UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Intel Corporation
Petitioner

v.

Qualcomm Incorporated
Patent Owner

Case IPR2019-00128
Patent 9,154,356

PATENT OWNER RESPONSE TO PETITION FOR *INTER PARTES* REVIEW PURSUANT TO 37 C.F.R. § 42.220

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Pursuant to the Board's Decision to institute an *inter partes* review, (Paper 9) ("Institution Decision"), Patent Owner Qualcomm, Inc. ("Qualcomm" or "Patent Owner") submits this Response in opposition to the Petition for *Inter Partes* Review of U.S. Patent No. 9,154,356 ("the '356 Patent").

I. INTRODUCTION

Petitioner's grounds for unpatentability are based on an unreasonably broad construction of the term "carrier aggregation." Under a proper construction of the term, the patentability of the challenged claims of the '356 Patent should be confirmed.

During prosecution, the applicant amended each of the independent claims of the '356 patent limiting their scope to an input RF signal "employing carrier aggregation." This narrowing amendment and the accompanying remarks distinguished the claimed invention over U.S. Patent 7,317,894 to Hirose. At the time, a person of ordinary skill would have understood that the term carrier aggregation, as recited in that amendment, meant "*simultaneous operation on multiple carriers that are combined as a single virtual channel to provide higher bandwidth*." This understanding is supported by the specification, the file history, and extrinsic evidence.

Lee, which is petitioner's primary reference for each alleged ground of unpatentability in this proceeding, fails to disclose the "employing carrier

aggregation" limitation. Lee discloses an input signal comprised of a WiFi signal and a Bluetooth signal, two independent un-aggregated signals. Recognizing this deficiency in Lee's disclosure, Petitioner proposes an unreasonably broad construction—"simultaneous operation on multiple carriers"—in order to argue that the '356 Patent claims read on Lee's input signal. Petitioner's proposed construction is so broad, however, that it violates the doctrine of prosecution disclaimer by attempting to recapture the subject matter that was disclaimed in order to overcome Hirose.

Furthermore, Petitioner's proposed construction reads out the term "aggregation." This failure to construe the term to indicate an "aggregation" of carriers improperly renders the term superfluous in the claims. Petitioner also fails to adequately explain how a person of ordinary skill understood that carriers are "aggregated" under its proposed construction. In fact, Petitioner's own inventors described carrier aggregation as referring to an "aggregation of multiple smaller bandwidths to form a virtual wideband channel." Under a proper construction of the term, Lee fails to disclose "carrier aggregation."

Petitioner also seeks to overcome this deficiency in Lee by combining it with the Feasibility Study. This is not a credible combination. A skilled artisan would not have been motivated to select and combine these distinctly different references. For example, Lee is directed to two "different kinds of radio connections" (WiFi and

Bluetooth); the Feasibility Study is directed to the same type of radio connections (LTE). As another example, Lee discloses an amplification circuit wherease the Feasibility Study does not disclose any circuits. Moreover, a skilled artisan would have had no reason to turn to Lee, a reference which addressed unrelated wireless communication standards, or the Feasibility Study, a reference that failed to even disclose an amplifier circuit. Absent a credible showing of a motivation to select and combine these two references with a reasonable expectation of success, Petitioner's ground is only impermissible hindsight reasoning.

As explained in further detail below, the patentability of the challenged claims of the '356 Patent should be confirmed.

II. THE ALLEGED GROUNDS OF UNPATENTABILITY

Pursuant to the Board's Institution Decision (Paper 9), the alleged grounds of unpatentability for this trial are:

- Ground 1: Anticipation under 35 U.S.C. §102 of claims 1, 7, 8, 11, 17, and 18 by Lee[1];
- Ground 2: Obviousness under 35 U.S.C. §103 of claims 7 and 8 over Lee; and

[1] U.S. Publ'n No. 2012/0056681 A1 (published Mar. 8, 2012) (Ex. 1335).

- Ground 3: Obviousness under 35 U.S.C. §103 of claims 1, 7, 8, 11, 17, and 18 over Lee and the Feasibility Study[2].

III. THE '356 PATENT AND ITS PROSECUTION HISTORY

A. Overview of the '356 Patent

The '356 Patent, titled "Low Noise Amplifiers for Carrier Aggregation," generally relates to the design and operation of amplifiers in a wireless device receiving radio frequency (RF) signals employing carrier aggregation. Ex. 1301; Ex. 2024 (Declaration of Dr. Daniel Foty) ¶ 50.

Receiving signals that employ carrier aggregation, which is a communication technique that Qualcomm pioneered, allows a mobile device to increase the bandwidth available to a user for receiving the user's desired content. With carrier aggregation, data is split up (multiplexed) and transmitted over multiple frequencies (component carriers) to create a higher bandwidth channel for the device. Ex. 2024 ¶ 51. Carrier aggregation therefore allows more data to be transmitted more quickly than traditional single-frequency methods. *Id*.

A typical mobile device, however, is not always receiving RF signals employing carrier aggregation. For example, sometimes a mobile device can receive RF signals on a single carrier, and at other times it receives no RF signals at all. One

[2] 3rd Generation Partnership Project (3GPP) TR 36.912 V9.1.0 (2009-12) (Ex. 1304).

aspect of the invention of the ’356 Patent is a receiver design that offers the flexibility of activating circuitry to receive a signal employing carrier aggregation when needed and deactivating that circuitry when it is not needed. Ex. 2024 ¶ 53. By allowing flexibility of circuit components between carrier aggregation and non-carrier-aggregation modes, a mobile device can conserve power when less bandwidth is needed, and provide increased bandwidth to the user when desired. Ex. 2024 ¶ 62.

Aspects of the ’356 Patent may be found in the RF transceiver of a mobile device. The RF transceiver is a component that receives radio-frequency (RF) signals transmitted over the air (which can be at frequencies in the MHz to GHz ranges) and converts the RF signals to baseband signals that can be provided to digital circuitry for processing, for example, to recover user data. Ex. 2024 ¶ 48 n.7. The RF transceiver is connected to the antenna that receives the RF signals through circuitry, which prepares the received signals for conversion to baseband signals, such as by filtering the signals. *Id*.

The ’356 Patent’s claims are directed to an RF receiver (for example, within an RF transceiver) with two amplifiers that separately amplify a common input RF signal, where each of the two amplifiers can be independently enabled or disabled. By independently controlling the amplifier stages, the amplifier stages can be enabled for carrier aggregation operation or disabled for single carrier (non-carrier-

aggregation) operation. Ex. 1301 at 20:43-61. For example, the two amplifiers can be enabled in carrier aggregation mode. Ex. 2024 ¶ 53. Alternatively, one of the amplifiers can be enabled and the other disabled in non-carrier-aggregation mode. *Id*. By allowing the flexibility to disable an amplifier stage when it is not needed for carrier aggregation, the invention of the '356 Patent reduces power consumption in the RF transceiver and extends battery life for the mobile device. *Id*. ¶ 62.

Claims 1 and 17 illustrate embodiments of the '356 Patent's inventions:

> 1. An apparatus comprising:
>
> a first amplifier stage configured to be independently enabled or disabled, the first amplifier stage further configured to receive and amplify an input radio frequency (RF) signal and provide a first output RF signal to a first load circuit when the first amplifier stage is enabled, the input RF signal employing carrier aggregation comprising transmissions sent on multiple carriers at different frequencies to a wireless device, the first output RF signal including at least a first carrier of the multiple carriers; and
>
> a second amplifier stage configured to be independently enabled or disabled, the second amplifier stage further configured to receive and amplify the input RF signal and provide a second output RF signal to a second load circuit when the second amplifier stage is enabled, the second output RF signal including at least a second carrier of the multiple carriers different than the first carrier.
>
> 17. A method comprising:
>
> amplifying a first input radio frequency (RF) signal with a first amplifier stage to obtain a first output RF signal when the first amplifier stage is enabled, the first amplifier stage

> configured to be independently enabled or disabled, the first input RF signal employing carrier aggregation comprising transmissions sent on multiple carriers at different frequencies to a wireless device, the first output RF signal including at least a first carrier of the multiple carriers; and
>
> amplifying the first input RF signal or a second input RF signal with a second amplifier stage to obtain a second output RF signal when the second amplifier stage is enabled, the second amplifier stage configured to be independently enabled or disabled, the second output RF signal including at least a second carrier of the multiple carriers different than the first carrier.

Ex. 1301 at 20:43-61; 22:11-27.

B. Prosecution History of the '356 Patent

The '356 Patent issued from U.S. Patent Application No. 13/590,423 (the "'423 Application"), filed August 21, 2012, and claims priority to U.S. Provisional Application No. 61/652,064, filed May 25, 2012. Ex. 1301. The '423 Application underwent a lengthy and comprehensive examination, spanning five rejections and advisory actions, two requests for continued examination, and hundreds of cited references, including an International Search Report ("ISR") and Written Opinion.

The first office action issued November 14, 2013, and rejected independent claims 1 and 17, among other claims, as obvious over U.S. Patent No. 7,751,513 ("Eisenhut"). Ex. 1312 at 3-5. To overcome the rejection, Applicant amended claim 1 as follows:

> 1. An apparatus comprising:
> a first amplifier stage configured to receive and amplify an input radio frequency (RF) signal and provide a first output RF signal to a first load circuit when the first amplifier stage is enabled, the input RF signal comprising transmissions sent on multiple carriers at different frequencies to a wireless device, the first output RF signal including at least a first carrier of the multiple carriers; and
>
> a second amplifier stage configured to receive and amplify the input RF signal and provide a second output RF signal to a second load circuit when the second amplifier stage is enabled, the second output RF signal including at least a second carrier of the multiple carriers different than the first carrier.

