Filed on behalf of Intel Corporation
By: David L. Cavanaugh, Reg. No. 36,476
John V. Hobgood, Reg. No. 61,540
Benjamin S. Fernandez, Reg. No. 55,172
Gregory H. Lantier, *pro hac vice*
Wilmer Cutler Pickering Hale and Dorr LLP
1875 Pennsylvania Ave., NW
Washington, DC 20006
Tel: (202) 663-6000
Email: David.Cavanaugh@wilmerhale.com
John.Hobgood@wilmerhale.com
Ben.Fernandez@wilmerhale.com
Gregory.Lantier@wilmerhale.com

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INTEL CORPORATION,
Petitioner,

v.

QUALCOMM INCORPORATED,
Patent Owner.

Case IPR2019-00048
U.S. Patent No. 9,154,356

PETITIONER'S NOTICE OF APPEAL

Pursuant to 35 U.S.C. §§ 141-144 and 319, and 37 C.F.R. § 90.2-90.3, notice is hereby given that Petitioner Intel Corporation appeals to the U.S. Court of Appeals for the Federal Circuit from the Final Written Decision entered July 8, 2020 (Paper 36) in IPR2019-00048, attached as Exhibit A, and all prior and interlocutory rulings related thereto or subsumed therein.

In accordance with 37 C.F.R. § 90.2(a)(3)(ii), Petitioner indicates that the issues for appeal include the holding that claims 1, 9, 10, 17, and 18 of U.S. Patent 9,154,356 are not unpatentable, as well as any finding or determination supporting or related to these issues, including the findings as to reasons for combining prior art references. Additionally, Petitioner identifies claim construction as an issue for appeal, including the construction of "carrier aggregation."

Pursuant to 37 C.F.R. § 90.3, this Notice of Appeal is timely, having been duly filed within 63 days after the date of the Final Written Decision.

A copy of this Notice of Appeal is being filed simultaneously with the Patent Trial and Appeal Board, the Clerk's Office for the United States Court of Appeals for the Federal Circuit, and the Director of the U.S. Patent and Trademark Office.

Dated: September 4, 2020

Respectfully submitted,

/Benjamin S. Fernandez/

Benjamin S. Fernandez, Reg. No. 55,172

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 90.2(a)(1) and 104.2(a), I hereby certify that, in addition to being filed electronically through the Patent Trial and Appeal Board's End to End (PTAB E2E) system, a true and correct original version of the foregoing PETITIONER'S NOTICE OF APPEAL is being filed by Priority Mail Express on this 4th day of September, 2020, with the Director of the United States Patent and Trademark Office, at the following address:

Office of the General Counsel
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

Pursuant to 37 C.F.R. § 90.2(a)(2) and Federal Circuit Rule 15(a)(1), and Rule 52(a),(e), I hereby certify that a true and correct copy of the foregoing PETITIONER'S NOTICE OF APPEAL is being filed in the United States Court of Appeals for the Federal Circuit using the Court's CM/ECF filing system on this 4th day of September, 2020, and the filing fee is being paid electronically using pay.gov.

I hereby certify that on September 4, 2020, I caused a true and correct copy of the PETITIONER'S NOTICE OF APPEAL to be served via electronic mail, as previously agreed by the parties, on the following counsel for Patent Owner:

David B. Cochran (dcochran@jonesday.com)

Matthew W. Johnson (mwjohnson@jonesday.com)

Joseph M. Sauer (jmsauer@jonesday.com)

Joshua R. Nightingale (jrnightingale@jonesday.com)

David M. Maiorana (dmaiorana@jonesday.com)

Thomas W. Ritchie (twritchie@jonesday.com)

William E. Devitt (wdevitt@jonesday.com)

/Benjamin S. Fernandez/
Benjamin S. Fernandez
Registration No. 55,172

EXHIBIT A

Trials@uspto.gov
571-272-7822

Paper 36
Date: July 8, 2020

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INTEL CORPORATION,
Petitioner

v.

QUALCOMM INCORPORATED,
Patent Owner.

IPR2019-00048
Patent 9,154,356 B2

Before MICHELLE N. WORMMEESTER, SCOTT B. HOWARD, and AARON W. MOORE, *Administrative Patent Judges*.

MOORE, *Administrative Patent Judge*.

JUDGMENT
FINAL WRITTEN DECISION
No Challenged Claims Unpatentable
35 U.S.C. § 318(a)

TABLE OF CONTENTS

I. INTRODUCTION

A. Background

Intel Corporation ("Petitioner") filed a Petition for *inter partes* review of claims 1, 9, 10, 17, and 18 of U.S. Patent No. 9,154,356 B2 (Ex. 1101, "the '356 patent"). Paper 3 ("Pet."). Qualcomm Incorporated ("Patent Owner") filed a Preliminary Response. Paper 7.

On July 10, 2019, we instituted an *inter partes* review of claims 1, 9, 10, 17, and 18. Paper 8 ("Inst. Dec."), 20. Patent Owner then filed a Patent Owner Response (Paper 12, "PO Resp."), Petitioner filed a Reply (Paper 19, "Pet. Reply"), and Patent Owner filed a Sur-Reply (Paper 23, "PO Sur-Reply"). An oral hearing was held on April 7, 2019, and a transcript of the hearing is included in the record. Paper 30 ("Tr.").

The Board has jurisdiction under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73.

For the reasons that follow, we determine that Petitioner has *not* shown by a preponderance of the evidence that claims 1, 9, 10, 17, and 18 of the '356 patent were unpatentable.

B. Related Matters

Petitioner filed two petitions, IPR2019-00128 and IPR2019-00129, seeking *inter partes* review of claims 1–8, 10, 11, 17, and 18 of the '356 patent based on prior art different than that presented in this petition. On May 27, 2020 we issued Final Written Decisions in those cases, determining that Petitioner had not shown that any claims were unpatentable.

Petitioner filed another petition, IPR2019-00047, seeking *inter partes* review of claims 1, 7, 8, 10, 11, 17, and 18 of the '356 patent based on prior

art different than that presented in this petition and the ’128 and ’129 petitions, and concurrently filed another petition, IPR2019-00049, seeking *inter partes* review of claims 2–8 and 11 of the ’356 patent based on the same prior art presented in this petition.

