX-27C reproduced below, [ ]

[

] *See* Hearing Tr. (Kay) at 139:-5-16

[

] 141:3-13 ([

]

The evidence therefore shows that the [

] does not satisfy the "drain providing the second supply voltage" claim limitation. Indeed, [

] *See* RX-1602C (Apsel WS) at Q147-149; Hearing Tr. (Kay) at 139:17-140:3. The

evidence also demonstrates that the [ ] transistor cannot satisfy the limitation requiring a "source coupled to ground." RX-1602C (Apsel WS) at Q143-144.

I therefore find that the '558 Accused Products do not satisfy the NMOS transistor limitation of claim 6. For this reason, there can be no infringement of dependent claim 7.

4. Claim 7

The record evidence demonstrates that the '558 Accused Products do not infringe claim 7 of the '558 Patent.

a. The apparatus of claim 6,

As discussed above, the '558 Accused Products do not satisfy all limitations of claim 6 and therefore do not infringe dependent claim 7.

b. wherein the supply generator is operative to generate the second supply voltage based on the envelope signal and either the boosted supply voltage or the first supply voltage.

The '558 Accused Products also do not infringe claim 7 because they do not satisfy the additional claim limitation "the supply generator is operative to generate the second supply voltage based on the envelope signal and either the boosted supply voltage or the first supply voltage."

Qualcomm argues that this limitation is satisfied by Qorvo's boost converter [ ]and linear envelope amplifier [ ] CIB at 11. Mr. Kay from Qorvo testified at the hearing that [

]

Hearing Tr. (Kay) at 112:17-113:3. Qualcomm therefore contends that "the only disputed issue is whether the [ ] is operative to generate the second supply voltage based on the envelope signal and the first supply voltage (*i.e.*, battery voltage)." CIB at 11.

Qualcomm cites to testimony by Mr. Kay and Apple's expert Dr. Apsel to argue that this limitation is satisfied. CIB at 12-13 (citing Hearing Tr. (Kay) at 92:3-4 [

] Hearing Tr. (Apsel) at 934:18-25). Based on this evidence, Qualcomm argues: "[T]here is no dispute that the [ ] receives the battery voltage, Vbat, and generates a voltage for the [ ] based on that battery voltage." *Id.* at 13 (citing Hearing Tr. (Kay) at 92:3-4).

Qualcomm's argument fails to establish that the '558 Accused Products satisfy this claim limitation because it relies on a misreading of claim 7. The claim requires that the "second supply voltage" be generated "based on the envelope signal and either the boosted supply voltage or the first supply voltage." Figure 3 of the '558 Patent illustrates this feature, wherein envelope amplifier 170a receives both the envelope signal (received by op-amp 310) and either a first supply voltage "vbat" or a boosted supply voltage "vboost" (received at the source terminal of PMOS transistor 314). JX-0001 ('558 Patent) at 4:39-46, Fig. 3. Using those inputs, envelope amplifier 170a generates the second supply voltage, which is output at node E. *Id.*

Qualcomm's infringement theory cannot be reconciled with the teachings of the '558 Patent, as it effectively renders meaningless the requirement that the "second supply voltage" be generated "***based on*** . . . either the boosted supply voltage first supply voltage." Qualcomm relies on an overbroad interpretation of the term "based on," which I had previously construed to have its plain and ordinary meaning to a person of skill in the art. *See* Order No. 28, at 9-10. Referring back to Figure 3 of the '558 Patent, Qualcomm's theory would find infringement based on the Vbat input to boost converter 180, instead of on the Vbat input to PMOS transistor 314. In effect,

this means that an envelope amplifier using only Vboost as an input to PMOS transistor 314, and eschewing Vbat as an input, would infringe claim 7.

Such attempts to read limitations out of patent claims have been rejected by the Federal Circuit. *See, e.g.*, *Becton, Dickinson & Co. v. Tyco Healthcare Grp., LP*, 616 F.3d 1249, 1257 (Fed. Cir. 2010) ("Claims must be 'interpreted with an eye toward giving effect to all terms in the claim.'"). I decline to interpret "based on" in this claim limitation in a way that would make it redundant or superfluous. Accordingly, Qualcomm has failed to show that the '558 Accused Products practice this limitation of claim 7, and have failed more broadly in their attempt to demonstrate infringement of claim 7.

C. Technical Prong

1. General Principles of Law[7]

A violation of section 337(a)(1)(B), (C), (D), or (E) can be found "only if an industry in the United States, with respect to the articles protected by the patent, copyright, trademark, mask work, or design concerned, exists or is in the process of being established." 19 U.S.C. § 1337(a)(2). Section 337(a) further provides:

> (3) For purposes of paragraph (2), an industry in the United States shall be considered to exist if there is in the United States, with respect to the articles protected by the patent, copyright, trademark, mask work, or design concerned—
>
> (A) significant investment in plant and equipment;
>
> (B) significant employment of labor or capital; or
>
> (C) substantial investment in its exploitation, including engineering, research and development, or licensing.

[7] The legal principles set forth in this section apply equally to the technical prong analysis of the other patents asserted in this investigation.

19 U.S.C. § 1337(a)(3).

These statutory requirements consist of an economic prong (which requires certain activities)[8] and a technical prong (which requires that these activities relate to the intellectual property being protected). *Certain Stringed Musical Instruments and Components Thereof*, Inv. No. 337-TA-586, Comm'n Op. at 13 (May 16, 2008) ("*Stringed Musical Instruments*"). The burden is on the complainant to show by a preponderance of the evidence that the domestic industry requirement is satisfied. *Certain Multimedia Display and Navigation Devices and Systems, Components Thereof, and Products Containing Same*, Inv. No. 337-TA-694, Comm'n Op. at 5 (July 22, 2011) ("*Navigation Devices*").

"With respect to section 337(a)(3)(A) and (B), the technical prong is the requirement that the investments in plant or equipment and employment in labor or capital are actually related to 'articles protected by' the intellectual property right which forms the basis of the complaint." *Stringed Musical Instruments* at 13-14. "The test for satisfying the 'technical prong' of the industry requirement is essentially same as that for infringement, i.e., a comparison of domestic products to the asserted claims." *Alloc, Inc. v. Int'l Trade Comm'n*, 342 F.3d 1361, 1375 (Fed. Cir. 2003). "With respect to section 337(a)(3)(C), the technical prong is the requirement that the

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[8] The Commission practice is usually to assess the facts relating to the economic prong at the time that the complaint was filed. *See Certain Coaxial Cable Connectors and Components Thereof and Products Containing Same*, Inv. No. 337-TA-560, Comm'n Op. at 39 n.17 (Apr. 14, 2010) ("We note that only activities that occurred before the filing of a complaint with the Commission are relevant to whether a domestic industry exists or is in the process of being established under sections 337(a)(2)-(3).") (citing *Bally/Midway Mfg. Co. v. U.S. Int'l Trade Comm'n*, 714 F.2d 1117, 1121 (Fed. Cir. 1983)). In some cases, however, the Commission will consider later developments in the alleged industry, such as "when a significant and unusual development occurred after the complaint has been filed." *See Certain Video Game Systems and Controllers*, Inv. No. 337-TA-743, Comm'n Op., at 5-6 (Jan. 20, 2012) ("[I]n appropriate situations based on the specific facts and circumstances of an investigation, the Commission may consider activities and investments beyond the filing of the complaint.").

activities of engineering, research and development, and licensing are actually related to the asserted intellectual property right." *Stringed Musical Instruments* at 13.

2. The '558 Domestic Industry Products

Qualcomm argues that the technical prong of the domestic industry requirement is satisfied for the '558 Patent because certain of its products practice claim 7, which depends from claim 6. *See* CIB at 14. The Domestic Industry ("DI") Products for the '558 Patent ('558 DI Products") are Qualcomm's [

] *See id.* A full list of '558 DI Products is provided in the table set forth in Section VI.B below.

The record evidence shows that [

]

CX-13C (Kelley WS) at Q49-55, Q117-120, Q178-181; CX-4C (Marra WS) at Q57, Q63, Q68, Q96, Q117; CX-4636C (Shi WS) at Q11-12. Thus, [

] CX-13C (Kelley WS) at Q55, Q120, Q181; CX-4C (Marra WS) at Q57-64, Q92-97, Q113-118.

With respect to the technical prong of the domestic industry requirement, the parties only dispute whether or not the '558 DI Products practice the PMOS and NMOS transistor limitations of claim 6. *See* RRSB at 19; SRSB at 13-17. The '558 Accused Products and the '558 DI Products [

] The parties do not dispute that the record evidence shows the '558 DI Products practice all other limitations of claims 6 and 7. *See* RRSB at 19; SRSB at 13-17.

3. Claim 6

The record evidence shows that the '558 DI Products do not practice all limitations of independent claim 6 of the '558 Patent, from which claim 7 depends. Therefore, Qualcomm does not satisfy the technical prong of the domestic industry requirement with respect to the '558 Patent.

a. An apparatus for wireless communication, comprising: a power amplifier operative to receive and amplify an input radio frequency (RF) signal and provide an output RF signal; and

The record evidence shows that the '558 DI Products incorporate a power amplifier ("PA") that receives and amplifies an input RF signal and provides an output RF signal. CX-13C (Kelley WS) at Q56-58, Q120-123, Q182-184; CX-284C; CX-2496C; CX-2470C.

b. a supply generator operative to receive an envelope signal and a first supply voltage, to generate a boosted supply voltage having a higher voltage than the first supply voltage, and to generate a second supply voltage for the power amplifier based on the envelope signal and the boosted supply voltage,

The record evidence shows that the '558 DI Products comprise a supply generator operative to receive an envelope signal. CX-13C (Kelley WS) at Q59-61, Q124-125, Q185-186; CX-323C.10; CX-284C; CX-4636C (Shi WS) at Q22-24; CX-2479C.10, CX-2496C.2; CX-330C.7, 17; CX-2470C. Each [ ] operative to receive a first supply voltage. CX-13C (Kelley WS) at Q62-64, Q126-127, Q187-188; CX-4C (Marra WS) at Q98-99, Q119-122, Q65-67; CX-4636C (Shi WS) at Q20-21; CX-2491C.9; CX-2475C.34; CX-2492C.4; CX-2497C.6-7. Each [ ] is also operative to generate a boosted supply voltage higher than the first supply voltage. CX-13C (Kelley WS) at Q62-65, Q128-129, Q189; CX-4C (Marra WS) at Q98-99, Q119-122, Q65-67; CX-4636C at Q20-21; CX-2491C.9; CX-2475C.34; CX-2492C.4. Each [ ] is further operative to generate a second supply

voltage for the PA based on the envelope signal and the boosted voltage. CX-13C (Kelley WS) at Q66-67, Q130-131, Q190-191; CX-4636C (Shi WS) at Q14-16; CX-2491C.9; CX-323C.10, 13; CX-2475C.34; CX-2479C.10, 13; CX-2492C.4; CX-330C.7, 17, 26.

c. wherein the supply generator incorporates an operational amplifier (op-amp) operative to receive the envelope signal and provide an amplified signal,

The evidence shows that the '558 DI Products incorporate an op-amp operative to receive the envelope signal, [ ] and provide an amplified signal. CX-13C (Kelley WS) at Q69-74, Q133-137, Q193-197; CX-4C (Marra WS) at Q69-74, Q101-105, Q124-125; CX-2463C.198; CX-2464C.384; CX-2462C.112.

d. a driver operative to receive the amplified signal and provide a first control signal and a second control signal,

The record evidence demonstrates that the '558 DI Products comprise a driver operative to receive the amplified signal and provide a first control signal and a second control signal. CX-13C (Kelley WS) at Q75-77, Q138-142, Q198-201; CX-2463C.198, 209; CX-2464C.410, 441; CX-2462C.109, 134.

e. a P-channel metal oxide semiconductor (PMOS) transistor having a gate receiving a first control signal, a source receiving the boosted supply voltage or the first supply voltage, and a drain providing the second supply voltage, and

The record evidence shows that [

] *See* Hearing Tr. (Marra) at 47:3-7, 28:13-30:8 [ ]

Hearing Tr. (Shi) at 69:8-70:5 [

]

[ ] *See* Hearing Tr. (Marra) at 26:22-30:24; CX-2463C.209. [

[

] *See* Hearing Tr. (Marra) at 30:9-24. [

] *See* Hearing Tr. (Marra) at 26:22-30:24. [

] *See id.* Therefore, [

] *See* RX-1602 (Apsel WS) at Q348-352, Q392, Q414.

Qualcomm argues [

] CIB at 14-16. Nevertheless, the record evidence demonstrates that [

] Qualcomm's fact witness Mr. Shi testified that [

] Hearing Tr. (Shi) at 73:21-23 [

]; *see also* Hearing Tr. (Marra) at 30:18-24; Hearing Tr. (Kelley) at 173:9-15. Qualcomm's fact witness Mr. Marra also testified that [

]

Hearing Tr. (Marra) at 30:18-24, 36:4-7; *see also* Hearing Tr. (Shi) at 73:21-23 [

]

Therefore, I find that [

] Accordingly, the '558 DI Products do not practice the PMOS transistor limitation of claim 6.

f. an N-channel metal oxide semiconductor (NMOS) transistor having a gate receiving the second control signal, a drain providing the second supply voltage, and a source coupled to circuit ground.

The record evidence shows that [

] *See* Hearing Tr. (Shi) at 69:8-70:5 [

] Hearing Tr. (Marra) at 32:9-36:7. [

] *Id.*

[

] *Id.*

Qualcomm argues that the [

] *See* CIB at 14-16. Nevertheless, the record evidence demonstrates that the [

] In particular, Qualcomm's witnesses testified that the [

] *See* Hearing Tr. (Shi) at 73:21-23 [

]; Hearing Tr. (Marra) at 32:9-36:7; Hearing Tr. (Kelley) at 173:9-15. Moreover, Qualcomm's fact witness Mr. Marra testified that [

]

Hearing Tr. (Marra) at 35:10-19.

Therefore, I find that the [

] Accordingly, the '558 DI Products do not practice the NMOS transistor limitation of claim 6.

4. Claim 7

The record evidence demonstrates that the '558 DI Products do not practice claim 7 of the '558 Patent. Qualcomm has therefore failed to prove satisfaction of the technical prong of the domestic industry requirement based on claim 7 of the '558 Patent.

a. The apparatus of claim 6,

As discussed above, the '558 DI Products do not satisfy all limitations of claim 6 and therefore fail to practice dependent claim 7.

b. wherein the supply generator is operative to generate the second supply voltage based on the envelope signal and either the boosted supply voltage or the first supply voltage.

Qualcomm adduced evidence at the hearing to show that the '558 DI Products practice this limitation of claim 7. CX-0013C (Kelley WS) at Q92, Q152, Q211. Neither Apple nor the Staff dispute that this limitation is satisfied. *See* RRSB at 19; SRSB at 13-17.

D. Validity

1. General Principles of Law[9]

One cannot be held liable for practicing an invalid patent claim. *See Pandrol USA, LP v. AirBoss Railway Prods., Inc.*, 320 F.3d 1354, 1365 (Fed. Cir. 2003). Nevertheless, each claim of a patent is presumed to be valid, even if it depends from a claim found to be invalid. 35 U.S.C. § 282; *DMI Inc. v. Deere & Co.*, 802 F.2d 421 (Fed. Cir. 1986).

A respondent that has raised patent invalidity as an affirmative defense must overcome the presumption of patent validity by "clear and convincing" evidence of invalidity. *Checkpoint Systems, Inc. v. United States Int'l Trade Comm'n*, 54 F.3d 756, 761 (Fed. Cir. 1995).

[9] The legal principles set forth in this section apply equally to the validity analysis of the other patents asserted in this investigation.

a. Obviousness

Under section 103 of the Patent Act, a patent claim is invalid "if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains."[10] 35 U.S.C. § 103. While the ultimate determination of whether an invention would have been obvious is a legal conclusion, it is based on "underlying factual inquiries including: (1) the scope and content of the prior art; (2) the level of ordinary skill in the art; (3) the differences between the claimed invention and the prior art; and (4) objective evidence of nonobviousness." *Eli Lilly and Co. v. Teva Pharmaceuticals USA, Inc.*, 619 F.3d 1329 (Fed. Cir. 2010).

The objective evidence, also known as "secondary considerations," includes commercial success, long felt need, and failure of others. *Graham v. John Deere Co.*, 383 U.S. 1, 13-17 (1966); *Dystar Textilfarben GmbH v. C.H. Patrick Co.*, 464 F.3d 1356, 1361 (Fed. Cir. 2006). "[E]vidence arising out of the so-called 'secondary considerations' must always when present be considered en route to a determination of obviousness." *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1538 (Fed. Cir. 1983). Secondary considerations, such as commercial success, will not always dislodge a determination of obviousness based on analysis of the prior art. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 426 (2007) (commercial success did not alter conclusion of obviousness).

"One of the ways in which a patent's subject matter can be proved obvious is by noting

[10] The standard for determining whether a patent or publication is prior art under section 103 is the same as under 35 U.S.C. § 102, which is a legal question. *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561, 1568 (Fed. Cir. 1987).

that there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims." *KSR*, 550 U.S. at 419-20. "[A]ny need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed." *Id.*

Specific teachings, suggestions, or motivations to combine prior art may provide helpful insights into the state of the art at the time of the alleged invention. *Id.* at 420. Nevertheless, "an obviousness analysis cannot be confined by a formalistic conception of the words teaching, suggestion, and motivation, or by overemphasis on the importance of published articles and the explicit content of issued patents. The diversity of inventive pursuits and of modern technology counsels against limiting the analysis in this way." *Id.* "Under the correct analysis, any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed." *Id.* A "person of ordinary skill is also a person of ordinary creativity." *Id.* at 421.

Nevertheless, "the burden falls on the patent challenger to show by clear and convincing evidence that a person of ordinary skill in the art would have had reason to attempt to make the composition or device, or carry out the claimed process, and would have had a reasonable expectation of success in doing so." *PharmaStem Therapeutics, Inc. v. ViaCell, Inc.*, 491 F.3d 1342, 1360 (Fed. Cir. 2007); *see KSR*, 550 U.S. at 416 (a combination of elements must do more than yield a predictable result; combining elements that work together in an unexpected and fruitful manner would not have been obvious).[11]

[11] Further, "when the prior art teaches away from combining certain known elements, discovery of a successful means of combining them is more likely to be nonobvious." *KSR*, 550 U.S. at 416 (citing *United States v. Adams*, 383 U.S. 39, 52 (1966)).

b. Lack of a Written Description

The issue of whether a patent is invalid for failure to meet the written description requirement of 35 U.S.C. § 112, ¶ 1 is a question of fact. *Bard Peripheral Vascular, Inc. v. W.L. Gore & Assocs., Inc.*, 670 F.3d 1171, 1188 (Fed. Cir. 2012). A patent's written description must clearly allow persons of ordinary skill in the art to recognize that the inventor invented what is claimed. The test for sufficiency of a written description is "whether the disclosure of the application relied upon reasonable conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date." *Id.* (quoting *Ariad Pharm., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (*en banc*)).

c. Indefiniteness

The definiteness requirement of 35 U.S.C. § 112 ensures that the patent claims particularly point out and distinctly claim the subject matter that the patentee regards to be the invention. *See* 35 U.S.C. § 112, ¶ 2; *Metabolite Labs., Inc. v. Lab. Corp. of Am. Holdings*, 370 F.3d 1354, 1366 (Fed. Cir. 2004). If a claim's legal scope is not clear enough so that a person of ordinary skill in the art could determine whether or not a particular product infringes, the claim is indefinite, and is, therefore, invalid. *Geneva Pharm., Inc. v. GlaxoSmithKline PLC*, 349 F.3d 1373, 1384 (Fed. Cir. 2003).[12]

Thus, it has been found that:

> When a proposed construction requires that an artisan make a separate infringement determination for every set of circumstances in which the composition may be used, and when such determinations are likely to result in differing outcomes (sometimes infringing and sometimes not), that construction is likely to be indefinite.

[12] Indefiniteness is a question of law. *IGT v. Bally Gaming Int'l, Inc.*, 659 F.3d 1109 (Fed. Cir. 2011).

Halliburton Energy Servs. v. M-I LLC, 514 F.3d 1244, 1255 (Fed. Cir. 2008).

The Supreme Court recently addressed the issue of indefiniteness, and stated that a finding of indefiniteness should not be found if the claims, "viewed in light of the specification and prosecution history, inform those skilled in the art about the scope of the invention with reasonable certainty." *Nautilus, Inc. v. Biosig Instruments, Inc.*, 134 S.Ct. 2120, 2129 (2014).

2. Conception and Reduction to Practice

The application for the '558 Patent was filed on June 23, 2011, but Qualcomm argues it is entitled to claim a May 2010 priority date for claim 7. *See* CIB at 17-19. This dispute is relevant in view of Apple's invalidity arguments. For instance, Apple argues that claim 7 is invalid as obvious based on the Kang reference (RX-267), which was published in October 2010.

To establish entitlement to an earlier patent priority date, the patentee must show both conception and reasonable diligence in reducing the invention to practice. *See, e.g.*, *Apator Miitors ApS v. Kamstrup A/S*, 887 F.3d 1293, 1295 (Fed. Cir. 2018). Qualcomm claims that a set of documents dated [ ] before the filing date of the '558 Patent show conception of the claimed invention. *See* CIB at 17-19; CX-2501C at 28-30; CX-905C; *see also* CX-2499C. The evidence suggests that the inventors had arrived at the idea [ ] *See* CX-905C and CX-2501C at 29. Nevertheless, the documentary evidence does not provide corroboration that the inventors were in possession of "a definite and permanent idea of the complete and operative invention" integrating all elements of the claimed invention by May 2010. *See Allergan, Inc. v. Apotex Inc.*, 754 F.3d 952, 967 (Fed. Cir. 2014) ("Conception is 'the formation in the mind of the inventor, of a definite and permanent idea of the complete and operative invention, as it is hereafter to be applied in practice.'"); RX-4C (Apsel WS) at Q81-110, Q432-437. Moreover, the

record is missing certain evidence, such as an invention disclosure form and laboratory notebooks, one would normally expect to see when a patentee seeks to establish and corroborate an earlier priority date. *See* RX-1486C (Marra Dep. Tr.) at 154:9-17 [

] Therefore, the record testimony and corroborating evidence fail to show that the named inventors had fully conceived of the final form of the claimed invention in early 2010.

The record evidence also does not establish reasonable diligence in reducing the claimed invention to practice. "To establish diligence in reduction to practice, the 'basic inquiry is whether . . . there was reasonably continuing activity to reduce the invention to practice.' And, the inventor must not abandon, suppress, or conceal the invention after he or she reduces it to practice." *Tyco Healthcare Grp. LP v. Ethicon Endo-Surgery, Inc.*, 774 F.3d 968, 975 (Fed. Cir. 2014) (citations omitted). Qualcomm relies on four documents in support of its reduction to practice argument. *See* CRSB at 11 (citing CX-3257C; CX-3261C; CX-3254C; CX-4568C). These documents are dated [ ] respectively. There are unexplained gaps between the documents—over five months between CX3261C and CX-3254C, and over seven months between CX-3254C and CX-4568C. Qualcomm has not provided any explanation for these gaps in the documentary evidence, and cannot prove that it was working on the claimed invention during the time covered by the gaps. Based on these gaps, I find that Qualcomm has failed to show diligence in reduction to practice. *See In re Meyer Mfg. Corp.*, 411 F. App'x 316, 319-20 (Fed. Cir. 2010) (holding patentee failed to demonstrate diligence due to "an unexplained gap of just over two months").

Therefore, Qualcomm has not demonstrated that it is entitled to a patent priority date earlier than the June 23, 2011 filing date for the '558 Patent.

3. Kang: Obviousness

Apple argues that claim 7 of the '558 Patent is invalid for obviousness under 35 U.S.C. § 103 over Kang (RX-267)[13] in view of the knowledge of a person of ordinary skill in the art. RIB at 6-11. Based on the record evidence, I find that Apple has failed to show that claim 7 is obvious over Kang.

Claim 7 requires that "the supply generator is operative to generate the second supply voltage based on the envelope signal and either the boosted supply voltage or the first supply voltage." Kang neither discloses nor provides a motivation for using anything other than the boosted supply voltage with Kang's disclosed hybrid switching amplifier ("HSA") device. *See* CX-20C (Kelley WS) at Q157 ("Adding a selectable boost would destroy the claimed benefits of Kang."). Kang instead discloses that "[t]he supply voltage of the linear stage of the HSA is increased from 3.4 to 5 V by the boost converted depicted in Fig.4," so that "the output voltage swing of the supply modulator is boosted up to 4.5 V." RX-267.0004 (Kang). Kang teaches that this change "delivers a higher efficiency and broadband characteristics" than an earlier design of HSA device with a lower maximum output voltage. *Id.*

Apple relies on testimony from Mr. Lennart Mathe, a named inventor of the '558 Patent, to argue that a person of ordinary skill would be motivated to modify Kang to implement a selectable voltage supply. *See* RIB at 9 (citing RX-1488C (Mathe WS) at 164:4-16). Yet, evidence that a person of ordinary skill would have been able to implement a selectable voltage

[13] Kang et al., "A Multimode/Multiband Power Amplifier with a Boosted Supply Modulator," *IEEE Transactions on Microwave Theory and Techniques*, vol. 50, no. 10 (Oct. 10, 2010) ("Kang").

supply does not prove that such a person would have been motivated to modify the Kang teaching to do so. *See* CX-20C (Kelley WS) at Q151.

Apple also argues that the '558 Patent's disclosure of average power tracking shows a motivation to switch between different voltage supply levels. *See* RIB at 10 (citing JX-001 ('558 Patent) at 4:18 and plot 270 in Fig. 2B). But there is no clear rationale for why one of ordinary skill in the art would combine the envelope tracker in Kang with average power tracking, a substantially different power supply generation technique that might require multiple supply voltages. *See* JX-001 ('558 Patent) at Fig. 2 (depicting envelope tracking).

Apple has failed to show clearly and convincingly that a person of ordinary skill in the art would be motivated to modify the teachings of Kang to achieve the selective boost feature of the '558 Patent. I therefore conclude that claim 7 of the '558 Patent is not invalid as obvious based on Kang.

4. Chu: Obviousness

Apple argues that claim 7 of the '558 Patent is invalid as obvious over Chu (RX-587)[14] and Choi 2010 (RX-155)[15] or Choi Thesis (RX-604)[16] in view of U.S. Patent No. 5,929,702 to

[14] Chu et al., "A 10 MHz Bandwidth, 2 mV Ripple PA Regulator for CDMA Transmitters," *IEEE J. of Solid-State Circuits*, vol. 43, no. 12 (Dec. 12, 2008) ("Chu"). Chu is prior art under 35 U.S.C. § 102(b).

[15] Choi et al., "Envelope Tracking Power Amplifier Robust to Battery Depletion" (2010) ("Choi 2010").

[16] Choi, "A Study on Polar Modulated Power Transmitters for Wireless Communication" ("Choi Thesis"). The Choi Thesis was publicly available at the National Assembly Library in Korea by April 2, 2010, more than one year prior to June 23, 2011, and is prior art under 35 U.S.C. § 102(b). *See* RX-2 (Choi WS) at Q16-30.

Myers et al. ("Myers") (RX-589).[17] RIB at 11-15. Based on the record evidence, Apple has failed to show that claim 7 is obvious over Chu in combination with the other references.

Claim 7 requires that "the supply generator is operative to generate the second supply voltage based on the envelope signal and either the boosted supply voltage or the first supply voltage." Apple argues that this additional limitation is met by incorporating the teaching of Myers in combination with Chu's disclosure for a power supply generator that can use a boosted supply voltage. *See* RIB at 14-15.

Nevertheless, Apple fails to demonstrate why a person of ordinary skill in the art would be motivated to combine Myers with the Chu and Choi 2010/Choi Thesis references. Myers, which pre-dates the other references by over nine years, discloses a "multi-range modulator" device having at least two different switched modes of operation and correspondingly different operating ranges based on its ability to receive different supply voltages. *See* RX-589 (Myers) at 6:6-7:3; *see also* CX-20C (Kelley WS) at Q158, Q164, Q169. The device taught in Myers differs from the linear amplifiers used for envelope tracking in the Chu and Choi references. *See* CX-20C (Kelley WS) at Q158, Q164, Q169.

Apple argues that motivation to combine is shown based on deposition testimony given by named inventor Mr. Mathe to the effect that a circuit designer would be able to implement a selectable voltage supply in an envelope amplifier. *See* RIB at 15. Yet, evidence that a person of ordinary skill in the art would have had the ability to implement a selectable voltage supply does not demonstrate why that person would modify the Chu and Choi teachings to do so. *See* CX-20C (Kelley WS) at Q151.

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[17] Myers was filed on November 28, 1997. RX-589 (Myers) at 1.

Apple also argues that the '558 Patent's disclosure relating to average power tracking shows a motivation to combine. *See* RIB at 15 (citing JX-001 ('558 Patent) at 4:18 and plot 270 in Fig. 2B). Even though Myers appears directed to a device that performs average power tracking, the Chu, Choi 2010, and Choi Thesis references are directed to envelope trackers with no disclosure or relationship to average power tracking. *See* RX-155, RX-587, RX-589, RX-604. The evidence fails to establish a motivation for combining the Chu and Choi 2010 or Choi Thesis references with Myers, or for otherwise adopting and using average power tracking techniques in the context of these references.

Apple has failed to show clearly and convincingly that a person of ordinary skill in the art would be motivated to combine the teachings of Chu and Choi 2010 or Choi Thesis with Myers to achieve the selective boost feature of the '558 Patent. I therefore conclude that claim 7 of the '558 Patent is not invalid as obvious based on Chu in combination with Choi 2010 or Choi Thesis in view of Myers.

5. Secondary Considerations

Qualcomm argues that secondary considerations of commercial success, unmet need, industry praise, and licensing demonstrate that claim 7 of the '558 Patent is not obvious. CRSB at 13-15. Yet, inasmuch as the '558 DI Products do not practice claim 7 of the '558 Patent, there is no nexus to commercial success or industry praise with respect to these products. Similarly, Qualcomm identifies no nexus between its licenses and the technology claimed in the '558 Patent, but instead points to a list of licensees without putting the licenses or their terms into evidence, demonstrating what patents were licensed, or showing that any license was motivated by claim 7. *See* CRSB at 14, n.9. I therefore find Qualcomm's secondary considerations arguments unpersuasive even though Apple has failed to prove its obviousness case.

6. Indefiniteness and Written Description

Apple argues that asserted claim 7 of the '558 Patent is indefinite and lacks sufficient written description under 35 U.S.C. § 112 because it "recites an additional limitation that the boosted voltage is ***required*** and ***not required*** to generate the 'second supply voltage.'" RIB at 19-20 (emphasis original). Apple's invalidity arguments based on 35 U.S.C. § 112 are not persuasive and were previously addressed in the *Markman* order, which stated that "claim 7 contains the phrase 'operative to,' which indicates that the claimed invention has multiple modes of operation in which a second supply voltage can be generated in different ways," and that "[t]he internal inconsistency alleged by Apple does not exist, inasmuch as the claim language does not require that these different modes of operation take place simultaneously." Order 28 at 10; *see* RX-4C (Apsel WS) at Q471 (reiterating arguments raised at the *Markman* hearing).

The evidence demonstrates that a person of ordinary skill in the art would have understood, with reasonable certainty, that the '558 Patent contemplates different modes of operation that are activated at different times. *See Nautilus, Inc. v. Biosig Instruments, Inc.*, 134 S. Ct. 2120, 2124 (2014) ("[A] patent is invalid for indefiniteness if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention."); CX-20C (Kelley WS) at Q221-23. Apple did not introduce argument or testimony at the evidentiary hearing to counter the teaching of the '558 Patent that the claims do not require providing both voltages simultaneously, just that the claimed device be operative to provide one or the other at different times. *See* JX-1 ('558 Patent) at 5:31-33, 6:29-33, 8:58-62.

Accordingly, I find that neither claim 6 nor claim 7 of the '558 Patent is invalid for indefiniteness or for lack of written description.