Ex. 1313 at 2. Applicant made a similar amendment to claim 17. *Id*. at 5. Applicant additionally included arguments that Eisenhut does not teach or suggest at least the elements added by amendment. *Id*. at 7-9.

The Patent Office then issued a final office action on April 18, 2014, rejecting claims 1 and 17 (among others) as anticipated by U.S. Patent No. 7,317,894 ("Hirose"). Ex. 1314 at 2-4. In response, Applicant amended claims 1 and 17 to recite "the input RF signal *employing carrier aggregation* comprising transmissions sent on multiple carriers at different frequencies to a wireless device," and "the first input RF signal *employing carrier aggregation* comprising transmissions sent on multiple carriers at different frequencies to a wireless device," respectively. Ex. 1315 at 2, 5. Applicant further argued that Hirose did not utilize an input RF signal

employing carrier aggregation, "which results in an *increased aggregated* data rate." *Id*. at 7-9 (emphasis in original).

The Patent Office then issued an advisory action indicating that the claim amendments raised new issues that would require additional searching. Ex. 2001. Accordingly, on July 17, 2014, Applicant filed a request for continued examination ("RCE") that included the aforementioned amendments and arguments. Ex. 2002.

The Patent Office next issued a non-final office action on August 1, 2014, rejecting claims 1 and 17 as anticipated by U.S. Patent No. 8,442,473 ("Kaukovuori"). Ex. 1316 at 3-5 ("Kaukovuori, et al. teaches a *method of receiving data* transmitted via a combination of at least a plurality of radio frequency signals *using carrier aggregation*" (emphasis in original)). In response, Applicant argued that Kaukovuori does not teach or suggest "[a first amplifier stage configured to ... amplify/ amplifying ... with a first amplifier stage] ... when the first amplifier stage is enabled ... and [a second amplifier stage configured to ... amplify/ amplifying ... with a second amplifier stage] ... when the second amplifier stage is enabled," as recited in claims 1 and 17. Ex. 1317 at 7-9.

On December 26, 2014, the Patent Office issued a second final office action, again rejecting claims 1 and 17 as anticipated by Kaukovuori. Ex. 1318 at 7-9. After an Examiner Interview discussing possible claim amendments, Applicant amended the independent claims, including claims 1 and 17, to recite that the first amplifier

stage is configured to "*be independently enabled or disabled* . . ." and the second amplifier stage is configured to "*be independently enabled or disabled* . . . ." Exs. 1319; 1320 at 2, 5. In light of this amendment, the Examiner allowed the pending claims. Ex. 1321 at 2, 5.

Prior to paying the issue fee, Applicant filed a second request for continued examination in order to permit the Patent Office to consider additional prior art disclosed in an Information Disclosure Statement. Ex. 2003. After reviewing the references, the Examiner again issued a Notice of Allowance, and the '423 Application issued on October 6, 2015 as the '356 Patent. Ex. 1322.

IV. CLAIM CONSTRUCTION

The "broadest reasonable construction in light of the specification" is the governing claim construction standard in this proceeding. 37 C.F.R. § 42.100(b) (prior to November 13, 2018 amendment). "Under this standard, claim terms are generally given their ordinary and customary meaning, as would be understood by a skilled artisan in the context of the entire disclosure." *Polygroup Ltd. MCO v. Willis Elec. Co., Ltd*, 759 F. App'x 934, 939 (Fed. Cir. 2019). The parties dispute the proper construction of the term "carrier aggregation" under this standard.

For the purpose of this proceeding, Patent Owner does not dispute Petitioner's contention that a person of ordinary skill in the art "at the time of the alleged invention would have had at least an M.S. degree in electrical engineering (or

equivalent experience) and would have had at least two years of experience with the structure and operation of RF transceivers and related structures (or the equivalent)." Petition at 32.

A. "carrier aggregation"

Patent Owner's Proposed Construction	Petitioner's Proposed Construction
"simultaneous operation on multiple carriers that are combined as a single virtual channel to provide higher bandwidth"	"simultaneous operation on multiple carriers"

In 2012, at the time of the invention of the '356 Patent, a person of ordinary skill in the art would have understood that "carrier aggregation" was a term of art that meant "*simultaneous operation on multiple carriers that are combined as a single virtual channel to provide higher bandwidth*." This proposed construction is supported by both intrinsic and extrinsic evidence, as explained below. On the other hand, Petitioner's proposed construction is unreasonably broad and it violates the doctrine of prosecution disclaimer. Moreover, the term "carrier aggregation" cannot simply mean "simultaneous operation on multiple carriers," as Petitioner proposes, because that reads out the word "aggregation."

1. Patent Owner's Construction Is The Ordinary And Customary Meaning, As Would Be Understood By A Skilled Artisan In The Context Of The Entire Disclosure.

While it is true that "simultaneous operation on multiple carriers" is an attribute of carrier aggregation, Ex. 1301 at 1:32–33, a person of ordinary skill would

have further understood the term to mean that the multiple carriers are combined (aggregated) as a single virtual channel. This understanding is consistent with the objective of aggregating carriers to provide a combined higher bandwidth channel for communications. *Id*. at 2:63–67; Ex. 2024 ¶ 83. This construction is confirmed by the specification and the file history, and is further supported by extrinsic evidence.

a. The Specification Supports Patent Owner's Proposed Construction

The specification states that the term "carrier may refer to a range of frequencies used for communication and may be associated with certain characteristics." *Id*. at 1:33–35. Each of the multiple carriers "may also be referred to as a *component carrier*." *Id*. at 1:37–40.[3] The plain meaning of the adjective "component" indicates that a "component carrier" constitutes a part of something larger. In particular, the component carriers are components that are combined to form a single aggregated carrier. Ex. 2024 ¶ 84.

The specification depicts the aggregation of component carriers in Figures 2A to 2D. *Id*. at 3:6–38, Figs. 2A–2D. Each figure illustrates that by aggregating four component carriers, the system is capable of delivering data using a single virtual

[3] Emphasis and highlighting added throughout this Response unless otherwise noted.

channel that has the equivalent of four times the bandwidth of a single non-aggregated carrier. Ex. 2024 ¶ 85.

Thus, for example, while earlier LTE systems were limited to 20 MHz channels, LTE Release 11 (which provided support for LTE-Advanced functionality) could be configured to aggregate up to five of these 20 MHz channels as component carriers of a single virtual channel having a bandwidth capacity of up to 100 MHz. Ex. 1301 at 2:63–67; Ex. 2024 ¶ 86. The specification explains that LTE carriers may be aggregated from frequency bands listed in 3GPP TS (Technical Specification) 36.101. Ex. 1301 at 2:63–67. In 3GPP TS 36.101, carrier aggregation is described as an "[a]ggregation of two or more component carriers in order to support wider transmission bandwidths." Ex. 2026 at 14; *see also* Ex. 2015 at 12 (identifying 3GPP TS 36.101 in an Information Disclosure Statement during prosecution and indicating that it was considered by the examiner).

The figure below illustrates the LTE-Advanced carrier aggregation. In earlier LTE systems, a user device connects to the wireless network over a single 20 MHz carrier frequency. Ex. 1301 at 2:63–67; Ex. 2024 ¶ 87. As the maximum-available data rate of the single-carrier wireless connection is the rate-limiting step for the end user, requests for a large amount of data (e.g., a video) can only be received at the data rate of that single carrier. Ex. 2024 ¶ 87. To relieve this rate-limiting step, LTE-Advanced added the ability for network equipment to practice carrier

aggregation. Ex. 1301 at 2:63–67; Ex. 2024 ¶ 87. When an end user requests a large amount of data, the network will activate carrier aggregation to deliver that data more quickly. Ex. 2024 ¶ 87. This is done by multiplexing the incoming data stream, which is illustrated by the "single (fast) data pipe," so that the incoming data stream is separated into multiple streams that are transmitted over multiple component carriers at the same time. *Id*. The user device receives and de-multiplexes (aggregates) the multiple streams to recreate the original incoming data stream. *Id*. The result is that the incoming data stream is received more quickly because it was transmitted in a higher bandwidth virtual channel. *Id*.