The Petition states that Patent Owner “has asserted the ’356 patent against Apple in *Certain Mobile Electronic Devices and Radio Frequency and Processing Components Thereof*, Investigation No. 337-ITC-1093, currently pending before the International Trade Commission” and “also has asserted the ’356 patent against Apple in another currently pending case, *Qualcomm Inc. v. Apple Inc*., No. 3:17-cv-02398 (S.D. Cal.).” Pet. 1. In updated mandatory notices filed on October 7, 2019, Petitioner advised the Board that the District Court litigation has been dismissed and that the ITC investigation has been terminated. *See* Paper 13.

C. The ’356 Patent

The ’356 Patent is directed to “[l]ow noise amplifiers . . . supporting carrier aggregation.” Ex. 1101, code (57). In the embodiment described in the Abstract, an “input RF signal includes transmissions sent on multiple carriers at different frequencies,” a “first amplifier stage receives and amplifies [the input signal] and provides a first output RF signal to a first load circuit when the first amplifier stage is enabled,” and a “second amplifier stage receives and amplifies the input RF signal and provides a second output RF signal to a second load circuit when the second amplifier stage is enabled.” *Id*.

Figure 6A, reproduced below, details an example of a low noise amplifier according to the '356 patent. *Id.* at 1:54–55.

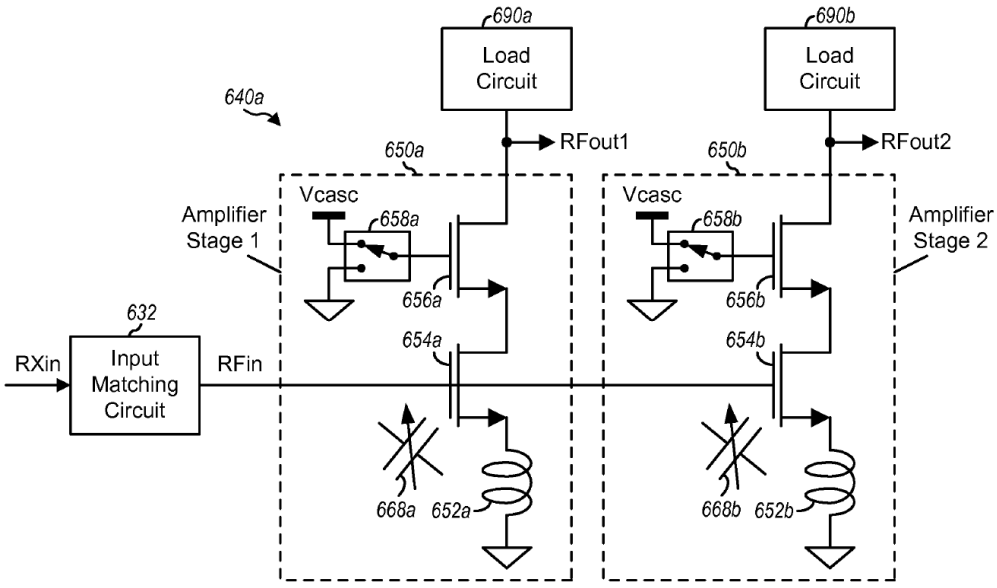

FIG. 6A

Figure 6A shows "an LNA with inductive degeneration and cascode shutoff." Ex. 1101, 1:54–55.

As shown above, amplifier stage 650a includes source degeneration inductor 652a, gain transistor 654a, cascode transistor 656a, and switch 658a. Ex. 1101, 7:58–8:4. Similarly, amplifier stage 650b includes source degeneration inductor 652b, gain transistor 654b, cascode transistor 656b, and switch 658b. *Id.* at 8:4–9. Both amplifier stages 650a and 650b are coupled to common input matching circuit 632 and to respective load circuits 690a and 690b. *Id.* at 7:47–49.

In operation, matching circuit 632 receives receiver input signal RXin, performs input matching for low noise amplifier 640a, and provides input RF signal RFin to low noise amplifier 640a. Ex. 1101, 7:49–52. Input RF signal RFin may include transmissions on one set of carriers or

transmissions on two sets of carriers in the same band, with each set including one or more carriers. *Id.* at 7:55–57, 8:16–18, 8:30–32. An RF signal with transmissions on multiple sets of carriers is called a carrier aggregated RF signal. *Id.* at 8:16–18.

Low noise amplifier 640a operates in either a non-carrier aggregation (non-CA) mode or a carrier aggregation (CA) mode, depending on the type of input RF signal it receives. Ex. 1101, 8:24–32, 8:36–44. In the non-CA mode, low noise amplifier 640a receives transmissions on one set of carriers and provides one output RF signal to one load circuit. *Id.* at 8:30–32. Only one amplifier stage is enabled, while the other amplifier stage is disabled. *Id.* at 8:46–47. To illustrate, Figure 6C is reproduced below.

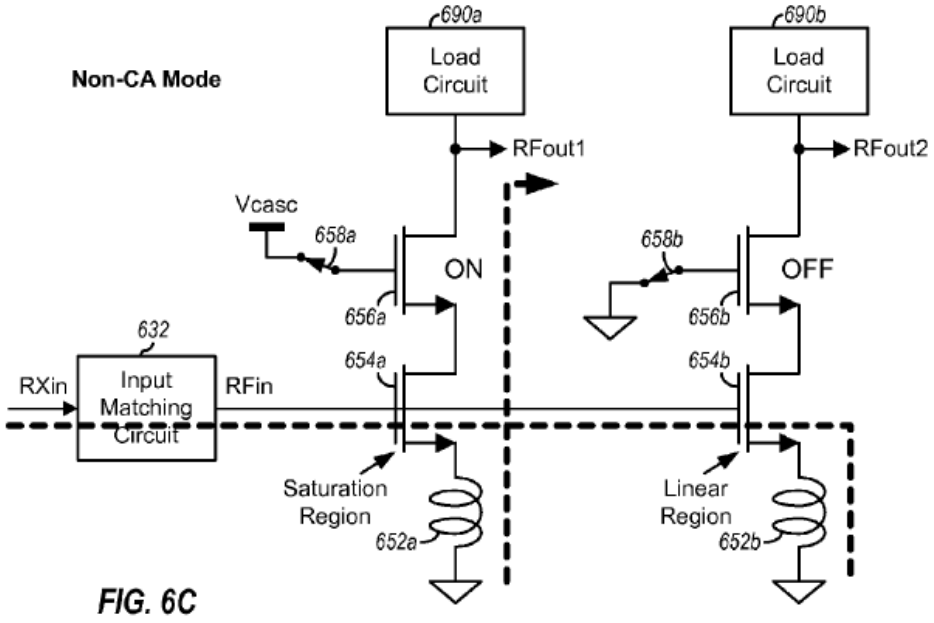

Figure 6C shows "an LNA with inductive degeneration and cascode shutoff." Ex. 1101, 1:54–55.