IV. The '936 Patent

Asserted U.S. Patent No. 8,633,936 ("the '936 patent") is titled, "Programmable Streaming Processor with Mixed Precision Instruction Execution." JX-0005. The '936 patent issued on January 21, 2014, and the named inventors are Yun Du, Chun Yu, Guofang Jiao, and Stephen Molloy. *Id.*

Qualcomm asserts independent claim 19 and dependent claims 25, and 27 of the '936 patent. The relevant claims read as follows:

> 19. A device comprising:
>
> a controller configured to receive a graphics instruction for execution within a programmable streaming processor, wherein the indication of the data precision is contained within the graphics instruction and wherein the graphics instruction is a first executable instruction generated by a compiler that compiles graphics application instructions, to receive an indication of a data precision for execution of the graphics instruction, and to receive a conversion instruction that, when executed by the programmable streaming processor, converts graphics data associated, with the graphics instruction, from a first data precision to converted graphics data having a second data precision, wherein the conversion instruction is different than the graphics instruction and wherein the conversion instruction is generated by the compiler; and
>
> a plurality of execution units within the processor,
>
> wherein the controller is configured to select one of the execution units based on the indicated data precision and cause the selected execution unit to execute the graphics instruction with the indicated data precision using the converted graphics data associated with the graphics instruction.
>
> 25. The device of claim 19, wherein the plurality of execution units includes at least one full-precision execution unit and at least one half-precision execution unit, and wherein when the indicated data precision for execution of the graphics instruction comprises a half precision, the controller is configured to shut down power to the at least one full-precision execution unit and cause the at least one half-precision execution unit to execute the graphics instruction using the graphics data.

27. The device of claim 19, wherein the device comprises a wireless communication device handset.

JX-0005 at 19:1-24, 19:53-61, 19:64-65.

A. Claim Construction

The following terms of the '936 Patent were previously construed in a *Markman* order:

- "programmable streaming processor" – construed to mean "instruction-based processor capable of concurrently executing threads of instructions on multiple data streams"
- "(conversion/executable) instruction(s) [to] . . . convert[] graphics data . . . [from a] (first/second/different) data precision [to a] . . . (second/first/indicated) data precision" – construed to mean "an instruction that when executed converts, within the same data type, graphics data having one data precision to graphics data having a different data precision"

Order No. 28, at 29-35 (Mar. 5, 2018).

A person of ordinary skill in the art was defined as having a Master's degree in Electrical Engineering, Computer Engineering, or Computer Science plus at least two years of relevant experience with graphics processing and processor architectures, or a Bachelor's degree in one of those fields plus at least four years of relevant experience. *Id.* at 8-9.

B. Infringement

1. The '936 Accused Products

Qualcomm accuses the [ ] graphics processing unit ("GPU") within the iPhone 8, iPhone 8 Plus, and iPhone X (the "'936 Accused Products") of infringing claims 19, 25, and 27 of the '936 Patent. The accused functionality is in Apple's [

] in the [ ] GPU. *See* CIB at 20.

2. Claim 19

The record evidence shows that the '936 Accused Products do not practice all limitations of independent claim 19 of the '936 Patent, from which claims 25 and 27 depend.

a. A device comprising: a controller

The undisputed evidence shows that the '936 Accused Products include a [

] CX-3139C.29, .42; CX-3139C. 29; CX-11C (Annavaram WS) at Q67-73.

b. configured to receive a graphics instruction for execution within a programmable streaming processor,

The record evidence shows that the controller in the '936 Accused Products is "configured to receive a graphics instruction for execution within a programmable streaming processor." CX-11C (Annavaram WS) at Q83-92; CX-3139C.6; CX-3139C.31, .64, .19; CX-2341C.379. Specifically, the [

] *Id.* at Q77-78. Dr. Annavaram provided credible testimony that [

] *Id.* at Q80. He concluded that "it is clear that the [

] This demonstrates that these floating point arithmetic instructions are 'graphics instructions' as that term would be understood by a person of ordinary skill in the art." *Id.* at Q81.

Neither Apple nor the Staff disputes that the '936 Accused Products satisfy this claim limitation. *See* RRSB at 47-60; SRSB at 35-53.

c. wherein the indication of the data precision is contained within the graphics instruction and

The evidence demonstrates that [

].[18] CX-2341.325;

see also RX-1603C (Davis WS) at Q126-30, Q168. [

] CX-11C (Annavaram WS) at Q97-100; CX-2341.328, .338.

d. wherein the graphics instruction is a first executable instruction generated by a compiler that compiles graphics application instructions,

The evidence shows that the '936 Accused Products do not contain a "compiler" that both (1) compiles graphics application instructions and (2) generates a first executable instruction. The '936 Accused Products therefore do not satisfy this claim limitation. For this reason alone, the '936 Accused Production do not infringe claim 19 of the '936 Patent.

i. Literal Infringement

No party disputes the way in which the '936 Accused Products work with respect to the accused functionality. Apple uses both a [ ] to compile the software that runs on the '936 Accused Products. To create shader programs for execution on an Apple GPU, developers write software in an application programming interface such as Metal or OpenGL ES 3.0. CX-11C (Annavaram WS) at Q105. Metal and OpenGL use different high-level programming languages. RX-1603C (Davis WS) at Q155. After composing an application program, a software developer uses a front-end compiler on the developer's own

[18] Qualcomm's expert Dr. Annavaram testified that [

] Hearing Tr. (Annavaram) at 317:9-17. I therefore find that the [ ] are not "graphics instruction[s]" as recited in claim 19.

machine to compile the Metal or OpenGL source code into an intermediate language called "AIR" ("Apple Intermediate Representation"). *Id.* at Q143; *see* CX-11C (Annavaram WS) at Q104-05. Using the front-end compiler, the developer uploads the AIR file to the Apple App Store. At that point, the application program becomes downloadable to a phone by a potential end user. RX-1603C (Davis WS) at Q143. [

] *Id.* at Q144. [

] *Id.* at Q146. [

]

CX-11C (Annavaram WS) at Q104-05; *see* RX-1603C (Davis WS) at Q145.

Thus, the parties agree that instructions on the '936 Accused Products [

] It is therefore undisputed that the claimed "graphics application instructions" are converted into the claimed "executable instructions," which are in turn received by the controller of the '936 Accused Products. The sole dispute lies in whether Apple's [

] can satisfy the "compiler" limitation. *See, e.g.*, CIB at 29.

With respect to its literal infringement allegations, Qualcomm argues that (1) the claim term "compiler" is not limited to a single-stage compiler and (2) a "compiler" is understood in the art to cover [ ] *See* CIB at 30-33. Dr. Annavaram provided testimony in support of Qualcomm's position: "A person of ordinary skill in the art would understand a compiler chain, even one consisting of multiple different stages, to be carried out by a

'compiler.' The term 'compiler' is not necessarily understood in the art as a single component or stage, but rather is commonly used to describe a multi-stage compilation process." CX-11C (Annavaram WS) at Q111. Nevertheless, Qualcomm's arguments regarding the construction of "compiler" in the context of the '936 Patent are not persuasive, in that they are not supported by the patent specification.

The '936 specification teaches that a "compiler 402 may be formed by one or more processors executing computer-readable instructions," and that "***these*** one or more ***processors*** may be part of . . . the application development platform." JX-5 ('936 Patent) at 13:66-14:4 (emphasis added). The specification does not teach [ ] and only refers to multiple processors running as parts of a single compiler, which could all be located on a development platform. Indeed, Apple's expert Dr. Davis testified that [

] *See* Hearing Tr. (Davis) at 1011:2-12. Contrary to Qualcomm's position, this portion of the '936 specification does not teach that the apparatus of claim 19 can comprise [

] Were an apparatus comprised of [ ][19] [

]

Qualcomm also argues that construing "compiler" to require a single compiler would preclude an embodiment disclosed in the '936 specification. *See* CIB at 30-31, n.13. Specifically,

[19] *See Tate Access Floors, Inc. v. Interface Architectural Res., Inc.*, 279 F.3d 1357, 1370 (Fed. Cir. 2002) ("It is well settled that the term 'a' or 'an' ordinarily means 'one or more.'").

Qualcomm argues that the term "compiler" "even encompasses a process where [

]" *Id.* (citing JX-5 ('936 Patent) at 14:4-5 ("[C]ompiled instructions may be stored on a computer-readable data storage medium."). The '936 specification does indeed teach storing "compiled instructions" on a "data storage medium," but this indicates that the inventors contemplated using an offline compiler that compiled source code all the way into executable instructions, and not the [ ] at issue in the '936 Accused Products.

Therefore, in view of the intrinsic evidence, I construe "complier" as recited in claim 19 of the '936 Patent to mean a single-platform complier. Based on this construction, I find that the '936 Accused Products do not literally infringe claim 19. As discussed above, Apple uses a front-end complier on the developer platform to convert Metal or OpenGL code files into an AIR file. This AIR file is then downloaded to an end-user '936 Accused Product, [

] *See* RX-1603C (Davis WS) at Q154; Hearing Tr. (Davis) at 1010:11-21.

ii. Doctrine of Equivalents

Qualcomm argues that, if it is found the '936 Accused Products do not literally infringe claim 19, infringement can still be found under the doctrine of equivalents. CIB at 33-34. Specifically, Qualcomm argues: [ ] performs substantially the same function in substantially the same way to achieve substantially the same result—*i.e.*, it uses specialized software to transform human readable source code into machine executable

instructions." *Id.* at 33 (citing CX-11C (Annavaram WS) at Q112-113; *Insta-Foam Prods., Inc. v. Universal Foam Sys., Inc.*, 906 F.2d 698, 702 (Fed. Cir. 1990) ("[I]nfringement under the doctrine of equivalents is not precluded merely because the accused device performs functions in addition to those performed by the claimed device.")).

Qualcomm cannot prevail on its doctrine of equivalents argument because the claimed equivalent was disavowed during prosecution of the '936 Patent in order to obtain allowance of claim 19. "A patentee who narrows a claim as a condition for obtaining a patent disavows his claim to the broader subject matter[.]" *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 535 U.S. 722, 736-37 (2002); *see also Biagro Western Sales Inc. v. Grow More Inc.*, 423 F.3d 1296, 1305 (Fed. Cir. 2005). During prosecution, claim 21, which eventually became issued claim 19, was rejected as obvious in light of U.S. Patent Nos. 7,418,606 ("Holmer") and 5,784,588 ("Leung"). JX-10 ('936 prosecution history) at JX-10.430. In response, the applicants narrowed the claim by adding the limitation "and wherein the graphics instruction is a first executable instruction generated by a compiler that compiles graphics application instructions[.]" *Id.* at JX-10.418. They argued:

> In contrast to the hardware mechanisms described by Holmer, the techniques of claim 1 may be implemented in software. For example, claim 1 recites "wherein the graphics instruction is a first executable instruction generated by a compiler that compiles graphics application instructions" and "wherein the conversion instruction is different than the graphics instruction, wherein the conversion instruction is generated by the compiler." The techniques of claim 1 in contrast to the techniques of Holmer need not require the use [of] specialized hardware conversion mechanisms. . . . Independent claims 11, 21, 31, and 41 recite limitations similar to those discussed above in relation to claim 1.

Id. at JX-10.432-433. Ultimately, the claim as amended was allowed. *Id.* at JX-10.685. The applicants added the single-compiler limitation to the claim in order to obtain allowance over the

prior art, and Qualcomm is now estopped from arguing that a [ ] is the equivalent to the claimed single compiler.

Qualcomm argues that its doctrine of equivalents argument is not barred because the claim amendment "bore no relation" to the equivalents argument. CIB at 33 (emphasis omitted). This argument fails to persuade, as the generation of instructions by a compiler was the key factor Qualcomm identified as distinguishing the prior art, and Qualcomm could have phrased its amendments to include [ ] instead of the single compiler recited in the claim language.

Even if prosecution history estoppel did not bar Qualcomm's doctrine of equivalents argument, the evidence does not support a finding of infringement. Dr. Davis provided credible testimony that Apple's [ ] approach works in a different way from the claimed invention to achieve a different result. RX-1603C (Davis WS) at Q163. By separating the compiler used by the developer from [

] *Id.* In particular, the evidence shows that Apple [

] *Id.* The single compiler recited in claim 19 does not operate in this way. Dr. Davis testified that [

] *Id.* As Apple's [ ] performs a different function, in a substantially different way, to obtain a different result when compared to the single compiler disclosed in the '936 Patent, the doctrine of equivalents is inapplicable to the "compiler" limitation of claim 19.

Therefore, I find that the '936 Accused Products do not practice the "compiler" limitation of claim 19, either literally or under the doctrine of equivalents.

> **e. to receive an indication of a data precision for execution of the graphics instruction, and to receive a conversion instruction that, when executed by the programmable streaming processor, converts graphics data associated, with the graphics instruction, from a first data precision to converted graphics data having a second data precision, wherein the conversion instruction is different than the graphics instruction and wherein the conversion instruction is generated by the compiler; and**

The parties dispute whether the '936 Accused Products practice this limitation, with Qualcomm arguing that they do, and Apple and the Staff arguing that Qualcomm has failed to prove its infringement case. *See* CIB at 20-29; RRSB at 47-54; SRSB at 47-53.

The primary dispute lies in whether the '936 Accused Products are "configured to receive . . . a conversion instruction that . . . is different than" the alleged graphics instruction. Qualcomm argues that [

] CIB at 20 (citing CX-11C (Annavaram WS) at Q120-157). Qualcomm argues:

[

]

Id. (emphasis added).

It is my conclusion that the record evidence, when considered together, fails to establish by a preponderance of the evidence that the '936 Accused Products as imported are "configured

to" receive [ ] As an initial matter, Qualcomm's expert Dr. Annavaram was unable to locate the [ ]in the Apple source code produced for inspection:

[

]

Hearing Tr. (Annavaram) at 275:6-9, 294:11-13.

Qualcomm argues that other forms of evidence nevertheless demonstrate that the '936 Accused Products satisfy this limitation of claim 19. For example, Qualcomm identifies Apple's [

] *See* CIB at 20-21. Although this document shows that the '936 Accused Products were ***capable*** [ ] it fails to show that the '936 Accused Products were actually "configured" [ ] as required by the claim limitation.

Qualcomm also cites to deposition testimony from Apple engineers to argue that software in the '936 Accused Products is configured to [ ] CIB at 21-22. Qualcomm's arguments are not persuasive, as the testimony from Messrs. Duprat and Potter explains [ ]

(CX-4602C (Potter Dep. Tr.) at 192-94; CX-4603C (Duprat Dep. Tr.) at 145); [

] (CX-4603C (Duprat Dep. Tr.) at 188-89); [

] (CX-4603C (Duprat Dep. Tr.) at 146); and [

] (CX-4603C (Duprat Dep. Tr.) at 191). In my view, this deposition testimony fails to show that the '936 Accused Products are configured [ ]

At the hearing, Qualcomm's expert Dr. Annavaram provided testimony stating that [

] CX-11 (Annavaram WS) at Q136-39. Specifically, Dr. Annavaram testified [

] CX-11C (Annavaram WS) at Q139. Despite this analysis, the evidence fails to show that [

] such that it would read on the limitations of claim 19.

Qualcomm further argues [

]

CIB at 23 (emphasis original) (citing CX-11C (Annavaram WS) at Q140-149; CX-4923C (Annavaram WS) at Q3-6); 23-25. It is argued that [

] CIB at 23-24 (citing CX-11C (Annavaram WS) at Q142; CX-4553C.61-.62, .64; CX-4921C.3-.4, .16; CX4922C at

APL-QC1065_10848896; CX-631C.47; CX-630C). Qualcomm's argument is weakened by Dr. Annavaram's cross-examination testimony, when he testified [

] Hearing Tr. (Annavaram) at 311:22-312:7, 313:6-12, 313:18-314:1. Dr. Annavaram also testified: [

] Hearing Tr. (Annavaram) at 325:25-326:3. Based on Dr. Annavaram's testimony, it is my conclusion [ ] fail to demonstrate that the '936 Accused Products [ ]

Qualcomm argues that it has provided its "best evidence of infringement" and that it is "not practical" to require that the accused instructions be captured on the '936 Accused Products before a finding of infringement can be made. Even if "not practical," adducing evidence that the '936 Accused Products are "configured to receive . . . a conversion instruction that . . . is different than" the claimed graphics instruction is nevertheless needed to support a finding of infringement. Based on my review of the record, I find that Qualcomm has failed to show by a preponderance of the evidence that the '936 Accused Products are "configured to" receive the [ ] instruction, and for this reason there is no infringement of asserted claim 19 of the '936 Patent.

f. a plurality of execution units within the processor,

The evidence shows the '936 Accused Products include [

] CX-3139C.18. No party disputes that this satisfies the "plurality of execution units" limitation of claim 19. *See* CX-11C (Annavaram WS) at Q167-169; *see* RRSB at 47-60; SRSB at 53.

g. wherein the controller is configured to select one of the execution units based on the indicated data precision and cause the selected execution unit to execute the graphics instruction with the indicated data precision using the converted graphics data associated with the graphics instruction.

The evidence shows that [

] CX-3139C.46; CX-3139C.19; CX-11C (Annavaram WS) at Q171-72. No party disputes that this claim limitation is satisfied. *See* RRSB at 47-60; SRSB at 53.

3. Claim 25

The record evidence demonstrates that the '936 Accused Products do not infringe claim 25 of the '936 Patent.

a. The device of claim 19,

As discussed above, the '936 Accused Products do not satisfy all limitations of claim 19 and therefore do not infringe dependent claim 25.

b. wherein the plurality of execution units includes at least one full-precision execution unit and at least one half-precision execution unit, and

As discussed above, the '936 Accused Products each contain [

] CX-2341C.252; CX-11C (Annavaram WS) at Q192. No party disputes that this claim limitation is satisfied. *See* CIB at 36; RRSB at 47-60; SRSB at 53.

c. wherein when the indicated data precision for execution of the graphics instruction comprises a half precision, the controller is configured to shut down power to the at least one full-precision execution unit and cause the at least one half-precision execution unit to execute the graphics instruction using the graphics data.

This claim limitation requires that the accused device "shut down power" to a full-precision execution unit. Qualcomm argues that the '936 Accused Products satisfy this limitation by [

] *See* CIB at 35 (citing CX-11C (Annavaram WS) at Q197). Apple argues that [

] *See* RRSB at 60.

Qualcomm points to the '936 specification in support of its position that the claimed "shut down" of "power" limitation can be satisfied by [ ] *See* CIB at 35 (citing JX-5 ('936 Patent) at 11:55-58, 12:2-5). The portions at issue read:

> In one aspect, shader processor **206** may be capable of using thread scheduler **224** to selectively power down, or disable, one or more of full-precision ALU's **236**A-**236**N and one or more of full-precision register banks **244**A-**244**N.

. . .

> Thus, in these types of scenarios, shader processor **206** may selectively power down, or disable, one or more of the full-precision components for power savings.

JX-5 ('936 Patent) at 11:55-58, 12:2-5.

Contrary to Qualcomm's position, I fail to see how these portions of the specification require that the term "shut down power" be construed to include [ ] The plain language of the claim requires that "power" be "shut down," which is not achieved by [ ]

Accordingly, I find that the '936 Accused Products do not infringe claim 25 of the '936 Patent for the additional reason that they do not satisfy the "shut down power" limitation.

4. Claim 27

The record evidence demonstrates that the '936 Accused Products do not infringe claim 27 of the '936 Patent.

a. The device of claim 19,

As discussed above, the '936 Accused Products do not satisfy all limitations of claim 19 and therefore do not infringe dependent claim 27.

b. wherein the device comprises a wireless communication device handset.

The Apple [ ] GPU is included within the iPhone 8, iPhone 8 Plus, and iPhone X, which are all "wireless communication device handsets." No party disputes that the '936 Accused Products satisfy this limitation of claim 25. *See* CIB at 36; RRSB at 47-60; SRSB at 53.

C. Technical Prong

1. The '936 Domestic Industry Products

Qualcomm argues that the technical prong of the domestic requirement is satisfied for the '936 Patent because certain of its products practice independent claim 19 and dependent claim 25. *See* CIB at 36. The '936 DI Products are Qualcomm's Adreno 3xx, Adreno 4xx, and Adreno 5xx series GPUs; all Qualcomm Snapdragon SoC ("system-on-chip") products that incorporate one of these Adreno GPUs, as set forth in CX-889C (at pages 4, 6, 36, 38, 43, 50, 52, 54, and 71) and CX-4552 (at pages 5, 27, and 29); and every Qualcomm test platform that incorporates one of these Snapdragon SoC products. *Id.* A full list of '936 DI Products is provided in the table set forth in Section VI.B below.

For purposes of the technical prong analysis, Qualcomm has identified [

] CIB at 36 (citing CX-11C (Annavaram WS) at Q219-230). No party disputes that [

] *See* RRSB at 60-63; SRSB at 54-60.

2. Claim 19

a. A device comprising: a controller

The parties do not dispute that [ ] satisfies the "controller" claim limitation. *See* RRSB at 60-63; SRSB at 54-60. Qualcomm has adduced evidence showing that [

] CX-670C.18, .21, and .23; CX-11C (Annavaram WS) at Q236-238; CX-674C.47; CX-672C.23.

b. configured to receive a graphics instruction for execution within a programmable streaming processor,

The parties do not dispute that [ ] satisfies this claim limitation. *See* RRSB at 60-63; SRSB at 54-60. Qualcomm's expert Dr. Annavaram provided testimony showing that the claimed "graphics instructions" are received for execution within the [ ] of the '936 DI Products, which are the claimed "programmable streaming processors." CX-11C (Annavaram WS) at Q243-252; CX-676C.122, .126-.127; CX-674C.200; CX-672C.38; CX-676C.21. Moreover, the [ ] document describes how the '936 DI Products are configured to receive [ ] CX-671C.18, .35. Each of these instructions includes [ ] and are therefore "graphics instructions." CX-11C (Annavaram WS) at Q256-258; CX-671C.43-.44, .51-.52. Similar "graphics instructions" are received by the [ ] CX-11C (Annavaram WS) at Q259; CX-673C.25, .38; CX-672.115, .120.

c. wherein the indication of the data precision is contained within the graphics instruction and

The parties do not dispute that the [ ] satisfies this claim limitation. *See* RRSB at 60-63; SRSB at 54-60. Dr. Annavaram testified that the "graphics instructions" identified above include an indication of data precision. CX-11C (Annavaram WS) at Q264-270; CX-671.43-.44, .36; CX-671C.51-.52, .50; CX-673.31, .39; CX-672C.119, .121.

d. wherein the graphics instruction is a first executable instruction generated by a compiler that compiles graphics application instructions,

The parties dispute that [ ] satisfies this "compiler" limitation of claim 19. Apple and the Staff argue that Qualcomm uses a [ ]

[

] *See* RRSB at 62-63; SRSB at 55-58.

Qualcomm's fact witness Mr. Zhang provided testimony regarding the operation of the '936 DI Products at the hearing. The '936 DI Products use [

] Hearing Tr. (Zhang) at 238:5-13, 238:20-22, 239:3-5. The '936 DI Products also use [

] Hearing Tr. (Zhang) at 239:15-22. Mr. Zhang's testimony is consistent with a [

] that states:

[

]

RX-1660C [ ] at 5.

Qualcomm argues that [ ] satisfies the claim limitation. *See* CIB at 38-39. Yet, as Mr. Zhang testified at the hearing, the [

]

[

]

Hearing Tr. (Zhang) at 239:12-17, 242:10-12.

As Mr. Zhang also explained, [

] Hearing Tr. (Zhang) at 241:15-21, 242:1-7. The source code for [

] RX-1603C (Davis WS) at Q269-70; Hearing Tr. (Zhang) at 242:20-243:3 [ ]

Qualcomm argues:"[T]o the extent the '936 DI Products do use [

] they still satisfy the claim limitation, both literally and under the doctrine of equivalents, [

] CIB at 38-39. Accordingly, my reasons for finding that the '936 DI Products do not practice the "compiler" limitation of claim 19 [ ]

Inasmuch as neither [

] as required by the claim limitation, neither one can be the claimed "compiler" of claim 19. For this reason, I therefore find that the '936 DI Products do not literally practice claim 19 of the '936 Patent. As for practicing the "compiler" limitation under the doctrine of equivalents, I find that Qualcomm

is precluded from arguing the doctrine of equivalents owing to prosecution history estoppel, as discussed above.

e. to receive an indication of a data precision for execution of the graphics instruction, and to receive a conversion instruction that, when executed by the programmable streaming processor, converts graphics data associated, with the graphics instruction, from a first data precision to converted graphics data having a second data precision, wherein the conversion instruction is different than the graphics instruction and wherein the conversion instruction is generated by the compiler; and

The parties dispute whether the '936 DI Products practice this limitation, as they did with respect to the infringement analysis. *See* CIB at 35-38; RRSB at 60-62; SRSB at 58-60.

Qualcomm identifies [ ] as the claimed "conversion instructions." CIB at 37 (citing CX-671C.35, .55, .57). Qualcomm argues: "These [ ] *Id.* (citing CX-671C.58-.59; CX-11C (Annavaram WS) at Q287-288). The evidence shows that the [ ] CX-673C.42-.47; CX-672C.122-.124.

Nevertheless, Qualcomm's technical prong arguments with respect to this claim limitation are not persuasive, [ ] In particular, Qualcomm argues that the '936 DI Products [ ] but Qualcomm's expert Dr. Annavaram testified that [

]

[

] Hearing Tr. (Annavaram) at 320:19-23.

Qualcomm also relies upon [

] Indeed,

Qualcomm's Senior Director of Technology testified that [

] Hearing Tr. (Zhang) at 243:11-17, 229:8-237:25. Dr. Annavaram also testified that the

[

] Hearing Tr. (Annavaram) at 320:11-18.

Based on my review of the record, I find that Qualcomm has failed to show by a preponderance of the evidence that the '936 DI Products are "configured to" receive [

] and for this reason they do not practice asserted claim 19 of the '936 Patent.

f. a plurality of execution units within the processor,

The parties do not dispute that the [ ] satisfies this claim limitation. *See* RRSB at 60-63; SRSB at 54-60. The documentary evidence shows that, [

] CX-670C.24, .21, .18; CX-676C.122 (describing [ ] CX-674C.50, .14; CX-672C.25, .26.

g. wherein the controller is configured to select one of the execution units based on the indicated data precision and cause the selected execution unit to execute the graphics instruction with the indicated data precision using the converted graphics data associated with the graphics instruction.

The parties do not dispute that [ ] satisfies this claim limitation. *See* RRSB at 60-63; SRSB at 54-60. Dr. Annavaram testified that the claimed "controller" of the '936 DI Products is configured to select an execution unit based on the indicated precision, causing it to execute the graphics instruction with the indicated precision. CX-11C (Annavaram WS) at Q316; CX-676C.122; CX-674C.50, .212; CX-672C.26, .77-.82. In addition, the instructions identified for the '936 DI Products operate on "graphics data." CX-11C (Annavaram WS) at Q297. They are received for execution in the "shader processor," and are generated by Qualcomm's GPU compiler. CX-11C (Annavaram WS) at Q293; CX-676C.122, .126-.127; CX-674C.200; CX-672C.38; CX-3989-01C – CX-3998-04C.

3. Claim 25

The record evidence demonstrates that the '936 DI Products do not practice claim 25 of the '936 Patent.

a. The device of claim 19,

As discussed above, the '936 DI Products do not satisfy all limitations of claim 19 and therefore do not practice dependent claim 25.

b. wherein the plurality of execution units includes at least one full-precision execution unit and at least one half-precision execution unit, and

Evidence adduced at the hearing shows that the '936 DI Products include at least [ ] thereby satisfying this claim limitation. CX-670C.24, .21, .18; CX-676C.122; CX-674C.50, .14; CX-672C.25, .26.

c. **wherein when the indicated data precision for execution of the graphics instruction comprises a half precision, the controller is configured to shut down power to the at least one full-precision execution unit and cause the at least one half-precision execution unit to execute the graphics instruction using the graphics data.**

For claim 25, which requires "shut[ting] down power" to a full-precision execution unit, Qualcomm argues that the '936 DI Products [ ] CIB at 39-40. [

] *See* RX-1603C (Davis WS) at Q296-306. Further, as Qualcomm engineer Chun Yu explained, [

] RX-1510C (Yu WS) at 132.

I therefore find that the '936 DI Products do not satisfy this claim limitation and do not practice claim 25 of the '936 Patent.

D. Validity

1. NVIDIA NV35 GPU: Anticipation

Apple argues that claim 19 of the '936 patent is anticipated by "NV35," a GPU sold by graphics card manufacturer NVIDIA. RIB at 40-46. NV35 and its accompanying driver software were included in a graphics card known as the NVIDIA GeForce FX5900. RX-6C (Davis WS) at Q60. NV35 was on sale more than one year before the April 2008 filing of the '936 Patent and is therefore prior art under 35 U.S.C. § 102(b) (pre-AIA). Hearing Tr. (Annavaram) at 1370:20-24; *see also* RX-407C (NV35 Sales Records); RX-1465C (Brown (NVIDIA) Dep. Tr.) at 27:31-31:8.

Based on the parties' argument and the record evidence, and for reasons similar to those discussed above with respect [

] I find that the NVIDIA NV35 does not anticipate claim 19 of the '936 Patent.

As an initial matter, claim 19 recites a "programmable streaming processor." Based on the evidence adduced at the hearing, it is my conclusion that NV35 had a programmable streaming processor, as that term was construed in my *Markman* Order. Specifically, NV35 had an "instruction-based processor capable of concurrently executing threads of instructions on multiple data streams." *See* Order No. 28, at 31 (construing "programmable streaming processor").

The record evidence shows that [

] RX-6C (Davis WS) at Q72. [

] RX-421C] at 173. [

] RX-6C (Davis WS) at Q117. [ ] a practice that my *Markman* Order recognizes as a form of "concurrent processing." *Id.* at Q72; *see* Order No. 28, at 31. [

]." RX-6C (Davis WS) at Q72.

Claim 19 also requires that the recited "graphics instruction" and "conversion instruction" be "generated by a compiler." For NV35, Apple has identified [

] as examples of "graphics instructions." RIB at 40. Apple identifies

[ ] examples of NV35 "conversion instructions." *Id.* at 45. Yet, Apple has failed to establish that any of these instructions are generated by a "compiler."

Apple relies on [

] RIB at 43 (citing RX-419C). [

] In particular, NVIDIA's corporate witness Pat Brown testified at deposition that [

] RX-1465C (Brown Dep. Tr.) at 138:18-20 [

] Therefore, I do not find the [ ] persuasive evidence of anticipation.

Apple further relies on the deposition testimony of NVIDIA's corporate witness to demonstrate that NV35 satisfies the "complier" limitation. *See* RIB at 44-45. Mr. Brown testified that a [

] RX-1465C (Brown Dep. Tr.) at 90:13-19. This testimony fails to meet the threshold of clear and convincing, however, [

] RX-839C at [

] Mr. Brown also testified that [

] *See* RX-1465C (Brown Dep. Tr.) at 81:20-82:9.

Apple's expert points to hardware documentation describing [

] RX-6C (Davis WS) at Q90. Nevertheless, the record evidence does not show that that [ ] As Dr. Annavaram testified, [

] CX-18C (Annavaram WS) at Q65, Q68. Dr. Annavaram's hypothetical would explain [ ] in the record evidence.

In sum, the evidence adduced by Apple fails to show, clearly and convincingly, that claim 19 of the '936 Patent is anticipated by the NVIDIA NV35 GPU product.

2. Sony PlayStation 3: Anticipation

Apple argues that the Sony PlayStation 3, which incorporates a CELL processor [

]

(collectively, "PS/3"), is a video game console that anticipates claims 19 and 25. RIB at 46-51. The PS/3 was on sale in the United States before December 2006 and is prior art under 35 U.S.C. § 102(b) (pre-AIA). *See* RX-6C (Davis WS) at Q283; RX-524C (Sony Invoice); RX-526C (Amazon Sales website) at .1-4; RX-1485C (Mallinson Dep. Tr.) at 16:17-24, 47:13-56:25.

Claim 19 recites a processor "configured to" receive "graphics instructions." Based on the record, it is my conclusion that Apple has failed to show, by clear and convincing evidence, that the PS/3 implementation of the CELL Processor was so configured. In particular, Apple has not demonstrated the required "graphics instructions."