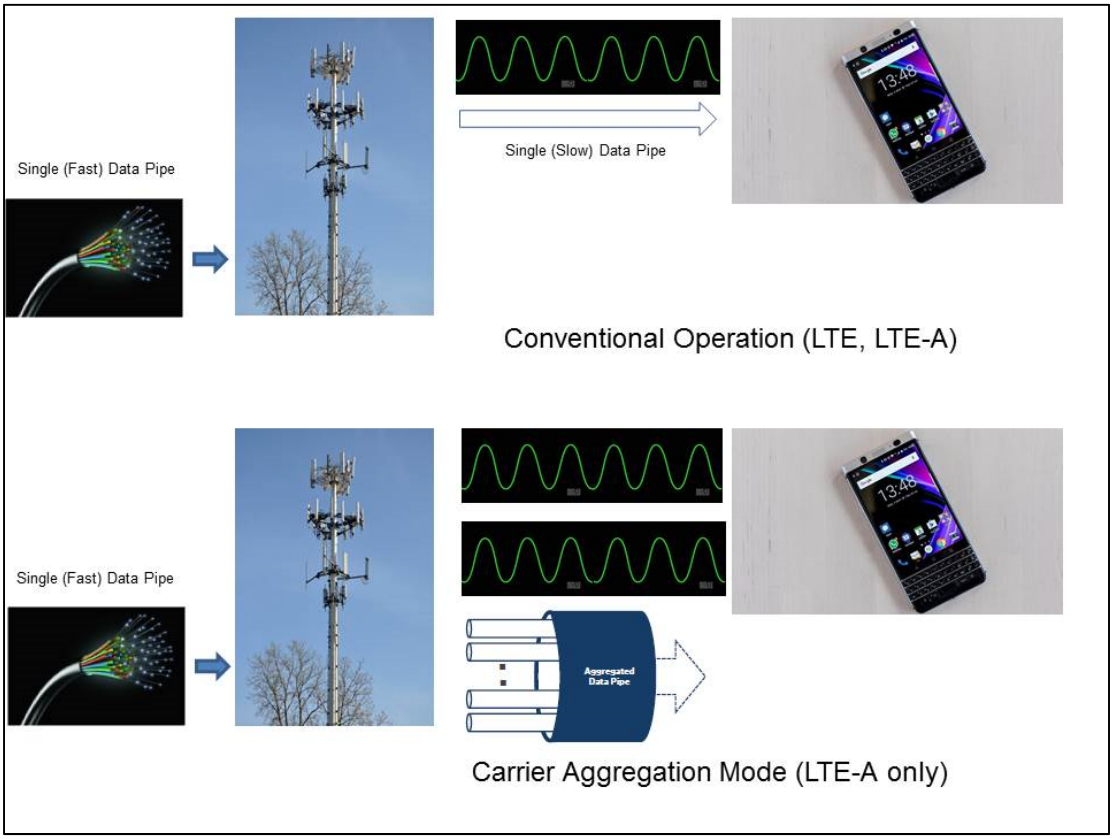


Figure 1: Conventional "Single Carrier" Operation and Carrier Aggregation Mode.

b. The File History Supports Patent Owner's Construction

The file history further confirms that a skilled artisan understood that carrier aggregation resulted in a single virtual channel to provide an increased bandwidth. Petitioner even points to one example of this confirmation in the file history in reference to the amendment to overcome the rejection based on Hirose, but contends that "Patent Owner did not argue during prosecution that carrier aggregation required anything more than non-redundant transmissions." Petition at 30. That is not correct. As evidenced by the very text Petitioner quoted from (reproduced below), the file history shows that Patent Owner explained that "carrier aggregation" requires an "***increased aggregated*** data rate":

> **Regarding amended independent claims 1 and 17**, Applicant's amended independent claims 1 and 17 recite, *inter alia*, "the [] input RF signal employing ***carrier aggregation***," which is **not** disclosed in Hirose. Generally, Applicant's claimed invention recites "carrier aggregation" which results in an ***increased aggregated*** data rate. In contrast, Hirose transmits the same signals over different paths which results in ***redundant*** data at a ***common*** data rate. Specifically, the

Ex. 1315 at 7 (bold and italics in original, highlighting added).

The file history also shows that the examiner rejected the claims over U.S. Patent 8,442,473 to Kaukovuori. According to the examiner, Kaukovuori disclosed "the input RF signal employing carrier aggregation" limitation. Ex. 1318 at 6–78. Kaukovuori explained that the "technique of Carrier Aggregation (CA) requires each utilised carrier signal to be demodulated at the receiver, *whereafter the message data from each of the signals can be combined in order to reconstruct the original data*":

> Long Term Evolution (LTE) Advanced is a mobile telecommunication standard proposed by the 3rd Generation Partnership Project (3GPP) and first standardised in 3GPP Release 10. In order to provide the peak bandwidth requirements of a 4th Generation system as defined by the International Telecommunication Union Radiocommunication (ITU-R) Sector, while maintaining compatibility with legacy mobile communication equipment, LTE Advanced proposes the aggregation of multiple carrier signals in order to provide a higher aggregate bandwidth than would be available if transmitting via a single carrier signal. This technique of Carrier Aggregation (CA) requires each utilised carrier signal to be demodulated at the receiver, whereafter the message data from each of the signals can be combined in order to reconstruct the original data. Carrier Aggregation can be used also in other radio communication protocols such as High Speed Packet Access (HSPA).

Intel 1325 ("Kaukovuori") at 1:19–35; Ex. 2024 ¶ 92.

As another example from the file history, the applicant filed foreign reference WO 2012/008705 with the PTO in connection with an Information Disclosure Statement ("IDS"). Ex. 2015 at 12 (considered by examiner Nov. 4, 2013); *see Powell v. Home Depot U.S.A., Inc.*, 663 F.3d 1221, 1231 (Fed. Cir. 2011) ("[P]rior art cited in a patent or cited in the prosecution history of the patent constitutes intrinsic evidence."). WO 2012/008705 described carrier aggregation as "a technology for *aggregating a plurality of unit carriers* . . . to be used simultaneously":

[7] LTE-Advanced (LTE-A) system, which is one of systems following three generation wireless communication systems, is undergoing a standardization work for a terminal, which can support not only the MIMO system but also a Carrier Aggregation (CA), which is a scheme for transmitting more data to a terminal or User Equipment (UE) using different multiple carriers. The LTE-A is a technology for aggregating a plurality of unit carriers, which are used in the conventional LTE release-8/9, to be used simultaneously. Such technology aims to extending a bandwidth up to 100 MHz.

[8] In other words, a carrier, which was defined fully up to 20 MHz in the conventional LTE release-8/9, is redefined as a component carrier, and one terminal is allowed to use maximum 5 component carriers by the carrier aggregation (CA) technology. Hereinafter, a terminal is referred to as User Equipment (UE).

[9] The CA is a way to get high throughput by aggregating a used band for each component carrier. There are three types of carrier aggregations which are intra-band contiguous aggregation, intra-band non-contiguous aggregation and inter-band non-contiguous aggregation for LTE-Advanced CA.

Ex. 2016 at [7]–[9]. This reference shows that the multiple component carriers are used together to create a single virtual channel to provide a higher bandwidth for a single data stream. *Id*.; Ex. 2024 ¶ 89.

As yet another example from the file history, the applicant filed foreign reference GB 2472978 with the PTO in connection with an IDS. Ex. 2015 at 10 (considered by examiner Nov 4, 2013). GB 2472978 states that "[i]n the carrier aggregation mode *data has been multiplexed* across multiple carrier frequencies . . . ." Ex. 2017 at 1. GB 2472978 further describes carrier aggregation as a technique to "*bond together* two parallel carriers." *Id*. at 5; Ex. 2024 ¶ 90.

c. Extrinsic Evidence Supports Patent Owner's Construction

Notably, Petitioner's own inventors at that time also understood that carrier aggregation meant that multiple carriers are combined (aggregated) as a single virtual channel to provide higher bandwidth. Ex. 2024 ¶¶ 98–100. U.S. Patent No.

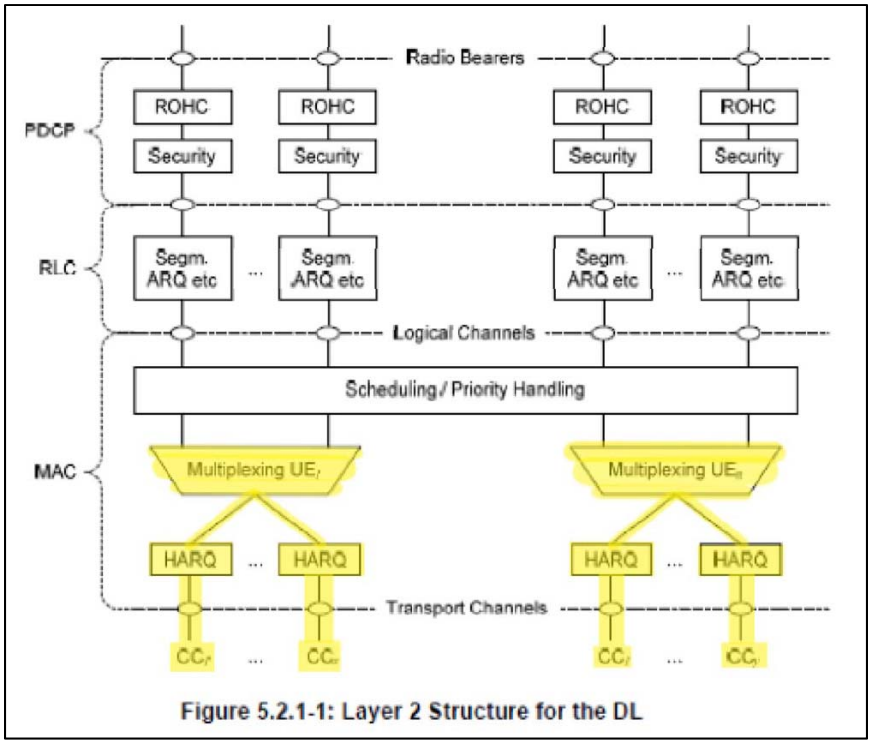
9,161,254, assigned to Intel Corporation, was filed May 3, 2013 and claimed priority to a September 28, 2012 provisional application. Ex. 2013. Petitioner's '254 Patent teaches that carrier aggregation is an "*aggregation of multiple smaller bandwidths to form a virtual wideband channel* at a wireless device (e.g., UE)":

> One technique for providing additional bandwidth capacity to wireless devices is through the use carrier aggregation of multiple smaller bandwidths to form a virtual wideband channel at a wireless device (e.g., UE). In carrier aggregation (CA) multiple component carriers (CC) can be aggregated and jointly used for transmission to/from a single terminal. Carriers can be signals in permitted frequency domains onto which information is placed. The amount of information that can be placed on a carrier can be determined by the aggregated carrier's bandwidth in the frequency domain. The permitted frequency domains are often limited in bandwidth. The bandwidth limitations can become more severe when a large number of users are simultaneously using the bandwidth in the permitted frequency domains.
>
> FIG. 1 illustrates a carrier bandwidth, signal bandwidth, or a component carrier (CC) that can be used by the wireless device. For example, the LTE CC bandwidths can include: 1.4 MHz 210, 3 MHz 212, 5 MHz 214, 10 MHz 216, 15 MHz 218, and 20 MHz 220. The 1.4 MHz CC can include 6 resource blocks (RBs) comprising 72 subcarriers. The 3 MHz CC can include 15 RBs comprising 180 subcarriers. The 5 MHz CC can include 25 RBs comprising 300 subcarriers. The 10 MHz CC can include 50 RBs comprising 600 subcarriers. The 15 MHz CC can include 75 RBs comprising 900 subcarriers. The 20 MHz CC can include 100 RBs comprising 1200 subcarriers.
>
> Carrier aggregation (CA) enables multiple carrier signals to be simultaneously communicated between a user's wireless device and a node. Multiple different carriers can be used. In some instances, the carriers may be from different permitted frequency domains. Carrier aggregation provides a broader choice to the wireless devices, enabling more bandwidth to be obtained. The greater bandwidth can be used to communicate bandwidth intensive operations, such as streaming video or communicating large data files.