As shown, amplifier stage 650a is enabled by connecting the gate of cascode transistor 656a to the Vcasc voltage via switch 658a, and amplifier stage 650b is disabled by shorting the gate of cascode transistor 656b to

circuit ground via switch 658b. Ex. 1101, 8:47–52. Amplifier stage 650a amplifies the input RF signal and provides an output RF signal to load circuit 690a. *Id.* at 8:52–54.

In the CA mode, low noise amplifier 640a receives transmissions on two sets of carriers and provides two output RF signals to two load circuits, one output RF signal for each set of carriers. Ex. 1201, 8:32–35. Both amplifier stages are enabled. *Id.* at 8:37–38. To illustrate, Figure 6B is reproduced below.

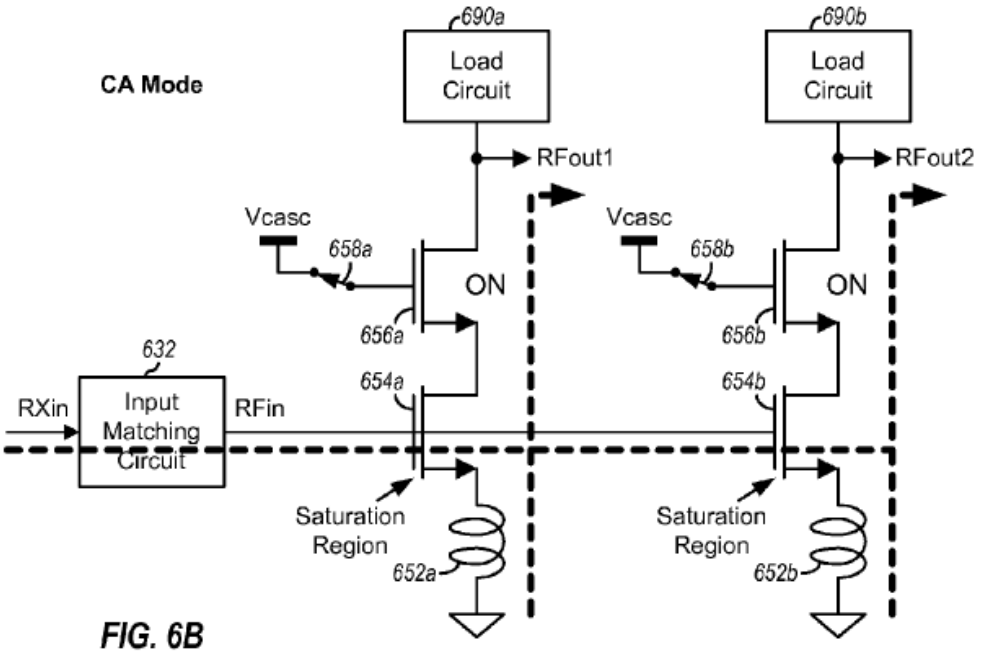

Figure 6C shows "an LNA with inductive degeneration and cascode shutoff." Ex. 1101, 1:54–55.

As shown, amplifier stages 650a and 650b are enabled by connecting the gate of cascode transistor 656a to the Vcasc voltage via switch 658a and coupling the gate of cascode transistor 656b to the Vcasc voltage via switch 658b. Ex. 1101, 8:37–40. The carrier aggregated RF signal splits at the input of low noise amplifier 640a, and then amplifier stages 650a and 650b amplify the carrier aggregated RF signal and provide two output RF

signals to two separate downconverters in load circuits 690a and 690b. *Id.* at 8:21–28. Specifically, amplifier stage 650a amplifies the input RF signal and provides the first output RF signal to load circuit 690a. *Id.* at 8:41–42. Similarly, amplifier stage 650b amplifies the input RF signal and provides the second output RF signal to load circuit 690b. *Id.* at 8:42–44.

D. The Claimed Subject Matter

Challenged claims 1 and 17 are independent. Because claim 1 is directed to an apparatus and claim 17 is directed a corresponding method, claim 1, which is reproduced below, exemplifies the subject matter addressed in this proceeding:

> 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.

Ex. 1101, 20:43–61.

E. Evidence Relied Upon

Petitioner relies on the following references:

Reference		Exhibit
Jeon	Sanggeun Jeon, et al., *A Scalable 6-to-18 GHz Concurrent Dual-Band Quad-Beam Phased-Array Receiver in CMOS*, IEEE Journal of Solid-State Circuits, Vol. 43, No. 12, at 2660 (December 2008)	1105
Xiong	U.S. Patent App. Pub. No. 2010/0237947 A1	1106
Youssef	Ahmed Youssef and James Haslett, *Digitally-Controlled RF Passive Attenuator in 65 nm CMOS for Mobile TV Tuner ICs*, in Proceedings of 2010 IEEE International Symposium on Circuits and Systems (June 2010)	1109
Feasibility Study	*3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Feasibility Study for Further Advancements for E-UTRA (LTE-Advanced) (Release 9)*, 3GPP TR 36.912, v9.1.0 (December 2010)	1104

Petitioner also relies on Declarations of Patrick Fay, filed as Exhibits 1102 and 1139. Patent Owner relies on a Declaration of Daniel Foty, filed as Exhibit 2024.