The record evidence shows that [

] RX-1480C (Hofstee Dep. Tr.) at 30:19-31:9 (emphasis added); *see also id.* at 96:8-97:3. For instance, [

] CX-759C.11 [

] CX-759C.9; *see also* CX-759C.8.

Apple identifies [

] but the evidence does not show these instructions were used on the PS/3 CELL Processor for graphics processing. *See* RIB at 47. In particular, Apple argues these instructions [

] *See* RIB at 47. Indeed, Apple's expert Dr. Davis testified that a "graphics instruction" is one that renders graphics. *See* RX-6C (Davis WS) at Q36 ("Some instructions ***specifically applicable to rendering graphics***, which may be referred to as graphics instructions, can be used in both GPUs and CPUs.") (emphasis added).

Apple relies on the testimony of Sony witness Dominic Mallinson in support of its invalidity position, but this uncorroborated testimony fails to establish that the [

] *See* RIB at 47-48 (citing RX-1485 (Mallinson Dep. Tr.)); *TypeRight Keyboard Corp. v. Microsoft Corp.*, 374 F.3d 1151, 1159 (Fed. Cir. 2004) ("[C]orroboration is required of any witness whose testimony alone is asserted to

invalidate a patent.") (citation omitted). Moreover, Mr. Mallinson's testimony [

] CX-759C.8, .9, .11; RX-1480C (Hofstee Dep. Tr.) at 95:16-97:10.

It is therefore my conclusion based on the record evidence that the PS/3 CELL was not configured to receive "graphics instructions" as recited in claim 19. Accordingly, claim 19 of the '936 is not rendered invalid as anticipated by the PS/3 CELL Processor.

3. NV35 and Holmer: Obviousness

Apple argues that NV35, when combined with U.S. Patent Application No. 2005/0066205 to Holmer ("Holmer"), renders claims 25 and 27 of the '936 Patent obvious. RIB at 51-54. Apple's obviousness argument is not persuasive, as Apple fails to demonstrate that a person of ordinary skill in the art would have been motivated to combine NV35 with Holmer to satisfy all the elements of claims 25 and 27.

Dr. Annavaram provided credible testimony explaining there was no motivation to incorporate the power savings techniques of Holmer into NV35 because [

] such as NV35, were primarily implemented in systems with a fixed power source. CX-18C (Annavaram WS) at Q87. For this reason, increasing power efficiency was a "lower priority." *See* CX-11C (Annavaram WS) at Q32. To the extent graphics processors were implemented into mobile, battery-operated devices, there was a trend towards

simplifying the processor architecture even at the expense of performance.[20] CX-18C (Annavaram WS) at Q13.

Apple argues four reasons why a person of ordinary skill in the art would be motivated to combine NV35 and Holmer to achieve the invention of claim 25:

- Holmer was authored by engineers at NVIDIA, which also developed NV35, and both were developed [ ]
- [ ]
- NV35 and Holmer are analogous art.
- With finite techniques available for power reduction, it would have been obvious to try shutting down unused units.

RIB at 52-53. These arguments, however, are not persuasive.

The evidence shows that [ ] RX-410C.3. Similarly, [ ]

[20] Holmer teaches a non-streaming, non-programmable (fixed function) "data pipeline that processes data in sequence" in light of the fact that "rendering of 3D objects can be extremely computation and power intensive and therefore is not conducive to battery-operated handheld devices." RX-765 (Holmer) ¶¶ 0024, 0004, 0032. Dr. Annavaram testified that Holmer exemplified the conventional wisdom at the time of the '936 Patent, which was that incorporating GPUs into handheld devices was only possible by simplifying the architecture and compromising on performance. CX-11C (Annavaram WS) at Q32; CX-18C (Annavaram WS) at Q13.

[ ] RX-413C.5. Apple's position that NV35 and Holmer are "analogous art" therefore ignores [ ] In addition, Apple's position belies the disclosure of the '936 Patent, which teaches the power-efficient implementation of a programmable streaming processor into a battery constrained device. *See* CX-11C (Annavaram WS) at Q30-31.

Apple argues that a person of ordinary skill in the art would have been motivated to combine NV35 with Holmer to arrive at claim 27 for the same reasons as those given for claim 25, but Apple's arguments for claim 27 are equally unavailing. *See* RIB at 53-54. The evidence adduced at the hearing fails to explain why or how a person of ordinary skill in the art would have been motivated to implement the architecture of NV35 into a mobile handheld device. Indeed, testimony from Dr. Annavaram suggests it would have been counterintuitive to incorporate [ ] such as NV35, into a mobile handheld device before the invention of the '936 Patent. *See* CX-18C (Annavaram WS) at Q91-93.

Therefore, I find that Apple has not shown by clear and convincing evidence that NV35 in combination with Holmer renders obvious claims 25 and 27 of the '936 Patent.

4. PlayStation 3 and Holmer: Obviousness

Apple argues that the PS/3, when combined with Holmer, renders claims 25 and 27 of the '936 Patent obvious. RIB at 51, 54. Yet, besides referring to its obviousness arguments with respect to NV35 in combination with Holmer, Apple's brief fails to establish a motivation to combine PS/3 and Holmer to arrive at the inventions of claims 25 and 27. *See id.* at 51, 54.

The record evidence also contradicts Apple's obviousness position. At the hearing, Dr. Annavaram provided credible testimony explaining that the CELL Processor within the PS/3

was a fixed-power supply device, which precludes a motivation to combine PS/3 and Holmer in a way to render claim 25 obvious. CX-18C (Annavaram WS) at Q145, Q168. Moreover, Sony's corporate witness testified [

] RX-1480C (Hofstee Dep. Tr.) at 135:1-5; *see* CX-18C (Annavaram WS) at Q171.

Therefore, I find that Apple has not shown by clear and convincing evidence that PS/3 in combination with Holmer renders obvious claims 25 and 27 of the '936 Patent.

5. Secondary Considerations

Qualcomm argues that secondary considerations of commercial success, unmet need, industry praise, and licensing demonstrate that claims 25 and 27 of the '936 Patent are not obvious. CRSB at 31-32. Yet, Qualcomm's arguments are not persuasive because they fail to show the required nexus to the '936 Patent.

With respect to licensing, Qualcomm points to a list of licensees but does not (1) offer evidence to show that any license was motivated by the '936 Patent's mixed-precision technology; (2) provide any license terms indicating a nexus; or (3) identify the patents at issue for each license. *See* CRSB at 32.

For commercial success there is similarly no nexus, because Qualcomm has not shown that its products practice the '936 Patent. Moreover, none of the testimony Qualcomm cites from Mr. Du or Dr. Annavaram shows a nexus between the claimed invention and specific sales. *See* CRSB at 31-32.

As for long-felt but unmet need, named inventor Mr. Yu testified that [

]

[ ] RX-1510C (Yu Dep. Tr.) at 96-97; *see* RX-6C (Davis WS) at Q409-11.

Turning now to praise, Qualcomm's witnesses testified that the '936 Patent [ ] RX-1471C (Du Dep. Tr.) at 47-48; RX-1506C (Wadrzyk Dep. Tr.) at 116-17.

Having reviewed the parties' arguments and the record evidence, I therefore find Qualcomm's secondary considerations arguments unpersuasive even though Apple has failed to prove its obviousness case.

V. The '490 Patent

Asserted U.S. Patent No. 9,535,490 ("the '490 patent") is titled, "Power Saving Techniques in Computing Devices." JX-0003. The '490 patent issued on January 3, 2017, and the named inventors are Vinod Harimohan Kaushik, Uppinder Singh Babbar, Andrei Danaila, Neven Klacar, Muralidhar Coimbatore Krishnamoorthy, Arunn Coimbatore Krishnamurthy, Vaibhav Kumar, Vanitha Aravamudhan Kumar, Shailesh Maheshwari, Alok Mitra, Roshan Thomas Pius, and Hariharan Sukumar. *Id.*

Qualcomm asserts independent claim 31 of the '490 patent. This claim reads as follows:

> 31. A mobile terminal comprising:
>
> a modem timer;
>
> a modem processor, the modem processor configured to hold modem processor to application processor data until expiration of the modem timer;
>
> an application processor;
>
> an interconnectivity bus communicatively coupling the application processor to the modem processor; and

> the application processor configured to hold application processor to modem processor data until the modem processor pulls data from the application processor after transmission of the modem processor to application processor data,
>
> wherein the modem processor is further configured pull data from the application processor after transmission of the modem processor to application processor data and before the interconnectivity bus transitions from an active power state to a low power state.

JX-0003 at 21:4-21.

A. Claim Construction

No terms of the '490 Patent were previously construed in the *Markman* order. In connection with the infringement analysis, I have construed three terms: "hold," "processor," and "after." The reasons for my constructions are discussed below along with the infringement discussion.

In the *Markman* order, a person of ordinary skill in the art was defined as having a Master's degree in Electrical Engineering, Computer Engineering, or Computer Science plus at least two years of relevant experience with multi-processor systems, or a Bachelor's degree in one of those fields plus at least four years of relevant experience. Order No. 28, at 8-9 (Mar. 5, 2018).

B. Infringement

1. The '490 Accused Products

Qualcomm accuses the iPhone 7, iPhone 7 Plus, iPhone 8, iPhone 8 Plus, and iPhone X products that include Intel modems (the "'490 Accused Products") of infringing claim 31 of the '490 Patent. *See* SIB at 7. All of these products include an Apple A10 or A11 application processor and Intel's XMM7360 or XMM7480 Modem Platform containing the X-Gold 736G or 748G baseband processor, with the A10 or A11 application processor and the X-Gold 736G or

748G baseband processor connected by a PCIe bus. CX-12C (Baker WS) at Q48-49, Q73; CX-931C.16; CX-3836C. [

] *See* CX-12C (Baker WS) at Q48, Q50; RX-1607C (Yalamanchili WS) at Q17.

2. Claim 31

Qualcomm has adduced evidence at the hearing establishing that the '490 Accused Products literally infringe each limitation of claim 31 of the '490 Patent.

a. A mobile terminal comprising:

No party disputes that each '490 Accused Product is a mobile terminal, *i.e.*, cell phone. *See* RRSB at 22-39; SIB at 9-18.

b. a modem timer;

The record evidence demonstrates that the '490 Accused Products satisfy this claim limitation. [

] CX-12C (Baker WS) at Q63-72; CX-3133C; CX-4604C.31:3-32:19; 73:13-74:3; CX-4606C.67:25-68:12. No party disputes that each '490 Accused Product has the claimed modem timer. *See* RRSB at 22-39; SIB at 9-18.

c. a modem processor, the modem processor configured to hold modem processor to application processor data until expiration of the modem timer;

The evidence shows that each '490 Accused Product contains an Intel X-GOLD™ 736G or 748G modem processor. CX-12C (Baker WS) at Q73. [

] *See* CIB at 43-50 (citing *id.* at Q75).

Apple argues that the '490 Accused Products do not satisfy this claim limitation:

[

]

RRSB at 34 (citations omitted).

The disagreement between Qualcomm and Apple centers on the construction of two claim terms, "hold" and "processor." *See* CIB at 43-49; RRSB at 23-32. No party proposed these terms as ones needing construction during the *Markman* phase of this investigation; I did not construe any terms from the '490 Patent in my *Markman* order. Nevertheless, I will address the constructions of these terms here.

i. Construction of "hold"

With respect to the meaning of "hold," Qualcomm argues:

> The plain and ordinary meaning of "hold" in claim 31 is not "store internally." The correct meaning is apparent from examining the role of the "hold" limitation in claim 31 as a whole. While the modem timer is running, the modem processor holds downlink data and the application processor holds uplink data. When the timer elapses, the modem processor transmits downlink data to the application processor and pulls uplink data from the application processor. These transfers occur across the interconnectivity bus during a high power state of the bus. When data is not flowing across the bus, the bus can stay in a low power state instead. This is the way claim 31 saves power. Thus, "hold" means to prevent data from traveling across the bus.

CIB at 43-44. The Staff generally agrees with Qualcomm's proposed construction. *See* SIB at 11.

Apple argues a different position:

> As used in the '490 patent, the term "hold" has its plain and ordinary meaning: to store, buffer, or accumulate data in a memory. As such, the "application processor configured to hold" limitation requires the application processor to store uplink data in its memory (and is not met where uplink data is stored in some other location the processor can access

> or where the uplink data is merely prevented from crossing the bus, as Qualcomm and the Staff incorrectly contend).

RRSB at 30.

Having considered the arguments of the parties and the record evidence, I have determined to construe "hold" in accordance with Qualcomm's proposal, *i.e.*, in the context of the '490 Patent, "hold" means to prevent data from traveling across the bus.

This construction is supported by the intrinsic evidence. The '490 specification uses "hold" as a synonym for "accumulate." JX-3 ('490 Patent) at 2:12-15 ("holding or accumulating the data"), 5:32-35 (same). The processors are said to hold (or accumulate) uplink and downlink data while the modem timer is running because the data is not allowed to cross the bus. *Id.* at 1:65-2:3 ("[A]s data is received by a modem processor in a computing device, the data is held until the expiration of a modem timer. The data is then passed to an application processor in the computing device over a peripheral component interconnect express (PCIe) interconnectivity bus."). When the modem timer elapses, the held data is "released," *i.e.*, allowed to flow across the bus. *Id.* at 9:37-40; 9:61-64; 11:12-14. By holding data, and thus preventing any activations of the bus before the transfers, power is conserved. *Id.* at 10:40-42. Nothing in the specification teaches that a specific type of storage must be used to practice the invention.

Apple's proposal, on the other hand, would exclude a preferred embodiment that uses a "modem host interface (MHI) over PCIe." *See* JX-3 ('490 Patent) at 8:57-9:6; *see also* CX-1239 (published version of application incorporated by reference into the '490 Patent specification). In the MHI embodiment, downlink data is transferred over the PCIe bus from RAM attached to the modem processor to RAM attached to the application processor using DMA. CX-1239 at [0008], [0034] (describing cellular downlink data transfer), [0053] (same), [0046] (describing memory-

mapped transfers over a PCIe bus). Apple's interpretation of "hold" excludes this embodiment, which uses an external memory. *See Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1583 (Fed. Cir. 1996) (stating that a construction excluding a preferred embodiment "is rarely, if ever, correct").

ii. Construction of "processor"

With respect to the meaning of "processor," Qualcomm argues:

> The plain and ordinary meaning of "processor" in claim 31 is not a single logic die. [
>
>]

CIB at 47 (citations omitted).

Apple argues a different position:

> "Processor" refers to the components residing on the same chip(s) as the circuitry that performs logic processing—which includes any internal "on-chip" memory, but not external "off-chip" memory coupled to the processor chip(s).

RRSB at 23.

The Staff generally agrees with Qualcomm's argument, and takes the position that the terms "modem processor" and "application processor" refer to the system component(s) or device(s) responsible for modem or application processing. *See* SIB at 3.

Having considered the arguments of the parties and the record evidence, I have determined to construe "processor" in accordance with the proposal by Qualcomm and the Staff, *i.e.*, in the context of the '490 Patent, "processor" refers to the system components responsible for logic processing, and does not require that all such components reside on the same chip or package.

This construction is supported by the intrinsic evidence. For example, the specification teaches that a "processor may also be implemented as ***a combination of computing devices***, e.g. . . . a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or ***any other such configuration***." JX-3 ('490 Patent) at 16:67-17:7 (emphasis added); Hearing Tr. (Krishna) at 722:13-17 ("any other such configuration" contemplates RAM); 721:10-23 (same). The specification also teaches a separate "base band processor" within the modem processor, implying that the modem processor is not limited to a single die. JX-3 ('490 Patent) at 7:30-36. Indeed, the specification teaches that all standard configurations of processors and memory lie within the scope of the invention. *Id.* at 17:15-19 ("An exemplary storage medium is coupled to the processor . . . . In the alternative, the storage medium may be integral to the processor.").

iii. Infringement Analysis

In view of my construction of the claim terms "hold" and "processor" discussed above, the record evidence establishes that the '490 Accused Products satisfy the claim limitation "a modem processor, the modem processor configured to hold modem processor to application processor data until expiration of the modem timer." [

] CX-12C (Baker WS) at Q75; *see also* RRSB at 33 [

]

d. an application processor;

The record evidence shows that each '490 Accused Product contains an Apple A10 [ ] or A11 [ ] application processor. CX-12C (Baker WS) at Q101. I therefore find that the '490 Accused Products satisfy this claim limitation.

e. an interconnectivity bus communicatively coupling the application processor to the modem processor; and

Evidence adduced at the hearing shows that each '490 Accused Product contains a PCIe interconnectivity bus coupling the application processor to the modem processor. CX-931C; CX-3836C; CX-4606C.23:6-11; CX-4605C.10:23-11:1; 77:21-78:5. Apple does not dispute that this claim limitation is satisfied. *See* RRSB at 22-39.

f. the application processor configured to hold application processor to modem processor data until the modem processor pulls data from the application processor after transmission of the modem processor to application processor data,

The record evidence demonstrates that the '490 Accused Products satisfy this claim limitation. [

] CX-12C (Baker WS) at Q106. [

] *Id.* at Q106-09; CX-4604C.87:9-18; CX-4605C.62:14-22; 61:13-22; 67:15-25; CX-4606C.189:22-190:2; CX-3848C.14.

[

] *See, e.g.*, RRSB at 22. [

] *See id.* at 22, 34-35. [ ]

reasons for rejecting Apple's argument with respect to this claim limitation are the same as the ones set forth above. I therefore find that the '490 Accused Products satisfy this claim limitation.

g. wherein the modem processor is further configured [to] pull data from the application processor after transmission of the modem processor to application processor data and before the interconnectivity bus transitions from an active power state to a low power state.

The record evidence is clear on how the '490 Accused Products operate with respect to this claim limitation. [

] CX-12C (Baker WS) at Q118. [

] CX-4920C (Yalamanchili Dep. Tr.) at 138:16-21. [

] CX-3990C, APL-QC1065-SC_00000956, [ ] CX-12C (Baker WS) at Q119-26; CX-3839C.7; CX-3841C.9; CX-3848C.8; CX-4606C.95:8-15; 101:3-10; 118:21-24; *see also* Hearing Tr. (Leucht-Roth) 731:9-14 [

] 736:5-21 [ ] 737:5-738:1 (same).

[

] CX-12C (Baker WS) at Q133; CX-3838C; CX-4604C.41:3-9; 38:13-40:21; CX-4605C.43:21-45:24. Thus, the '490 Accused Products satisfy this claim limitation.

i. Construction of "after"

[

]

The language of claim 31 itself, which recites that the uplink transfer starts "after transmission" of the downlink data, cuts against Apple's arguments. In plain English, "after transmission" refers to the time after the initiation (or start) of a data transfer. A good example of this is the mailbox rule familiar from law school where someone can say, "I've sent (or transmitted) the letter," even if the letter remains sitting in a mailbox waiting for pickup. [

] CX-12C (Baker WS) at Q118-39, Q203-20.

[

] CX-12 (Baker WS) at Q141-142.

Apple's proposed construction is also contradicted by the intrinsic evidence. The '490 specification teaches "initiation of the data transfer," and not completion of the data transfer. JX-3 ('490 Patent) at 2:16-20 ("[I]nstead of ***initiating*** data transfer based on the expiration of the downlink timer (with or without expiration of the uplink timer), accumulated data transfer may be initiated based on expiration of just an uplink accumulation timer.") (emphasis added); *see also id.* at 2:23, 2:44-45, 5:36-42, 9:41-42 ("The mechanism for data transfer may be ***initiated*** and controlled by the modem processor 44 (i.e., the device).") (emphasis added), Fig. 10

(referring to the "start" of transfers). In addition, Figure 5 and the accompanying text identifies two separate power goals that would not be achieved under Apple's proposal: "Thus, by consolidating the data into a single active period 102, the ***overall time that is spent in low power may be increased***, thus resulting in power savings. ***Additionally,*** power spent transitioning from a low power to active power state is reduced by the ***elimination of the second transition*** 62." JX-3 ('490 Patent) at 10:36-45 (emphasis added). The text inside the Figure 5 trapezoid, "Downlink Followed By Uplink Data," is consistent with a system in which downlinks start before uplinks, but the data transfers can overlap. The '490 Patent teaches that having an overlap in the transmission of downlink and uplink data is an important advantage of the claimed invention. *See id.*; Hearing Tr. (Baker) 859:2-860:10.

The preferred embodiment shown in Figure 10 also contradicts Apple's proposed construction. Figure 10 teaches that the downlink is started, and not necessarily finished, before starting to pull uplink data. JX-3 ('490 Patent) at Fig. 10. At block 230, the modem processor will "[s]tart transfer of accumulated data so far over link from modem (44) to AP (34)." After that transfer is started, the modem processor will, at block 240, "[s]tart data transfer over link from AP (34) to modem (44)." Nowhere does Figure 10 teach waiting for the downlink transfer to finish before starting the uplink transfer.

Therefore, having considered the arguments of the parties and the record evidence, I have determined to construe "after" in accordance with Qualcomm's proposal, *i.e.*, in the context of the '490 Patent, transmitting uplink data "after transmission" of downlink data means waiting until the downlink transmission has started before starting the uplink transmission. The entirety of the downlink data need not have been transmitted before starting the uplink transmission.

ii. Infringement Analysis

In view of my construction of the claim term "after" discussed above, the record evidence establishes that the '490 Accused Products satisfy the claim limitation "wherein the modem processor is further configured [to] pull data from the application processor after transmission of the modem processor to application processor data and before the interconnectivity bus transitions from an active power state to a low power state." [

] *See, e.g.*, CX-12C (Baker WS) at Q118.

It is therefore my determination that the '490 Accused Products infringe claim 31 of the '490 Patent.

C. Technical Prong

1. The '490 Domestic Industry Products

Qualcomm argues it has three "primary" '490 DI Products that practice claim 31 of the '490 Patent: [ ] *See* CX-12C (Baker WS) at Q157-64.

[

] *See id.* at Q160. A full list of '490 DI Products is provided in the table set forth in Section VI.B below.

[

] CIB at 57-58. In particular, [

]*Id.* at 58.

[

]

2. Claim 31

a. A mobile terminal comprising:

No party disputes that each '490 DI Product is a mobile terminal, *i.e.*, cell phone. *See* RRSB at 39-46; SIB at 18-24.

b. a modem timer;

The record evidence demonstrates that the '490 DI Products practice this claim limitation. Each '490 DI Product includes [

] CX-12C (Baker WS) at Q165; CX-3C (Krishna WS) at Q39, Q49-54; CX-1100C; CX-1103C; CX-1105C; CX-1107C; CX-1114C; CX-1115C, CX-1116C; CX-1117C. No party disputes that each '490 DI Product has the claimed modem timer. *See* RRSB at 39-46; SIB at 18-24.

c. a modem processor, the modem processor configured to hold modem processor to application processor data until expiration of the modem timer;

Evidence adduced at the hearing shows that each '490 DI Product contains a Qualcomm modem processor. CX-12C (Baker WS) at Q178; CX-3C (Krishna WS) at Q43-47; CX-1081C; CX-1112C; CX-1123C; CX-1124C; CX-1125C; CX-1126C; CX-1134C. The modem processor is configured [

] CX-12C (Baker WS) at Q172, Q188-92; CX-3C

(Krishna WS) at Q39-42, Q48; CX-1082C; CX-1100C; CX-1103C; CX-1104C; CX-1107C; CX-1113C; CX-1118C; CX-1119C; CX-1120C; CX-1122C; CX-2366C.

[

]

I therefore find that the '490 DI Products practice the claim limitation "a modem processor, the modem processor configured to hold modem processor to application processor data until expiration of the modem timer" [

]

d. an application processor;

The evidence shows that each '490 DI Product contains a Qualcomm application processor. CX-12C (Baker WS) at Q196; CX-3C (Krishna WS) at Q43-47. I therefore find that the '490 DI Products practice this claim limitation.

e. an interconnectivity bus communicatively coupling the application processor to the modem processor; and

Evidence of record shows that each '490 DI Product contains [

] that communicatively couples the application processor to the modem processor. CX-12C (Baker WS) at Q198-99; CX-3C (Krishna WS) at Q61-63; CX-1060C; CX-1081C; CX-1121C; CX-1123C; CX-1124C; CX-1125C; CX-1126C. The processors use [

] CX-12C at Q200-01; CX-3C (Krishna WS) at Q63; CX-1060C. Apple does not dispute that this limitation is satisfied. *See* RRSB at 39-46.

f. the application processor configured to hold application processor to modem processor data until the modem processor pulls data from the application processor after transmission of the modem processor to application processor data,

The record evidence shows that the application processor in each '490 DI Product [

] CX-12C (Baker WS) at Q203; CX-3C (Krishna WS) at Q64; CX-1082C. [

] CX-12C (Baker WS) at Q203; CX-3C (Krishna WS) at Q64-65.

[

] Apple argues that this claim limitation is not met by the Qualcomm modem processors inasmuch as they do not "hold" uplink data, because that data is stored in RAM. *See* RRSB at 45-46. [ ] Apple's arguments here are not persuasive.

I therefore find that the '490 DI Products practice the claim limitation "the application processor configured to hold application processor to modem processor data until the modem processor pulls data from the application processor after transmission of the modem processor to application processor data" [

]

g. wherein the modem processor is further configured [to] pull data from the application processor after transmission of the modem processor to application processor data and before the interconnectivity bus transitions from an active power state to a low power state.

The record evidence demonstrates that the modem processor in each '490 DI Product pulls uplink data from the application processor after transmission of the downlink data. CX-12C

(Baker WS) at Q212. [

] CX-12C (Baker WS) at Q212-15; CX-3C (Krishna WS) at Q68; CX-1060C; CX-1121C; CX-2366C. In particular, [

] CX-3C (Krishna WS) at Q55-60, Q65-67; CX-1154C; CX-1155C; CX-1153C; CX-2366C.

[

] RRSB at 40 (emphasis original). [

]

Apple also argues that the '490 DI Products do not practice this claim limitation because [ ] RRSB at 40-45. For this argument, Apple relies solely on deposition testimony from Qualcomm's engineer Mr. Krishna and cites to no other documentary evidence. *See id.* I am not persuaded by Apple's argument here.

At the hearing, Mr. Krishna provided credible testimony explaining why he gave the answers he did at his deposition. Mr. Krishna testified that he had initially been confused with respect to the level of granularity sought by the questions at his deposition. *See* Hearing Tr. (Krishna) at 706:9-707:7. His hearing testimony is clear that [

] *See, e.g.*, CX-3C (Krishna) at Q57-59, Q66-67; Hearing Tr. (Krishna) at 703:3-706:8. While testifying live at the hearing, Mr. Krishna also walked through Qualcomm's timing schematic and explained how it demonstrated that the [ ] Hearing Tr. (Krishna) at 709:7-711:6; CX-1154C.

Based on the testimonial and documentary evidence of record, I find that the downlink transmissions in the '490 DI Products always start before the uplink transmissions. Therefore, I find that the '490 DI Products practice the claim limitation "wherein the modem processor is further configured [to] pull data from the application processor after transmission of the modem processor to application processor data and before the interconnectivity bus transitions from an active power state to a low power state."

It is my further determination that Qualcomm has shown that the technical prong of the domestic industry requirement is satisfied because the '490 DI Products practice claim 31 of the '490 Patent.

D. Validity

Apple argues that claim 31 of the '490 Patent is obvious in view of U.S. Patent No. 9,329,671 (RX-1146) ("Heinrich") in combination with U.S. Patent No. 8,160,000 (RX-106) ("Balasubramanian"). RIB at 25-38. Based on my review of the record evidence and arguments of the parties, it is my conclusion that Apple has failed to show by clear and convincing evidence that claim 31 of the '490 Patent is invalid as obvious.

1. Disclosure of Heinrich

Heinrich (RX-1146) was filed on January 29, 2013, issued on May 3, 2016, and is prior art to the '490 Patent under post-AIA 35 U.S.C. § 102(a)(2). While Heinrich discloses a modem processor and an application processor connected by an interprocessor communication ("IPC")

bus, Heinrich takes a different approach to configuring and handling IPC communications for power savings when compared to the claimed invention of the '490 Patent. *See* RX-1146 (Heinrich) at 1:24-2:32, 4:6-12; *see* CX-19C (Baker WS) at Q169-172 ("Heinrich is exclusively concerned about the power state of one or more processors."). Specifically, Heinrich discloses the use of an IPC scheduler (computer program product) that may be used at a first processor for delaying and grouping information that lacks real-time sensitivity (*e.g.*, logging information) for sending to a second, remote processor at a subsequent time period when the second processor will be in an active state, in order to allow the second, remote processor to spend more time in a low power, sleep state where it does not process such information. *See* RX-1146 (Heinrich) at 2:55-3:11 ("computer program product"), 3:50-4:15 ("By grouping the non real-time sensitive IPC activities together and scheduling them for communicating to the second processor during a period in which the second processor is continuously in the first mode, the number of times that the second processor enters and exits the second mode (e.g. sleep mode) is reduced."); *see also id.* at 5:18-39, 7:8-27, 8:21-67, 11:23-52 ("particularly suited to IPC activities including logging information").

For example, in at least one embodiment, the IPC scheduler both identifies and then allocates a "lazy timer" to each of the "non real-time sensitive IPC activities." RX-1146 (Heinrich) at 7:65-8:20, 9:1-21. "In general, each lazy timer is configured to fire in response to the earlier of: (1) the expiry of a respective deadline provided to the lazy timer before which it is expected to fire, or (2) a determination that the [remote] application processor **106** is in the awake mode." *Id.* at 9:22-26, 9:1-21 ("However when one of the registered timers fires, all registered timers expire at the same time, causing all of the aggregated IPC activities to be served at the same time."). By aggregating non real-time IPC activities at the first processor in this

manner, Heinrich's device provides power savings by reducing the frequency with which the second, remote processor must be woken up from a sleep mode where it is not able to receive remote processor information. *See id.* at 9:1-67, 11:45-52 ("[T]he use of lazy timers to aggregate the non real-time sensitive IPC activities (such as those including logging information) together makes the log data transfers more 'bursty' and maybe [sic] aligned with other regular IPC activities. In this way, the application processor **106** may have time to enter the sleep mode between bursts of IPC activity."); *see also id.* at 5:34-39 ("If the Application Processor **106** is in the sleep mode when the IPC activity is initiated then it is 'woken up', i.e. switched to operate in an awake mode in order to process the IPC activity. As an example, the awake mode may have a power consumption which is greater than that of the sleep mode by a factor of approximately 50.").

Although Heinrich teaches that delaying and grouping of non real-time sensitive IPC activities can be done at either or both of the processors (*see* RX-1146 at 7:19-27), Heinrich does not disclose synchronizing data transmissions in two directions across an IPC bus. *See* Hearing Tr. (Baker) at 1399:20-1400:13; *see also* RX-19C (Baker) at Q214-216. Thus, Heinrich neither teaches nor discloses the claim 31 limitations requiring "an application processor configured to hold application processor to modem processor data until the modem processor ***pulls data from the application processor after transmission*** of the modem processor to application processor data" and "a modem processor [that] is further configured ***pull data from the application processor after transmission*** of the modem processor to application processor data." *See* RX-19C (Baker WS) at Q208-213, Q243. Nor does Heinrich expressly teach or disclose the claim 31 requirement for sending both downlink and uplink data "before the interconnectivity

bus transitions from an active power state to a low power state." *See id.* at Q243; Hearing Tr. (Baker) at 1404:3-11.

2. Disclosure of Balasubramanian

Balasubramanian (RX-106) is a Qualcomm patent that predates the '490 Patent. It issued on April 17, 2012, and is prior art to the '490 Patent under post-AIA 35 U.S.C. § 102(a)(1). Balasubramanian relates to a user device in a wireless or wired packet-switched communication network, such as a WiFi or WiMAX network. *See* RX-106 (Balasubramanian) at 4:1-29, 15:13-21. Balasubramanian discloses conserving device power by queuing transmission packets while transceiver components in the user device remain in a suspended state (power save mode), and then transmitting the queued packets during a single wake state for the transceiver. *See* RX-106 (Balasubramanian) at 2:55-63, 4:63-5:4, 7:1-3 (once in its wake state, the transceiver "may send the queued packets in relative close succession (e.g., back-to-back) over the communication link **116**"). Balasubramanian achieves power savings for the user device by increasing the amount of time that transceiver components can spend in a suspended state, as well as reducing the lag time associated with frequent transitions by the transceiver between its active and suspended states. *See id.* at 5:46-61, 14:49-67.