Ex. 2013 at 3:19–53 (U.S. Pat. No. 9,161,254); *see also, e.g.,* Ex. 2018 at 3:27–62 (U.S. Pat. No. 10,044,613, filed Dec. 13, 2013; assigned to Intel IP Corp.) ("carrier aggregation of multiple smaller bandwidths *to form a virtual wideband channel at a*

wireless device"); Ex. 2019 at 6 (Qualcomm Inc., STRATEGIES TO WIN IN LTE AND EVOLVE TO LTE ADVANCED (2013), https://www.qualcomm.com/documents/wireless-networks-strategies-win-lte-and-evolve-lte-advanced ("Carrier aggregation, as the name suggests, *combines multiple carriers (a.k.a. channels) at the device to provide a bigger data pipe* to the user."); Ex. 2020 ¶ [0003] (U.S. Pat. Pub. No. 2013/0217398, filed Nov. 28, 2012) ("Carrier aggregation provides an increase in data throughput capability by allowing different parts of the frequency spectrum to be *combined logically to form a single channel* (e.g. over-the-air interface between a base station and a user equipment). The technique of carrier aggregation thus allows an expansion of the effective bandwidth which can be utilized in wireless communication by concurrent utilization of radio resources across multiple carriers. *Multiple component carriers are aggregated to form a larger overall transmission bandwidth*.").

Furthermore, the Feasibility Study, which Petitioner relies on as prior art in this proceeding, evidences that skilled artisans understood that carrier aggregation meant combining carriers for operation as a single virtual channel. Ex. 1304. The Feasibility Study illustrates that carrier aggregation meant *multiplexing user data* for transmission to each user device (i.e., UE_1 – UE_n) *on component carriers* (i.e., CC_1 – CC_n).



Ex. 1304 at 10; Ex. 2024 ¶ 95. Thus, carrier aggregation delivered multiplexed data to the user in an aggregated higher bandwidth channel (a single virtual channel) so that higher-rate data (such as video) could be delivered at a higher rate than was possible in a single un-aggregated channel. *Id.* ¶ 96.

Textbooks and technical publications from the period provide even further confirmation. For example, one commentator (from Ericsson) explained that "[t]he basic principle for carrier aggregation is independent processing of the component carriers in the physical layer . . . while carrier aggregation is invisible" to the higher layers. ERIK DAHLMAN ET AL., 4G LTE/LTE-ADVANCED FOR MOBILE BROADBAND (Academic Press 2011) ("Dahlman") Ex. 2021 at 26. Dahlman illustrated this principle with a diagram (Figure 8.10 below), which is quite similar to Figure 5.2.1-

1 from the Feasibility Study (above), showing that the higher layer logical channels are "*multiplexed*" on to the component carriers. Ex. 2024 ¶ 95. As a result, the higher layers (including the user application, such as video streaming) could be configured to deliver data over a single higher bandwidth virtual channel.

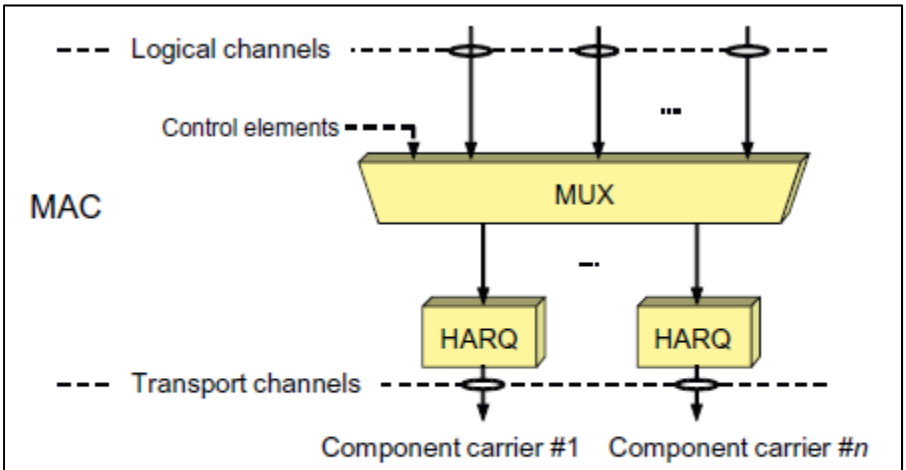
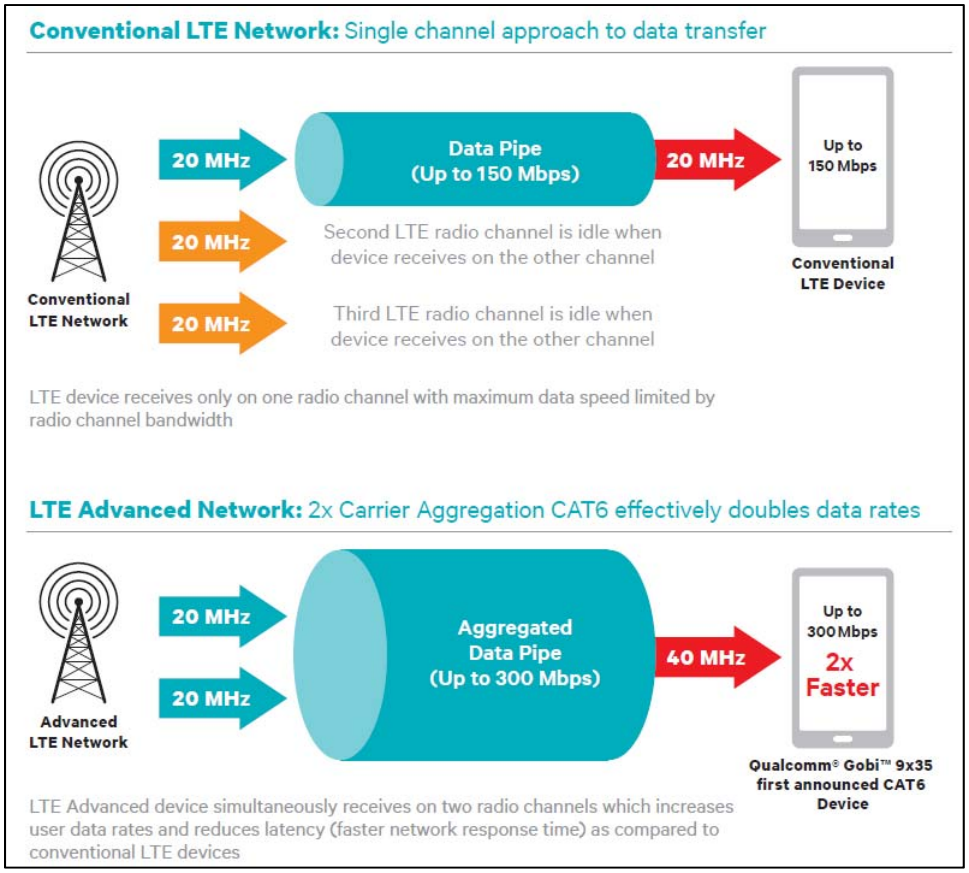


FIGURE 8.10

MAC operation in the case of multiple component carriers.

Ex. 2021 at 27 (highlighting in original).

The diagram below further illustrates the concept of a single virtual channel aggregated from component carriers as it was understood in the industry in 2014. In the illustration, two 20 MHz carrier are aggregated to provide a single data pipe. In other words, the diagram shows that carrier aggregation is more than just two data pipes operating separately and independently on two 20 MHz carriers. Ex. 2024 ¶ 97.



Qualcomm Carrier Aggregation Infographic (2014), Ex. 2022, available at https://www.qualcomm.com/media/documents/files/carrier-aggregation-infographic.pdf.

Accordingly, in view of the intrinsic and extrinsic evidence, the broadest reasonable interpretation of the term "carrier aggregation" is "*simultaneous operation on multiple carriers that are combined as a single virtual channel to provide higher bandwidth*."

2. Petitioner's Proposed Construction Should Be Rejected

Petitioner's proposed construction should be rejected because it is unreasonably broad and because it violates the doctrine of prosecution disclaimer. And, it is not how a skilled artisan understood the term.

a. The Proposed Construction Is Unreasonably Broad

Petitioner proposes the same unreasonably broad construction adopted by the ITC. Petition at 31. In this IPR, the Board, of course, "is not generally bound" by the ALJ's interpretation of this disputed term. *Power Integrations, Inc. v. Lee*, 797 F.3d 1318, 1326 (Fed. Cir. 2015).

In the ITC proceeding, Patent Owner proposed that "carrier aggregation" should mean "simultaneous operation on multiple carriers to increase the bandwidth for a user." Ex. 1336, App. A at 20. Patent Owner continues to maintain that is a correct construction, but seeks to further clarify it here because that construction merely serves to shift the parties' dispute to the meaning of the phrase "increase the bandwidth."