1. Jeon

Jeon is a paper that describes a tunable concurrent amplifier ("TCA") for use in a concurrent dual-band receiver that receives an incoming RF signal that contains two frequencies, one in a low-band (LB) and one in a high band (HB). Ex. 1105, 2663. The TCA "amplifies, filters, and finally splits the RF signal into two separate outputs; one at LB and the other at HB." *Id*. These two signals go through "separate double down-conversion

by subsequent RF and IF mixers." *Id.* Figure 6 of Jeon shows how the TCA receives an input signal ("RF Input") that includes the LB and HB frequencies, where LB and HB are amplified by separate cascode amplifiers "M1-M2" and "M3-M4":

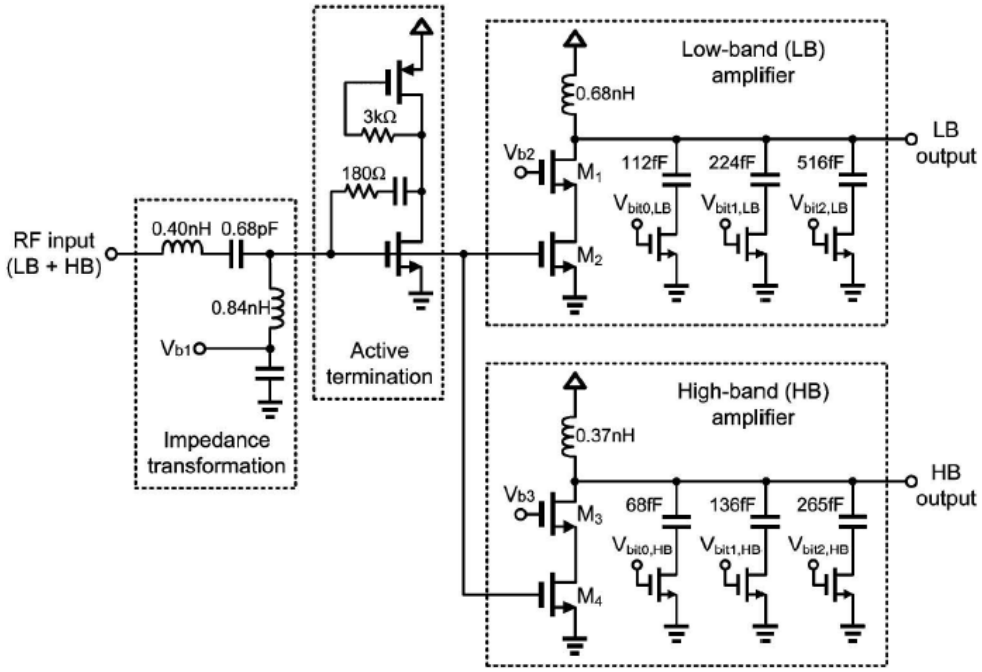

Figure 6 of Jeon is a "[s]chematic of [a] TCA with a single input and a dual output." Ex. 1105, 2664.

2. Xiong

Xiong is a patent application directed to "[t]echniques for designing a low-noise amplifier (LNA) for operation over a wide range of input power levels." Ex. 1106, code (57). The reference describes a low-noise ("LN") mode in which both gain paths (amplifiers) are enabled, and a high-linearity ("HL") mode, in which the only one gain path is enabled. *Id.* ¶ 29. It further explains that "the total gain provided to the input signal RF IN may advantageously be adjusted by selectively enabling or disabling the first

and/or second gain paths." *Id.* ¶ 30. Figure 3 of Xiong shows switches SW1 335 and SW2 325 controlling gain paths 301 and 302:

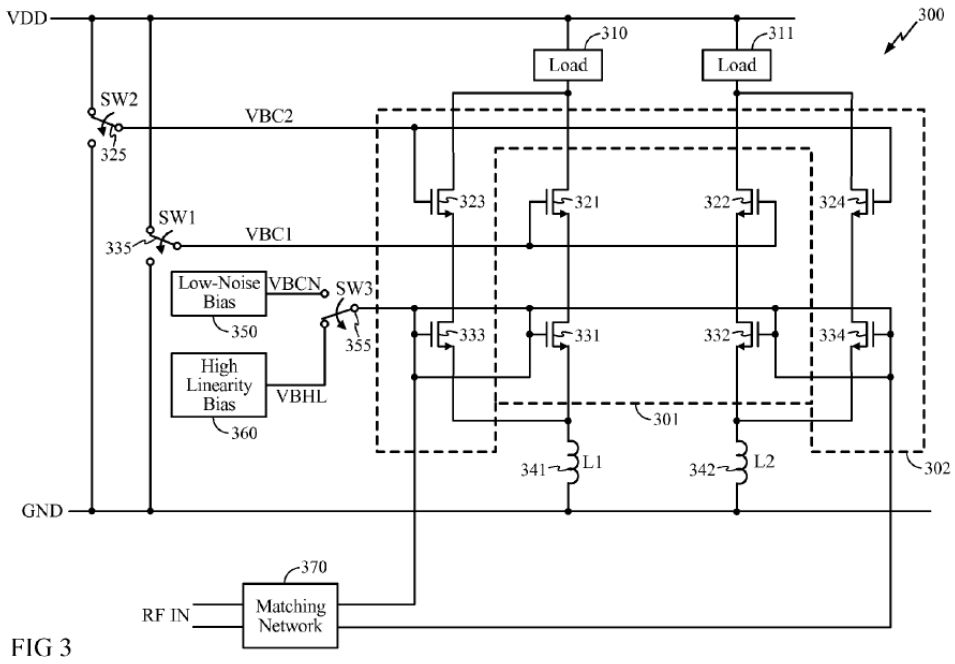

FIG 3

"FIG.3 illustrates an implementation of an LNA that adopts a dual architecture." Ex. 1106 ¶ 9.

3. Youssef

Petitioner argues that "Figure 1(b) of Youssef shows an RF attenuator that is coupled to an amplifier stage ("LNA") and . . . receives an input RF signal 'RFin'" and that "[a] POSITA would have been motivated to couple the first amplifier stage of Jeon in view of Xiong to the attenuation circuit of Youssef" because Youssef's attenuation circuit "prevent[s] a receiver from clipping at large input RF signals" and "Youssef expressly recognizes that an attenuation circuit can 'protect the RF performance . . . in the presence of interferer blockers.'" Pet. 66–68 (citing Ex. 1109, 1999–2000).

4. The Feasibility Study

The Feasibility Study is a 3GPP (Third Generation Partnership Project) technical report concerning evolution of E-UTRA (Evolved Universal Mobile Telecommunications System Terrestrial Radio Access), also known as LTE-Advanced. *See* Ex. 1104, 6–8. The Feasibility Study explains that LTE-Advanced adds "support for Carrier Aggregation, where two or more component carriers (CCs) are aggregated in order to support wider transmission bandwidths up to 100MHz and for spectrum aggregation." *Id.*

F. Grounds of Unpatentability

This trial was instituted on the following grounds:

References	Basis	Claims
Jeon, Xiong	§ 103	1, 17, 18
Jeon, Xiong, Youssef	§ 103	9, 10
Jeon, Xiong, Feasibility Study	§ 103	1, 17, 18
Jeon, Xiong, Youssef, Feasibility Study	§ 103	9, 10

II. ANALYSIS

We discuss below the level of skill in the art, claim construction, and the patentability of the present claims.