Balasubramanian is not directed to inter-processor communications within a mobile device terminal and thus does not disclose any of the claim 31 limitations. *See* RX-19C (Baker WS) at Q219. Balasubramanian also instructs against delaying data or using reduced power states at the modem-to-application processor level: "[C]omponents that generate data and packets and perform the queuing and other related operations remain active (e.g., in a wake state)," and "components associated with upper layers remain active to potentially provide

packets for the lower layers once lower layers return to the active state." RX-106 (Balasubramanian) at 5:16-29, Figs. 9-10; *see also* Hearing Tr. (Baker) at 1401:9-1402:19.

Within the context of communications between a transceiver and a network, Balasubramanian does disclose that transmission packets can be both sent and received by the transceiver during a single wake state. RX-106 (Balasubramanian) at 7:4-7. Balasubramanian teaches that the remote "network interface **112** may [optionally also] be adapted to queue packets destined for the user equipment **102** when the transceiver **110** is in a suspended state. In this case, when the transceiver **110** is transitioned to an active state, the network interface **112** may [also] send the queued packets to the transceiver **110**." *Id.* at 6:5-10.

Balasubramanian does not, however, disclose a transmission scheme wherein a component will "pull data" from a remote location only "after transmission" of its source data. *See* RX-106 (Balasubramanian) at 7:4-11 ("[T]he network interface **112** may use the receipt of an uplink packet as a trigger to transmit any downlink packets in its queue. Alternatively, the transceiver **110** may send a message to the network interface **112** requesting transmission of all queued packets."); *see also* RX-19C (Baker WS) at Q220-221; *contra* RX-7C (Yalamanchili WS) at Q399-412, Q414-416. In Balasubramanian, the wired or wireless WiFi or other similar communications link between the transceiver and the network interface would not have any reduced or low power state(s). *See, e.g.*, CX-19C (Baker WS) at Q183; Hearing Tr. (Baker) at 1395:16-1396:24.

3. Heinrich and Balasubramanian: Obviousness

Apple has failed to adduce evidence to show, clearly and convincingly, that a person of ordinary skill in the art would be motivated to modify or combine Heinrich with Balasubramanian to achieve the invention of claim 31 of the '490 Patent. Heinrich's objective is

different from the claimed invention—preferentially grouping and delaying certain non real-time sensitive IPC activities (*e.g.*, delayed transmission of logging data) to allow the remote processor to spend more time in a sleep or low power state. *See, e.g.*, RX-1146 (Heinrich) at 1:58-65, 3:50-4:15, 7:1-17; 8:21-67. Balasubramanian also has a different objective from the claimed invention—minimizing power consumed by transceiver components of a user device in a WiFi or other similar packet-switched network. *See* RX-106 (Balasubramanian) at 2:55-59, Fig. 2. Neither Heinrich nor Balasubramanian discloses or otherwise identifies the problem addressed by the claimed invention, which is achieving power savings for a mobile terminal with separate modem and application processors by reducing the frequency of power state transitions being made by the interconnectivity bus connecting the processors. *See* CX-19C (Baker) at Q170-172; Hearing Tr. (Baker) at 1409:18-1410:5.

The record evidence shows that a person of ordinary skill in the art would not have been motivated to combine Heinrich and Balasubramanian. Hearing Tr. (Baker) at 1412:15-1413:1 (Baker). A person of ordinary skill would also not have had a reasonable expectation of success in combining the references to achieve the invention of the '490 Patent. CX-19C (Baker WS) at Q185.

In particular, Dr. Baker provided credible testimony that the Heinrich and Balasubramanian references cannot be combined because their power goals are incompatible with each other, as well as with the '490 Patent. Specifically, Heinrich is focused on power savings for the processor, and Balasubramanian teaches turning a radio transceiver or an entire device off. Hearing Tr. (Baker) at 1403:15-22. By contrast, the '490 Patent focuses on saving power on the bus. Hearing Tr. (Baker) at 1403:23-1404:2.

As Dr. Baker testified, Heinrich discusses the latency involved in switching between different processor power states, and thereby demonstrates that the power used by the bus (as opposed to the power used by the processors) is not a concern in this reference. Hearing Tr. (Baker) at 1406:6-23. For instance, Heinrich recounts processor power state latency that is orders of magnitude higher than the switching time on an interconnectivity bus. RX-1146 (Heinrich) at 6:42-6:67 (showing latency measurements for switching processor power states); Hearing Tr. (Baker) at 1407:6-1408:7. Heinrich therefore bears little connection to the teachings of the '490 Patent, which is targeted to saving power used by the interconnectivity bus when both processors are awake. Hearing Tr. (Baker) 1408:8-12.

Dr. Baker also provided testimony showing that the Heinrich and Balasubramanian references cannot be combined because they are in different, dissimilar fields. Heinrich and the '490 Patent are in the field of interprocessor communication ("IPC"), but Balasubramanian does not relate to IPC and is directed almost exclusively to voice over IP ("VoIP") communications on a WiFi network. *See* CX-19C (Baker WS) at Q188; RX-106 (Balasubramanian) at 6:34-36, 7:29-31. Due to the many differences between the two fields, Balasubramanian does not suggest that its techniques are applicable to IPC, and Heinrich does not suggest that its IPC techniques could apply to a network like that taught in Balasubramanian. *See* CX-19C (Baker WS) at Q196-98.

The evidence also shows that the references cannot be combined because Heinrich's results alone were outstanding, which would suggest to a person of ordinary skill in the art that Heinrich's approach should not be modified. Hearing Tr. (Baker) at 1412:15-1413:1. Specifically, Heinrich contains testing data (including a table and two case studies) showing significant power savings. CX-19C (Baker WS) at Q232; RX-1146 (Heinrich) at 4:6-12,

10:44-49, 7:53-62, 13:53-15:25. Modifying Heinrich from a push-only system into a very different system wherein pushes would be coupled with pulls would increase the demands on the application processor and thus risk the large power savings that Heinrich had already achieved. CX-19C (Baker WS) at Q237.

Therefore, as Apple has failed to show clearly and convincingly that a person of ordinary skill in the art would have been motivated to combine Heinrich with Balasubramanian to arrive at the invention claimed in claim 31 of the '490 Patent, I find that Heinrich in combination with Balasubramanian does not render obvious claim 31 of the '490 Patent.

4. Secondary Considerations

Qualcomm argues that secondary considerations of commercial success, industry praise, licensing, copying, and unmet need demonstrate that claim 31 of the '490 Patent is not obvious. CRSB at 45-48. Qualcomm's arguments are mostly, but not wholly, unpersuasive.

For commercial success, Qualcomm argues that it "made over [ ] of products practicing the '490 Patent from 2013 through 2017. CRSB at 45. However, Qualcomm does not tie these sales to the claimed invention and has failed to establish the required nexus. Qualcomm's arguments for industry praise (which cites to marketing statements from Qualcomm) and licensing (which identifies licenses to multiple Qualcomm patents) also fail to establish a nexus to the '490 Patent. *See* CRSB at 46.

[

] *See* CRSB at 46-48; RRPB at 16-17. [

]

[

]

RRPB at 16-17 (emphasis original) (citations omitted).

[

] On the whole, the evidence does not support a finding of copying here.

Turning now to Qualcomm's long-felt need argument, the evidence does support a finding that there was a long-standing need in the art for technologies that provide power savings and improve the battery life for mobile devices. *See, e.g.*, RX-1146 (Heinrich) at 1:11-23 ("[F]or computer systems implemented on user devices, such as mobile smart phones and tablets, it is important to keep the power consumption of the computer system at a low level because, for example, the power supply to the user device may be limited."); *see also* RX-12C (Baker WS) at Q221-226, Q228; JX-003 ('490 Patent) at 1:23-25, 10:36-45. The record evidence indicates that the '490 claimed invention provides for significant device power savings on the order of approximately [ ] *See* Hearing Tr. (Krishna) at 716:19-717:2 ("Q: What were the results of those studies, power studies that you did, comparing your approach to the conventional

approach? A: In the measurements we did, what we saw was with this patent, we were able to save about [ ] percent of the power consumption."); CX-2366C.0013; *see also* JX-003 ('490 Patent) at 8:35-40 ("Thus, if two transitions (i.e., **60**, **62**) from low power to active power occur every time slot **58**, then thousands of transitions **60**, **62** consume substantial amounts of power and reduce the battery life of the mobile terminal **22**."). Overall, this evidence of long-felt need further supports my finding that claim 31 of the '490 Patent is not invalid as obvious over the prior art.

VI. Domestic Industry – Economic Prong

A. General Principles of Law

With respect to the economic prong, and whether or not section 337(a)(3)(A) or (B) is satisfied, the Commission has held that "whether a complainant has established that its investment and/or employment activities are significant with respect to the articles protected by the intellectual property right concerned is not evaluated according to any rigid mathematical formula." *Certain Printing and Imaging Devices and Components Thereof*, Inv. No. 337-TA-690, Comm'n Op. at 27 (Feb. 17, 2011) ("*Printing and Imaging Devices*") (citing *Certain Male Prophylactic Devices*, Inv. No. 337 TA-546, Comm'n Op. at 39 (Aug. 1, 2007)). Rather, the Commission examines "the facts in each investigation, the article of commerce, and the realities of the marketplace." *Id.* "The determination takes into account the nature of the investment and/or employment activities, 'the industry in question, and the complainant's relative size.'" *Id.* (citing *Stringed Musical Instruments* at 26).

With respect to section 337(a)(3)(C), whether an investment in domestic industry is "substantial" is a fact-dependent inquiry for which the complainant bears the burden of proof. *Stringed Musical Instruments* at 14. There is no minimum monetary expenditure that a

complainant must demonstrate to qualify as a domestic industry under the "substantial investment" requirement of this section. *Id.* at 25. There is no need to define or quantify an industry in absolute mathematical terms. *Id.* at 26. Rather, "the requirement for showing the existence of a domestic industry will depend on the industry in question, and the complainant's relative size." *Id.* at 25-26.

B. Qualcomm's Domestic Industry Products

The Domestic Industry products ("DI Products") consist of certain Qualcomm chipsets and testing platforms. They are identified in the table below on a patent-by-patent basis.

Patent	Domestic Industry Products[21]
'558 Patent	MTP APQ8084, MTP Fusion 4.5, MTP660, MTP8084, MTP845, MTP8926, MTP8928, MTP8974, MTP8992, MTP8994, MTP8996, MTP8998, MTP9625, MTP9630, MTP9635, MTP9640, MTP9645, MTP9650, MTP9655, MDM6X15, MDM9230, MDM9645, MDM9650, MDM9X25, MDM9X30, MDM9X35M, MDM9X40, MSM8926, MSM8928, MSM8958, MSM8974, MSM8974PRO, MSM8992, MSM8994, MSM8996, MSM8996AU, MSM8996PRO, MSM8996SG, MSM8998, QFE1035, QFE1040, QFE1045, QFE1100, QFE3100, QFE3335, QFE3345, QET/QFE4100, QFE4335, QFE4345, QPA4340, QPA5460, SDM660, SDM845, SDR660, WTR1605, WTR1625, WTR2605, WTR3925, WTR4905, WTR5975
'490 Patent	MTP9x35, MTP9x45, MTP9x55, MTP9x65/MTP20, MTP Fusion 4.5, MDM9x35, MDM9x45, MDM9x55, MDM9x65/SDX20
'936 Patent	Adreno 304, Adreno 305, Adreno 306, Adreno 308, Adreno 320, Adreno 330, Adreno 405, Adreno 418, Adreno 420, Adreno 430, Adreno 505, Adreno 506, Adreno 508, Adreno 510, Adreno 512, Adreno 519, Adreno 530, Adreno 540, Adreno 3xx, Adreno 4xx, Adreno 5xx, APQ8064, APQ8084, APQ8096, MSM8909, MSM8916, MSM8917, MSM8926, MSM8928, MSM8936, MSM8937, MSM8940, MSM8952, MSM8953, MSM8956, MSM8960AB, MSM8974, MSM8992, MSM8994, MSM8996, MSM8997, MSM8998, MSM8x12, MSM8x26, MSM8x30, SDM440, SDM630, SDM660, MTP APQ8084,

[21] [

]

Patent	Domestic Industry Products[21]
	MTP660, MTP8084, MTP8926, MTP8928, MTP8974, MTP8992, MTP8994, MTP8996, MTP8998

CIB at 63.

1. Qualcomm Chipsets

A "Snapdragon" is a Qualcomm designed SoC for incorporation into mobile devices. CX-11C (Annavaram WS) at Q216. [

] CX-6C (Martin WS) at Q14, Q18. [

] *Id.* at Q23. Adreno is the brand name for GPUs developed by Qualcomm, which are incorporated into Snapdragon chipsets. CX-11C (Annavaram WS) at Q210. [

] CX-3C (Krishna WS) at Q24; CX-6C (Martin WS) at Q24; CX-12C (Baker WS) at Q158. [

] CX-4C (Marra WS) at Q57; CX-13C (Kelley WS) at Q58. [

] RX-1487C.98:13-18; RX-1487C.98:24-99:10; CX-13C (Kelley WS) at Q54.

2. Qualcomm Test Platforms

The different types of Qualcomm test platforms include [

] *See* CX-2683C; CX-2684C; CX-6C (Martin WS) at Q9. The evidence shows that each type is [

]

[ ] CX-6C (Martin WS) at Q10-11. For instance, [

] *Id.* at Q10. Additionally, [

] *Id.*

Qualcomm's witness Christopher Martin testified that [

] CX-6C (Martin WS) at Q12. Thus, [

] *Id.* [ ] *Id.* at Q13. The general naming convention [

] *Id.* at Q14. For example, [

] *Id.*; Hearing Tr. (Thomas) at 1037:22-1038:1.

The evidence shows that all of Qualcomm's [ ] are manufactured in [ ]. CX-8C (Saroff WS) at Q7. [

] *See id.* at Q10; CX-2502C [

]

C. Qualcomm's Domestic Expenditures

Qualcomm has presented evidence, drawn from its ordinary business records, of investments related to articles allegedly protected by the asserted patents from [ ] through [ ] *See, e.g.*, CX-7C (Durkin WS) at Q24; CX-2657C [ ] spreadsheet); CX-2981C [ ]

[ ] Hearing Tr. (Saroff) at 375:19-22 (Qualcomm fiscal year begins in October).

Generally, the activities relevant to a determination of whether a domestic industry exists occur before the filing of the complaint, although in appropriate situations the Commission may consider later activities and investments. *Certain Video Game Systems and Controllers*, Inv. No. 337-TA-743, USITC Pub. No. 4377, Comm'n Op. at 5-6 (Feb. 2013). Here, the applications leading to the '558, '490, and '936 Patents were filed in 2011, 2014, and 2008, respectively, and Qualcomm filed its Complaint on July 7, 2017. JX-1 ('558 patent); JX-3 ('490 patent); JX-5 ('936 patent); 82 Fed. Reg. 37,899 (Notice of Institution). Fact discovery closed on March 5, 2018. *See* Order No. 7 at 2 (Sept. 19, 2017). Thus, the time period covered by Qualcomm's domestic industry data spans the life of the asserted patents through the filing of the Complaint, plus a short period thereafter [ ]. Given that Qualcomm presented significant domestic activities stretching back well before the filing of the Complaint, which are more than adequate to establish domestic industry, I find it is immaterial that it has also included some activities that occurred after filing of the Complaint. Hence I find that this time period is appropriate to consider for purposes of the economic prong analysis.

The record evidence establishes that the calculations underlying Qualcomm's economic prong arguments are based on [ ] data kept by Qualcomm in the ordinary course of business. [ ] CX-7C (Durkin WS) at Q16. Thus, "Qualcomm can, in the ordinary course of business, [ ] *Id.* at Q.28. Qualcomm's expert

Dr. Kerr analyzed three areas of Qualcomm activity to quantify Qualcomm's investments in articles allegedly protected by the asserted patents: (1) engineering, research and development, and sustaining activities; (2) domestic manufacturing of test platform domestic industry products; and (3) customer engineering support. CX-14C (Kerr WS) Q23. Each area is addressed in more detail below.

1. Qualcomm's Engineering, Research and Development Group

The evidence shows that engineering, research and development, and sustaining activities take place in [ ] CX-14C (Kerr WS) at Q24. Qualcomm engineers [ ] CX-7C (Durkin WS) at Q15. [ ] *Id.* [ ] *Id.* [ ] that Qualcomm uses in its ordinary course of business, and it [ ] CX-7C (Durkin WS) at Q16. [ ] *Id.* [ ][22] *Id.* at Q16,

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[22] [ ] Historical data, however, indicate that [ ] Thus, to calculate the amount of domestic spend related to [ ] CX-7C (Durkin WS) at Q20; CX-14C (Kerr WS) at Q27. I find that this method of calculating domestic [ ] expenses is reasonable under the circumstances. *See, e.g., Certain Mobile Device Holders and*

Q19. [

] *Id.* at Q16.

[

] *Id.* at Q17

[

]

The evidence shows that, in its ordinary course of business, Qualcomm uses [

] CX-7C (Durkin WS) at Q27. That is,

[

] *Id.* [

] *Id.* Dr. Kerr testified that this allocation methodology [ ] is "a reasonable approach used widely in corporate cost accounting systems." CX-14C (Kerr WS) at Q26. Thus, for each of Qualcomm's [

] yields the amount that Qualcomm argues was invested in labor,

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Components Thereof, Inv. No. 337-TA-1028, Comm'n Op. at 18 (Mar. 22, 2018) ("Often, complainants in section 337 investigations claim domestic investments relating to domestic industry articles by using allocation methodologies appropriate to the complainant's circumstances, as supported by the evidence in the record.").

plant, and equipment associated with [ ] *See* CX-7C (Durkin WS) at Q21-26; CX-2657C [ ] By adding together these amounts [ ] Qualcomm calculated the total investment in labor, plant and equipment it allocated to a particular DI Product. *See* CX-7C (Durkin WS) at Q30; CX-2981C [ ] spreadsheet) (showing domestic engineering, research and development, and sustaining expenditures for each of the domestic products on a yearly basis [ ]

By adding together the labor costs for each DI Product alleged to practice a particular Asserted Patent, and separately adding together the plant and equipment costs for each such product, Qualcomm calculated the investments in: (1) labor; and (2) plant and equipment that it argues were made for each individual Asserted Patent. *See* CX-7C (Durkin WS) at Q35-36; CX-2981C [ ] spreadsheet); CX-2655C [ ]

This precision of allocation and calculation is not common in section 337 economic prong analyses, wherein sales- or unit-based estimates or allocations are often used to calculate domestic expenditures. *See, e.g.*, *Certain Mobile Device Holders and Components Thereof*, Inv. No. 337-TA-1028, Comm'n Op. at 18 (Mar. 22, 2018) ("Often, complainants in section 337 investigations claim domestic investments relating to domestic industry articles by using allocation methodologies appropriate to the complainant's circumstances, as supported by the evidence in the record."). The Commission has often found that the economic prong is satisfied based on such estimates and allocations. *See, e.g.*, *id.* at 18-19 (noting that "[t]he Commission has generally assessed allocation issues based on complainants' presentation of measures such as

sales, revenues, costs, or employee time estimates" but affirming use of allocation method based on gross profits under specific circumstances of the case).

In view of the Commission's past use of sales- or unit-based allocations to analyze the economic prong, I find that Qualcomm's calculations here, which are based on actual data drawn from Qualcomm's ordinary financial records, are especially persuasive and clearly and convincingly establish its domestic industry.

2. Manufacturing

The record evidence shows that [

] CX-14C (Kerr WS) at Q34; CX-8C (Saroff WS) at Q7.

[

] CX-14C (Kerr WS) at Q34; CX-8C (Saroff WS) at Q14. The evidence also shows that [

] CX-8C (Saroff WS) at Q10; *see* CX-14C (Kerr WS) at Q45; CX-6C (Martin WS) at Q8.

Qualcomm adduced evidence show that [

] *See* CX-8C (Saroff WS) at Q11-12. In addition, [

] *Id.* at Q15-26. Dr. Kerr testified that [ ] to determine the total investment in manufacturing of domestic products on a patent-by-patent

basis. CX-14C (Kerr WS) at Q36; *see* CX-8C (Saroff WS) at Q15-29; CX-2660C [ ] spreadsheet); CX-2683C [ ] CX-2684C [ ] spreadsheet).

3. Customer Engineering and Support

Evidence adduced at the hearing shows that Qualcomm maintains a customer engineering and support network in the United States referred to as QTI Customer Engineering. CX-14C (Kerr WS) at Q29. QTI has between [ ] engineers stationed in [ ] who provide engineering and support for end users of Qualcomm products, including the DI Products. CX-9C (Chiniga WS) at Q6-7, Q11. The engineers' work is tracked through [ ] *Id.* at Q14. [ ] *Id.* at Q18-19; CX-2679C [ ] spreadsheet). Labor costs for QTI engineers, [ ] CX-9C (Chiniga WS) at Q22.

[ ] *Id.* at Q23; CX-14C (Kerr WS) at Q32 [ ] In particular, Qualcomm estimated that the average number of hours needed to resolve a ticket was [ ] CX-9C (Chiniga WS) at Q15-17. Multiplying the number of tickets associated with a particular DI Product by [ ] yields the total investment in customer engineering labor associated with that product. *Id.* at Q24; CX-14C (Kerr WS) at Q31-32. Totaling the labor investments for all of the

DI Products alleged to practice a given patent yields domestic labor expenses for customer engineering and support on a patent-by-patent basis. CX-9C (Chiniga WS) at Q25-26.

4. Qualcomm's Total Domestic Investment Per Patent

To obtain the total amount invested in a particular DI Product, Qualcomm added the total investment in engineering, research and development, and sustaining activities to the total investment in manufacturing and the total investment in customer engineering and support. CX-14C (Kerr WS) at Q45-46. Adding the totals for each DI Product alleged to practice a claim of an asserted patent resulted in a grand total amount invested for that patent. *Id.* Qualcomm's total domestic industry investments on a per-patent basis are summarized in the table below:

Summary of Qualcomm's Domestic Industry Investments

Patent	Engineering and R&D	Customer Engineering	Test Platform Manufacturing	Total Domestic Industry Investments
'558 Patent	[ ]	[ ]	[ ]	[ ]
'490 Patent	[ ]	[ ]	[ ]	[ ]
'936 Patent	[ ]	[ ]	[ ]	[ ]

JX-19C (Qualcomm's revised economic prong summary charts) at 1.

The figures for the '490 Patent were adjusted following the evidentiary hearing to remove costs associated with [ ] *Id.* at 2; *see* Hearing Tr. (Saroff) at 369:8-374:2.

D. Economic Prong Analysis

The evidence, including the corrected figures for the '490 Patent, demonstrates that Qualcomm has made significant investments in plant, equipment, and labor related to articles protected by the asserted patents. With respect to activities performed by Qualcomm's engineers at related to engineering, research, and development, the Commission recently and definitively stated:

> The statutory text of section 337 does not limit sections 337(a)(3)(A) and (B) to investments related to manufacturing or any other type of industry. It only requires that the domestic investments in plant and equipment, and employment of labor or capital be "with respect to the articles protected by the patent." 19 U.S.C. § 1337(a)(3). Moreover, even though subsection (C) expressly identifies "engineering" and "research and development" as exemplary investments in the "exploitation" of the patent, that language does not unambiguously narrow subsections (A) and (B) to exclude those same types of investments.

Certain Solid State Storage Drives, Stacked Electronics Components, and Products Containing Same, Inv. No. 337-TA-1097, Comm'n Op. at 8 (June 29, 2018).

Thus, for purposes of an economic prong analysis, Qualcomm's investments are properly analyzed under subsections (A) and (B) of 19 U.S.C. § 1337(a)(3). In light of the Commission's opinion in *Solid State Storage Drives*, I find it unnecessary to conduct an analysis of Qualcomm's investments under subsection (c) of 19 U.S.C. § 1337(a)(3). *Id.* at 8. Analysis of Qualcomm's investments under subsections (A) and (B) is sufficient to establish that Qualcomm has satisfied the economic prong of the domestic industry requirement of section 337.

1. Significant Investment in Plant and Equipment

As shown by the record evidence, Qualcomm's investments in plant and equipment related to articles protected by the asserted patents[23] are sufficient to satisfy the economic prong under 19 U.S.C. § 1337(a)(3)(A). Qualcomm is headquartered in San Diego, California, and has 92 facilities across the United States. CX-7C (Durkin WS) at Q9. The facilities occupy approximately 6.2 million square feet. *Id.* at Q10. Qualcomm asserts that from fiscal year [ ] through [ ] it invested [ ] billion in facilities and equipment needed to engage in engineering, research and development, and sustaining activities related to the DI Products. *See* CX-7C (Durkin WS) Q43. The specific figures for each asserted patent, drawn from Qualcomm's financial systems and revised as shown in exhibit JX-19C, are as follows:

Qualcomm Plant and Equipment Expenses, [ ]

	Plant and Equipment for Engineering, R&D, and Sustaining Activities	**Plant and Equipment in the Form of Raw Materials for Manufacturing**
'558 Patent	[ ]	[ ]
'490 Patent	[ ]	[ ]
'936 Patent	[ ]	[ ]

JX-19C (Qualcomm's revised economic prong summary charts) at 1.

As discussed further in Section VI.D.3 below, I find that this is sufficient to satisfy subparagraph (A) of Section 337(a)(3).

[23] As discussed above, the technical prong of the domestic industry requirement is satisfied only for the '490 Patent, and not for the '558 or '936 Patents. Nevertheless, for the sake of completeness, the economic prong investments for all three Asserted Patents are addressed in this initial determination.

2. Significant Employment of Labor or Capital

As shown by the record evidence, Qualcomm's employment of labor related to articles protected by the asserted patents is sufficient to satisfy the economic prong under 19 U.S.C. § 1337(a)(3)(B). As of June 16, 2017, Qualcomm employed [ ] engineers in the United States. CX-7C (Durkin WS) at Q12; CX-2652 [ ] Qualcomm asserts that from [ ] through [ ] it invested [ ] in labor costs for engineering, research and development, and sustaining activities related to the domestic products. *See* CX-7C (Durkin WS) at Q43; CX-2655C [ ] [ ] Qualcomm also asserts that its QCES manufacturing division incurred [ ] labor costs related to the domestic products during the same period. *See* CX-8C (Saroff WS) at Q26. Finally, Qualcomm asserts that its QTI customer engineering and support division incurred [ ] labor costs associated with engineering support for customers other than Apple. *See* CX-9C (Chiniga WS) at Q24. All of these are labor expenses that satisfy subparagraph (B) of section 337(a)(3). The specific figures for each asserted patent, drawn from Qualcomm's financial systems and revised as shown in exhibit JX-19C, are as follows:

Qualcomm Labor Expenses, [ ]

	Engineering, R&D, and Sustaining Activities	Manufacturing	Customer Engineering and Support
'558 Patent	[ ]	[ ]	[ ]
'490 Patent	[ ]	[ ]	[ ]
'936 Patent	[ ]	[ ]	[ ]

JX-19C (Qualcomm's revised economic prong summary charts) at 1.

As discussed further in Section VI.D.3 below, I find that this is sufficient to satisfy subparagraph (B) of Section 337(a)(3).

3. The Significance of Qualcomm's Investments

The evidence demonstrates that the investments summarized above are significant under both quantitative and qualitative analyses. *See Lelo Inc. v. International Trade Comm'n*, 786 F.3d 879, 885 (Fed. Cir. 2015). Determining whether an investment is "significant" under 19 U.S.C. § 1337(a)(3) is context-dependent. *Certain Printing and Imaging Devices and Components Thereof*, Inv. No. 337-TA-690, USITC Pub. No. 4289, Comm'n Op. at 31 (Nov. 2011).

Here, I find that Qualcomm's investments in plant and equipment and in labor are quantitatively significant in an absolute sense. *See* CX-14C (Kerr WS) Q49. For example, for the '490 Patent alone (the only Asserted Patent for which I have found there is a violation of section 337), Qualcomm has invested [ ] in plant and equipment and [ ] in labor related to articles alleged to practice the patent.

I also find that Qualcomm's investments are quantitatively significant when placed in context. [ ] of Qualcomm's global expenditures on engineering, research and development, and sustaining activities for the domestic products took place in the United States, demonstrating that Qualcomm's U.S. investments constituted a significant portion of the total invested in the domestic products. The relative percentages of domestic and foreign expenditures for the Asserted Patents are set forth in the table below:

Percentage of Qualcomm Engineering, R&D, and Sustaining Activities Expenses Incurred in the United States, [ ]

	U.S. Expenditures	Non-U.S. Expenditures
'558 Patent	[ ]	[ ]
'490 Patent	[ ]	[ ]
'936 Patent	[ ]	[ ]

CX-7C (Durkin WS) Q48-51; CX-2656C [ ] spreadsheet).

The evidence shows that overall, [ ] percent of Qualcomm's worldwide spending on engineering and research and development on domestic products took place in the United States. CX-14C (Kerr WS) at Q49. Of the worldwide cost of labor associated with engineering and R&D on domestic products, [ ] percent was incurred in the United States. *Id.*

Moreover, the record reflects that U.S. investments in the DI Products were a significant portion of Qualcomm's overall global operations. Qualcomm's global research and development expenditures for all products, and not just the DI Products, totaled approximately $5.5 billion in FY2014, $5.5 billion in FY2015, and $5.2 billion in FY2016, respectively. CX-7C (Durkin WS) at Q53; CX-4736 (Qualcomm 10-K 2016) at 15. In FY 2014, Qualcomm's domestic expenditures on DI Products represented [ ] percent of the $5.5 billion total. CX-7C (Durkin WS) at Q54. In FY2015, those domestic expenditures represented [ ] percent of the global total. *Id.* In FY2016, they represented [ ] percent of Qualcomm's entire global research and development expenses. *Id.* I find that these statistics illustrate the quantitative significance of Qualcomm's investments in plant, equipment, and labor associated with the DI Products.

I find that Qualcomm's investments are significant in a qualitative sense as well. "[T]he magnitude of the investment cannot be assessed without consideration of the nature and importance of the complainant's activities to the patented products in the context of the marketplace or industry in question." *Printing and Imaging Devices*, USITC Pub. No. 4289, Comm'n Op. at 31. The Treasury Department's Committee on Foreign Investment in the United States ("CFIUS") has recently recognized Qualcomm's importance to the mobile electronic device industry in particular, and to the national economy as a whole. CX-1929 (Ltr. from CFIUS to Broadcom and Qualcomm (Mar. 5, 2018)) at 2 ("Reduction in Qualcomm's long-term technological competitiveness and influence in standard setting would significantly impact U.S. national security."). Qualcomm's success in the marketplace has depended heavily on its domestic products, which have accounted for [ ] of Qualcomm's worldwide revenues in recent years. CX-14C (Kerr WS) at Q49. For example, in fiscal year 2015, revenue from sales of its DI Products represented [ ] percent of Qualcomm's annual revenue. *Id.* From fiscal year 2011 through YTD December 2017, Qualcomm's worldwide revenue from sales of the DI Products totaled [ ] *Id.*

It cannot be disputed that the DI Products are significant to Qualcomm's business and to the mobile device industry as a whole. Nor can it be disputed that Qualcomm's U.S. investments in those DI Products represent a significant percentage, approximately [ ] of Qualcomm's total investment in those products. Given the size of Qualcomm's qualifying expenses, their importance to the DI Products, the importance of those products to Qualcomm and to the marketplace, and the importance of Qualcomm as a whole to the U.S. mobile electronic device industry, the record evidence demonstrates that Qualcomm's expenses in plant, equipment, and labor are "significant" within the meaning of the statute. Accordingly, I find that

Qualcomm has satisfied the economic prong of the domestic industry requirement of 19 U.S.C. § 1337(a)(3).