Specifically, Petitioner argues that "receiving data over two 20 MHz carriers *increases bandwidth* to 40 MHz." Petition at 46. As explained above, two 20 MHz carriers operating independently do not provide a single virtual channel with an increased ***aggregated*** bandwidth. Ex. 2024 ¶ 111. The maximum capacity of any one channel remains 20 MHz. *Id*. But by aggregating two 20 MHz carriers as a

single virtual channel, the user device may operate using an aggregated 40 MHz channel that has a combined bandwidth equal to the sum of the bandwidths of the component carriers. *Id*. Petitioner relies solely on unsupported expert testimony for its argument in favor of such an unreasonably broad construction. Petition at 29 (citing Ex. 1302 ¶ 60). But "conclusory, unsupported assertions by experts as to the definition of a claim term are not useful to a court." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1318 (Fed. Cir. 2005).

b. The Doctrine of Prosecution Disclaimer Precludes Petitioner's Proposed Construction

It is well settled that "claims that have been narrowed in order to obtain the issuance of a patent by distinguishing the prior art cannot be sustained to cover that which was previously by limitation eliminated from the patent." *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 33 (1966). In order to overcome the rejection based on Hirose, the applicant amended the claims to limit their scope to an input RF signal "employing carrier aggregation". Ex. 1315 at 2, 5–9. Petitioner's proposed construction violates this doctrine by attempting to recapture disclaimed subject matter.

In the second office action, the examiner rejected the pending claims because Hirose disclosed "the input RF signal comprising transmissions sent on multiple carriers at different frequencies to a wireless device, . . . the input RF signal comprising satellite wave signal and ground wave signal." Ex. 1314 at 4.

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Regarding claim 1, Hirose discloses an apparatus (FIG. 6 digital broadcast receiver) comprising:

a first amplifier stage configured to receive and amplify an input radio frequency (RF) signal and provide a first output RF signal to a first load circuit when the first amplifier stage is enabled (variable gain amplifier 15, corresponding to the claimed first amplifier stage, receiving input RF signal (e.g. satellite wave signal and ground wave signal) and providing an output to intermediate frequency demodulation stage (for ground wave), which corresponds to the claimed first load circuit (see column 5 lines 1-30 and FIG. 6) ;

the input RF signal comprising transmissions sent on multiple carriers at different frequencies to a wireless device, the first output RF signal including at least a first carrier of the multiple carriers (as recited above, the input RF signal comprising satellite wave signal and ground wave signal (column 5 lines 1-4) and the output to intermediate frequency demodulation stage for ground wave, corresponding to the claimed first carrier of the multiple carriers);

Id. (highlighting added).

To overcome this rejection, the applicant amended the pending independent claims to add the "employing carrier aggregation" limitation:

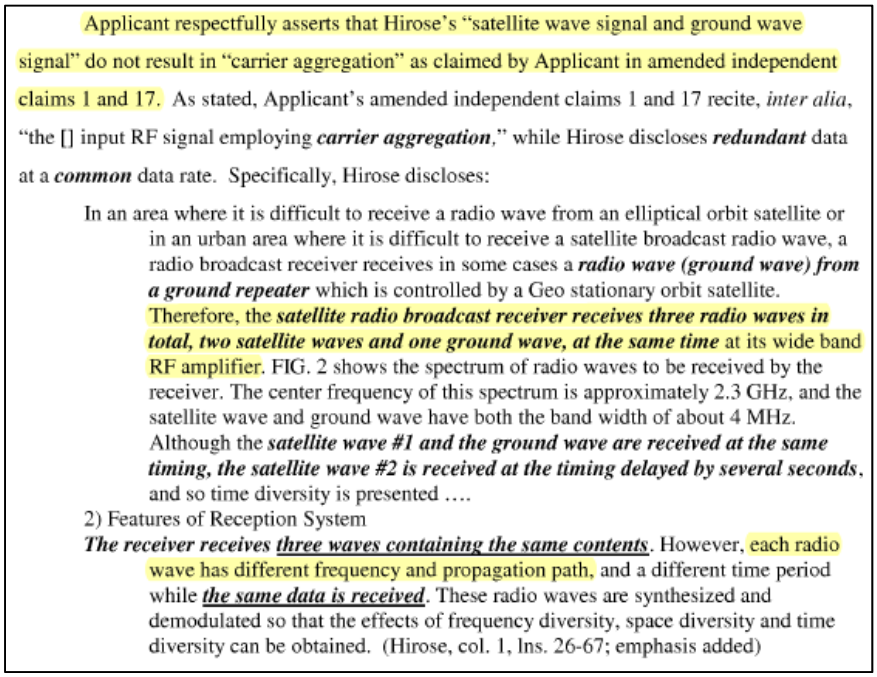
1. (Currently amended) An apparatus comprising:

a first amplifier stage configured to receive and amplify an input radio frequency (RF) signal and provide a first output RF signal to a first load circuit when the first amplifier stage is enabled, the input RF signal employing carrier aggregation comprising transmissions sent on multiple carriers at different frequencies to a wireless device, the first output RF signal including at least a first carrier of the multiple carriers; and

a second amplifier stage configured to receive and amplify the input RF signal and provide a second output RF signal to a second load circuit when the second amplifier stage is enabled, the second output RF signal including at least a second carrier of the multiple carriers different than the first carrier.

Ex. 1315 at 2.

In conjunction with the amendment, the applicant argued that "Hirose's 'satellite wave signal and ground wave signal' do not result in 'carrier aggregation' as claimed by Applicant."



Applicant respectfully asserts that Hirose's "satellite wave signal and ground wave signal" do not result in "carrier aggregation" as claimed by Applicant in amended independent claims 1 and 17. As stated, Applicant's amended independent claims 1 and 17 recite, *inter alia*, "the [] input RF signal employing ***carrier aggregation***," while Hirose discloses ***redundant*** data at a ***common*** data rate. Specifically, Hirose discloses:

> In an area where it is difficult to receive a radio wave from an elliptical orbit satellite or in an urban area where it is difficult to receive a satellite broadcast radio wave, a radio broadcast receiver receives in some cases a ***radio wave (ground wave) from a ground repeater*** which is controlled by a Geo stationary orbit satellite. Therefore, the ***satellite radio broadcast receiver receives three radio waves in total, two satellite waves and one ground wave, at the same time*** at its wide band RF amplifier. FIG. 2 shows the spectrum of radio waves to be received by the receiver. The center frequency of this spectrum is approximately 2.3 GHz, and the satellite wave and ground wave have both the band width of about 4 MHz. Although the ***satellite wave #1 and the ground wave are received at the same timing, the satellite wave #2 is received at the timing delayed by several seconds***, and so time diversity is presented ….
>
> 2) Features of Reception System
>
> ***The receiver receives three waves containing the same contents***. However, each radio wave has different frequency and propagation path, and a different time period while ***the same data is received***. These radio waves are synthesized and demodulated so that the effects of frequency diversity, space diversity and time diversity can be obtained. (Hirose, col. 1, lns. 26-67; emphasis added)

Ex. 1315 at 8 (bold and italics in original, highlighting added).

In sum, this amendment shows that Hirose discloses that "the satellite radio broadcast receiver *receives three radio waves* in total, two satellite waves and one ground wave, *at the same time* at its wide band RF amplifier." *Id*. As the examiner concluded, these radio waves disclose "transmissions sent on multiple carriers." Ex. 1314 at 4 ("the input RF signal comprising transmissions sent on multiple carriers at different frequencies to a wireless deivce"). Thus, Hirose discloses "simultaneous operation on multiple carriers." Ex. 2024 ¶ 113. To distinguish Hirose, the applicant amended the claims to recite "carrier aggregation." Ex. 1315. If the term "carrier

aggregation" simply meant "simultaneous operation on multiple carriers," the amendment would have been ineffective in overcoming Hirose. Ex. 2024 ¶ 113; *Omega Eng'g, Inc, v. Raytek Corp.*, 334 F.3d 1314, 1324 (Fed. Cir. 2003) ("[W]here the patentee has unequivocally disavowed a certain meaning to obtain his patent, the doctrine of prosecution disclaimer attaches and narrows the ordinary meaning of the claim congruent with the scope of the surrender.").

In addition, construing the term to mean "simultaneous operation on multiple carriers" also fails to recognize the applicant's argument to distinguish Hirose's "redundant data at a common data rate" on multiple carriers. Ex. 1315. Petitioner's proposed construction would permit the claims to read on multiple carriers that transmit "redundant data at a common data rate." Ex. 2024 ¶ 117.

Thus, "carrier aggregation" cannot have the meaning Petitioner proposes. It would be improper to construe the term so broadly that the limitation once again reads on Hirose. *Rheox, Inc. v. Entact*, Inc., 276 F.3d 1319, 1325 (Fed. Cir. 2002) ("Explicit arguments made during prosecution to overcome prior art can lead to narrow claim interpretations.").

c. Petitioner's Proposed Construction Is Not Indicative Of How A Skilled Artisan Understood The Term

According to Petitioner's expert, Petitioner's proposed construction "is consistent with" how a skilled artisan would understand the term carrier aggregation. Petition at 29. But that opinion is flawed because it is based solely on the patent

specification. Ex. 2014 at 59:17–60:13 ("That is how the '356 Patent describes it explicitly. . . . My understanding is that in a patent, when -- the author is free to define their own terms, be their own lexicographer, and they have clearly defined the term in the specification."); 61:5–25 ("These citations show me that the author of the '356 Patent meant simultaneous operation on multiple carriers through their definitions. And a person of ordinary skill in the art would also understand it's consistent with a person of ordinary skill of the art's understanding of carrier aggregation. *Those are the bases***.**"). Petitioner's expert failed to recognize that "a skilled artisan reads a claim term . . . in the context of the entire patent, including the written description and prosecution history, as well as relevant extrinsic evidence." *Howmedica Osteonics Corp. v. Zimmer, Inc.*, 822 F.3d 1312, 1320–21 (Fed. Cir. 2016). As explained above, both the prosecution history and the extrinsic evidence are highly relevant to the meaning of the term carrier aggregation. As a result of failing to consider at least the prosecution history, which included an amendment to add the term as a limitation to overcome a prior art rejection, Petitioner's expert testimony as to the understanding of a skilled artisan should be disregarded. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1318 (Fed. Cir. 2005) ("[A] court should discount any expert testimony that is clearly at odds with . . . the written record of the patent.").