A. Level of Ordinary Skill in the Art

Petitioner asserts that a person of ordinary skill in the art "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)." Pet. 34 (citing Ex. 1101 ¶ 58).

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).'" PO Resp. 11 (quoting Pet. 34).

We adopt Petitioner's characterization of the level of ordinary skill in the art, which we find to be generally consistent with the disclosure of the '356 patent.

B. Construction of "Carrier Aggregation"

In *inter partes* reviews filed before November 13, 2018, such as this one, claims of an unexpired patent are interpreted according to their broadest reasonable construction in light of the specification of the patent in which they appear. *See* 37 C.F.R. § 42.100(b) (2018); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2142–46 (2016); 83 Fed. Reg. 51,340. Under that standard, claim terms are generally given their ordinary and customary meaning, as would have been understood by one of ordinary skill in the art in the context of the entire disclosure. *See In re Translogic Tech., Inc*., 504 F.3d 1249, 1257 (Fed. Cir. 2007).

The only term that either party has identified for construction, and the only term we see a need to construe,[1] is "carrier aggregation," which appears in independent claims 1 and 17.

Petitioner argues that this term "should be construed as 'simultaneous operation on multiple carriers.'" Pet. 28. Patent Owner argues that it should be construed to mean "simultaneous operation on multiple carriers that are combined as a single virtual channel to provide higher bandwidth." PO Resp. 11. The parties thus both agree that the construction should include "simultaneous operation on multiple carriers," meaning that the dispute boils down to whether the construction appropriately also includes "that are combined as a single virtual channel to provide higher bandwidth."

We consider the other language of the claims themselves, the written description, the prosecution history and other intrinsic evidence, extrinsic evidence the parties have presented, and the ITC proceeding the parties have identified, in that order.

1. The Claim Language

Claim 1 recites that the "input RF signal employ[s] carrier aggregation comprising transmissions sent on multiple carriers at different frequencies to a wireless device."

Patent Owner argues that Petitioner's proposed construction is incorrect "because it reads out the word 'aggregation.'" PO Resp. 30. According to Patent Owner, "[a]ggregate means 'to collect together, assemble,'" and "it is the component carriers that are aggregated into a

[1] *See O2 Micro Intern. Ltd. v. Beyond Innovation Tech. Co., Ltd.*, 521 F.3d 1351, 1362 (Fed. Cir. 2008) (explaining that "claim construction is a matter of resolution of *disputed* meanings and technical scope") (emphasis added).

single virtual channel to provide higher bandwidth." *Id*. Patent Owner adds that "[s]ubstituting 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." *Id*.

Petitioner argues that its proposed construction does not read out "aggregation" because "[w]hen there is 'simultaneous operation on multiple carriers,' those carriers will be aggregated in the input RF signal." Reply 6; *see also id*. ("'[C]arrier aggregation' in the context of the challenged claims accounts for aggregation . . . because the multiple carriers would be present simultaneously in the input RF signal."); Tr. 9:19–13:11.

We are not persuaded by Petitioner's analysis because the claim recites *both* "aggregation" *and* "transmissions sent on multiple carriers," indicating that "aggregation" must mean something more than the presence of multiple carriers. We thus do not agree that "aggregation" simply means that multiple carriers are present in the input RF signal.

We conclude that the language of the claim itself is more supportive of Patent Owner's proposed construction, which gives meaning to the term "aggregation" beyond the concept of multiple carriers, which is already in the claim.

2. The Written Description

Finding that the claim language favors Patent Owner's proposed construction, we turn to the written description.

Petitioner points to passages in the specification stating that "[a] wireless device may support carrier aggregation, which is simultaneous operation on multiple carriers," "[w]ireless device 110 may support carrier aggregation, which is operation on multiple carriers," and "[c]arrier

aggregation may also be referred to as multi-carrier operation." *See* Pet. 30 (citing Ex. 1101, 1:32–35, 2:53–54, 2:54–55). According to Petitioner, these passages in the specification define the term. *See id*.

Patent Owner counters by pointing to where the '356 patent specification cites a technical report called "3GPP TS 36.101" in discussing carrier aggregation. *See* PO Resp. 13 (citing Ex. 1101, 2:63–67). 3GPP TS 36.101 defines carrier aggregation as "[a]ggregation of two or more component carriers in order to support wider transmission bandwidths." Ex. 2026, 14.

According to Patent Owner, "while earlier LTE systems were limited to 20 MHz channels, LTE Release 11 . . . 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." PO Resp. 13 (citing Ex. 1101, 2:63–67). This is described in 3GPP TS 36.101 as follows:

> In earlier LTE systems, a user device connects to the wireless network over a single 20 MHz carrier frequency. 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. To relieve this rate-limiting step, LTE-Advanced added the ability for network equipment to practice carrier aggregation. When an end user requests a large amount of data, the network will activate carrier aggregation to deliver that data more quickly. This is done by multiplexing the incoming data stream . . . so that the incoming data stream is separated into multiple streams that are transmitted over multiple component carriers at the same time. The user device receives and de-multiplexes (aggregates) the multiple streams to recreate the original incoming data stream. The result is that the incoming data stream is received more quickly because it was transmitted in a higher bandwidth virtual channel.

Ex. 2026, 13–14 (internal citations omitted).

Petitioner responds that "the LTE carrier aggregation expressly described at column 2, lines 63–67 is merely one example of carrier aggregation in the patent," and that "the applicant signaled that the invention would cover devices other than those that implement LTE." Reply 3 (citing Ex. 1101, 1:37–38, 2:40–53); Ex. 1139 ¶ 19.

We again agree with Patent Owner. The column 2 description and 3GPP TS 36.101 give a clear explanation of what carrier aggregation provides: separation of a single stream into multiple streams for concurrent transmission (a single virtual channel), followed by reassembly into the original stream. While it is true that the claims are not limited to LTE, they are limited to "carrier aggregation," and the patent's citation to 3GPP TS 36.101 tells us what that means.