Apple argues against a finding that Qualcomm has satisfied the economic prong of the domestic industry requirement, but its arguments are not persuasive. For example, Apple asserts that Qualcomm cannot satisfy the economic prong because its claimed investments in the DI Products [ ] are [ ] its overall, company-wide revenues [ ] RRSB at 66. Yet, not only is this type of comparison not required for an economic prong analysis (as it would disproportionally prejudice large, diversified companies like Qualcomm), it does nothing to show that the [ ] of domestically invested dollars in the DI Products are insignificant. *See Certain Mobile Electronic Devices*, Inv. No. 337-TA-794, Initial Determination at 604-05 (Oct. 3, 2012) (rejecting a comparison of claimed investments to overall operations because "such an analysis is not a requirement" and "such a comparison would hurt large, diversified companies that produce a wide range of products"); *Certain Mobile Electronic Devices,* Inv. No. 337-TA-794, Comm'n Op. at 104 (July 5, 2013) ("The fact that Samsung's total sales revenues in 2010 and 2011 were much greater than its domestic engineering and [R&D] expenses, as Apple argues, does not negate the fact that Samsung has invested millions of dollars domestically relating to protected articles.").

Apple also argues that Qualcomm's [ ] investment represents "no more than [ ] . . . of the [ ] in [DI] product revenues," and compares this [ ] figure to the "5% value-added figure found quantitatively insignificant . . . in *Lelo Inc. v. Int'l Trade Comm'n.*" RRSB at 65. But comparing the [ ] figure here (attained by dividing investments by revenue) to *Lelo's* five percent figure (attained by dividing component purchase prices by the total raw cost of the downstream devices) is not a sound methodology, as these

figures represent completely different metrics. Moreover, Apple's reliance on *Lelo* is inapt because in that investigation, the complainant's entire economic domestic industry was predicated on its purchase of "off-the-shelf" components and, unlike here, there was "no evidence of any investment made in capital or labor as a result of the purchased components." *See Lelo*, 786 F.3d 879, 884 (Fed. Cir. 2015).

Apple further argues that (a) Qualcomm's investments must be evaluated against its foreign manufacturing costs for chipsets (even though Qualcomm does not claim any domestic manufacturing costs for chipsets), and (b) Qualcomm's total claimed investments in test platform manufacturing and customer engineering represent [ ] in DI Product revenues. RRSB at 65, 67. Neither of these analyses is germane in the context of this investigation. Qualcomm only needs to prove the significance of its claimed investments in a reasonable context, and not in every imaginable context, and it is my determination that Qualcomm has done so.

VII. Public Interest Considerations

A. Introduction

After considering the evidence relevant to the Public Interest, I find the Public Interest will not be served by the issuance of an exclusion order of any type as a result of this investigation. I base my finding on the evidence of record. Specifically, while Apple was able to present uncontroverted and competent testimonial evidence of what the result of an exclusionary order would be, Qualcomm presented opinion testimony which I find to be less than credible than the evidence presented by Apple. In addition, Qualcomm made what I consider to be diversionary or "strawman arguments" that I believe did not move things forward in its briefing.

Even though the Office of Unfair Import Investigations said they credited the testimony proffered by Apple, I find they ultimately ignored the meaning of that evidence to propose a partial exclusionary order I consider to be inherently risky and unrealistic because we are, ultimately, talking about a matter with tangible national security implications to the United States. In addition, it appears to me that the Staff:

a. Based at least some of its conclusions upon testimony I find to be less than credible, some of which is noted below; and

b. Focused on matters, such as the issue of iPhone availability in 2018-2019 (*e.g.*, SIB at 46-50), that miss the real issue the Staff itself identified, which is the baseband chipsets verses the products Qualcomm accused.

B. The Parties' Public Interest Contentions

1. Qualcomm's Contentions

After asserting (incorrectly) that there is an overwhelming evidence of a violation,[24] Qualcomm contends that because the patents at issue are not standard essential patents ("SEPs"), Apple could simply stop using the infringing features and thus avoid the effect of an exclusion order. CIB at 70. Qualcomm notes that by law, the Public Interest requires consideration of whether the requested relief (seeking the exclusion of certain mobile devices and not components thereof), would have an adverse impact on (1) the public health and welfare; (2) competitive conditions in the United States economy; (3) the production of like or directly competitive articles in the United States; and (4) United States consumers. *Id.* at 70-71. Qualcomm asserts the

[24] I found Apple only infringed one claim of one valid patent (the '490 patent) of those asserted.

listed public interest factors plainly favor entry of an exclusion order and notes the Staff agreed. *Id.*

a. The Focus of the Investigation: There Are Numerous Substitutes for the Accused Devices

Qualcomm's first specific contention is that there are numerous reasonable substitutes for the accused devices. CIB at 73-74. Specifically, Qualcomm alleges that for each model or variant of accused iPhone, there is a corresponding model of non-accused Apple device available in the United States after an exclusion order, including the Qualcomm-equipped iPhone 7, iPhone 7 Plus, iPhone 8, iPhone 8 Plus, and iPhone X devices, as well as earlier generation iPhones such as the iPhone 6s and iPhone 6s Plus, which Qualcomm asserts are reasonable substitutes. *Id.* Additionally, Qualcomm asserts Apple can meet the demand for non-accused devices. *Id.*

Qualcomm next alleges there are numerous other comparable mobile devices sold in the United States, including the Samsung Galaxy S8, S8 Plus, S8 Active, S9, and S9 Plus; Samsung Note 8; Google Pixel 2 and 2XL; and LG V30 and V30+. Qualcomm claims these smart phones are reasonable substitutes to the accused devices because they are comparable or even superior to the accused devices. CIB at 74. Qualcomm claims that the OEMs of its noted substitutes can satisfy any incremental increase in demand that may result from orders and that the wireless carriers and retailers maintain commercially significant inventories of these devices in the United States. *Id.*

Qualcomm alleges that since there are reasonable substitutes for the accused devices, none of the four public interest factors are relevant to the issuance of an exclusion order against the accused devices. CIB at 74. Qualcomm asserts the accused devices thus cannot affect the public health, safety or welfare. Similarly, Qualcomm asserts there would be no effect on

Factor 2: Competitive Conditions because, as Apple admits, the industry is "very competitive" and Apple is "confronted by aggressive competition in all areas" of its business, which is "characterized by frequent product introductions and rapid technological advances." *Id.* at 74-75; *see, e.g.*, *Certain Consumer Electronics and Display Devices with Graphics Processing and Graphics Processing Units Therein*, Inv. No. 337-TA-932, Recommended Determination on Remedy and Bond, at 9 (Oct. 22, 2015).

With regard to Factor 3: Production of Like or Directly Competitive Articles, Qualcomm accurately asserts that neither the accused devices or any substitutes are manufactured in the United States and thus an exclusion order cannot have an adverse impact on the production of like or directly competitive articles in the United States.[25] CIB at 75. Regarding Factor 4: U.S. Consumers, Qualcomm alleges exclusion of the accused products would not harm U.S. consumers given the allegedly wide range of reasonable substitutes, which Qualcomm asserts are either priced the same or less than the accused products and have equivalent functionality. *Id.* at 76.

Qualcomm also argues that an exclusion order would serve the public interest by protecting and incentivizing inventions in a technology-intensive field like cellular communications because competition is enabled through innovation, which benefits both the U.S. economy and U.S. consumers. CIB at 76. In addition to protecting Qualcomm's intellectual property, protecting its huge investment, and incentivizing more R&D investment in valuable R&D, Qualcomm claims an exclusion order would encourage Apple to innovate around the infringing features of the iPhone. *Id.* at 76-77.

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[25] The premise of this argument is that the entire smart phone is all that is relevant, and not the baseband chipsets.

b. Shifting the Focus to Intel's Chipsets

Qualcomm further argues Apple has sought to shift the focus of the investigation to a component of the accused devices, their baseband chipsets. CIB at 71, 73-78. This leads to Apple's contention that an exclusion order would give Qualcomm a monopoly in the merchant market for premium LTE baseband chipsets, which Qualcomm alleges is Apple's choice because Apple could and should have ensured that Intel-based iPhones do not infringe Qualcomm's patents so that Apple could use Intel chipsets. Qualcomm asserts Apple's monopoly claim is wrong because it depends on a made-up market that Apple manipulated to suit its position. *Id.* at 71, 78-86. Qualcomm asserts the baseband chipset business is highly competitive and that it has no monopoly power and that it is actually Apple that dominates suppliers of "premium" baseband chipsets. *Id.* at 79-83. Thus, Qualcomm's point of view is that an exclusion order would enhance competition, whereas declining to issue an exclusion order would not only immunize Apple for a violation in this investigation, it would also immunize any other Apple iPhone with an Intel chip facing an exclusion order for any patent asserted by any patent holder. *Id.*

Qualcomm also disputes that enforcing the patents at issue would (1) drive Intel from the baseband chipset business; (2) force Intel out of 5G development altogether; or (3) lead to other bad things. CIB at 72, 86-97. Qualcomm contends Intel needs no special protection and that even though Intel may leave the baseband chipset business, an order enforcing Qualcomm's patents would not be the cause of it leaving the business because the infringing features could simply be removed from the accused iPhones. *Id.* Qualcomm also disputes that any exclusionary order

would require[26] Intel to abandon 5G because it alleges Intel would have more of Apple's business after an exclusion order, and thus it would make no sense for Intel to remove itself from 5G development in view of the strategic importance of 5G and the potential upside of 5G. *Id.* Qualcomm also disputes that Intel courtroom testimony is inconsistent with its conduct outside the courtroom with its shareholders, customers, and partners. *Id.*

The specific allegations supporting this aspect of Qualcomm's arguments are complicated. Qualcomm alleges that Apple concentrates on baseband chipsets because concentrating on the accused devices will not help it. CIB at 78. Qualcomm asserts the correct focus for the Public Interest analysis is the accused devices and identifies *Digital Media Devices* as authority. *Id.* (citing *Certain Electronic Digital Media Devices and Components Thereof* ("*Digital Media Devices*"), Inv. No. 337-TA-796, Comm'n Op. at 120 (Sept. 6, 2013)). Notwithstanding this focus, Qualcomm asserts that Apple's accusation of an incipient monopoly fails because (1) it depends on a made-up market, gerrymandered to suit Apple's rhetoric; (2) Apple's monopoly claim is misplaced; (3) Apple, not Qualcomm, is the dominant force in "premium" baseband chipsets; and (4) issuing the requested orders would actually ensure fair competition, whereas declining to issue the orders would not only give Apple a free pass in this Investigation, but also effectively immunize any iPhone with an Intel chip against an exclusion order for any patent asserted by any patent-holder.

[26] Qualcomm uses this specific word, "require," in its brief. I heard no such testimony or argument. Instead, what I heard was that an exclusionary order like that requested would *cause* or *result* in Intel reducing or terminating 5G investment.

i. The Market

Qualcomm contends Apple's opposition to an exclusion order based upon the Public Interest factors ultimately depends upon Apple's made-up market, the "so-called U.S. 'premium' LTE baseband chipset market." CIB at 78. According to Qualcomm, Apple did nothing to establish this market using proper economic analysis, but instead makes vague or circular assertions supported by witnesses contending premium chipsets are found in premium mobile devices. *Id.* at 78-79. Qualcomm further asserts the word "premium" has no objective meaning and there is no connection between premium mobile devices and premium baseband chipsets. *Id.* at 79.

Qualcomm criticizes Apple's alleged reliance on the use of words Qualcomm labels as "jargon" such as "flagship," "leading edge," and "latest and greatest," words Qualcomm alleges have no definite meaning in economics or in the industry. CIB at 79. Qualcomm avers Apple's use of such words or terms, which it alleges have no certain meaning and are not capable of rigorous expert analysis, makes it impossible to determine which chipsets are "premium" and which are not. *Id.*

ii. Existence of a Monopoly

Qualcomm disputes Apple's claim that an exclusion order would make Qualcomm a monopolist because Apple allegedly "ignores the global nature of the chipset market and it ignores the presence of multiple competitors in that market." CIB at 79. According to Qualcomm, chipset suppliers compete globally to sell their chipsets to OEMs and no chipset supplier develops or sells chipsets specifically for U.S. smartphones in this highly competitive

market. *Id.* at 80.[27] Moreover, according to Qualcomm, at least four companies make chipsets with advanced features and performance, but by eliminating all makers but Qualcomm and Intel, Qualcomm accuses Apple of reducing the market to a so-called "merchant" or "open" market, by which Apple means suppliers who are willing to sell to third parties. *Id.* Qualcomm disputes this is true and offers that Samsung does not refuse to sell to third-parties because it already sells chipsets to Meizu.[28] *Id.*

Qualcomm also disputes the effect of demonstrative exhibit RDX-28.4, which illustrates how a Qualcomm monopoly would result from an exclusion order, because Qualcomm claims Apple theorized a fictional U.S. chipset market and ignored dispositive facts about chipset competition. CIB at 81. Among other things, Qualcomm alleges that Apple wrongly eliminated Intel from the chart because Apple ignored the global character of the chipset market even though Intel could allegedly sell more chipsets for iPhones outside the United States alone than all of the chipsets it sells today.[29] *Id.* According to Qualcomm, when Apple's errors are considered, things look very different from the picture Apple presented at the hearing. *Id.* Qualcomm alleges that after Apple's release of the 2018 iPhones, Qualcomm is likely to supply baseband chipsets for only about [ ] of iPhones and less than 50% of Samsung smartphones, even in the event of an exclusion order with Intel [ ]

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[27] This argument is irrelevant to the existence of a market for a certain kind of chipset.

[28] I note this fact was not disputed. However, Mr. Blevins did testify that [ ] *See, e.g.*, Hearing Tr. (Blevins) at 610:23-611:1.

[29] I find this particular argument to be disingenuous. Apple's argument has been all along that Intel, [ ] would exit the premium baseband chipset market if it could not sell chipsets for use in the United States. This was the core of Ms. Evan's unrebutted and highly credible testimony.

[ ] *Id.* at 82. Qualcomm also argues that if it gains Intel's share of chipset sales for current-generation U.S. iPhones, it will nevertheless have only [ ] of chipset sales for current-generation iPhones worldwide and about [ ] of Apple's total iPhone sales [ ] *Id.* Based upon this and other analysis presented by Qualcomm, it is argued there will be no Qualcomm monopoly in LTE baseband chipsets, "premium" or otherwise in the event of an exclusion order. *Id.* at 82-83.

Qualcomm further argues that even if Apple were not mistaken about a Qualcomm monopoly, a monopoly would be no impediment to an exclusion order. CIB at 83. Qualcomm asserts that commercial success does not make intellectual property unenforceable, but instead creates an incentive to innovate. *Id.* Qualcomm claims its own success is the result of many years of massive and sustained R&D effort. *Id.*

iii. Apple's Domination

Qualcomm alleges that its role in the baseband chipset business is not as important as Apple's role is. CIB at 83. Specifically, Qualcomm alleges Apple is the sole mobile device maker of significant size that requires "standalone" or "thin" modems (*i.e.*, baseband chipsets that do not integrate an applications processor and other components) and that all the other major OEMs use integrated chipsets known as "systems-on-a-chip" ("SoCs"), which are not interchangeable with thin modems. *Id.* at 83-84. Qualcomm thus argues that these thin modems are specifically developed and customized for Apple's needs and, as the sole significant purchaser of thin modems, Apple therefore has decisive power in its own alleged market. *Id.* at 84. According to Qualcomm, this gives Apple real power and Apples exercises its power to dominate. *Id.* at 84-85.

iv. Issuing the Exclusion Order Will Enhance Competition

Qualcomm avers:

> Notwithstanding Apple's rhetoric about an exclusion order creating the risk of a Qualcomm monopoly, it is the denial of an exclusion that would threaten competitive conditions in the U.S. economy. That is not simply because Apple is already a monopsonist in the alleged market for baseband chipsets used in the iPhone, though it is. It is not simply because, as a monopsonist, Apple has exercised its unmatched power to pick its suppliers, [ ] RX-1C at Q151; Tr. 1566:17-22 (Thompson), though it has. And it is not simply because Apple has exercised its might as one of the most powerful companies in the world—with a market capitalization greater than the GDPs of all but 16 nations—to cause its contract manufacturers to withhold [ ] royalties owed to Qualcomm for Apple's use of Qualcomm's technology in the iPhone, though it has. *See Id.* at 528:24-532:23, 653:2-5 (Blevins); 1613:12-21 (Thompson).

CIB at 85-86.

Qualcomm reiterates its contention that the real problem is that "Apple seeks, by way of its public interest allegations, to effectively immunize for the iPhone from any Commission exclusion order." CIB at 86. By accepting Apple's public interest arguments, Qualcomm argues:

> . . . the Commission could not enforce any patent against an iPhone with an Intel chipset because, according to Apple and Intel, that would put Intel out of business and initiate a parade of horribles. It would not matter whose patent were asserted against the iPhone. Qualcomm's patent portfolio would be unenforceable in the ITC, as would the patents of Apple's and Intel's competitors, or of any other third party. Not only would that rob Qualcomm and others of the fruits of billions of dollars of R&D spending and thus disincentivize innovation, but it would also give Apple (and Intel) an unfair advantage over their competitors. Apple would be free to use any IP that read on the iPhone, including numerous Qualcomm patents, without risk of an exclusion order (as any exclusion order that barred the sale of iPhones with an Intel chipset would, according to Apple, run afoul of the public interest), whereas Samsung and Apple's other OEM competitors could not. This is plainly not in the public interest.

Id.

v. The Effect of an Exclusion Order on Intel

Qualcomm disputes that Intel will exit the baseband chipset market if the Commission issues an exclusion order against the Apple accused products, and also disputes Intel would abandon 5G development work. CIB at 86. Qualcomm contends no rational actor would act in such a fashion.

Qualcomm asserts the requested orders are not directed at Intel, but at Apple. CIB at 87. While acknowledging the requested orders would only cover iPhones with an Intel chipset, Qualcomm asserts that is because such an exclusion order targeting non-Qualcomm baseband chipsets is "the only way of addressing Apple's infringement without harming Qualcomm's own baseband chipset business." *Id.* According to Qualcomm, a limited exclusion order applicable only to Apple mobile devices with non-Qualcomm baseband chipsets ensures that iPhones remain available for sale in the United States following an exclusion order and will not cause severe harm to U.S. consumers. *Id.*

Qualcomm argues that while an exclusion order would impact the importation into the United States of iPhones with Intel chipsets, it would not have a negative effect on Intel's business. CIB at 88. Qualcomm asserts iPhone sales outside the United States would be unaffected by the exclusion order and that those sales are more than enough to provide Intel with the sales volume it claims to need in order to remain in business, and could even result in the sales of more chipsets for Apple devices following an exclusion order compared to today.[30] *Id.*

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[30] I reiterate that I find it frustrating that Qualcomm does not acknowledge the credible testimony of Ms. Evans that [

] This makes Qualcomm's arguments about a possible increase in business elsewhere irrelevant, as well as makes the speculative testimony about Intel capacity equally irrelevant.

vi. Will Intel Abandon 5G?

Qualcomm alleges there is no credible evidence, even if Intel were to exit the baseband chipset market entirely, that Intel intends to abandon participation in the imminent worldwide transition to "5G," the fifth generation of wireless technology. CIB at 93. Qualcomm points out that 5G is expected to be revolutionary, including an extension of cellular capabilities far beyond smartphones to tens of billions of additional devices. *Id.* According to Qualcomm, Intel's financial statements and press releases tout the extraordinary business opportunities presented by 5G and Intel's commitment to focusing its business strategy on obtaining those opportunities and 5G is "foundational to Intel." *Id.*

Qualcomm avers Intel has estimated [

] CIB at 93.

Qualcomm states that Intel claims it has become deeply involved in the development of 5G, is in the production development phase of 5G, and has even announced its first 5G modem. CIB at 94. Qualcomm also points out Intel is partnering or collaborating with others for 5G development, including AT&T, Ericsson, Sprint, Nokia, etc. *Id.* Qualcomm asserts that, given these facts and Intel's ability to make a profit, it makes no sense for Intel to abandon 5G because Apple could not use a few inventions described by Apple and Intel as trivial. *Id.* Qualcomm also argues that even if Intel withdrew from 5G development, 5G development would continue regardless, especially since Intel's role is comparatively small. *Id.* at 95.

Qualcomm disputes that Intel is acting as if it will abandon 5G development if the Commission issues an exclusion order addressed to the accused devices. CIB at 96-97. Specifically, Qualcomm avers:

Even if it were believable that Intel would abandon 5G in the event an exclusion order—despite all of the evidence to the contrary—it is inconceivable that Intel would do so without extensive analysis or concrete planning. [

] *See* *id.* at 1212:6-11, 1230:15-1231:8 (Eisenach). Instead, [

] Tr. 1128:21-1130:11 (Evans); 1157:11-14 (Bowers)—[

] *See id.* at 1062:8-14, 1068:10-13, 1083:9-16; 1114:4-8 (Evans); 1166:11-20 (Bowers). Notably, Mr. Bowers, in-house counsel for Intel's Communication and Devices Group, offered his view about Intel's likely exit from the baseband chipset business without knowledge of the asserted patents or accused features. *Id.* at 1147:20-1148:8. Such speculative and self-interested testimony is plainly insufficient. *See Magnetic Data Storage*, Comm'n Op. at 139-140 ("[W]e do not believe Sony's speculation about what could occur is sufficient to override the actual fact of Sony's infringement.").

Moreover, the testimony of Intel's witnesses (Ms. Evans and Mr. Bowers) stands in sharp contrast to Intel's public actions and disclosures. Intel did not take the step of becoming a party to this Investigation, even though it is represented by exactly the same counsel as Apple. [

] Instead, Intel's disclosures repeatedly reaffirm Intel's commitment to 5G. *See, e.g.*, CX-2195 at 16, 18, 45, 47, 201. [

] *Id.* at 1061:4-1062:3 (Evans); 1167:5-10 (Bowers); Tr. 1218:21-25 (Eisenach). Unsurprisingly, no witness was willing to testify that [

] Tr. 1055:16-23 (Evans); 1166:15-20 (Bowers). In sum, nothing in Intel's public acts suggests that its chipset business is on the verge of a catastrophic business setback and an abandonment of key corporate strategy.

Id. at 95-97.

vii. Harm Is Avoidable

Qualcomm alleges that Apple's contentions that Intel will exit the chipset market or abandon 5G is contradicted by Apple's assertions about the patents at issue, all of which are non-SEPs. CIB at 97. According to Qualcomm, Apple has argued that the inventions of the asserted patents are not that important to smartphone operation and, if that is true, Intel would not abandon its baseband chipset business and foundational 5G strategy. In that situation, the better step for Intel would be to cooperate with Apple to stop the use of any infringing features. *Id.* This, according to Qualcomm, is a matter that the Commission has considered in the past when deciding whether to issue an exclusion order. *Id.* (citing *Food Slicers and Components Thereof*, Inv. No. 337-TA-76 (June 22, 1981)).

c. The Relevance of Past Qualcomm Actions

Qualcomm argues that Apple takes the position that Qualcomm's patents should not be enforced because Qualcomm allegedly engaged in anti-competitive conduct in the past. CIB at 72, 97-100. Qualcomm correctly asserts that Apple appears to accuse Qualcomm of engaging in anti-competitive conduct. Nevertheless, as Qualcomm points out, Apple did not plead an antitrust violation and did not offer evidence sufficient to prove such a violation. Qualcomm correctly notes that Apple withdrew its affirmative defenses involving anti-competitive practices. Qualcomm also correctly observes that, even though certain government regulators have brought actions against Qualcomm in other fora, Apple has no right to infringe Qualcomm's patents. Qualcomm closes by accurately contending that allegations unrelated to the four Public Interest Factors are irrelevant to this investigation and cannot justify Apple's infringement of Qualcomm's patents.

2. Apple's Contentions

Apple argues this investigation is so unusual that even if a violation of section 337 were found, no exclusion order should issue because the risks are simply too great. Such an order would reduce the number of suppliers in the critical merchant market for premium LTE baseband chipsets from two to one. RIB at 54. According to Apple, this reduction of suppliers would reduce competition in the United States and would harm U.S. national security and competitiveness.

a. Two Suppliers of Premium LTE Baseband Chipsets Is Better Than One Monopolist for Competitive Conditions in the United States

Apple alleges the relevant market for this investigation is for supply to third parties (the "merchant market") of premium baseband chipsets (currently premium LTE baseband chipsets and eventually 5G baseband chipsets), and that Qualcomm and Intel are the only suppliers to that market in the United States. RIB at 56. (Apple alleges its position is consistent with that of the Staff.) Next, Apple posits that competitive conditions are better with two suppliers of premium baseband chipsets rather than Qualcomm having a complete monopoly. *Id.*

i. The Premium Baseband Chipset Market Is the Critical Market That Would Be Impacted by the Proposed Exclusion Order

Apple contends that Qualcomm, Apple, and Intel witnesses agreed there is a market for premium LTE baseband chipsets offering the most advanced features and functionality. For example, Apple notes that James Thompson, Qualcomm's Chief Technology Officer and the only Qualcomm fact witness to address public interest issues, testified that "[t]here's a tier, a global market for what—a tier called premium, which is really defined by Apple and Samsung." RIB at 57 (citing Hearing Tr. (Thompson) at 1538:4-9). Apple noted Dr. Thompson testified that

the premium tier of chipsets is "really where you introduce all the new features" and, accordingly, those chipsets support the most recent version of cellular standards and are manufactured with the "latest node" of process technology. *Id.* (citing Hearing Tr. (Thompson) at 1538:10-1539:9).

Apple contends Dr. Thompson's testimony is consistent with the testimony of Aicha Evans, Intel's Chief Strategy Officer,[31] who identified a "premium segment" of baseband chipsets from which Intel would exit if the proposed exclusion order issues. RIB at 57 (citing Hearing Tr. (Evans) at 1069:13-22). Ms. Evans explained that a premium baseband chipsets is "the type of wireless technology that takes advantage of the highest throughput, being able to scale into very dense cities, like New York City or Washington, as well as being able to operate in very difficult signal conditions." *See id.* Continuing, Apples notes that Ms. Evans also explained that "[p]remium chipsets are those that have the latest features and comply with the latest releases of the standards." *Id.* (citing RX-8C (Evans WS) at Q50. Apple also pointed out that OEMs that purchase chipsets (like Apple) must have very reliable premium chipsets for premium phones. *Id.* (citing Hearing Tr. (Blevins) at 637:1-3).

Apple connected 5G development to the issue of premium baseband chip manufacture and development by establishing that cellular innovation is concentrated in the premium tier of baseband chipsets and thus progress in premium chips is critical to the development and implementation of next generation 5G. RIB at 58. Specifically, Apple noted that Ms. Evans testified cellular chipsets found in cell phones have always been pivotal for cellular technology development as a gateway device and that Dr. Thompson consistently explained that features

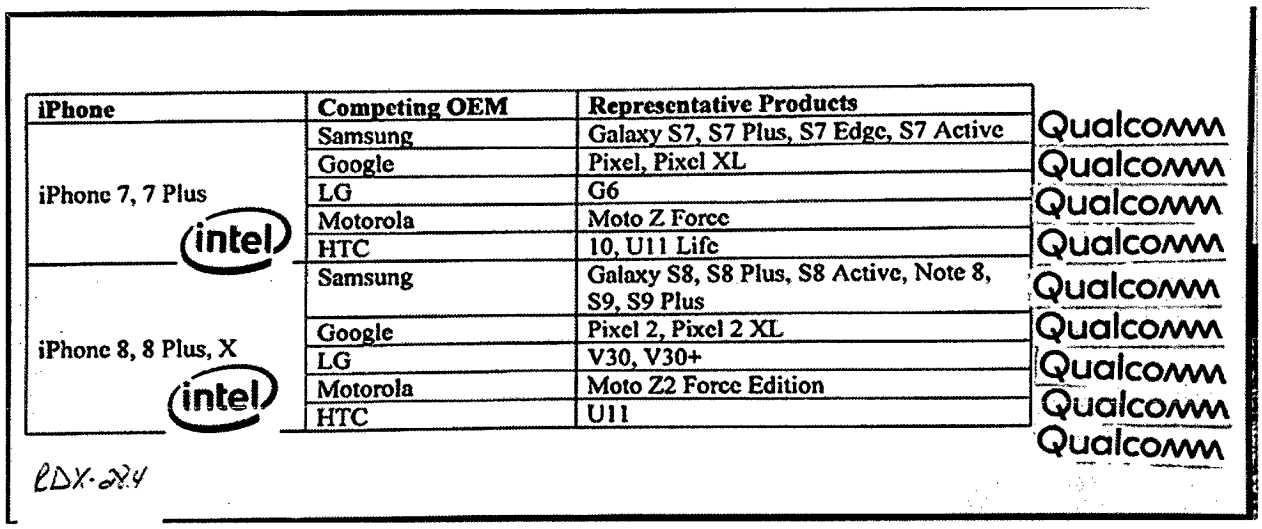
[31] Ms. Evans had also been in charge of the Intel business segment responsible for the baseband chipsets.

first introduced in the premium tier chips get passed down into lower tiers of chipsets. *Id.* Apple also offered that Dr. Thompson acknowledged that the first chipsets to offer 5G connectivity will be in the premium tier and that premium baseband chipsets are a very important level of product. *Id.* Hence, Apple contends 5G chipsets will have far-reaching effects on the public interest, with implications for national competitiveness, national security, and public welfare while premium baseband chipsets will be at the vanguard of 5G innovation and development. *Id.*

Apple contends its economic experts, Dr. Jeffrey Eisenach and Dr. Fiona Scott Morton, in applying economic principles to the factual evidence, confirmed there is a premium LTE baseband chipset market and that smartphone OEMs would not consider lower-tier baseband chipsets to be reasonable substitutes. RIB at 58. Apple asserts that top-of-the-line OEMs want top-of-the-line chipsets (premium chipsets), which also "typically command higher prices as compared to chipsets used in non-premium smartphones. *Id.* (citing Hearing Tr. (Scott Morton) at 1288:13-17).

ii. Intel and Qualcomm Are the Only Two Competitors for Sales in the Merchant Market for Premium Baseband Chipsets

Apple alleges Intel and Qualcomm are the only two competing sellers of premium baseband chipsets in the merchant market (including in the United States). RIB at 59. According to Apple, with the exception of Intel's portion of sales to Apple, Qualcomm is the only merchant supplier to all OEMs selling premium smartphones in the United States and offers RDX-28.4 to illustrate its point:



iPhone	Competing OEM	Representative Products	
iPhone 7, 7 Plus (intel)	Samsung	Galaxy S7, S7 Plus, S7 Edge, S7 Active	Qualcomm
	Google	Pixel, Pixel XL	Qualcomm
	LG	G6	Qualcomm
	Motorola	Moto Z Force	Qualcomm
	HTC	10, U11 Life	Qualcomm
iPhone 8, 8 Plus, X (intel)	Samsung	Galaxy S8, S8 Plus, S8 Active, Note 8, S9, S9 Plus	Qualcomm
	Google	Pixel 2, Pixel 2 XL	Qualcomm
	LG	V30, V30+	Qualcomm
	Motorola	Moto Z2 Force Edition	Qualcomm
	HTC	U11	Qualcomm

RDX-28.4

Id. Apple explains it based RDX-28.4 on [

] *Id.* (citing RX-1461C (Amon Dep. Tr.) at 118-19; CX-2344C (Amon Ex. 6) at 2). Apple alleges the alternatives in RDX-28.4 represent "flagship products or premium products from Samsung, Google, LG, Motorola, and HTC," and that Qualcomm supplies chipsets for each of those products. *Id.* Apple asserts Qualcomm is the only supplier of baseband chipsets for all listed alternatives to the accused iPhones, except for a portion of Samsung phones incorporating chipsets Samsung self-supplies. *Id.* (citing RX-1483C (Kressin Dep. Tr.) at 82; Hearing Tr. (Thompson) at 1541:5-1542:4, 1556:11-17; Hearing Tr. (Sidak) at 515:9-516:5; Hearing Tr. (Mulhern) at 1456:25-1458:13; Hearing Tr. (Evans) at 1112:8-1114:3; Hearing Tr. (Scott Morton) at 1329:4-1330:3).