Petitioner's proposed construction is also incorrect because it reads out the word "aggregation." The proposed construction fails to impart any meaning to the

word aggregation, e.g., what is aggregated, why is it aggregated, how is it aggregated, etc. Aggregate means "to collect together, assemble." Ex. 2025 at 4. As explained above, it is the component carriers that are aggregated into a single virtual channel to provide higher bandwidth. Ex. 2024 ¶ 118. A proper construction must reflect that "aggregation" is an essential characteristic of carrier aggregation. Furthermore, a person of ordinary skill in the art would have understood that "carrier aggregation" is not equivalent to any "simultaneous operation on multiple carriers." *Id*. Instead, a person of ordinary skill in the art would have recognized "carrier aggregation" as a term of art in the context of the '356 patent specification and file history. *Id*.

Petitioner's proposed construction also adds little, if any, additional meaning beyond the surrounding claim language. The claim recites "multiple carriers" in the same phrase that the term "carrier aggregation" appears: "the input RF signal employing carrier aggregation comprising transmission sent on multiple carriers . . ." Substituting Petitioner's proposed construction would result in a claim that recited "the input RF signal employing *simultaneous operation on multiple carriers* comprising transmissions sent on multiple carriers." In fact, if "carrier aggregation" were equivalent to multiple carrier operation, the applicant would have had no reason to separately distinguish terms such as "multiple bands" and "multiple radio technologies," which also implicate multiple carrier operation. Ex. 1301 at 3:43–49; Ex. 2024 ¶ 119.

Accordingly, for the reasons explained above, the Board should reject Petitioner's proposed construction.

V. OVERVIEW OF THE CITED REFERENCES

A. U.S. Patent Pub. No. 2012/0056681 ("Lee")

Lee proposes an apparatus in which "a low-noise amplifier (LNA) of the multi-radio device can be configured to commonly amplify a plurality of radio-frequency signals . . . such as the Bluetooth connection and the WiFi connection" to "reduce the hardware cost and the chip size of the multi-radio device." Ex. 1335 at [0002]. At the time of Lee's invention, both WiFi and Bluetooth used only the 2.4 GHz "ISM" (Industrial-Scientific-Medical) band. Ex. 2024 ¶ 123.

Lee describes "signal amplification circuits," each of which includes one or more "input stages" for receiving a signal, one or more "output stages" coupled to one or more output ports, and one or more "selecting stages" for coupling input and output stages.

During prosecution of the '356 Patent, Qualcomm submitted an Information Disclosure Statement (IDS) listing Lee. Ex. 2004 at 3. The Examiner subsequently considered Lee and signed and dated the IDS. *Id*. at 3, 5.

Not only did the Examiner consider the Lee reference, the Examiner also considered an International Search Report and Written Opinion of the International Searching Authority that provided a detailed discussion of how Lee allegedly reads

on the claims. Ex. 2005. The Lee reference was one of only four references cited in the ISR and Written Opinion – far from being buried in a stack of references listed on an IDS. The Examiner considered these documents and initialed, signed, and dated the IDS. Ex. 2004 at 5. In allowing the claims of the '356 Patent, the Examiner thus considered Lee as well as the ISR and Written Opinion discussing Lee.

B. 3GPP TR 36.912 V9.1.0 (2009-12) ("the Feasibility Study")

The Feasibility Study is a Technical Report (TR) on Further Advancements for Evolved Universal Terrestrial Radio Access (E-UTRA) (LTE-Advanced) by the 3rd Generation Partnership Project ("3GPP"). Ex. 1304.

"At the 3GPP TSG RAN #39 meeting, the Study Item description on 'Further Advancements for E-UTRA (LTE-Advanced)' was approved. The study item covers technology components to be considered for the evolution of E-UTRA, e.g. to fulfil the requirements on IMT-Advanced." *Id*. at 8.

"This document [was] intended to gather all technical outcome[s] of the study item, and draw a conclusion on [the] way forward. In addition this document includes the results of the work supporting the 3GPP submission of "*LTE Release 10 & beyond (LTE-Advanced*" to the ITU-R as a candidate technology for the IMT-Advanced." *Id*. at 7.

VI. GROUND 1: LEE DOES NOT ANTICIPATE CLAIMS 1, 7, 8, 11, 17, OR 18

Ground 1 is deficient because the petition fails to show that Lee discloses the "carrier aggregation" limitation of independent claims 1 and 17. For at least this reason, dependent claims 7, 8, 11, and 18 also fail to be anticipated.

A. Claim 1

Claim 1 recites a first amplifier stage configured to receive and amplify an "input RF signal employing carrier aggregation." Lee fails to disclose this limitation. Petitioner incorrectly asserts that Lee's "VIN" signal comprises "a Bluetooth and a WiFi signal" that teach "the input RF signal employing carrier aggregation." Petition at 45–46.

Lee never describes the VIN signal as "employing carrier aggregation." Ex. 2024 ¶¶ 138–39. Instead, Lee consistently refers to two separate and distinct input signals "(e.g., a Bluetooth signal and a WiFi signal) received by a single antenna." Ex. 1335 at [0017]. The two input signals emanate from separate and distinct "wireless connections." *Id*. at [0002]. Lee fails to disclose that the signals or connections are "aggregated." Ex. 2024 ¶ 139. Petitioner cites no evidence to the contrary. *Id*.

Petitioner attempts to overcome this deficiency in Lee's disclosure by proposing an unreasonably broad construction of the term "carrier aggregation." As explained above however, "carrier aggregation" means more than just "simultaneous

operation on multiple carriers." Ex. 2024 ¶ 140. The mere presence of both a Bluetooth signal and a WiFi signal cannot establish "carrier aggregation" without evidence of anything being aggregated. *Id*. Standing alone, the disclosure of two unrelated carrier signals is not evidence of an "aggregation" because it ignores the meaning of the word "aggregation." *Id*. And the amendment during prosecution to add the term "carrier aggregation" to result in an "increased aggregated rate" confirms that Lee does not disclose an "input RF signal employing carrier aggregation." *Id*.; Ex. 1315.

Petitioner argues in the alternative that Lee's Bluetooth signal and WiFi signal "increases bandwidth." Petition at 46–47. According to Petitioner's expert, "receiving data over two 20 MHz carriers increases bandwidth to 40 MHz." *Id*. From this premise, Petitioner's expert concludes that "Lee therefore teaches carrier aggregation." *Id*. But Petitioner's expert cites no evidence or authority to support that opinion. *See id.* (citing Ex. 1302 ¶ 81); *see also, e.g., ActiveVideo Networks, Inc. v. Verizon Commc'ns, Inc.*, 694 F.3d 1312, 1327 (Fed. Cir. 2012) (rejecting expert testimony that "was conclusory and factually unsupported"). Nor does Petitioner's expert argue that Lee's Bluetooth and WiFi connections are combined (aggregated) as a single virtual channel. Petition at 46–49; *see also* Ex. 2024 ¶¶ 141–42. Petitioner's expert argues, again without citing any evidence, that "Lee uses

multiple carriers to send different data." Petition at 49 (citing Ex. 1302 ¶ 83).[4] Even so, "different data" does not establish that the input signal employs carrier aggregation. Ex. 2024 ¶ 143.

Petitioner fails to cite any examples of skilled artisans aggregating WiFi and Bluetooth signals. This is likely because it would not have been useful to do so. Ex. 2024 ¶ 144. At the time of the invention of the '356 Patent, WiFi, which was developed for wireless computer networking, supported channels of up to 40 MHz bandwidth. *Id*. Bluetooth, which was originally developed for wireless headsets, supported channels of just 1 MHz bandwidth. *Id*. Applying Petitioner's reasoning, an aggregated WiFi and Bluetooth signal would result in increasing bandwidth from 40 MHz to 41 MHz. *Id*. We are left to assume that Petitioner did not identify such examples (if any even existed) because the benefit of such an aggregation would have been insignificant. *Id*.

At the time of the invention of the '356 patent, a person of ordinary skill would not have understood Lee to disclose a VIN signal "employing carrier aggregation." Ex. 2024 ¶ 145. Accordingly, Lee fails to anticipate claim 1 and each of its dependent claims.

[4] Petitioner's expert concedes that "[t]here is no indication in Lee that the data transmitted by the Wi-Fi signal and the data transmitted by the Bluetooth signal are redundant" and also that "Lee does not expressly disclose" that the data transmitted in the Wi-Fi signal and the data transmitted by the Bluetooth signal are different. Ex. 2014 at 65:6–21.

B. Claim 7

As explained above, Lee fails to disclose "the input RF signal employing carrier aggregation" limitation of claim 1. Because claim 7 depends from claim 1, Lee fails to anticipate claim 7 for the same reason.