We do not agree with Petitioner that the portions of the description to which Petitioner points define carrier aggregation, for several reasons. First, the specification does not use the conventional techniques for indicating a definition; for example, it does not use the word "define," state that the meaning applies to the "term" carrier aggregation, or place carrier aggregation in quotation marks. We thus conclude that, read in context, these passages simply describe some characteristics of carrier aggregation. Second, the passages differ, the first describing "simultaneous operation on multiple carriers," the second simply requiring "operation on multiple carriers," and the third not mentioning simultaneous operation or multiple carriers. *See* Ex. 1001, 1:32–35, 2:53–54, 2:54–55. Petitioner does not explain how these three different passages provide a single definition of carrier aggregation, or provide us with a basis for choosing one over the other. Third, given the wealth of evidence discussed below that carrier

aggregation had a specific meaning in the art, we conclude that an application drafter seeking to broaden that known meaning would have needed to be quite clear that the usual meaning did not apply in the '356 patent. There is no such clarity.

We conclude that the intrinsic evidence, specifically column 2, lines 63–67 of the '356 patent and the citation to 3GPP TS 36.101, favors Patent Owner's construction. In particular, we determine that the specification provides strong support for the concept—if not the exact words—that the multiple carriers must be "combined as a single virtual channel to provide higher bandwidth." The portions of the description cited by Petitioner generally describe, but do not define, carrier aggregation.

3. The File History

The prosecution history may "facilitate[] claim construction by revealing the intended meaning and scope of technical terms and may even trump the weight of specification language in some circumstances." *TDM Am., LLC v. U.S.*, 85 Fed. Cl. 774, 788 (2009). For example, "an applicant's amendment accompanied by explanatory remarks can define a claim term by demonstrating what the applicant meant by the amendment." *Personalized Media*, 952 F.3d 1336, 1340 (Fed. Cir. 2020).

The parties discuss the Examiner's rejections based on U.S. patents to Hirose and Kaukovuori, and the contents of certain other references that were cited during prosecution. We address these in that order.

a. Hirose

The original claims of the '356 patent recited an "input RF signal comprising transmissions sent on multiple carriers at different frequencies to

a wireless device." Ex. 1101, 30. The Examiner rejected the claims, relying for this limitation on Hirose, which discloses a "satellite radio broadcast receiver [that] receives three radio waves in total, two satellite waves and one ground wave, at the same time at its wide band RF amplifier," where the "three waves contain[] the same contents." *See* Ex. 1114, 3; Ex. 1124, 1:31–34, 5:1–4. To overcome the rejection, the applicant amended the claims to limit the input RF signal to one "employing carrier aggregation," and argued that Hirose's "receipt of diversity signals does not disclose 'carrier aggregation.'" Ex. 1115, 8 ("Specifically, a disclosure in Hirose of receipt of the 'same data' over 'three [different] waves' does not anticipate Applicant's invention of 'the [] input RF signal employing carrier aggregation' as claimed." (emphases omitted)).

Patent Owner argues that Hirose supports its construction because the applicant argued that the "claimed invention recites 'carrier aggregation' which results in an increased aggregated data rate," but that "Hirose transmits the same signals over different paths which results in redundant data at a common data rate." PO Resp. 16 (emphases omitted) (quoting Ex. 1115, 7). According to Patent Owner, "[i]f the term 'carrier aggregation' simply meant 'simultaneous operation on multiple carriers,' the amendment would have been ineffective in overcoming Hirose." *Id.* at 28.

Petitioner responds that "[i]f Hirose's simultaneous signals contained non-redundant (*i.e.*, different) data, [the applicant] could not have made the argument that it did, and therefore the most natural reading of the prosecution history is that the applicant was distinguishing Hirose on the basis of its redundant transmissions." Pet. Reply at 5. According to

Petitioner, any "disclaimer was of systems that receive transmissions of redundant data over multiple channels." *Id*. at 5 n.2.

We agree with Patent Owner. Though there may not be a "clear and unmistakable disclaimer," we conclude that the treatment of Hirose during prosecution supports Patent Owner's construction because it confirms that merely receiving data on multiple channels simultaneously was not, at least in the eyes of the Examiner, "carrier aggregation."

b. Kaukovuori

After the applicant overcame the Hirose rejection by amending the claims to recite "carrier aggregation," the Examiner rejected claims 1 and 17 as anticipated by Kaukovuori, which the Examiner expressly found to teach carrier aggregation. *See* Ex. 1116, 2–4 (finding that Kaukovuori "teaches a method of receiving data transmitted via a combination of at least a plurality of radio frequency signals using carrier aggregation"). Kaukovuori describes carrier aggregation as "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" where "the message data from each of the signals can be combined in order to reconstruct the original data" (Ex. 1125, 1:27–33), which parallels Patent Owner's construction.

The applicant did not dispute that Kaukovuori included carrier aggregation, but instead responded by arguing that the claims were patentable due to how the claimed amplifier stages were enabled, and then amending the claim language regarding that feature. *See* Ex. 1117, 7–9; Ex. 1120, 2. This sequence suggests that both the Examiner and the Applicant considered Kaukovuori's disclosure of using multiple carriers to provide a

higher aggregate bandwidth by combining carriers to disclose carrier aggregation within the meaning of the claims.[2]

We agree with Patent Owner that the treatment of Kaukovuori during prosecution also favors its construction.

c. Other References of Record

"[P]rior art cited in a patent or cited in the prosecution history of the patent constitutes intrinsic evidence," and, when it "sheds light on the meaning of a term[,] it can have particular value as a guide to the proper construction of the term, because it may indicate not only the meaning of the term to persons skilled in the art, but also that the patentee intended to adopt that meaning." *V-Formation, Inc. v. Benetton Group SpA*, 401 F.3d 1307, 1311 (Fed. Cir. 2005); *see Arthur A. Collins, Inc. v. N. Telecom Ltd.*, 216 F.3d 1042, 1045 (Fed. Cir. 2000).

Patent Owner points to WO 2012/008705, a reference cited during the prosecution of the '356 patent, which states that "LTE-A is a technology for *aggregating a plurality of unit carriers* . . . to be used simultaneously" with the aim of "extending" bandwidth, as well as to GB 2472978, another cited reference, which describes how "[i]n the carrier aggregation mode *data has been multiplexed* across multiple carrier frequencies" and where carrier aggregation is described as a technique to "*bond together* two parallel carriers." PO Resp. 17–18; Ex. 2016 ¶ 7 (emphasis added); Ex. 2017, code (57), 1:8–11 (emphasis added).

[2] We also note that Petitioner's expert, Dr. Fay, cites Kaukovuori as "one example of a receiver configured to support carrier aggregation by sending different carriers to different receive paths." Ex. 1102 ¶ 42.