Apple asserts the evidence demonstrates Intel and Qualcomm are the only merchant suppliers of premium baseband chipsets. RIB at 60. Thus, Apple alleges that if Intel leaves the premium baseband chipset market, Qualcomm will be the only merchant market supplier for premium baseband chipsets. *Id.* This means, according to Apple, since 5G technology is first introduced in premium chipsets, that Intel's exclusion will also leave Qualcomm "to be poised"

as the only merchant market supplier for 5G premium chipsets and will permit Qualcomm to enjoy a complete monopoly in the premium baseband chipset market for both LTE and 5G technologies. *Id.*

iii. Competitive Conditions in the United States Are Better With Intel and Qualcomm Competing Than Under a Qualcomm Monopoly

Apple asserts the legislative history of section 337 makes clear that "[t]he public health and welfare and the assurance of competitive conditions in the United States economy must be the overriding considerations in the administration of [section 337]." RIB at 60 (citing S. Rep. No. 93-1298, at 197 (1974) (Senate Report), *reprinted in* 1974 U.S.C.C.A.N. 7186, 7330). Apple contends the imperative to protecting this aspect of public interest "would be particularly true in cases where there is any evidence of price gouging or monopolistic practices in the domestic industry." *Id.* at 61.

Apple asserts that Qualcomm's proposed exclusion order would reinstate Qualcomm as a monopolist and cause harm to competitive conditions in the United States since the order would only exclude iPhones containing Intel chipsets. RIB at 61. Such a remedy would have lasting anti-competitive effects for the future, because as Ms. Evans explained, [

] and is [

] if an exclusion order issues. *Id.* (citing Hearing Tr. (Evans) at 1091:14-21).

Apple claims Intel's "exit would deal a heavy blow to competitive conditions in the premium baseband chipset market" because competition from Intel for premium baseband chipsets both for both LTE and 5G enhances quality, keeps prices lower, encourages innovation, and serves the public interest more. RIB at 61 (citations to various Qualcomm witnesses omitted).

Following its discussion of why Qualcomm witnesses thought competition was advantageous, Apple summarized testimony from other witnesses (Blevins and Evans) who also explained the crucial importance of competition between Qualcomm and Intel. *Id.* at 62-63. In general, the witnesses explained the advantages of competition and established the significant disadvantages inherent with the lack of competition. *Id.*

Apple next mentions how reinstating Qualcomm's monopoly through an exclusion order would undermine the prospects for 5G competition to benefit the United States' national interests and its security. RIB at 64. Apple stated that if Intel is excluded from the market for 4G chipsets, it will also be unable to participate in the market for 5G chipsets, thus harming U.S. leadership in 5G. *Id.* Apple also alleged that both Mr. Thompson and Ms. Evans agree that keeping Intel in the 5G effort would be good for the future of 5G development and the interests if the United States. *Id.*

b. The Proposed Exclusion Order Would Almost Certainly Cause Intel to Exit the Premium Baseband Chipset Market and Give Qualcomm a Monopoly

Apple contends, that if Intel is barred from selling chipsets for Apple iPhones sold in the United States, it is nearly certain to exit the market for premium baseband chipsets, as verified by the testimony of Ms. Alicia Evans, Intel's Chief Strategy Officer, to wit:

[

]

RIB at 65 (citing Hearing Tr. (Evans) at 1114:4-8 (emphasis added)). Apple notes Ms. Evans explained why access to the U.S. market is essential:

[

]

Id. (citing Hearing Tr. (Evans) at 1114:14-21).

Apple claims Intel invested [

] RIB at 65-66. Apple offers that [

] *Id.* at 66. Apple contends Ms. Evans's testimony made clear that [

] *Id.* Apple then quoted Ms. Evans on [

]

Id. at 66-67 (quoting Hearing Tr. (Evans) at 1132:11-22).

Next, Apple referenced the testimony of Mr. Steven Bowers, Intel's Assistant Director of Intel Product Assurance and Security (who has helped to execute Intel's 5G strategy), because he testified that Intel was highly likely to exit the market for premium baseband chipsets (for both LTE and 5G) if the proposed exclusion order issues, to wit: [ ]

[

] RIB at 67 (citing Hearing Tr. (Bowers) at 1162:16-1163:3). Continuing, Apple quotes Mr. Bowers for the proposition that Intel would exit the baseband business altogether if there is an exclusion order:

[

]

Id. (citing Hearing Tr. (Bowers) at 1154:12-19).

Apple also contends, through the testimony of its Director of Purchasing, Mr. Blevins, that if Apple could no longer use chipsets from Intel for iPhones in the United States, that

[

] RIB at 68 (citing RX-1C (Blevins WS) at Q164).

Mr. Blevins further explained that a chipset supplier's ability to prove its product in the U.S. cellular ecosystem is so important that [

] *Id.* (citing RX-1C (Blevins WS) at Q165). Apple also had Mr. Blevins confirm that if the proposed exclusion order issues, [

] to wit:

[

]

[

]

Id. at 68 (citing Hearing Tr. (Blevins) at 645:5-22).

Apple contends its two economist experts agree, consistent with the testimony of Ms. Evans, Mr. Bowers, and Mr. Blevins, that applying economic principles shows that Intel would not survive losing its business of selling baseband chipsets for U.S.-destined iPhones. RIB at 68. Apple then quotes Dr. Scott Morton to support its contention that working with U.S. mobile network operators is critical, to wit:

> It's very important because the—a lot of the way the modem gets better is by being used. When the operators and the chip maker discover that it doesn't function in some corner of Manhattan or some particular context where there's a configuration of buildings or a lot of traffic or something. And then that modem is improved, tweaked and improved.
>
> That's a continuous process of innovation. [
>
>]
>
> So it's a critical part of making the chip better to be actually selling it and using it in the United States.

Id. at 69 (citing Hearing Tr. (Scott Morton) at 1325:16-1326:13; RX-11C (Scott Morton WS) at Q133).

Next, Apple discusses the testimony of Dr. Eisenach to make some of the same points made by Dr. Morton and to emphasize that (1) [ ] (2) Intel thus is [ ] and (3) for Intel to lose business would [ ]*Id.* at 69. Apple also contends that Dr. Eisenach demonstrated that [ ] a point

illustrated in demonstrative exhibit RDX-10.2C. *See id.* Apple notes that according to Dr. Eisenach, [

]

Id. at 70 (citing RX-10C (Eisenach WS) at Q17.) Hence, Apple contends Intel is nearly certain to exit the premium baseband chipset market in the event of an exclusion order barring Intel from supplying premium baseband chipsets to Apple for U.S.-bound iPhones. *Id.*

i. Qualcomm's Arguments that Intel's Baseband Chipset Business Could Survive Qualcomm's Proposed Exclusion Order Is Incorrect

Apple offers Demonstrative Exhibit 32C (based upon testimony) to summarize why Qualcomm's arguments about Intel not leaving the baseband chipset business are incorrect, to wit:

[

]

RIB at 70.

Apple contends Qualcomm is wrong to argue that Intel could survive the proposed exclusion order by selling baseband chipsets for iPhones sold outside the United States. Apple's reasons include: (1) [

] (2) Apple would be unable to develop iPhones in California for use outside the United States because it could not import the Intel-based iPhones that it needs for product development; and (3) Qualcomm is waging global litigation to foreclose sales of iPhones with Intel chipsets in key foreign markets. RIB at 71-72.

- **Intel Could Not Survive by Selling Chipsets to Other Smartphone OEMs**

Apple asserts Intel could not compensate for lost sales of chipsets to Apple by selling to other smartphone OEMs and notes that [ ]

[ ] RIB at 72 (citing Hearing Tr. (Evans) at 1112:16-1113:14). Apple asserts Intel's presence in the premium LTE baseband chipset market is contingent on its position with Apple and that [ ] *Id.* (citing RX-10C (Eisenach WS) at Q21; RX-11C (Scott Morton WS) at Q131; RDX-11.1C; RX-1461C (Amon Dep. Tr.) at 36-37). Apple also notes that because Samsung self-supplies a portion of its own premium LTE baseband chipset requirement, Apple represents an even higher percentage of premium LTE baseband merchant market demand than its share of premium smartphone sales would imply. *Id.* at 72-73 (citing RX-8C (Evans WS) at Q11; RX-10C (Eisenach WS) at Q20, Q28; RX-11C (Scott Morton WS) at Q55-56, Q131).

Apple also points out it is the only buyer of thin modems, the only type of LTE premium baseband chipset that Intel currently supplies, because most premium smartphone OEMs other than Apple use an SoC solution that is different from a baseband chipset. RIB at 73. Hence there are no other customers to take Apple's place with Intel. *Id.* (citing RX-8C (Evans WS) at Q52. Accordingly, Ms. Evans testified that [ ] to wit:

[

]

Id. (citing RX-8C (Evans WS) at Q74. Apple contends that this is consistent with Dr. Eisenach's testimony. *Id.*

- **Intel Cannot Survive by Selling Baseband Chipsets for Non-Smartphone Applications**

Apple alleges Intel cannot stay in the premium baseband chipset business if it sold chipsets for applications other than smartphones, because [

]

See RIB at 74 (citing Hearing Tr. (Evans) at 1084:19-24). Apple notes that Ms. Evans testified that [

] *Id.* (citing Hearing Tr. (Evans) at 1073:15-17). Thus, Apple alleges [

] *Id.*

- **Intel Cannot Sustain Its Premium Baseband Chipset Business by [**

]

Apple also strongly disputes Qualcomm's argument that Intel would remain in the baseband chipset business notwithstanding the proposed exclusion order because Intel would supposedly [ ] RIB at 74. Apple notes that, as Ms. Evans testified, Intel [

] *Id.* (citing RX-8C (Evans WS) at Q27; Hearing Tr. (Evans) at 1069:6-12). Apple describes how Ms. Evans explained that before Intel started selling

baseband chipsets to Apple, [

]

Id. at 74. Next, Apple describes how Ms. Evans explained Intel's thinking on the business issue of the baseband chips, to wit:

[

]

(*Id.* at 1110:24-1111:10; *see also id.* at 1114:22-24 [

]

Ms. Evans explained that [

]

[

] (Tr. [Evans] at 1115:20-1116:9.) [

] (*Id.* at 1070:25-1071:13.)

[

] (Tr. [Evans] at 1115:1-7; *see also id.* at 1104:10-13 [

]

Id. at 74-76.

Apple then alleges that Dr. Scott Morton confirmed the basic economic logic of Ms. Evan's position, that is:

[

]

RIB at 76 (citing Hearing Tr. (Scott Morton) at 1335:3-8. Then Apple notes the Staff pointed out that [

] *Id.* (citing Hearing Tr. (Staff's Opening) at 139:10-12).

ii. No Other Premium LTE Baseband Chipset Suppliers Will Fill the Void if Intel Exits

Apple alleges that if Intel exits the market for premium LTE baseband chipsets, Qualcomm's monopoly would be reinstated. Apple insists there are no other suppliers that would fill the competitive void left by Intel. RIB at 76-77.

- **Samsung LSI and HiSilicon Supply Premium Baseband Chipsets Only to Their Affiliates**

Apple alleges that with the exception of Qualcomm and Intel, Samsung LSI and Huawei's HiSilicon division are the world's only suppliers of premium LTE baseband chipsets. RIB at 77. Ms. Mulhern, an expert witness for Qualcomm, conceded this fact. *See id.* Nevertheless, Apple points out that neither Samsung LSI nor HiSilicon supply the U.S. merchant market with premium chipsets, that "Samsung has never sold a baseband processor to any U.S. OEM," and that "the only OEM that Samsung has provided its premium baseband processor to is Samsung." *Id.* (citing Hearing Tr. (Mulhern) at 1438:7-20. Apple noted that Mr. Sidak agreed with Ms. Mulhern on whom Samsung sells to. *Id.* Next, Apple points out that Ms. Mulhern explained HiSilicon does not sell premium LTE baseband chipsets to any OEMs other than its affiliate Huawei and that she is "not even aware of any attempt by HiSilicon to sell premium baseband chips to any party other than Huawei." *Id.* (citing Hearing Tr. (Mulhern) at 1441:24-1442:5).

Further, Apple asserts Samsung and Huawei are unlikely to begin supplying premium LTE baseband chipsets to any OEMs in the foreseeable future, especially to a U.S. OEM, such as arch smartphone rival Apple. RIB at 77-78. Apple noted that [

] *Id.* at 78. Apple next stated [

] *Id.* (citing Hearing

Tr. (Blevins) at 610:23-611:1). Apple then asserted that [

] *Id.*

Apple noted that Huawei's HiSilicon, had previously confronted U.S. national security objections and likely would again should it seek to sell premium baseband chipsets for smartphones sold in the United States. *Id.* at 78. In addition, Apple noted that Ms. Evans explained that [

] *Id.* at 78-79 (citing Hearing Tr. (Evans) at 1089:10-19).

- **New Entry into Premium LTE Baseband Chipsets Is Unlikely**

Apple contends there are high barriers to entering the premium baseband chipset market that make it unlikely any new entrant would emerge in time to fill Intel's void and mitigate the harm to competitive conditions in the United States flowing from an exclusion order. RIB at 79.

In support, Apple states Dr. Thompson agreed that it takes "an enormous amount of research, development and hard work" to develop a premium baseband chipset, a process that is "very expensive" and can take "three or four years." RIB at 79 (citing Hearing Tr. (Thompson) at 1539:25-1541:4). Next, Apple explained that its economic experts identified several barriers to entry in the premium baseband chipset market, such as the baseband chipset business is "fast moving" and it is "research and development-intensive." *Id.* One Apple expert testified that significant structural barriers suggest "if Intel is removed from the market as a result of the proposed exclusion order, the competition its presence created in the premium LTE baseband chipset market is not likely to be replaced and Qualcomm's monopoly position in merchant sales

will be restored." *Id.* (citing RX-11C (Scott Morton WS) at Q67. In addition, Apple notes that testimony mentioned that companies have left the market and there has been consolidation. *Id.*

Apple also described [

] RIB at 79-80. Apple further explains that [

] *Id.* at 80. Moreover, Qualcomm's public interest experts concurred that "MediaTek's processor is not currently capable of offering the premium features that characterize the premium baseband chipset market." *Id.*

iii. If Intel Exits the Market for Premium LTE Baseband Chipsets, It Will Not Be a Competitor for 5G Baseband Chipsets or Related Innovation

Apple alleges that since 5G technologies are rooted in today's 4G LTE technologies, "Intel cannot succeed in the former if forced to exit the latter." RIB at 80. Further, Apple explains the loss of the potential revenue from 5G chipsets and innovation is another reason that Intel would decide to exit the market for premium baseband chipsets, since success with 5G is dependent upon 4G success. *Id.* at 80-81. Moreover, Intel's own internal document confirms this premise, and Intel witnesses confirm that 4G is the foundation and key to 5G. *Id.* at 81. Apple's economic expert explicitly confirmed the economic soundness of the link between the success of Intel's 4G program and Intel's ability to succeed with 5G. *Id.*

Apple also contends that if Intel cannot compete to supply 5G baseband chipsets for smartphones, it will be a weaker competitor and innovator for 5G innovation more generally. RIB at 82. Consistent with Dr. Thompson's testimony, premium chipset technologies provide the

pathway (the first step) to developing other 5G products. *Id.* Consistent with Dr. Thompson's logic, Apple notes that Ms. Evans explained [

] *Id.*

Next, Apple explains there are significant business barriers beyond the technological barriers that would reduce Intel's 5G investments in the event the USITC issues Qualcomm's proposed exclusion order. RIB at 82. Specifically, Apple argues as follows:

> At a high level, as Ms. Evans explained, [
>
>] (RX-8C [Evans] at Q.82.) [
>
>]
>
> - [
>
>](Tr. [Bowers] at 1154:17-23.)
> - [
>
> .] (*Id.* at 1155:2-13.)
> - [
>
>]

[

] (*Id.* at 1155:16-1156:5.)

- [

] (*Id.* at 1156:9-1157:3.)

Mr. Bowers further testified that [

] (*Id.* at 1157:15-21.)

RIB at 82-83.

c. Intel's Exit from Premium LTE and 5G Chipsets Will Harm Competitive Conditions in the United States

Apple claims Intel's exit from premium baseband processors will "severely impair U.S. competitive conditions in current-generation 4G premium LTE premium baseband chipsets, and, critically, in upcoming 5G technologies that are essential to U.S. national security and economic competitiveness." RIB at 84. Apple alleges that the first harm will be to 4G premium baseband chipsets because Qualcomm will be reinstated as a monopoly and diminish Intel's role as a leader in 5G innovation more generally. *Id.*

i. A Qualcomm Monopoly Will Cause the Quality of Premium Baseband Chipsets to Decrease, and Prices to Increase

According to Apple, before Intel entered the premium baseband chipset market,

[ ]

[ ] RIB at 84 (citing RX-1C (Blevins WS) at Q74; RX-10C (Eisenach WS) at Q56-58). Once Intel became a second supplier, [

]

Id.(citing RX-1C (Blevins WS) at Q142). According to Apple, [

] *Id.* at 85.

ii. A Qualcomm Monopoly in Premium Baseband Chipsets Would Stifle Intel's Contributions to 5G Standards and Innovation and Harm National Security

Apple alleges that while there will be very substantial immediate harm to U.S. competitive conditions concerning current 4G chipsets upon Intel's exit from the premium baseband chipset business, the most serious harm would be reduced innovation in 5G technology. RIB at 85. Apple alleges U.S. leadership in 5G is critical for several reasons, not the least of which is national security and U.S. economic competitiveness. *Id.*

- **Intel is Positioned to Make Important Contributions to 5G in the United States as a Chipset Innovator**

Without the proposed exclusion order, Apple contends Intel is positioned to be a critical U.S. 5G baseband chipset innovator, in addition to being the only domestic challenger in 5G baseband innovation to Qualcomm. RIB at 85. Apple notes that Ms. Evans explained: "5G spans a variety of technical areas beyond traditional cellular wireless transmission, including reliance on advanced computing and cloud computing. Intel has significant experience across almost the full range of technologies that are relevant to 5G and we could bring that experience to bear on 5G." *Id.* at 85-86 (citing RX-8C (Evans WS) at Q79). Apple noted that Ms. Evans explained

Intel's exceptional advantages for 5G and also stated that [

] *Id.* at 86.

Apple also alleges Intel has worked to be a 5G innovator and to have a leadership role in standard-setting efforts. RIB at 86. Apple states that Intel employees write and submit contributions, chair or co-chair working groups, participate in standard development meetings through 3GPP (the umbrella organization responsible for cellular wireless telecommunications standards), deploy new hardware prototypes, collaborate with other industry participants such as Verizon, work to expand technologies to new areas, and play other critical roles in standard development activities. *Id.* at 86-87. Apple next contends Intel's 5G investment led to the introduction of Mobile Trial Platforms (MTPs—one which was introduced at the hearing as physical exhibit RPX-4C), which simulate client-side baseband chipsets and are "by far the first 5G client-side prototypes to be deployed and tested with actual network subscribers in the United States on U.S. wireless networks." *Id.* at 87 (citing RX-9C (Bowers WS) at Q37). According to Apple, these MTPs enable 5G field testing capable of generating data that cannot be obtained from abstract specifications or lab testing, which in turn enables development of technologically superior premium baseband chipsets for 5G networks. *Id.* Moreover, these MTPs have been successfully deployed worldwide. *Id.*

- **5G Is Critical for U.S. National Security**

Apple alleges U.S. leadership in 5G is critical to national security because of the vast increase in speed, breadth, and volume of data for sensitive applications it will permit. RIB at 87. According to Apple, Ms. Evans explained why U.S. leadership is important as follows: [

]

[ ] *Id.* (citing Hearing Tr. (Evans) at 1089:13-17). Apple also offered Dr. Eisenach's explanation of why 5G development was so critically important. *Id.* at 88. To put it in a nutshell, Apple's offer of Dr. Eisenach's testimony said 5G will be a part of everything there is in society, beyond communications to even being our arms and legs. *Id.* (citing Hearing Tr. (Eisenach) at 1268:5-21. Thus, Dr. Eisenach concluded "it is critical that we have strong and secure U.S. suppliers of such technology, to protect the private and public entities that will depend on 5G connectivity, and to ensure they can use that connectivity without sensitive information being compromised and without private and public functions being disrupted." *Id.* (citing RX-1612C (Eisenach WS) at Q22).

Apple asserts the issue of 5G is so important that China has made great efforts and is currently leading the race to 5G because 5G influence is a "national priority" in China, with its efforts being directed by the government. RIB at 88 (citing Hearing Tr. (Thompson) at 1546:14-1547:6; SX-11 (Final Report – Global Race to 5G) at 000091 (noting "government commitment to achieving 5G success")). In short, China wants to be the 5G leader and has enlisted the support of Huawei and HiSilicon to achieve that goal, while Korean companies, *e.g.* Samsung, are also expending efforts to take leading roles in 5G. *Id.*

Apple alleges that national security concerns analogous to 5G control became very well recognized when, on March 12, 2018, President Trump prohibited Broadcom's proposed acquisition of Qualcomm. RIB at 88-89. Apple notes that before that decision, the Committee on Foreign Investment in the United States ("CFIUS"), which investigates proposed foreign acquisitions of U.S. companies for national security implications, found that harm to an important U.S. 5G innovator's "technological competitiveness and influence in standard setting would significantly impact U.S. national security." *Id.* at 89 (citing CX-1929 (CFIUS Letter) at

.0002). Apple went on to mention that CFIUS stated there were well-known U.S. security concerns with Huawei and other Chinese telecommunications companies and thus a shift to Chinese dominance in 5G would have substantial negative national security consequences for the United States. *Id.* Apple then notes that Dr. Thompson of Qualcomm testified about [

] *Id.* (citing Hearing Tr. (Thompson) at 1545:21-25, 1546:21-23).

- **5G Is Critical for U.S. Economic Competitiveness**

Apple contends (without any real pushback by Qualcomm) that U.S. leadership in 5G is also essential for U.S. economic competitiveness because 5G technologies promise an unprecedented leap forward in cellular connectivity, making numerous new applications possible through increased performance. RIB at 89. Apple notes that 5G networks will expand to encompass new frequencies, antenna designs, and equipment locations and thus will "drive significant improvements in the speed, reliability, and efficiency of mobile wireless networks." *Id.* at 90 (citing RX-8C (Evans WS) at Q80). Further explaining what could be expected from 5G, Apple states:

> And as Mr. Bowers testified about the improvements offered by 5G:
>
> > 5G is a collection of evolutionary advances in cellular standards and associated wireless technologies that, taken together, create revolutionary wireless communications capabilities. These improvements provide faster transmission speeds, greater data throughput, lower latency, and other benefits, while also enabling new use cases and expanding the number and kinds of devices that have cellular connections.
>
> (RX-9C [Bowers] at Q.22.)

> The new technologies underlying 5G components will make possible many new cellular based technologies. Dr. Eisenach identified three broad categories of applications for 5G technologies. First, Enhanced Mobile Broadband will provide extremely high data speeds, allowing more immersive consumer experiences. Second, Machine-to-Machine connections—also known as the "Internet of Things" or "IoT"—will expand connectivity to new devices and in new settings, such as "homes, agriculture, energy, public safety, and transportation networks." Third, Mission-Critical Services will require low-latency and high-reliability connections for sensitive operations, such as "autonomous vehicles, automated industrial processes, and remote surgery equipment." (RX-10C [Eisenach] at Q.139.)[32]
>
> Accordingly, U.S. leadership in 5G is the gateway to extraordinary national economic opportunities. One study estimated that "U.S. leadership in 4G accounted for nearly $100 billion of the increase in annual GDP by 2016 as the trajectory of the wireless industry's contribution to U.S. GDP shifted from a projected $350.3 billion in 2016 to a realized $445.0 billion," accompanied by increases in 4G-related employment and domestic revenues. (SX-16 [How America's 4G Leadership Propelled the U.S. Economy] at -000376.) To achieve these results, U.S. firms invested approximately "$300 billion in deploying next generation networks over the past ten years." (SX-14 [The Global Race to 5G] at -000366.) For 5G networks, one forecast from April 2018 estimates that there may be $275 billion in upcoming 5G investment by America's wireless industry, generating $500 billion in economic growth 3 million new jobs -00358; *see also* Tr. [Scott Morton] at 1319:3-15 (discussing SX-14).)

RIB at 90-91.

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[32] Apple's brief included the following footnote here:

> Similarly, one text on 5G innovation identifies three broad types of 5G services: "very high-speed mobile and wireless broadband services; ultra-reliable, low-latency communications; and massive IoT or machine-type connections." (SX-11 [Final Report - Global Race to 5G] at 000034; *see also* Tr. [Scott Morton] at 1320:9-21 (agreeing with definition).)

RIB at 90 n.23.

iii. If Intel's Capacity to Contribute to the 5G Ecosystem Is Diminished, the Public Interest in U.S. Leadership in 5G Innovation Product Security Will Be Harmed

Apple's key allegation is that a Qualcomm monopoly in the market for premium baseband chipsets will harm the competitive conditions of the merchant market and the potential for the United States to be a leader in 5G innovation. RIB at 91. Claiming that the cellular industry is uniquely important for national security, Apple also claims the two U.S.-based baseband chipset suppliers (Intel and Qualcomm) are more focused on developing 5G technologies, standards, and components. *Id.* Hence, Apple contends an "exclusion order would undermine those efforts and 'cripple' Intel's 5G investments, consolidating from two to one the number of U.S. baseband chips suppliers involved in 5G innovations and endangering U.S. leadership in 5G." *Id.*

Apple then discusses how its experts said national security would be harmed by reiterating its discussion about the effect of Intel's exit from the market on 5G—which leaves only Qualcomm and would damage the United States' ability to compete in the international 5G market and would have significant negative implications for national security, especially if the United States fails to become the leader in 5G innovations. *Id.* According to Apple's witness, it is essential the United States continue to be competitive and retain its first mover advantage and that requires at least two competitors. *Id.* at 91-92.

Apple also argues a decline in U.S. innovation would not stop with Intel, but would also extend to Qualcomm. RIB at 92. Basically, Apple's witnesses concluded Intel is need to make Qualcomm try harder-run faster. *Id.*

Focusing beyond national security, Apple contends a decline or elimination of Intel's participation in 5G would have negative affect the U.S. economy and consumers. RIB at 92.

Apple alleges this bad effect would be caused by a very large loss in potential jobs and a large loss in spending that would result from effort by both Intel and Qualcomm. *Id.* Apple emphasizes an exclusion order would undermine those potential gains if Intel is forced out of the market or diminished, undermining the pace of innovation in these areas. *Id.*

Apple next contends that Qualcomm's witnesses agreed competition in the U.S. 5G market is a positive force. RIB at 92-93. For example, Qualcomm's Chief Technology Officer Dr. Thompson agreed that "two American chipset suppliers for premium baseband chips is better than one." *Id.* at 93 (citing Hearing Tr. (Thompson) at 1556:23-28).

d. An Exclusion Order Would Also Harm the Public Under Section 337's Other Public Interest Factors

Apple contends generally that an exclusion order will cause harm under section 337's other three public interest factors. RIB at 93.

i. Harm to U.S. Smartphone Consumers

Apple alleges U.S. smartphone consumers suffer harm from Intel's exit as a competitor in the premium LTE baseband chipset market and in future technologies, including 5G. RIB at 93. Specifically, Apple alleges that if Qualcomm is restored as a monopolist, chipset quality and innovation will suffer and "these effects would be passed through to mobile phones and tablets, causing higher prices and lower innovation and quality for U.S. consumers." *Id.* at 93-94 (citing RX-11C (Scott Morton WS) at Q24).

Apple reiterates that for 5G, Intel's exit would deprive U.S. customers of benefits flowing from intense quality and innovation competition between Intel and Qualcomm in 5G baseband technology. RIB at 94. Apple claims this means U.S. consumers will be harmed by delayed access to "(i) important technologies that will power autonomous vehicles and remote surgeries

and (ii) higher data throughput—enabling immersive media experiences—and greater connectivity among devices through the Internet of Things." *Id.* at 94 (citing RX-10C (Eisenach WS) at Q138-39; RX-11C (Scott Morton WS) at Q137; RX-8C (Evans WS) at Q82-85).

Apple next argues that if the proposed exclusion order applied to iPhones scheduled to be launched in 2018, U.S. consumers would be hurt by being denied access to any current-generation iPhones, [

] RIB at 94 (citing RX-1C (Blevins WS at Q151, Q155). Using the word [ ] Mr. Blevins explained that an exclusion order affecting 2018 iPhone models would mean [

] *See id.* (citing RX-1C (Blevins WS at Q176-78). Apple alleges that denying U.S. consumers access to leading-edge iPhones would cause substantial harm to U.S. consumer welfare. *Id.* (citing RX-10C (Eisenach WS) at Q141). As Dr. Eisenach testified, if consumers had been denied access to the iPhone 7 and iPhone 7 Plus, "the average consumer would have lost consumer surplus of between [ ]" *Id.* (citing RX-10C (Eisenach WS) at Q141.

ii. Harm to U.S. Public Health and Welfare

Apple reiterates that removing Intel from the market for future technologies, including 5G, would have grave consequences for innovation and quality competition. RIB at 94-95. That, Apple argues, would in turn delay or lower the quality of new technologies promising great benefits for U.S. public health and welfare, including healthcare technologies and autonomous vehicles. *Id.* at 94-95. Moreover, Apple alleges Qualcomm acknowledges the importance of 5G

innovation to the public health and welfare on such diverse issues as self-driving cars, electrical grids, drones, and health care applications. *Id.* at 95.

iii. Reduced Production of Directly Competitive Products in the United States

Apple's final argument concerning the public welfare involves the effect of an exclusion order upon production of directly competitive products in the United States, *i.e.*, Intel's U.S. production of baseband chipsets. RIB at 95. Apple notes that [

] *Id.* (citing RX-9C (Bowers WS) at Q59-60). Intel says it will be investing [

] *Id.* (citing Hearing Tr. (Evans) at 1118:9-20; RX-8C (Evans WS) at Q64; RX-10C (Eisenach WS at Q150). But, Ms. Evans testified if Intel exits the market for premium LTE baseband processor chipsets, it could have to [ ] *Id.* (citing Hearing Tr. (Evans) at 1118:20-23, 1072:18-22).

e. Denying an Exclusion Order Is the Only Way to Protect the Public Interest

Apple contends my suggestion that Qualcomm sell a license to Intel and the Staff's suggestion of a limited exclusion order will not work. RIB at 96.

i. The Staff's Posited 5G "Carve-Out" Will Not Protect the Public Interest

Apple contends the Staff recognized the threat that Intel's exit from 5G would pose to U.S. national security and the national interest and proposed a modification to the exclusion order, one that would not apply to "products incorporating 5G technology," but only to Apple

iPhones incorporating LTE technology. RIB at 96; *see* SIB at 69-76. Apple disagrees with the Staff's proposed remedy because Apple contends it would not alleviate any of the harms to the public interest described above. RIB at 96. Apple notes that even with the carveout for 5G, if Intel cannot supply 4G baseband chipsets for iPhones sold in the United States, it will exit baseband chipsets altogether. *Id.*

Apple reiterates that Intel's ability to compete in 5G baseband chipsets and 5G innovation depends on its participation in the premium (4G) LTE baseband chipset market. RIB at 96. Apple argues Ms. Evans verified this assertion when she testified [

] *Id.* (citing Hearing Tr. (Evans) at 1115:8-14). Apple notes the Staff then asked Ms. Evans whether, if there was a gap of [ ] between issuance of an order excluding iPhones with Intel LTE baseband chipsets and commercial availability of Intel 5G chipset—[ ] would Intel would still exit the 5G baseband chipset business. *Id.* (citing Hearing Tr. (Evans) 1127:11-1128:9). Apple argued:

> Ms. Evans testified, even assuming [
>
>] (*Id.* [Evans] at 1132:12-25; 1127:11-1128:9, 1084:5-10.) Regardless, Ms. Evans explained that [

]

[

]

(Tr. [Evans] 1127:11-1128:9) (emphasis added.)