Lee also fails to anticipate claim 7 for an additional reason. Lee fails to disclose each of the elements of claim 7 "arranged as in the claim." *Microsoft Corp. v. Biscotti, Inc.*, 878 F.3d 1052, 1068 (Fed. Cir. 2017). Whereas Petitioner relies on circuit 200 in Lee's Figure 2 for claim 1, Petitioner switches to the embodiment disclosed as circuit 400 in Figure 4 for claim 7. Petition at 56. But even within the framework of circuit 400, Petitioner improperly mixes different embodiments to set forth its anticipation case. Ex. 2024 ¶ 147. For some limitations, Petitioner alleges the anticipating circuit operates in a "shared mode"; for other limitations the anticipating circuit operates in a "combo mode." *Id*. Lee does not disclose circuit 400 operating in both modes in a single embodiment. *Id*. Therefore, Lee fails to anticipate because "anticipation is not proven by multiple, distinct teachings that the artisan might somehow combine to achieve the claimed invention." *Microsoft*, 878 F.3d at 1069.

1. "a first amplifier stage configured to be independently enabled or disabled"

Petitioner argues that the "transistor M'_1 and output stage 304_1" of circuit 400 in Figure 4 are "configured to be independently enabled or disabled." Petition

at 56–57 (citing Lee ¶ 37 (describing circuit 300)). In paragraph 36, Lee explains that, in a "shared mode," the "output stages 304_1-304_N are enabled in a time-division manner." Ex. 1335 ¶ 36. When output stage 304_1 is enabled, output stage 304_N is disabled. *Id*.; Ex. 2024 ¶ 148. When output stage 304_1 is disabled, output stage 304_N is enabled. Ex. 1335 ¶ 36; Ex. 2024 ¶ 148; *see also* ¶ 37 ("If the *output stages 304_1 and 304_N are enabled alternately under the mode*, the signal amplification circuit 300 refers to the input signal VIN to generate the processed signal VOUT_1 for WiFi connection and the other processed signal VOUT_N for Bluetooth connection alternately."). Thus, Lee fails to disclose that output stage 304_1 is enabled or disabled independent of output stage 304_N. Ex. 2024 ¶ 148.

Petitioner further argues in the same paragraph that "circuit 400 may also operate in combo mode." Petition at 57 (citing Ex. 1335 ¶¶ 41, 42, 33). But that "alternative design" refers to a different embodiment than the "shared mode" described above in the context of circuit 300. Ex. 1335 ¶¶ 36–37; Ex. 2024 ¶ 149. Lee fails to disclose circuits that simultaneous embody both a time-division "shared mode" and a "combo mode." Ex. 2024 ¶ 149. Thus, Lee fails to anticipate claim 7.

2. "the first amplifier stage further configured to receive and amplify an input radio frequency (RF) signal and provide a first output RF signal to a first load circuit when the first amplifier stage is enabled"

Petitioner contends this limitation is satisfied by an embodiment where the output stages are enabled in a time-division manner as discussed above. Petition at

57–58 (citing Ex. 1335 ¶ 37 ("the output stages 304_1 and 304_N are enabled alternately"). But, as explained above, circuit 400 cannot be "independently enabled or disabled" in a "shared mode." Ex. 2024 ¶ 150. To the extent that the limitation above is satisfied by the "combo mode," which is a different embodiment, circuit 400 could not also operate in a "time-division" "shared mode." *Id*. Thus, Lee fails to anticipate claim 7.

3. "the input RF signal employing carrier aggregation comprising transmissions sent on multiple carriers at different frequencies to a wireless device"

Lee fails to disclose "the input RF signal employing carrier aggregation" for the same reasons explained above with respect to claim 1. Ex. 2024 ¶ 151. Thus, Lee fails to anticipate claim 7.

4. "a second amplifier stage configured to be independently enabled or disabled"

Petitioner argues that the "transistor M'_N and output stage 304_N" of circuit 400 in Figure 4 are "configured to be independently enabled or disabled." Petition at 58–59. Petitioner's argument fails for the same reasons explained above with respect to the first amplifier stage. Ex. 2024 ¶ 152. Thus, Lee fails to anticipate claim 7.

5. "the second amplifier stage further configured to receive and amplify the input RF signal and provide a second output RF signal to a second load circuit when the second amplifier stage is enabled"

Petitioner contends this limitation is satisfied by an embodiment where the output stages are enabled in a time-division "shared mode" as discussed above. Petition at 59–60 (citing Ex. 1335 ¶ 37 ("the output stages 304_1 and 304_N are enabled alternately"). The Petitioner's argument fails for the same reasons explained above with respect to the first amplifier stage. Ex. 2024 ¶ 153. Thus, Lee fails to anticipate claim 7.

* * * *

For the reasons stated above, Lee fails to anticipate claims 1 and 7. Lee fails to anticipate dependent claims 8, 11, 17, and 18 for the same reasons.

VII. GROUND 2: LEE DOES NOT RENDER OBVIOUS CLAIMS 7 OR 8

Recognizing that claims 7 and 8 are not anticipated by Lee, Petitioner includes Ground 2 as an obviousness challenge based on a combination of different embodiments disclosed by Lee. As explained above, Lee fails to disclose "the input RF signal employing carrier aggregation." For at least this reason, Lee does not render obvious claims 7 or 8.

As an additional reason supporting the patentability of claims 7 and 8, Petitioner fails to sufficiently articulate why a skilled artisan would have been motivated to combine Lee's embodiments. *In re Stepan Co.*, 868 F.3d 1342, 1346 (Fed. Cir. 2017) ("Whether a rejection is based on combining disclosures from multiple references, combining multiple embodiments from a single reference, or

selecting from large lists of elements in a single reference, there must be a motivation to make the combination and a reasonable expectation that such a combination would be successful, otherwise a skilled artisan would not arrive at the claimed combination.").

Petitioner's stated motivation to combine is conclusory. Petitioner disparages Lee's circuit 200 of Figure 2 as a "circuit ready for improvement" that needs "improved input matching performance." Petition at 71. Yet, the embodiment of Figure 2 already includes "matching network 210" in order to "meet the impedance matching requirements." Ex. 1335 ¶ 26; Ex. 2024 ¶ 156. Petitioner fails to sufficiently explain why Lee included a "matching network 210" that needed "improvement." If it was obvious that "matching network 210" needed improvement, as Petitioner argues, then that begs the question as to why Lee did not simply include the "feedback circuit" of Figure 4 in circuit 200 of Figure 2 as the combination Petitioner proposes. Ex. 2024 ¶ 156. Petitioner's stated reason is that "input matching performance can be improved greatly." Petition at 70. But, Petitioner's conclusory assertions lack sufficient support and lead to hindsight bias. Ex. 2024 ¶ 156.

For the reasons stated above, Lee fails to render obvious claims 7 and 8.

VIII. GROUND 3: LEE AND THE FEASIBILITY STUDY DO NOT RENDER OBVIOUS CLAIMS 1, 7, 8, 11, 17, OR 18

Petitioner argues that claims 1, 7, 8, 11, 17, and 18 are obvious over Lee and the Feasibility Study. As explained above, Lee fails to disclose "the input RF signal employing carrier aggregation" limitation of claims 1 and 17.

The Petition, however, fails to sufficiently articulate a motivation to combine these two disparate references. In fact, a skilled artisan would not have had a reason to select these two references which are not directed to the problems addressed by the claimed invention. Ex. 2024 ¶ 158.

Lee is directed to a "signal amplification circuit" having an input signal that is "shared between different radio connections, such as" Bluetooth and WiFi. Ex. 1335 at [0002]; Ex. 2024 ¶ 159. Lee does not disclose that its circuit may be shared between the same type of radio connections, such as LTE. Ex. 2024 ¶ 159. Nor does Lee disclose carrier aggregation. *Id*.

The Feasibility Study is directed to "Further Advancements" for LTE-Advanced, an industry standard for mobile communications. Ex. 1304; Ex. 2024 ¶ 160. According to the Feasibility Study, LTE-Advanced offers "support for *Carrier Aggregation*, where two or more [LTE] *component carriers* are aggregated." Ex. 1304 ¶ 5.1 (italics in original). Yet the Feasibility Study does not even disclose an amplifier circuit. Ex. 2024 ¶ 161. Moreover, Petitioner's expert admits that the

Feasibility Study does not relate to Wi-Fi or Bluetooth operation. Ex. 2014 at 57:10–22.

A. Petitioner Fails To Establish That The Feasibility Study Is Analogous Art

"A reference qualifies as prior art for an obviousness determination under § 103 only when it is analogous to the claimed invention." *In re Klein*, 647 F.3d 1343, 1348 (Fed. Cir. 2011). "Two separate tests define the scope of analogous prior art: (1) whether the art is from the same field of endeavor, regardless of the problem addressed and, (2) if the reference is not within the field of the inventor's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved." *Id*. It is not readily apparent that the Feasibility Study, which fails to disclose an amplifier circuit (or any other circuit for that matter), is from the same field of endeavor or is reasonably pertinent to the problem addressed by the '356 Patent. Petitioner sets forth no evidence to establish that either test is satisfied. Accordingly, the Board should reject the Feasibility Study as non-analogous art.

B. Petitioner Fails To Sufficiently Articulate A Motivation To Combine

Petitioner fails to sufficiently articulate why a skilled artisan would have been motivated to combine these two distinctly different references. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007) ("[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.").