Petitioner argues that "Patent Owner's citations to extrinsic evidence cannot change the broadest reasonable interpretation of carrier aggregation" and that "Petitioner's proposed construction of 'carrier aggregation' is broad enough to encompass each of the differing examples of carrier aggregation provided in Patent Owner's extrinsic evidence sources." Pet. Reply 6. We find these arguments unpersuasive because (a) they don't address this intrinsic evidence, (b) the broadest reasonable interpretation must give meaning to "aggregation," but Petitioner's construction does not, and (c) the broadest reasonable construction must be reasonable *in light of the specification*,[3] which, as discussed above, shows that one of skill in the art would have known that "carrier aggregation" means combining carriers to achieve a higher aggregate bandwidth.

We conclude that this additional prior art that was made of record during prosecution provides further evidence supporting Patent Owner's construction.

4. Extrinsic Evidence

Petitioner cites Dr. Fay to support its argument that its proposed construction is "consistent" with a person of ordinary skill in the art's understanding of the term. *Id*. at 31; *see* Ex. 1102 ¶ 62. Dr. Fay, however, cites no evidence other than the specification to support the idea that "carrier aggregation" is simply simultaneous operation on multiple carriers. Nor, we find, does he persuasively explain how his proposed construction accounts

[3] *See In re Translogic Tech., Inc.*, 504 F.3d at 1257 (explaining that "claims must be read in view of the specification" which is "the single best guide to the meaning of a disputed term") (quoting *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc)).

for "aggregation." The mere presence of multiple carriers in the input signal cannot be "aggregation" of the carriers because the claim already recites "multiple carriers" in the input signal. Aggregation must mean something more than multiple carriers existing at the same time.[4]

Patent Owner cites Dr. Foty for support of its proposed construction, and Dr. Foty provides citations to various pieces of supporting extrinsic evidence. *See* PO Resp. 18–23; Ex. 2024 ¶¶ 94–110 (citing Ex. 1104, 10; Ex. 2013, 3:19–22 ("One technique for providing additional bandwidth . . . is through the use [of] carrier aggregation of multiple smaller bandwidths to form a virtual wideband channel at a wireless device."); Ex. 2018, 3:27–62 (describing "carrier aggregation of multiple smaller bandwidths to form a virtual wideband channel at a wireless device"); Ex. 2019, 6 ("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 ¶ 3 ("Multiple component carriers are aggregated to form a larger overall transmission bandwidth."); Ex. 2021, 26–27; Ex. 2022).

Dr. Fay argues that the extrinsic evidence does not support Patent Owner's proposed construction because "in a case such as this, where the intrinsic evidence so clearly supports the definition that Patent Owner included in its specification, a [person of ordinary skill in the art] would assign extrinsic evidence little or no relevance." Ex. 1139 ¶ 26. We are unpersuaded because, as explained above, we do not find a definition, or

[4] We agree with Petitioner that its proposed construction is not "inconsistent" with the meaning that this term had in the art, but find that Patent Owner's proposed construction is *both* "consistent" with *and* better captures what the term would have meant to one of skill in the art at the time of the application.

redefinition, of "carrier aggregation" in the portions of the description cited by Petitioner, or elsewhere in the '356 patent.

Dr. Fay also argues that "many of the extrinsic references included with Patent Owner's Response were dated or filed well after the filing date of the '356 patent, and are also not prior art to the '356 patent." Ex. 1139 ¶ 26 (citing Exhibits 2018, 2019, and 2022). This is not persuasive because it does not address the rest of the evidence (i.e., Exhibits 1104, 2013, 2020, and 2021), which we find to be more than enough. The later references are approximately contemporaneous and, we find, sufficiently consistent with the earlier evidence to provide further support for Patent Owner's construction.

Having reviewed the expert testimony and the cited materials, we credit Patent Owner's expert over Petitioner's, primarily because Patent Owner's expert's opinion has substantial evidentiary support. We conclude that the expert testimony and extrinsic evidence is significantly more supportive of Patent Owner's construction.

5. The ITC Investigation

Petitioner asserts that the Administrative Law Judge ("ALJ") in the related ITC investigation "construed 'carrier aggregation' as Petitioner proposes here." Pet. 33. Patent Owner explains that it proposed before the ITC that "'carrier aggregation' should mean 'simultaneous operation on multiple carriers to increase the bandwidth for a user,'" and that it 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.'" PO Resp. 24.

Page 17 of the ITC claim construction order shows that the ALJ interpreted "carrier aggregation" to mean "simultaneous operation on multiple carriers." Ex. 1136, 17. However, page 17 is simply a summary table of the constructions; the ALJ's analysis is contained in pages 20 to 30 of Appendix A to the order, of which pages 21, 22, 26, 28, and 29 are missing from the version filed as Exhibit 1136.

We conclude that we are unable to evaluate the ITC claim construction due to Petitioner's failure to submit a complete version of the ITC order, leaving us unable to tell what evidence was before the ITC judge, what arguments were made, or why the judge reached that decision. Given the lack of information about what happened in the ITC case, and the large amount of evidence that supports Patent Owner's position, we do not find the ITC claim construction to warrant favoring Petitioner's proposed construction over Patent Owner's.[5]

6. Conclusion

We determine that the claim language, the written description, the prosecution history and other intrinsic evidence, and the extrinsic evidence all favor Patent Owners' construction. We thus construe "carrier aggregation" to mean "simultaneous operation on multiple carriers that are combined as a single virtual channel to provide higher bandwidth."

[5] We also note that the ITC case was terminated after the Initial Determination, never reaching a Final Determination (*see* Petitioner's Updated Mandatory Disclosures (Paper 13) at 2), and that the Staff sided with Patent Owner in the ITC (*see* Ex. 1136, App. A, p. 25).

C. Patentability of Claims 1, 9, 10, 17, and 18

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter 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. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) any secondary considerations, if in evidence.[6] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

1. Obviousness in View of Jeon and Xiong (Grounds 1 and 2)

Petitioner reads the limitations of claims 1, 17, and 18 onto a combination of Jeon and Xiong (Ground 1), and adds Youseff for claims 9 and 10 (Ground 2). Independent claim 1 recites, among other limitations, that "the input RF signal employ[s] carrier aggregation comprising transmissions sent on multiple carriers at different frequencies to a wireless device." Independent claim 17 includes an analogous limitation.