RIB at 96-97. Further, Apple claims Dr. Scott Morton agreed Intel would exit the baseband chipset market even if the carve-out reduced the amount of time Intel was out of the market, because 5G and 4G have intertwined standards and "those 4G standards keep improving. So it's not really possible to stay abreast of 5G unless you're also right on the frontier of 4G." *Id.* at 97 (citing Hearing Tr. (Scott Morton) at 1335:20-1336:6).

ii. Qualcomm Will not Grant Intel a License

Apple noted that I asked if Qualcomm would be willing to license its patents to Intel as a way of resolving this dispute. RIB at 97. However, Qualcomm will not do this, for it admittedly refuses to license competing chipset suppliers. *Id.* Further, Qualcomm's expert Ms. Mulhern, stated she was not aware of a single chip manufacturer that Qualcomm has licensed. *See id.* at 98 (citing Hearing Tr. (Mulhern) at 1465:12-1466:1).[33]

f. Intel's Exit Would Vitiate the FTC's Efforts to Promote Premium-Baseband-Chipset Competition in the FTC's Parallel Case Against Qualcomm

After examining the Record I find that no evidence was received relevant to this heading and accordingly it will not be discussed.

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[33] Apple explains that Ms. Mulhern made this admission after being questioned about the statement of Evan Chesler, Qualcomm's lead attorney, in a hearing in the Southern Northern District of California, when he stated: "***We do not license other chip manufacturers. We do not.*** We license the people who make the devices." RIB at 98 (citing RDX-31.11C (emphasis added); Hearing Tr. (Mulhern) at 1462:18-1464:11).

g. The Harm to the Public Interest Substantially Outweighs any Countervailing Public Benefits from an Exclusion Order

Apple alleges the unusual circumstances of this case, where Qualcomm requests an exclusion order that would reinstate its premium baseband chipset monopoly, the deep and broad harms to the public interest that would result from the proposed exclusion order substantially outweigh any public benefit from granting it. RIB at 99. According to Apple, Qualcomm offers only one reason for the Commission to issue an exclusion order to promote the public interest, *i.e.*, protecting Qualcomm's patent rights would "promot[e] innovation." *Id.* However, Apple explains, correctly, that if the Commission denies Qualcomm's requested exclusion order as against the public interest, Qualcomm has a remedy. *Id.* Apple offers that Qualcomm is asserting the same patents in district court and, if it proves infringement of valid and enforceable patents, it can obtain monetary damages. *Id.* (citing Hearing Tr. (Sidak) at 508:25-509:10). Apple claims that although it is Qualcomm's clear preference to have an exclusion order allowing it to recapture its monopoly in the premium baseband chipset market, Qualcomm also understands that royalties can compensate it. *Id.* at 99-100.

Apple alleges Qualcomm has not shown that such monetary damages would be insufficient to continue incentivizing research and development. RIB at 100. On the contrary, Apple contends there is credible evidence from Dr. Scott Morton that because there is a path to money damages in the district court litigation, the exclusion order sought here is not necessary to preserve Qualcomm's incentives to invest. *Id.* (citing RX-11C (Scott Morton WS) at Q174).

3. The Staff's Contentions

The Staff submits that an exclusion order would not harm the public health and welfare, production of like or competitive articles (the accused devices) in the United States, or U.S.

consumers and that it would not harm competitive conditions with respect to the accused iPhone models. SIB at 36. However, Staff opines an exclusion order that is not tailored in some fashion is likely to harm competitive conditions in the U.S. market for premium baseband processor chips and that harm to the U.S. economy could be minimized by imposing an exclusion order containing certain carve-outs designed to protect competitive conditions for third parties, while upholding the right of a patent holder to fully enforce its intellectual property rights against an infringing party. *Id.*

The Staff points out that the public interest analysis is not an equitable defense to patent infringement, but is instead an element of the trade statute from which the Commission's authority is derived, one that the Commission is specifically required to consider even if neither side presents any evidence on the subject. SIB at 37. Instead, the purpose of public interest factors analysis is to determine the effect of a remedy under section 337 on four statutory public interest factors, which are "the public health and welfare, competitive conditions in the United States economy, the production of like or directly competitive articles in the United States, and United States consumers[.]" *Id.* (citing 19 U.S.C. § 1337(d)(1)). The Staff contends the focus of the public interest inquiry should be on the effect on the "United States economy," 19 U.S.C. § 1337(d)(1), that will occur if the Commission imposes a remedy that excludes infringing iPhones with Intel baseband processor modems from the United States.[34] *Id.*

The Staff accurately points out this investigation is unusual because the focus of the investigation is only on accused devices that do not have a particular component, *i.e.*, a baseband processor chip manufactured by the Complainant. SIB at 38. Qualcomm is a chip maker, not a

[34] I agree.

smartphone manufacturer, and thus the remedy specifically requested by Qualcomm would not exclude any iPhone that contains a Qualcomm baseband processor chip, even if that device infringes an asserted patent. *Id.* (citing JX-14 (Qualcomm Stipulation re: Scope of Remedy). Moreover, the asserted domestic products are not mobile electronic devices, but are chips, including baseband processor chips, and the chipsets and mobile testing platforms that contain them. *Id.* The Staff explains this investigation will affect the U.S. market for baseband processor chips at least as much, if not more, than the U.S. market for mobile electronic devices, so the Staff argues that in this investigation any analysis of the effect of a remedy on the public interest should consider the effects on both the mobile electronic device market and the baseband processor chip market, including the market for future 5G baseband processor technologies that foreseeably would be affected. *Id.*

The Staff disagrees with Qualcomm and states the Commission is not limited to considering the mobile electronic device market only.[35] SIB at 38. The Staff notes the statute calls for an analysis of "competitive conditions *in the United States economy*," not merely competitive conditions in the domestic industry. *Id.* at 38-39 (citing 19 U.S.C. § 1337(d)(1) (emphasis added)). Secondly, the Staff points out the scope of the investigation is defined as "certain mobile electronic devices *and radio frequency and processing components thereof*." *Id.* at 39 (citing 82 Fed. Reg. 37899 (Notice of Investigation) (emphasis added)). The Staff asserts the word "components" in the case caption, as explained in the Complaint itself, is particularly important because it is what distinguishes accused products from non-accused products. *Id.* Because the scope of the investigation is defined by the Complainant to be directed to a

[35] I agree with the Staff and Apple on this issue and so find. However, I cannot find any follow-up to this by the Staff.

particular subset of components (here, baseband chips), the Staff submits it is appropriate to consider the effect of a remedy on the U.S. market for those particular baseband chips. *Id.* The Staff's final point is that Qualcomm has requested a remedy specifically designed to affect competition in the baseband processor market by banning downstream products containing its competitor's chips while allowing unrestricted imports of downstream products containing Qualcomm's baseband processor chips. *Id.*

a. Background: The Evolution of Cellular Standards and Technologies[36]

The Staff explains the background of how cell phones operate on networks that conform to a common set of standards established in standard setting organizations. SIB at 40. The Staff notes that standards are technical rules everyone agrees to follow to ensure everyone's products will operate with another. *Id.* (citing RX-8C (Evans WS) at Q16). Essentially, for wireless phones, Standard Setting Organization ("SSO") members include carries like Verizon, infrastructure manufacturers/developers like Nokia, device manufacturers such as Apple and Samsung, and baseband processor chipset manufacturers like Qualcomm and Intel. *Id.*

i. Early Smartphone Standards: 2G and 3G

The Staff notes that cellular standards developed in "generations," with the first smartphones using second generation ("2G") standards, which were meant primarily for voice, but permitted email, text messaging, and some browsing. SIB at 40. The Staff points out that Europe led 2G development, with the European community adopting GSM as its single digital standard, allowing carriers in countries like Germany, France, and the UK to harmonize their

[36] I found this discussion to be helpful for those who are not familiar with SSOs and why 4G and 5G matter.

research and development efforts. *Id.* Importantly for this investigation, the Staff explains the United States was so far behind that it was still adding customers to 2G when other countries were transitioning to 3G. *Id.*

3G technologies supported greater smartphone functionality, including more sophisticated web browsing and music and video downloading with various carriers using various methods. SIB at 40-41. For 3G development, the Staff explains Japan led the way so that by 2007, Japan had 50 percent 3G penetration, while Italy and Germany had 25 percent and 12 percent, respectively, with the United States having only 3.5 percent 3G penetration in 2007, the same year the 2G iPhone launched. *Id.* at 41.

ii. The Current Standard: 4G

The Staff asserts the Record shows that the introduction of the iPhone, and other smartphones more generally, prompted much rapid investment and development among U.S. wireless industry leaders and greater involvement of government policymakers. SIB at 41. By the time the United States rolled out 4G in 2011, the Staff explained that policymakers had auctioned off the spectrum required to meet the industry's demands and siting rules governing wireless infrastructure had been streamlined, causing the United States to became the acknowledged leader in the 4G development of 4G technology. *Id.*

The Staff states that today's most advanced standards in use are 4G standards. SIB at 41. Further, the leading 4G standard is Long Term Evolution, or "LTE," which all major carriers, including AT&T, T-Mobile, Verizon, and Sprint use. *Id.* Continuing, the Staff explains that since 3G carries most voice traffic and because LTE coverage is not universal, smartphones that incorporate LTE functionality require multi-mode baseband chipsets making them backwards-compatible with earlier standards. *Id.* The Staff then notes that while all major carriers now

operate 4G/LTE networks, "AT&T and T-Mobile networks are backwards-compatible with the GSM family of standards, while Verizon and Sprint are backwards-compatible with the CDMA family of standards." *Id.* The accused products are iPhones containing Intel baseband processor chipsets, which are designed for use only on legacy GSM carriers such as AT&T and T-Mobile, while all remaining iPhones contain Qualcomm baseband processor chipsets that can be used on any carrier network, including Verizon and Sprint, since they are backwards-compatible with both older networks. *Id.* at 42.

iii. The Future Standard: 5G

The Staff notes that according to the Record, the next generation of cellular standards, 5G, is in development and the commercial introduction of 5G-compliant technology is imminent. SIB at 42. The Record shows that the expected benefits of 5G over previous cellular standards can be categorized in three ways: (1) very high-speed mobile and wireless broadband services; (2) ultra-reliable low-latency communications; and (3) massive Internet of Things ("IoT") or machine-type connections. *Id.*

The Staff continues by noting U.S. industry has invested around $300 billion in deploying next generation networks over the past 10 years (both 4G and now 5G), with another $275 billion forecasted specifically for 5G development, plus the major carriers have conducted trials across the United States. SIB at 42-43. Relevant to this investigation, the Staff points out:

> Currently, Intel and Qualcomm are two of the leading U.S. companies invested in 5G development. [
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>]
> Hearing Tr. at 1060:2-4, 1083:21-1084:11 (Evans); CX-21C (Mulhern reb.) Q.48. According to Apple, [
>] at 589:14-590:6 (Blevins); *but see* CX-21C (Mulhern reb.) Q.62 (predicting a 2020 5G Qualcomm product). Notwithstanding these investments, according to

> CTIA the United States lags behind both China and South Korea in terms of 5G readiness. SX-14 at 7, 10. [
>] Hearing Tr. at 615:7-10 (Blevins).
>
> The U.S. Treasury Department Committee on Foreign Investment in the United States ("CFIUS") has stated that the U.S. government has a strong interest in remaining "dominant in the standards setting space" for 5G, and that "a shift to Chinese dominance in 5G would have substantial negative national security consequences for the United States." CX-1929 (Ltr. from CFIUS to Broadcom and Qualcomm (Mar. 5, 2018)) at 2-3. According to Qualcomm executive Dr. James Thompson, CFIUS [
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>] Hearing Tr. at 1546:16-1547:10 (Thompson). "Chinese companies including Huawei have increased their engagement in 5G standardization working groups as part of their efforts to build out a 5G technology. For example Huawei has increased its RD expenditures and owns about 10 percent of 5G essential patents." CX-1929 (CFIUS Ltr.) at 2-3. Thus, it is far from certain that the United States will continue to be a leader in 5G technology as the 5G standard is finalized over the next few years. *See* Hearing Tr. at 1088:16-1089:19 (Evans).
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> [
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> *Id.* at 1089:10-19 (Evans).

SIB at 43-44.

b. The Effect of a Remedy on the Mobile Electronic Devices Market

The Staff asserts the United States has one of the fastest growing and most feature-rich smartphone markets in the world and that the U.S. market is highly competitive. SIB at 44. The

Staff agrees the smartphone market is generally divided into tiers, "with premium products, including Apple's iPhones and certain of Samsung's most advanced products, having the most advanced feature set and the there are other tiers below them. *Id.* The Staff contends that to consumers, "nonaccused iPhones with Qualcomm baseband processor chips are functionally identical to the accused iPhones with Intel baseband processor chips and could act as perfect substitutes for the accused devices," and thus the Staff contends an exclusion order would not adversely affect any of the statutory public interest factors with regard to the U.S. smartphone market. *Id.* at 45.

i. Public Health and Welfare

In the Staff's view, any remedy imposed in this investigation would not adversely affect the public health and welfare because the accused products are "common consumer goods, which the Commission has consistently found do not present public health, safety or welfare concerns."[37] SIB at 45. The Staff correctly notes the accused products are consumer electronics products and that there are alternatives. *Id.*

ii. Competitive Conditions

The Staff asserts there are sufficient alternatives to the Apple iPhones containing the Intel chip, such as those containing the Qualcomm baseband chipsets.[38] SIB at 45-46. Hence, the Staff asserts if the requested remedy is imposed, Apple will still be able to sell unrestricted quantities

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[37] This is overly simplistic and arguably inconsistent. While the smartphones themselves may be "common" consumer items, the baseband chipsets that even the Staff admits are properly a part of what must be considered in this investigation (SIB at 37, 67), are really what the issue is. These chipsets are hardly common consumer items and they and Intel's fate in making them are the heart of all of Apple's arguments. Arguably, the Staff's entire point is irrelevant, as are all arguments about smartphones as a consumer item herein.

[38] I reiterate the comment I made in the previous footnote.

of iPhones that contain Qualcomm baseband processor chips of which it can obtain an adequate supply.[39] *Id.* at 46-50.

With regard to new iPhone models, the Staff recognized that [

] SIB at 48. The Staff also seemed to recognize it was [

] *Id.* at 49. But, the Staff concluded adequate substitutes would be available because the Staff posits Apple could continue to produce the existing Qualcomm-based iPhone 7, iPhone 7 Plus, iPhone 8, iPhone 8 Plus, and iPhone X models through 2018. *Id.* This would mean [

][40] *Id.*

The Staff is also of the view that competitive conditions in the U.S. market for mobile electronic devices would not be adversely affected even if Apple chose not to mitigate the effect of an exclusion order by increasing the production of Qualcomm-based iPhones. SIB at 49. While ignoring the strong preferences many Apple users have for their iPhones and the inherent lack of credibility of certain witnesses, the Staff concludes that because there are sufficient and available (for U.S. consumers) third-party alternatives to Apple's iPhones, consumers will not be harmed. *Id.* The Staff provided a list of such smartphones offered by Qualcomm's President and,

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[39] For reasons discussed in my Findings on the Public Interest, I am not inclined to give any testimony by Dr. Sidak any weight.

[40] I reiterate my previous note with regard to Dr. Sidak.

interestingly, all of the phones contain Qualcomm baseband processor chips. *Id.* at 50. Based upon evidence I am not inclined to give credibility to (for reasons of self-interest, etc.), the Staff is of the view that competitive conditions in the U.S. market for mobile electronic devices would not be adversely affected by the remedy requested in this investigation.

iii. Production of Like or Directly Competitive Articles

The Staff states there is no evidence of an adverse impact on the production of like or directly competitive mobile electronic devices in the United States if a remedy issues because there is no significant smartphone manufacturing in the United States. SIB at 51.

iv. U.S. Consumers

The Staff, in text effectively repeating its previous argument about the availability of substitute iPhones, concludes U.S. consumers of mobile electronic devices would not be adversely affected by the requested remedy in this investigation. SIB at 51.

c. The Effect of a Remedy on the Baseband Processor Market

The Staff explains that baseband processor chipsets are the components of mobile handsets that enable them to interact with a carrier's cellular network and consist of three parts: (1) a baseband processor; (2) a radio frequency ("RF") integrated circuit (or transceiver); and (3) a power management integrated circuit. SIB at 52. The Staff further describes how baseband processor chipsets can be integrated with applications processors on a single silicon die into a system-on-a-chip, or "SoC," and if they are not on an SoC they are called "thin modems," which is the only kind of modem Apple buys from Intel or Qualcomm, because it uses its own in-house applications processor. *Id.*

The Staff, in a manner consistent with Apple, describes how the baseband market for LTE chipsets, like smartphones, falls into premium, mid- (or mainstream), and low-end (or entry

level) tiers. SIB at 52. The Staff also explains that premium baseband chipsets have more features and comply with the latest standards and typically have more capability. *Id.* at 52-53.

The Staff agrees that for premium tier baseband chipsets, demand for LTE baseband processor chipsets in the United States is dominated by two of the premium-tier smartphone producers: Apple and Samsung, which account for approximately [

] SIB at 53. Moreover, the Staff notes that since 2012, Apple has usually accounted for [

] *Id.* At present, Apple is the only significant buyer of premium-tier thin modems for smartphones because, among other things, Samsung produces its own SoCs for use in its premium-tier smartphones, and therefore has no need for thin modems sold on the merchant market. *Id.*

The Staff agrees with Apple that supply of premium-tier LTE baseband processor chipsets in the global merchant market is limited to Qualcomm and Intel. SIB at 53. Similarly, the Staff acknowledges there are only two other suppliers of premium tier LTE chipsets, Samsung and HiSilicon (Huawei), and neither sells premium tier chipsets in the open market because 100 percent of the premium-tier LTE chipsets produced by Samsung and HiSilicon[41] are consumed internally and are not available to chipset consumers such as Apple. *Id.* at 53-54. The Staff explains that this meant, from 2011 through the third quarter of 2016, Apple relied on Qualcomm for 100 percent of the premium LTE chipsets in its iPhones, which only abated with

[41] HiSilicon cannot sell chipsets in the United States without legal challenge. *See* SIB at 54.

the development and production of comparable Intel chipsets, which Apple uses in [ ] of its iPhones. *Id.* at 54.

As the Staff explains, entering the premium baseband processor market is exceedingly difficult for it "takes hundreds of millions, if not billions, of dollars depending on the starting point. Research and development, and substantial firm-specific capital, including both intellectual property and human capital." SIB at 54 (citing RX-8C (Evans WS) at Q60). The Staff quotes Ms. Evans to explain the multi-year effort to design, test, and perfect the chipsets with the OEM, and the Staff follows this up with how Qualcomm's Dr. Thompson said [ ] *Id.*

The Staff concedes that considering the:

> [U]nusual market conditions for baseband processor chips in the United States, particularly for premium-tier LTE thin modems of the type used by Apple, the Staff cannot exclude the possibility that imposing a remedy affecting the U.S. baseband processor market would adversely affect the public interest, specifically "competitive conditions in the U.S. economy." If the adverse effects of an exclusion order fell only on Intel without harming the U.S. economy more broadly, then the Staff would conclude that an exclusion order would not harm the public interest. However, an examination of the statutory public interest factors as applied to the premium baseband processor market indicates that an untailored exclusion order in this investigation likely would produce ripple effects causing long-term harm to competitive conditions. In particular, there is a risk that an untailored remedy would damage innovation and the ability of the United States to maintain its position as a leader in the development of 5G technology.

SIB at 55. The Staff argues, that in the balance, the strong interest in protecting intellectual property rights indicates that the Commission should issue a limited (tailored) exclusion order

and a cease-and-desist order to Apple if a violation of section 337 is found.[42] *Id.* However, the Staff states that such a limited order should be tailored to limit its effects on third parties, including Intel. *Id.*

i. Public Health and Welfare

The Staff asserts "Apple has not alleged, and the evidence does not show, that a remedy in this investigation would affect the baseband processor market in any way damaging to public health and welfare." SIB at 55.

ii. Competitive Conditions

The Staff admits the first effect of an exclusion order would be to reduce the market share of Intel in the U.S. market for premium LTE chipsets, effectively reducing Intel's share of the market for premium LTE thin modems for use in Apple smartphones sold in the United States from [ ] to zero. SIB at 55. The Staff notes Intel witnesses testified that the actual effect on Intel would be even greater, in that Intel is "nearly certain" to exit the global premium-tier baseband processor chipset business if it cannot sell to Apple, and that this would leave Qualcomm as the only supplier in the entire world of premium-tier baseband processor chipsets for mobile electronic devices. *Id.* at 56. The Staff seemingly agrees that the exclusion order would have the effect of impairing Intel's ability to continue research and development of 5G technology for mobile electronic devices and hindering its ability to research other uses of 5G technology. *Id.*

The Staff also admits the possibility that the exclusion order, by reducing the number of U.S. sources of innovation, could threaten the ability of the United States to maintain its slim

[42] The Staff seemingly ignores the certainty that Qualcomm will seek and obtain monetary damages if infringement is found.

edge in 5G technology, which could effectively cede the race to set the direction of 5G standards to China. SIB at 56. Most importantly, the Staff concedes ceding the race to China would constitute an adverse effect on "competitive conditions in the U.S. economy." *Id.* (citing 19 U.S.C. § 1337(d)(1)). Based upon the possibility of an adverse effect on competitive conditions in the U.S. economy, the Staff recommends any issuance of an exclusionary order be tailored to reduce the effects on 5G technology development. *Id.*

- **It is more likely than not that Intel would exit significant segments of the premium LTE baseband processor market in the event of an exclusion order.**

The Staff concedes the evidence indicates that it is more likely than not that Intel will exit the premium LTE baseband processor chipset market entirely in response to the significant loss in market share that an exclusion order would cause.[43] SIB at 56. The Staff asserts Ms. Evans also testified that [

] *Id.* at 57. The Staff points out that Apple's expert, Jeffrey Eisenach, corroborated Ms. Evans' testimony, to wit:

[

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Id. (citing RX-10C (Eisenach WS) at Q17).

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[43] I disagree emphatically with this characterization of the evidence cited. What I heard in the hearing room and what is reflected in the Record is that Ms. Evans said Intel will exit the baseband chip market [

] Ms. Evans then explained in detail why this was so.

The Staff admits Ms. Evans' statement that Intel is [ ] to exit the premium baseband processor chipset market in the event of an exclusion order that would [ ] is plausible. SIB at 57. The Staff acknowledges that the Intel division responsible for the baseband processor chipsets sold to Apple ("IMC") [ ] *Id.* (citing Hearing Tr. (Evans) at 1074:4-11). Moreover, Intel has [ ] *Id.* The Staff acknowledges Intel has [ ] *Id.* at 57-58. The Staff admits that it is reasonable to "assume" that Intel will [ ] and it is reasonable to "assume" an exclusion order could tip the balance in favor of shutting down the business.[44] *Id.* at 58.

The Staff then describes Qualcomm's arguments that Intel would stay in the business because it would supply chipsets to iPhones sold in the global market. SIB at 58. The Staff points out the evidence at the hearing established that relying exclusively on sales to Apple for use in iPhones sold overseas would not be feasible because Apple would be prohibited from importing Intel-equipped phones into the United States for necessary development and testing at its U.S. research facilities. *Id.* The Staff maintains therefore, that Apple would be unable able to develop

[44] The Staff's use of the word "assume" is unhelpful and not meaningful in terms of any evidentiary standard. I disagree and would say that I find, based upon the strong evidence presented by Apple, that Intel will take these steps.

any iPhones with Intel chips, including phones intended for sale in the global market, unless an exclusion order allowed imports of infringing products for internal testing at Apple. *Id.*

The Staff next discusses the possibility that Apple could redesign its products to remove any features found to infringe the Asserted Patents, which would allow Apple to continue to sell iPhones containing Intel chips, meaning Intel would thus not need to exit the baseband processor market unless Apple decided to replace Intel as a supplier [

] or with Qualcomm. SIB at 59. According to the Staff, a redesign could be especially likely if the only violation found is infringement of a single claim of a single patent, as the Staff has argued should be the case. *Id.* However, the Staff concedes there is evidence that [

] *Id.* The Staff further concedes the evidence shows [

es] *Id.*

Given these facts the Staff admits: "The evidence suggests that a sufficiently lengthy hiatus would cause Intel to exit the premium baseband processor market even if Apple redesigned its products."[45] *Id.*

[45] This in an optimistic statement. The Record demonstrates Intel will exit.

- **While it is likely that Intel would continue to research 5G technology in the event of an exclusion order, that research would be significantly hindered by Intel's exit from the mobile wireless market.**

The Staff alleges the evidence shows it is more likely than not that Intel would *not* exit *every* aspect of the burgeoning market for 5G technology, even if it exited the market for premium baseband processor chipsets for mobile wireless devices. SIB at 60 (emphasis added). According to the Staff, neither Intel nor Apple claimed Intel would cease all research in 5G in the event of an exclusion order. *Id.*

The Staff next argues the evidence indicates that "5G services are broadly considered as being of three main types: Very high speed mobile and wireless broad band services, ultra reliable, low latency communications and massive IOT or machine-type connections." SIB at 60. Continuing, the Staff notes that Apple's expert testified that the market Intel would likely exit (if there is an exclusion order) is the market for the first type of 5G, "very high speed mobile and wireless broad band services." *Id.* The Staff alleges Intel would not exit the market for "ultra reliable, low latency communications" or the market for "massive IOT or machine-type connections." *Id.* at 61. The Staff notes that Ms. Evans agreed that over the next 30 years, 5G will be implemented in [

]46 *Id.*

Hence, the Staff agrees with Qualcomm that it is not plausible that Intel would walk away from potential gains, but, given the alternative paths for pursuing 5G, it is likely that Intel would walk

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46 I have problems with the interpretation the Staff seemingly places on Ms. Evans's statement. Her statement contains no context and uses the word "could" which is plainly speculative. Hence, I have no understanding how the Staff could reasonably have taken the inference it claims it did.

away from the [ ] smartphone segment, ceding a monopoly in that area to Qualcomm and focusing its 5G efforts elsewhere. *Id.*

Further qualifying its argument, the Staff notes the evidence indicates, despite the promise of future revenues from 5G products, that if Intel abandons the premium LTE baseband processor market, it would be a significant burden to Intel and it would hinder the development of future products. SIB at 61. While the Staff is not persuaded Intel would halt its 5G efforts completely in response to even a short interruption in sales, which is what Intel's witnesses claimed they would, the Staff does agree the 4G business at Intel and the prospects of 5G business are inextricably linked from a business perspective and from a technology perspective." *Id.* Continuing, the Staff agrees with Intel that the 5G standard is "an evolution, a refinement, improvement of the standards that were drafted in 4G. So you have to bear in mind what you do in 4G in many respects will be replicated and refined and reused, if you will, in 5G." *Id.* (citing Hearing Tr. (Bowers) at 1153:21-1154:1). The Staff then outlined why, from a business perspective, Intel's commercial viability in 4G is "essential" to its ability to innovate in 5G, to wit:

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- [ ]
- [ ]
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Id. at 62. While theorizing that Intel might be able to overcome the barriers testified to by Mr. Bowers and while having an incentive to do so,

> [T]he Staff submits that the pace of 5G innovation at Intel would inevitably be slowed down following an exit from the premium LTE baseband wireless chipset market. Without a solid foundation of 4G wireless baseband sales to build on, it would be very difficult for Intel to continue to make progress in its 5G efforts. *Id.* at 1157:4-10 (Bowers) [
>
>]

Id.

- **The ripple effect of an Intel exit from the LTE baseband market could harm the development of 5G technology in the United States.**

The Staff concludes that were Intel to exit the global market for premium LTE baseband processors caused by an exclusion order, Qualcomm will have a global monopoly in premium baseband processors in the merchant market. SIB at 62 (citing RX-8C (Evans WS) at Q8-10, Q76). The Staff acknowledges that Apple says this would be "likely to harm competition in future markets for 5G baseband chipsets and to reduce innovation and competition in 5G technologies." *Id.* Moreover, the Staff points out that Aicha Evans testified that were Intel to exit the market, that would cause [

] *Id.* at 62-63. The Staff agrees each of these potential effects is a matter of concern. *Id.* at 63.

The Staff argues "it is a staple doctrine of economic theory that monopolies reduce innovation and result in higher prices."[47] SIB at 63. The Staff quotes credible and logical testimony from Ms. Evans and Dr. Morton that is specifically on point and that supports the Staff's argument. *Id.* Interestingly, the Staff offers "that the contradictory testimony by Qualcomm's expert, Dr. Sidak, that monopolies can actually increase innovation, should not be considered credible."[48] *Id.* (citing Hearing Tr. (Sidak) at 492:25-493:7).

The Staff agrees there is evidence Intel's 5G innovation relies on its success in 4G. SIB at 63. The Staff agrees that without a presence in 4G, Intel would be unlikely to afford continued investments of billions of dollars in 5G research and development. *Id.* Tellingly, the Staff seemingly agrees (by the citation of evidence so saying) that the exit of Intel will: (1) reduce 5G innovation; (2) reduce investment by companies associated with Intel (in its ecosystem), to include network operators like AT&T and the vendors of equipment for cellular networks like Nokia and Ericsson; and (3) also likely slow down innovation at Apple. *Id.* at 63-64.

The Staff also claims that even if non-Intel entities continue to invest heavily in 5G technology, the fundamental nature of that investment would change as the result of a Qualcomm monopoly in premium 4G technology because Qualcomm would be able to steer 5G standards toward more proprietary Qualcomm-inspired solutions and be able to license things at a cost above a competitive level. SIB at 64. The Staff notes that Dr. Scott Morton testified Qualcomm will try to "perpetuate its exclusionary patent licensing model in 5G. Qualcomm's strategy in this

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[47] Even though this conclusion is supported by significant and credible testimony of record, it is such an accepted truism that it would not be error to take notice of the validity of this theory.

[48] This observation is another illustration of why I give no credibility to Dr. Sidak, which is discussed below. The problem for the Staff with Dr. Sidak is, if they give him no credibility on a major statement like this, why should the Staff give him any credibility on anything else?

regard is more likely to be successful if Intel exits or is substantially diminished following an exclusion order." *Id.* at 64 (citing RX-11C (Scott Morton WS) at Q170). The Staff, again, disparaged Dr. Sidak's testimony to the contrary.[49] *Id.*

Third, the Staff states the evidence indicates Intel's decision to exit the market for premium LTE baseband modems for smartphones would [

] SIB at 64. The Staff noted that Ms. Evans testified [

] *Id.* The Staff then cites other evidence that indicates Intel's exit from the baseband chipset business would have an [

] *Id.* at 64-65.

The Staff states it is concerned with the potential loss of leadership to U.S. industry as a whole. SIB at 65. Discussing evidence provided by Ms. Evans, the Staff concedes that if an exclusion order causes Intel to halt or significantly reduce its investment in 5G technology, the United States could lose its competitive edge in 5G. *Id.* at 65. The possibility of losing its competitive edge in 5G raises national security concerns that affect the public interest. *Id.* (citing CX-1929 (Ltr. from CFIUS to Broadcom and Qualcomm, at 2-3 (Mar. 5, 2018) (U.S. government has a strong interest in remaining "dominant in the standards setting space" for 5G, as "a shift to Chinese dominance in 5G would have substantial negative national security consequences for the United States"))). Thus, the Staff concedes "that if an exclusion order causes Intel to exit the market for premium LTE baseband processors and diminish its

[49] I reiterate my previous footnote.

investment in 5G technology, then in the Staff's view there will be an adverse effect on competitive conditions in the U.S. economy." *Id.*

iii. Production of Like or Directly Competitive Articles

The Staff next points out that unlike smartphones, 13 percent of the "wafers" used to manufacture baseband processor chipsets are produced in the United States. SIB at 65. The Staff explains that chipset fabrication happens in three general stages: (1) design (including R&D); (2) front-end fabrication, in which "fabs" create electronic circuits on silicon wafers; and (3) back-end testing/assembly/packaging, in which wafers are sliced into individual semiconductors, encased in plastic, and put through a quality-control process. *Id.* at 65-66. The Staff points out that Intel and Samsung are vertically integrated and perform all three steps in-house, and that Intel conducts 70 percent of its wafer fabrication in the United States in Arizona, New Mexico, and Oregon. *Id.* at 66. However, the Staff explains that Qualcomm [

] *Id.*

The Staff notes that most of Intel's wafer production has been conducted in the United States and that [

] SIB at 66. The Staff asserts [

]

Id.