Petitioner fails to explain why a skilled artisan would combine Lee, which is directed to "*different kinds of radio connections*," Ex. 1335 at [0002] and the Feasibility Study, which is directed to the *same type of radio connections* (e.g., LTE), Ex. 1304 ¶ 5.1. Ex. 2024 ¶ 163. Petitioner also fails to explain why a skilled artisan would combine Lee, which is directed to Bluetooth and WiFi, and the Feasibility Study, which is directed to LTE cellular communications. Ex. 2024 ¶ 163. Petitioner also fails to explain why a skilled artisan would combine Lee, which does not disclose carrier aggregation, and the Feasibility Study, which does not even disclose an amplifier circuit. *Id*. The Federal Circuit has emphasized that "[a] reason for combining disparate prior art references is a critical component of an obviousness analysis." *InTouch Techs., Inc. v. VGO Commc'ns, Inc.*, 751 F.3d 1327, 1351 (Fed. Cir. 2014). But "[w]ithout any explanation [from Petitioner] as to how or *why* the references would be combined to arrive at the claimed invention, we are left with only hindsight bias that *KSR* warns against." *Metalcraft of Mayville, Inc. v. The Toro Co.*, 848 F.3d 1358, 1367 (Fed. Cir. 2017).

According to Petitioner, the "motivation to combine Lee with the teachings of the Feasibility Study *arises from the references themselves*." Petition at 74. To support this argument, Petitioner relies in particular on a statement in the Feasibility

Study that, for certain aggregation scenarios, a receiver "would have multiple RF front-ends." *Id*. at 73 (citing Ex. 1304 at 26 ("separate RF front end[s] are necessary")). Petitioner's rhetoric is misplaced. Indicating that "separate RF front end[s] are necessary" is nothing more than the statement of a problem. Ex. 2024 ¶ 164. That is an insufficient motivation to combine because "knowledge of a problem and motivation to solve it are entirely different from motivation to combine particular references." *Metalcraft*, 848 F.3d at 1367.

Petitioner also asserts that a person of ordinary skill would have been motivated to combine the references "to use the input RF signal employing carrier aggregation of the Feasibility Study with the amplification blocks of Lee in order to *achieve the[ ] benefits* [of carrier aggregation] and *unlock the features* of LTE-Advanced." Petition at 74. But this testimony from Petitioner's expert "is generic and bears no relation to any specific combination of prior art elements. It also fails to explain *why* a person of ordinary skill in the art would have combined elements from specific references in the way the claimed invention does." *ActiveVideo Networks, Inc. v. Verizon Commc'ns, Inc.*, 694 F.3d 1312, 1328 (Fed. Cir. 2012). A person of ordinary skill would not have been motivated to combine the Feasibility Study, which relates to mobile communications in a large range of frequency bands, with Lee, which relates to two independent communication protocols operating in the same frequency band. Ex. 2024 ¶¶ 165, 173–75.

C. A Person Of Ordinary Skill Would Not Have Been Motivated To Select And Combine Lee And The Feasibility Study

"Too often the obviousness analysis is framed as an inquiry into whether a person of skill, with two (and only two) references sitting on the table in front of him, would have been motivated to combine . . . the references in a way that renders the claimed invention obvious." *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1337 (Fed. Cir. 2016). "The real question is whether [a] skilled artisan would have plucked one reference out of the sea of prior art" to combine with the other "to address some need present in the field." *Id*. Petitioner fails to establish that a skilled artisan would have been motivated to select these two references. *Eli Lilly & Co. v. Zenith Goldline Pharm., Inc.*, 471 F.3d 1369, 1379 (Fed. Cir. 2006) ("[T]he law requires *a motivation to select the references* and to combine them in the particular claimed manner to reach the claimed invention.").

Faced with the problems addressed by the claimed invention, a person of ordinary skill would not have selected either Lee or the Feasibility Study from the sea of prior art.[5] Ex. 2024 ¶¶ 164–65. These two references are simply too far afield from the technology addressed by the '356 Patent. Ex. 2024 ¶¶ 167–69. Petitioner's assertion that Lee "teaches the exact type of receiver" (Petition at 73–74) recognized

[5] For example, Google Patents identified "About 24,933 results" in response to a search for "low noise amplifiers" prior art having a priority date before May 25, 2012. Ex. 2023; Ex. 2024 ¶ 164.

by the Feasibility Study is incorrect. Ex. 2024 ¶ 172. According to Petitioner, the Feasibility Study identifies a "mixer, AGC [Automatic Gain Control], ADC [Analog to Digital Conversion" as components of an "RF front end. Petition at 73–74 (citing Ex. 1304 at 26). However, Lee teaches an amplifier circuit. Automatic Gain Control is not an amplifier; it is a feature that an amplifier may be designed to include. Ex. 2024 ¶ 172. Thus, Lee does not teach the mixer, AGC, or ADC identified in the Feasibility Study. *Id*.

The '356 Patent is directed to a circuit with two amplifier stages that separately amplify an input RF signal employing carrier aggregation. Ex. 2024 ¶ 167. The specification discloses, for example, an input RF signal aggregated with up to five LTE carriers from 35 different frequency bands. Ex. 1301 at 2:63–67; Ex. 2024 ¶ 167.

In contrast, Lee is directed to signals from "different radio connections," WiFi and Bluetooth. Ex. 1335 at [0002]. Lee does not disclose a signal employing "carrier aggregation." Ex. 2024 ¶ 168. And at the time, WiFi and Bluetooth signals were transmitted in the same frequency band (2.4 GHz "ISM" (Industrial-Scientific-Medical)). *Id*. Lee would not have been selected to address a need for an amplifier for input signals carrying aggregated LTE carriers from among a plurality of frequency bands. *Id*. This is because WiFi and Bluetooth are wireless communication standards that are unrelated to LTE. *Id*.; Ex. 2014 at 55:15–18,

55:24–56:3, 57:10–22. Bluetooth was developed for use in ultra-low power, low data rate personal area communications; WiFi was developed for low power, local area communications; and, LTE was developed for use in high power, wide area, mobile communications. Ex. 2024 ¶ 168. Furthermore, WiFi and Bluetooth transmit signals in different frequency bands than LTE. *Id*. And Lee described input signals from "different" radio connections, whereas the '356 Patent discloses embodiments where input signals are aggregated from the same type of radio connections. *Id*. A person of ordinary skill in the art would have had no reason to select Lee to design an amplifier for LTE carrier aggregation applications. *Id*.

The Feasibility Study is directed to LTE-Advanced, a cellular communication technology. Ex. 2024 ¶ 169. But it does not even disclose an amplifier circuit, which is the subject of the claimed invention. *Id*.; *see* Ex. 1301 at 20:43-61 (claiming "a first amplifier stage" and "a second amplifier stage"). Nor does it disclose key limitations of the claimed invention, such as "amplifier stage[s]" that are "independently enabled or disabled." Ex. 2024 ¶ 169. Indeed, Petitioner contends that the only element of the challenged claims that the Feasibility Study discloses is "carrier aggregation." Petition at 72. A person of ordinary skill in the art would have had no reason to select the Feasibility Study to design an amplifier for carrier aggregation. Ex. 2024 ¶ 169–71.

* * * *

It is well established that a patent "is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007). As explained above, Petitioner fails to sufficiently articulate why a skilled artisan would have been motivated to combine Lee and the Feasibility Study, which are distinctly different references. Ex. 2024 ¶¶ 173–75. And, as also explained above, a skilled artisan would not have even had reason to select these references for a combination that would allegedly render the claims obvious. *Id*. ¶ 176. Given the teachings of these references, a person of ordinary skill in the art would not have been motivated to select and combine them with a reasonable expectation of success. *Id*. ¶¶ 173–76.

Accordingly, Petitioner has not shown that the claims are obvious over these two references.

IX. CONCLUSION

The Board should reject Petitioner's alleged grounds of invalidity and hold that claims 1, 7, 8, 11, 17, and 18 are not unpatentable.

Respectfully submitted,

Date: August 21, 2019

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TABLE OF EXHIBITS

Exhibit	Description
2013	U.S. Patent No. 9,161,254
2014	Transcript of the Deposition of Patrick Fay, Ph.D.
2015	'356 Patent File History – List of References Considered By Examiner
2016	'356 Patent File History – Foreign Reference WO 2012/008705
2017	'356 Patent File History – Foreign Reference GB 2472978
2018	U.S. Pat. No. 10,044,613
2019	Qualcomm Inc., STRATEGIES TO WIN IN LTE AND EVOLVE TO LTE ADVANCED (2013)
2020	U.S. Pat. Pub. No. 2013/0217398
2021	ERIK DAHLMAN ET AL., 4G LTE/LTE-ADVANCED FOR MOBILE BROADBAND (Academic Press 2011) (excerpted)
2022	Qualcomm Carrier Aggregation Infographic (2014)
2023	Google Patents search results for "low noise amplifiers" prior art having a priority date before May 25, 2012
2024	Declaration of Daniel Foty, Ph.D.
2025	THE OXFORD ENGLISH DICTIONARY (Oxford University Press) (2d ed. 1989) (excerpted)
2026	3GPP TS 36.101 V11.0.0, 3RD GENERATION PARTNERSHIP PROJECT; TECHNICAL SPECIFICATION GROUP RADIO ACCESS NETWORK; EVOLVED UNIVERSAL TERRESTRIAL RADIO ACCESS (E-UTRA); USER EQUIPMENT (UE) RADIO TRANSMISSION AND RECEPTION (RELEASE 11), MARCH 2012 (excerpted)

CERTIFICATE OF COMPLIANCE

I, the undersigned, certify that the above Patent Owner Preliminary Response complies with the applicable type-volume limitations of 37 C.F.R. § 42.24 (b)(1). This Preliminary Response contains 9,729 words, as counted by the word count function of Microsoft Word. This is less than the limit of 14,000 words as specified by 37 C.F.R. § 42.24(a)(i).

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that a copy of the foregoing **Patent Owner Response To Petition For *Inter Partes* Review Pursuant To 37 C.F.R. § 42.220** and supporting exhibits was served on August 21, 2019 by email at the following address of record:

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