Petitioner's Grounds 1 and 2 are based on its construction of "carrier aggregation" as meaning "simultaneous operation on multiple carriers." *See, e.g.*, Pet. 52–53 (arguing that "Jeon teaches 'a dual-band signal containing two different frequencies concurrently," which teaches carrier aggregation). Because, for the reasons detailed above (*see* Section II.B), we find "carrier

[6] Patent Owner does not present any objective evidence of nonobviousness (i.e., secondary considerations) as to any of the challenged claims.

aggregation" to additionally require that the carriers "are combined as a single virtual channel to provide higher bandwidth," we find that Petitioner has not shown claims 1 and 17 to be unpatentable. Because claims 9, 10, and 18 depend from and thus include all of the limitations of claims 1 or 17, Petitioner has also not shown those claims unpatentable in view of Jeon and Xiong.[7]

2. Obviousness in View of Jeon, Xiong, and The Feasibility Study (Grounds 3 and 4)

Grounds 3 and 4 are essentially the same as grounds 1 and 2, except that Petitioner adds the Feasibility Study. *See* Pet. 72–76. Petitioner contends that "[t]o the extent Patent Owner argues that Jeon in view of Xiong fails to teach an input RF signal employing carrier aggregation, . . . the Feasibility Study also discloses this element." Pet. 72.

We agree with Petitioner that the Feasibility Study describes carrier aggregation under Patent Owner's (and our) construction. Indeed, it is good evidence to support that construction. However, we find that Petitioner has not articulated a motivation sufficient to support the combination.

Petitioner contends that one "would have been motivated to use the Feasibility Study's carrier-aggregated input RF signal with the Jeon/Xiong front-end architecture because of the benefits of carrier aggregation identified in the Feasibility Study" and because "[f]or example, the Feasibility Study teaches that carrier aggregation provides wider

[7] Because this issue is dispositive, we do not reach the parties' dispute about whether the combination includes independently enabled and disabled amplifiers. *See Beloit Corp. v. Valmet Oy*, 742 F.2d 1421, 1423 (Fed. Cir. 1984) (endorsing the "use of a single dispositive issue approach" to save "unnecessary cost and effort").

transmission bandwidths and spectrum aggregation and is supported by the LTEAdvanced standard." Pet. 74 (citing Ex. 1104, 8; Ex. 1102 ¶¶ 128, 130). These, however, are only motivations to use carrier aggregation, not a motivation to combine the carrier aggregation of the Feasibility Study with the specific hardware of Jeon and Xiong.

Petitioner next argues that "Jeon in view of Xiong . . . teaches the exact type of receiver that the Feasibility Study recognizes would work with signals employing carrier aggregation" and "[t]he motivation . . . thus arises from the references themselves." Pet. 73–74. Petitioner similarly argues that "the combination requires nothing more than replacing the Jeon/Xiong 'dual-band signal containing two different frequencies concurrently' with the received 'Carrier Aggregation' signals described in the Feasibility Study." Pet. 74. Petitioner also argues that "[a] POSITA would have had a reasonable expectation of success in using the carrier-aggregated input RF signals as described in the Feasibility Study with the receiver front-end of Jeon in view of Xiong." Pet. 74.

These arguments are insufficient to establish a motivation to combine because we do not reach the questions of whether the combination could have worked, or whether one of skill in art would reasonably have expected to succeed, unless there is a reason to make the combination in the first place. *See KSR*, 550 U.S. at 418 (explaining that "a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art"); *InTouch Techs., Inc. v. VGO Commc'ns, Inc.*, 751 F.3d 1327, 1352 (Fed. Cir. 2014) (explaining that the obviousness inquiry does not merely ask whether a skilled artisan could combine the references, but instead whether "they

would have been motivated to do so"). Because Petitioner has not established such a motivation, we conclude that the combination is impermissibly inspired only by a hindsight effort to marry the allegedly independently enabled/disabled amplifiers of Jeon/Xiong with the carrier aggregation of the Feasibility Study. *See Metalcraft of Mayville, Inc. v. The Toro Co.*, 848 F.3d 1358, 1367 (Fed. Cir. 2017) ("[W]e cannot allow hindsight bias to be the thread that stitches together prior art patches into something that is the claimed invention.").

As Petitioner has not sufficiently articulated a non-hindsight technical reason why one of skill in the art would have made this particular combination,[8] Petitioner has not shown that claims 1 and 17 were unpatentable in view of Jeon, Xiong, and the Feasibility Study. Because claims 9, 10, and 18 all depend from and include all of the limitations of claims 1 or 17, Petitioner has also not shown those claims unpatentable in view of those references.

[8] The '365 patent's combination of independently enabled/disabled amplifiers and carrier aggregation "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 (Dr. Foty) ¶ 54; *see also* Ex. 1102 (Dr. Fay) ¶ 56 ("The independent enabling or disabling of amplifier stages allows the LNA of the '356 patent to support both carrier aggregation and non-carrier aggregation in different modes."). Petitioner does not argue that the ordinarily skilled artisan would have been motivated to combine Jeon, Xiong, and the Feasibility Study for that reason.

III. CONCLUSION

Claims 1, 9, 10, 17, and 18 have not been shown to be unpatentable. The results are summarized below.

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1, 17, 18	103	Jeon, Xiong		1, 17, 18
9, 10	103	Jeon, Xiong, Youssef		9, 10
1, 17, 18	103	Jeon, Xiong, Feasibility Study		1, 17, 18
9, 10	103	Jeon, Xiong, Youssef, Feasibility Study		9, 10
Overall Outcome				1, 9, 10, 17, 18

IV. ORDER

For the reasons given, it is:

ORDERED that claims 1, 9, 10, 17, and 18 of U.S. Patent 9,154,356 B2 have not been shown to be unpatentable;

FURTHER ORDERED that, because this is a Final Written Decision, the parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

FOR PETITIONER:

David Cavanaugh
John Hobgood
Ben Fernandez
WILMER CUTLER PICKERING HALE
AND DORR LLP
david.cavanaugh@wilmerhale.com
john.hobgood@wilmerhale.com
ben.fernandez@wilmerhale.com

FOR PATENT OWNER:

David B. Cochran
Matthew W. Johnson
Joseph M. Sauer
Joshua R. Nightingale
David M. Maiorana
Thomas W. Ritchie
JONES DAY
dcochran@jonesday.com
mwjohnson@jonesday.com
jmsauer@jonesday.com
jrnightingale@jonesday.com
dmaiorana@jonesday.com
twritchie@jonesday.com