The Staff notes that Apple's expert, Jeffrey Eisenach, testified that an exclusion order would [ ] but the Staff believes

this is not necessarily so. SIB at 66. The Staff states that one factor limiting significant adverse effects on Intel employment in the United States is that Apple sells many iPhones outside the U.S., and thus if an exclusion order were tailored to allow Apple to continue to import infringing iPhones for internal prototype development and testing, then Apple could continue to use Intel chips in iPhones sold overseas. *Id.* at 67. The Staff therefore says [

] and thus the Staff submits that an exclusion order would not have a significant adverse impact on the production on baseband chipsets if the exclusion order was tailored.[50] *Id.*

iv. U.S. Consumers

The Staff continues with the final statutory public interest factor, which is the effect of a remedy on U.S. consumers. SIB at 67. The Staff correctly observes there are no retail consumers of LTE baseband processors because processors are purchased by OEMs such as Apple for use in consumer devices such as smartphones, and this means the only effect that an exclusion order would have on U.S. consumers would be the effect that it might have on the prices of downstream products such as iPhones. *Id.* The Staff reiterates that has Apple asserted an Intel exit from the LTE market would allow Qualcomm to return to allegedly anticompetitive conduct in this market, which could cause higher prices and reduced quality and innovation for U.S. consumers. *Id.*

[50] My problem with this statement is that to accept it requires I ignore Ms. Evan's testimony. She said [ ] Intel will exit the baseband chipset business. *See also supra* pp. 157-58. Hence I reject the Staff's conclusion.

The Staff disagrees with Apple. The Staff states the impact of an exclusion order on prices for LTE chipsets within the United States is unlikely to be significant for two key reasons, to wit:

> First, Qualcomm already has considerable power in this market, which has [ ] *See* SX-2C (Strategy Analytics Baseband Market Share Tracker Q1 2017). In general, [ ] *Id.*
>
> Moreover, like the rest of the industry, [ ] *Id.*; CX-21C (Mulhern reb.) Q.12.
>
> Second, the Staff submits that a bilateral monopoly situation exists in this market, with Apple having power on the buying side, both in the conventional sense of a large share of the market for premium LTE chipsets and in terms of overall financial resources. SX-22C (Qualcomm's 1st Supp. Resps. to Staff's 1st Set of Interrogs. (corrected) (Oct. 20, 2017)) at 38 ("Apple is a dominant participant in the mobile communications ecosystem, with extraordinary buyer power and the ability to extract disproportionately favorable commercial terms."). There is evidence that [ ] RX-10C (Eisenach) Qs.99-101. It is reasonable to conclude that Apple's buying power has the same limiting effect on Qualcomm. Thus, in the Staff's view, Apple's significant market power as a major buyer in the premium LTE market will likely mitigate any potential increase in Qualcomm chipset prices as a result of an exclusion order.

SIB at 67-68.

The Staff also argues there is evidence that any increase in chipset prices [ ] would be unlikely to affect consumer behavior given the prices for Apple's smartphones. SIB at 68. Thus, the Staff concludes an exclusion order would not have a significant adverse impact on either U.S. consumers of baseband processors like Apple or on U.S. retail consumers of downstream products using those processors. *Id.*

d. Any Adverse Effect on the Public Interest Can Be Mitigated by Tailoring the Remedy Imposed to Exclude Products Incorporating 5G Technology

The Staff reiterates that the evidence shows competitive conditions in the U.S. economy, particularly in the area of baseband processor research and development, would be adversely affected by a remedy that excluded all accused iPhones with non-Qualcomm baseband processors from the United States. SIB at 69. However, there is a strong public interest in protecting intellectual property rights by excluding infringing imports. *Id.* (citing *Certain Two-Handle Centerset Faucets and Escutcheons, and Components Thereof*, Inv. No. 337-TA-422, USITC Pub. No. 3332, Comm'n Op. at 9 (Jul. 2000)). The Staff states it is not suggesting there should be no remedy at all if the accused iPhones are found to infringe one or more claims of the asserted patents and reiterates that violations of section 337 "are unlawful, and when found by the Commission to exist shall be dealt with, in addition to any other provision of law[.]" *Id.* (citing 19 U.S.C. § 1337(a)(1)). Hence, in the Staff's view, if a violation of section 337 is found in this investigation, a limited exclusion order and a cease-and-desist order should issue. *Id.*

Nevertheless, the Staff asserts the Commission has the authority to do more than either issue a complete exclusionary order or no order at all. SIB at 69. The Staff correctly observes the Commission need not choose between a remedy harming the public interest or no remedy at all. *Id.* Instead, the Staff contends the Commission has the authority to create a remedy that would mitigate its effects on the public interest and has done so previously. *Id.* The Staff observes that in *Certain Personal Data and Mobile Communications Devices*, the Commission delayed the effective date of an exclusion order by four months to minimize the impact of that order on third parties. *Id.* (citing *Certain Personal Data and Mobile Communications Devices and Related Software*, Inv. No. 337-TA-710, USITC Pub. No. 4331, Comm'n Op. at 83 (June 2012)). In

Certain Baseband Processor Chips, the Commission creatively applied a grandfathering exception that allowed imports of infringing products that were already being imported as of June 7, 2007. *Id.* at 69-70 (citing *Certain Baseband Processor Chips and Chipsets, Transmitter and Receiver (Radio) Chips, Power Control Chips, and Products Containing Same, Including Cellular Telephone Handsets*, Inv. No. 337-TA-543, USITC Pub. No. 4258, Comm'n Op. at 151-53 (Oct. 2011), *rev'd on other grounds*, *Kyocera Wireless Corp. v. International Trade Comm'n*, 545 F.3d 1340 (Fed. Cir. 2008) (holding that a limited exclusion order may not apply to nonrespondents)).

The Staff notes there are also numerous examples of exclusion orders containing a carve-out for warranty repairs and replacements. SIB at 70 (citing *Certain Magnetic Data Storage Tapes and Cartridges Containing the Same*, Inv. No. 337-TA-1012, Comm'n Op. at 127 (Apr. 2, 2018); *Certain Mobile Devices, Associated Software, and Components Thereof*, Inv. No. 337-TA-744, USITC Pub. No. 4384, Comm'n Op. at 21-22 (Mar. 2013) (granting exemption for components used in the service, repair, or replacement of damaged smartphone devices); *Certain Sleep-Disordered Breathing Treatment Systems and Components Thereof*, Inv. No. 337-TA-890, Comm'n Op. at 47 (Dec. 23, 2014) (exclusion order exempting infringing parts imported for service and repair); *Certain Liquid Crystal Display Devices*, Inv. No. 337-TA-631, USITC Pub. No. 4186, Comm'n Op. at 27 (Dec. 2010)). The Staff explains that in *Certain Air Mattress Systems*, for example, the Commission issued a limited exclusion order but declined to issue a cease-and-desist order, even after finding a violation, so that the respondent's products in inventory in the United States could continue to be used as replacements in the health care industry. *Id.* In *Certain Air Mattress Systems*, the Staff explained the Commission held, due to the existence of significant certification requirements for therapeutic air mattresses, a lack of

available alternatives to the respondent's products "could harm the health and welfare of the U.S. public if a CDO directed against Sizewise is issued because replacement products are unlikely to become available within the remaining life of the patent[.]" *Id.* at 70-71 (citing *Certain Air Mattress Systems, Components Thereof, and Methods of Using the Same*, Inv. No. 337-TA-971, Comm'n Op. at 60 (June 20, 2017)).

The Staff contends "there are also many examples of exclusion orders with certification provisions allowing imports of products certified to be noninfringing." SIB at 71 (referencing, *e.g.*, *Certain Dental Implants*, Inv. No. 337-TA-934, Comm'n Op. at 49 (May 11, 2016); *Certain Marine Sonar Imaging Devices, Including Downscan and Sidescan Devices, Products Containing the Same*, Inv. No. 337-TA-921, Comm'n Op. at 80 (Jan. 6, 2016); *Certain Semiconductor Chips with Minimized Chip Package Size and Products Containing Same*, Inv. No. 337-TA-605, USITC Pub. No. 4282, Comm'n Op. at 72 (Nov. 2011); *Certain Curable Fluoroelastomer Compositions and Precursors Thereof*, Inv. No. 337-TA-364, USITC Pub. No. 2890, Comm'n Op. at 4 (May 1995)).

The Staff recommends the remedy in this investigation should follow the line of flexible exclusion orders issued by the Commission. SIB at 71. Thus, the Staff recommends if an adverse effect on the public interest is found, any imposed remedy be tailored to minimize its impact on third parties, particularly the U.S. baseband processor industry. *Id.* Accordingly, the Staff recommends three possible options, to wit:

> [A]n exception allowing imports of mobile electronic devices containing both 4G and 5G technology; a carve-out for imports of infringing products for internal development and testing of products intended for overseas markets; and a certification provision allowing imports of iPhones containing Qualcomm baseband processor chipsets and any iPhones redesigned to avoid infringement of the asserted patents.

Id.

i. Carve-Out for 5G Technology

The Staff's first recommendation is that any exclusion order could be tailored to preserve Intel's ongoing role in 5G development and not applied to any future versions of the iPhone incorporating 5G technologies. SIB at 71-72. The Staff believes its recommendation would preserve current incentives for Intel and others to continue to invest in fundamental research in 5G technology, while still giving a remedy to Qualcomm excluding current and future 4G iPhones. *Id.* at 72. The Staff explains that such an exclusion order would exclude Apple's Intel-based 2018 iPhones, [ ] *Id.* Such an order would mean [ ] and the Staff contends the U.S. Customs and Border Protection could easily enforce such a remedy, particularly if a certification provision were included. *Id.*

The Staff acknowledges Intel claims even with this broad exception would force it to exit the market for premium LTE baseband processor chips in the event of an exclusion order. However, the Staff (without saying what it would be) "submits that there must be some length of business interruption short enough that Intel would bear with the revenue loss for a while longer rather than exiting the market altogether."[51] SIB at 72. Even though Intel's witnesses did not identify the minimum interruption that would trigger an exit, there are only approximately [ ] between the January 2019 target date for this investigation and [ ] and thus the Staff suggests it is reasonable to conclude that

[51] I interpret this to mean the Staff asks the Commission to risk admitted harms on a guess.

[

] in light of the anticipated future profits from 5G products.[52] *Id.* at 72-73.

The Staff concedes [

] SIB at 73. The Staff discusses how a 5G carve-out remedy would [

] *Id.* The Staff predicts, that after the Staff's estimated [ ] Apple could resume sales of iPhones with Intel 5G chips in the United States. *Id.* The Staff admits its suggested carve-out remedy would not guarantee Intel a revenue stream during the estimated [ ] this is not be the goal, however it would permit 5G research and commercialization to continue if Intel chooses to make the investment and thus preserve incentives to continue R&D, not to guarantee results.[53] *Id.*

ii. Exception for Research, Development, and Testing of Prototypes

The Staff concedes an exclusionary order would prohibit Apple from importing prototype iPhones containing Intel chips into the United States. SIB at 73. The Staff notes that Apple's research efforts are based in California and that [ ]

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[52] I disagree. There is not a scintilla of evidence in the Record to suggest what a reasonable interruption that Intel would or would not be able to bear. This is guessing, pure and simple. The Staff exacerbates its argument with the paragraph of its brief that follows, wherein it admits the [ ] and says this would be true in any event. However, the Staff fails to consider that Intel will [ ] The bottom line is the interruption would be at least [ ] with less sales to follow, for an unspecified period with a great deal less revenue coming in. I consider it very likely Intel will exit [ ]

[53] Consistent with the previous paragraph and the proceeding note, I do not find the Staff's position to be supported by any evidence or sound logic. Rather, this paragraph is a product of wishful thinking.

[ ] *Id.* (citing Hearing Tr. (Blevins) at 592:2-11). The Staff admits Apple would thus not be able to continue developing iPhones with Intel chips, even for sale outside the United States, thus effectively expanding the reach of any remedy to prevent product sales beyond the U.S. borders, which the Staff admits is not the intent of the statute. (*Id.*

According to the Staff, the extraterritorial effect of an exclusion order can be easily avoided by permitting a carve-out that allows the continued importation of mobile electronic devices (iPhones, etc.) with non-Qualcomm baseband processor chips for the purpose of testing and development at Apple. SIB at 74. The Staff explains that these imported devices could not be sold in the United States, only imported for internal use (by Apple). *Id.* This means any cease-and-desist order would specify that Apple was permitted to collaborate with baseband processor chip suppliers such as Intel in testing and developing such prototypes. *Id.* (citing *Cf. Magnetic Data Storage Tapes*, Comm'n Op. at 132 (proposal to include restriction against compliance verification testing in cease-and-desist order rejected because it would "amount to a 'world-wide' prohibition" against respondents' products, as even foreign sales required testing in the United States before sale). According to the Staff, this would allow Apple and Intel to continue working together on baseband processor technology and permit Apple to import and test prototypes containing baseband processor chips by any future entrants in the premium baseband processor chipset market, [ ] thereby promoting increased competition in that market. *Id.* (referencing Hearing Tr. (Blevins) at 625:20-626:19 (describing discussions with Samsung)). The Staff, accordingly, recommends the carve-out it describes should be "included in any remedy, whether or not there is also a carve-out for 5G products." *Id.*

iii. Certification Provision

The Staff's final exclusion order remedy recommendation is that the order should include a certification provision permitting Apple to certify particular imports are not subject to an exclusion order and should be permitted entry. SIB at 74. The Staff contends the Commission has commonly included such certification provisions in limited exclusion orders where a respondent imports both infringing and noninfringing products. *Id.* (referencing, *e.g.*, *Certain Dental Implants*, Comm'n Op. at 49; *Certain Marine Sonar Imaging Devices*, Comm'n Op. at 80; *Certain Curable Fluoroelastomer Compositions*, USITC Pub. No. 2890, Comm'n Op. at 4). Going further, the Staff states that including certification provisions work where U.S. Customs and Border Protection may not be able to easily determine by inspection whether an imported product violates a particular exclusion order. *Id.* at 74-75 (citing *Certain Semiconductor Chips*, Inv. No. 337-TA-605, USITC Pub. No. 4282, Comm'n Op. at 72). The Staff avers that the products to be certified in this investigation would include Apple iPhones containing Qualcomm baseband processor chips and products redesigned to avoid infringement. *Id.* at 75. Further, the Staff states that if the above suggested carve-outs suggested are included in the remedy, the products to be certified would also include prototypes being imported for internal testing and/or products containing 5G technology. *Id.* The Staff notes that baseband processor chips are not easily amenable to visual inspection and also notes that because iPhones are specifically designed to ensure that users perceive no difference between a Qualcomm-based iPhone and an Intel-based iPhone, a certification provision would assist U.S. Customs and Border Protection. *Id.*

The Staff closes as follows:

> [A] remedy tailored to not cover 5G products, prototypes imported for internal testing, or products subject to a certification provision would balance the competing interests in enforcing Qualcomm's intellectual property rights and protecting third parties from harm. Accordingly, if a violation of Section 337 is found the Staff submits that a remedy should issue, but that the remedy should be tailored in the manner discussed above.

SIB at 75.

C. Findings

As detailed above, Apple argues the present investigation is unusual enough that even if a violation of §337 is found, the public interest would not be served if the Commission issues an exclusion order. RIB at 54. Apple maintains an exclusion order would leave Qualcomm as the only supplier of premium baseband chip sets for premium phones in the United States and also harm the role and ability of the United States in developing emerging 5G technology to the likely detriment of U.S. national security and competitiveness. RIB at 54-55.

Apple's argument stems from the following facts, which I find have been clearly established by the Record:

1. There are only two suppliers of premium baseband chip sets in the merchant market for premium smart phones (Qualcomm and Intel) and the premium baseband chipset market is the appropriate market;
2. Intel has [

]

3. It is much more likely than not (nearly certain) that Intel will exit the premium base band chip market if it cannot sell its chips for use for Apple smart phones to be sold in the United States;
4. Since the premium base band chip is a "gateway" product, Intel will disengage from 5G development and supply efforts related to this kind of product.

Apple established No. 1 above through credible testimony, including the testimony of Dr. James Thompson, Qualcomm's Chief Technology Officer. Apple established Nos. 2-4 above through the unrebutted, unequivocal, uniquely credible, and highly logical testimony of Aicha Evans, Chief of Strategic Planning for Intel and the former General Manager of the Intel Segment responsible for the baseband chipsets. I find Ms. Evans' testimony to be decisive on all matters upon which she offered her testimony concerning Intel's intentions and plans. In addition, Apple also offered the highly credible and specific testimony of Dr. Scott Morton, Dr. Jeffrey Eisenach, and Mr. Steven Bowers on many relevant points concerning the Public Interest or premium baseband chipsets generally. All three of these witnesses offered testimony (as often quoted by Apple or the Staff) consistent with that of Ms. Evans and that confirmed the likely harm to the U.S. economy and competitive conditions within the U.S. economy if an exclusion order were issued. On the other hand, I found Qualcomm's non-fact witnesses,[54] especially its economic witnesses, to be far less credible, for a myriad of reasons, including the likelihood of bias, the speculative and conclusory nature of their testimony, and the number of unsupported assumptions I found to be inherent with the testimony they offered.

[54] I am not addressing Qualcomm's witnesses on infringement, invalidity, or domestic industry in this paragraph.

For example and more specifically, the Record will show the amount of money paid to Mr. Sidak, before the current investigation, was approximately $1 million over several years and that the company he owns has invoiced between $3 million and $4 million for just this investigation alone. Hearing Tr. 470-472. In my almost 39 years of practicing law, I have never seen or heard of anything even approaching this level of financial commitment by a witness to a party. Moreover, even absent this financial commitment, I was troubled by his testimony, for example his testimony about there being enough iPhones without the introduction of any new models in 2018 (CX-16C at Q36) ignored reality. From his financial relationship with Qualcomm bias may be presumed, and I find it would be an abuse of my discretion to give any material credibility to this witness or his findings. I also note the Staff questioned his credibility twice during their discussion of the Public Interest, and that I noted it above.

With regard to Ms. Mulhern's testimony on behalf of Qualcomm, I found her testimony to be of questionable value because it seemed to me she was offering conclusions (conclusory testimony) based on assumption. I recall this because I personally asked questions of her in reaction thereto.

Apple emphatically contends the strongest public interest factor under section 337 for not granting an exclusion order involves the issue of competitive conditions in the US economy. RIB at 55. Specifically, I find that Apple established:

1. Two suppliers is better than one monopolist where quality, innovation, supply, and prices are considered;
2. Intel will almost certainly exit the baseband chip market because none of Qualcomm's proposed solutions for Intel to mitigate the impact of the

proposed exclusion order would enable Intel to stay in the premium base band chip market;

3. Intel would also not be a player in the coming critical 5G baseband chip market since it would not be able to remain in the 4G market if it had to get out of it [ ] and thus there would only be one 5G chipmaker in the United States;
4. 5G is crucial to U.S. national security and competitiveness in the national economy and thus Intel's exit would harm the national interests of the United States.

Apple also offered credible argument and clear evidence that a monopoly created by any exclusion order would also affect other public interest factors, to wit:

1. Deprive U.S. smartphone consumers of quality improvements because of a lack of competition;
2. Cause the public health and welfare to be adversely impacted because Intel will no longer put competitive pressure on Qualcomm for 5G baseband chipsets and innovation, matters that have a very large potential or even a certainty to improve or harm the public health and welfare (national security) of the United States;
3. Production of like products in the United States will decline because [

]

In general, I found Apple's argument and recitation of the facts to be nearly compelling and certainly persuasive. Although certainly partisan, Apple's arguments were the more rational and realistic and did not depend on unrealistic expectations.

Despite the foregoing, before I continue, it is important to me for anyone reading this Initial Determination to understand that the issue of a complainant's right to an exclusionary order is something that is important to me. To my own mind, it takes exceptional circumstances to justify not granting an exclusionary order once a violation has been found. That being said, I think the circumstances here are unique and the risk of harm to the public interest is tangible. Hence, I think issuing any kind of exclusionary order would be against the statutory public interest factors mentioned above.

Another relevant matter that I note is that Qualcomm is an established and profitable concern that has an adequate remedy at law for any patent infringement by Apple. It also matters to me that Qualcomm introduced no credible evidence that an exclusionary order against the accused products is necessary to protect its domestic industry, its incentive to innovate, or profitability.[55]

It matters less to me that Qualcomm refuses to license its products and that it is hard to do business with. It seems to me that is its choice and that it is not alone in acting in this way.

I must say, with some regret, that I found Qualcomm's argument and recitation of the facts, both as presented in its original and responsive brief (CRSB at 48-74) as being particularly unhelpful and largely irrelevant to the Statutory Public Interest factors. While it is unavoidable that Qualcomm would depend upon witnesses I found to have offered speculative and unreliable

[55] *See supra* p. 159 (regarding testimony from Dr. Scott Morton).

testimony, it is less encouraging that Qualcomm would "double down" on weak or irrelevant arguments. One that comes to immediate mind is one the Staff addressed[56] and that was also contradicted by various witnesses, which is Qualcomm's strange argument that the merchant market for the premium baseband chips is a "made up market" and hence premium baseband chipsets are not properly part of the investigation. *See* CIB at 71, 78-79. This episode was unhelpful and wasteful.

However, it matters greatly to me that I find the Record establishes that an exclusionary order will leave only one premium baseband chip maker in the merchant market. There is credible and significant testimony in the Record verifying monopolies are bad and that competition is necessary for quality, innovation, competitive pricing, and, in this case, the preservation of a strong U.S. presence in the development of 5G and thus the national security of the United States. Moreover, it is obvious that the issue of national security should be a matter of pre-eminent importance in this investigation, especially when 5G development, innovation, control, and dominance will so dramatically affect competitive conditions in the U.S. economy in the long run. Hence, if the Commission does issue an exclusion order as Qualcomm requests, it will do so with the near certainty there will be real harm to the United States on a potentially very broad basis.

The National Security issues inherent with 5G are too serious to risk. As CFIUS realized, it is important to have U.S. leadership in 5G. RIB at 89. I believe if there is any realistic risk these interests would be harmed by the issuance of an exclusion order against the accused products that we have a duty to err on the side of caution and not issue that exclusion order.

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[56] The Staff addressed the issue of whether the investigation should focus on premium baseband chipsets. SIB at 38.

Here, I find a real and palpable likelihood the National Security interests will be jeopardized, as logically and compellingly argued by Apple and supported by the evidence in the Record. Moreover, it seems plain the Staff recognized this potential and that is why it argued for a tailored order.

I find the Staff's proposed "exclusionary order light" recommendation to be based upon unrealistic and inaccurate analysis, application, and understanding of the facts, and thus their recommendation is inherently risky.[57] I find no science behind the Staff's recommendation, just wishful thinking. Hence, there is nothing in the Record supporting the "assumption" that the Staff's recommended exclusion order can do anything to prevent certain harm arising out of reinstating Qualcomm's baseband chipset monopoly and Intel's subsequent exit from that market. Moreover, I find the compromise suggested by the Staff as not being supported by the witnesses I listened to.

One thing that especially troubled me is that while the Staff should have understood Intel would exit the baseband chip market if the Commission issued an exclusion order involving its chipsets sold in the United States, the Staff did not appreciate the importance of the U.S. sales as explained by Ms. Evans and what it was actually asking Intel to endure with its "tailored" exclusion order.[58] Specifically, the Staff admits Intel would certainly be without any 4G (LTE) revenue for [ ] (or much longer) from its baseband chipsets after the issuance of its tailored exclusion order ("exclusion order light"). Nevertheless, the Staff still speculates (or "assumes") that Intel would forbear from exiting the market without a fixed reentry date before it

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[57] *See supra* notes 50 and 52 on pages 181 and 187, respectively.

[58] *See supra* note 43 on page 172, wherein I noted a problem with the Staff's interpretation of what Ms. Evans said in this regard.

could sell chips in the United States through Apple again.[59] Moreover, the Staff's guess ignores the likelihood that Intel's Board of Directors, [

] would [

] The bottom line for me is that I see the Staff's recommended tailored exclusion order as being a guarantee: (1) of a Qualcomm monopoly; (2) of harm to everyone (especially the economy of the United States) involved but Qualcomm; and (3) of harm to the National Security of the United States.

VIII. Conclusions of Law

1. The Commission has subject matter, personal, and *in rem* jurisdiction in this investigation.

2. The accused products have been imported into the United States.

3. The accused products infringe claim 31 of U.S. Patent No. 9,535,490. The accused products do not infringe claim 7 of U.S. Patent No. 8,698,558, or claims 19, 25, or 27 of U.S. Patent No. 8,633,936.

4. The technical prong of the domestic industry requirement is satisfied with respect to U.S. Patent No. 9,535,490. The technical prong of the domestic industry requirement is not satisfied with respect to U.S. Patent No. 8,698,558 or U.S. Patent No. 8,633,936.

5. The economic prong of the domestic industry requirement has been satisfied with respect to the asserted patents.

6. It has not been shown by clear and convincing evidence that any asserted claim is invalid.

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[59] *See supra* note 44 on page 173.

IX. Initial Determination on Violation

Accordingly, it is my initial determination that that a violation of section 337 of the Tariff Act, as amended, has occurred in the importation into the United States, the sale for importation, or the sale within the United States after importation, of certain mobile electronic devices and radio frequency and processing components thereof, with respect to asserted claim 31 of U.S. Patent No. 9,535,490.

Further, this initial determination, together with the record of the hearing in this investigation consisting of (1) the transcript of the hearing, with appropriate corrections as may hereafter be ordered, and (2) the exhibits received into evidence in this investigation, is hereby certified to the Commission.

In accordance with 19 C.F.R. § 210.93(c), all material found to be confidential by the undersigned under 19 C.F.R. § 210.5 is to be given *in camera* treatment.

The Secretary shall serve a public version of this initial determination upon all parties of record and the confidential version upon counsel who are signatories to the Protective Order, as amended, issued in this investigation.

Pursuant to 19 C.F.R. § 210.42(h), this initial determination shall become the determination of the Commission unless a party files a petition for review pursuant to § 210.43(a) or the Commission, pursuant to § 210.44, orders on its own motion a review of the initial determination or certain issues herein.

X. Remedy and Bonding

This is the recommended determination ("RD") of the administrative law judge on remedy and bonding in *Certain Mobile Electronic Devices and Radio Frequency and Processing Components Thereof*, United States International Trade Commission Investigation No.

337-TA-1065. As indicated in the Final Initial Determination ("ID") on violation set forth above, I have found a violation of section 337 of the Tariff Act, as amended (19 U.S.C. § 1337) as to Apple.

A. Limited Exclusion Order

The Commission has broad discretion in selecting the form, scope, and extent of the remedy in a section 337 proceeding. *Viscofan, S.A. v. U.S. Int'l Trade Comm'n*, 787 F.2d 544, 548 (Fed. Cir. 1986). A limited exclusion order directed to a respondent's infringing products is among the remedies that the Commission may impose. *See* 19 U.S.C. § 1337(d).

Qualcomm and the Staff argue that a limited exclusion order should issue in the event the Commission finds a violation of section 337. CIB at 70; SIB at 36. Apple does not deny that a limited exclusion order would be an appropriate remedy in the event a violation of section 337 is found, but argues that an exclusion order would be against the public interest. *See* RIB at 54-100.

Having considered the arguments of the parties and the evidence of record, it is my recommendation that in the event the Commission determines a violation of section 337 has occurred, it should not issue a limited exclusion order covering mobile electronic devices and radio frequency and processing components thereof found to infringe the Asserted Patents because the Statutory Public Interest Factors weigh against such a remedy.

B. Cease and Desist Order

Section 337 provides that in addition to, or in lieu of, the issuance of an exclusion order, the Commission may issue a cease and desist order as a remedy for a violation of section 337. 19 U.S.C. § 1337(f)(1). The Commission may issue a cease and desist order when it has personal jurisdiction over the party against whom the order is directed. *Gamut Trading Co. v. U.S. Int'l Trade Comm'n*, 200 F.3d 775, 784 (Fed. Cir. 1999).

The Commission "generally issues a cease and desist order only when a respondent maintains a commercially significant inventory of infringing products in the United States." *Certain Ground Fault Circuit Interrupters and Products Containing Same*, Inv. No. 337-TA-615, Comm'n Op. at 24 (Mar. 26, 2009). Indeed, cease and desist orders are usually issued "when there is a commercially significant amount of infringing imported product in the United States that could be sold so as to undercut the remedy provided by an exclusion order." *Certain Protective Cases and Components Thereof*, Inv. No. 337-TA-780, Comm'n Op. at 28 (Nov. 19, 2012) (quoting *Certain Laser Bar Code Scanners and Scan Engines, Components Thereof, and Products Containing Same*, Inv. No. 337-TA-551, Comm'n Op. (Pub. Version) at 22 (June 14, 2007)).

Turning now to the record evidence, Apple has stipulated as to importation and inventory of the Accused Products. JX-13C. According to the stipulation, as of December 31, 2017, [

] JX-13C.2-3. Apple does not dispute that this inventory is commercially significant. *Id.*

Qualcomm argues that the Commission should issue a permanent cease and desist order should it find a violation of section 337. CIB at 70. The Staff agrees that a cease and desist order would be appropriate if a violation of section 337 is found. SIB at 36.

Having considered the arguments of the parties and the evidence of record, it is my recommendation that in the event the Commission determines a violation of section 337 has occurred, it should not issue a cease and desist order as to Apple because the Statutory Public Interest Factors weigh against such a remedy.

C. Bond

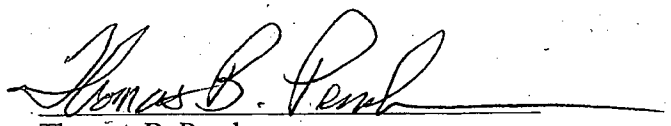
Qualcomm does not seek a bond for the sixty-day Presidential review period in the event a limited exclusion order is issued in this investigation. See CIB at 70. Apple and the Staff agree that no bond should be required from Apple during the sixty-day Presidential review period. RRSB at 69; SIB at 36.

Qualcomm has not adduced evidence showing that it sells products that directly compete with Apple's accused iPhone products, and there is no evidence in the record of what a reasonable royalty rate would be for Qualcomm's patented technology. Therefore, I find that a zero-percent bond for the sixty-day Presidential review period is appropriate in the event the Commission issues a limited exclusion order in this investigation.

XI. Order

To expedite service of the public version, each party is hereby ordered to file with the Commission Secretary no later than October 8, 2018, a copy of this initial determination with brackets to show any portion considered by the party (or its suppliers of information) to be confidential, accompanied by a list indicating each page on which such a bracket is to be found and providing a written justification for any proposed redaction specifically explaining why the piece of information sought to be redacted is confidential and why disclosure of the information would be likely to cause substantial harm or likely to have the effect of impairing the Commission's ability to obtain such information as is necessary to perform its statutory functions pursuant to Commission Rules 210.5 and 201.6(a). At least one copy of such a filing shall be served upon my office, and the brackets shall be marked in red. If a party (and its suppliers of information) considers nothing in the initial determination to be confidential, and thus makes no

request that any portion be redacted from the public version, then a statement to that effect shall be filed.



Thomas B. Pender
Administrative Law Judge

Issued: September 28, 2018

CERTAIN MOBILE ELECTRONIC DEVICES AND RADIO FREQUENCY AND PROCESSING COMPONENTS THEREOF

INV. NO. 337-TA-1065

PUBLIC CERTIFICATE OF SERVICE

I, Lisa R. Barton, hereby certify that the attached **PUBLIC INITIAL DETERMINATION** has been served by hand upon the Commission Investigative Attorney, Lisa Murray, Esq. and the following parties as indicated, on OCT 29 2018

Lisa R. Barton, Secretary
U.S. International Trade Commission
500 E Street SW, Room 112A
Washington, D.C. 20436

FOR COMPLAINANT QUALCOMM INCORPORATED	
S. Alex Lasher, Esq. **QUINN EMANUEL URQUHART & SULLIVAN, LLP** 1300 I Street NW, Suite 900 Washington, D.C. 20005	( ) Via Hand Delivery (✓) Express Delivery ( ) Via First Class Mail ( ) Other: _____
FOR RESPONDENT APPLE INC.	
Lauren A. Degnan, Esq. **FISH & RICHARDSON P.C.** 1000 Maine Avenue SW, Suite 1000 Washington, D.C. 20024	( ) Via Hand Delivery (✓) Express Delivery ( ) Via First Class Mail ( ) Other: _____