UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INTEL CORPORATION

Petitioner,

v.

QUALCOMM INCORPORATED

Patent Owner.

IPR2018-01328
U.S. Patent No. 9,608,675

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 United States Court of Appeals for the Federal Circuit from the Final Written Decision on Remand entered March 23, 2022 (Paper 46) in IPR2018-01328, 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 1–3, 5, 7–15, 17–21, 23–25, and 27 are not unpatentable, the construction of "plurality of carrier aggregated transmit signals," any finding or determination supporting or related to these issues, and all other issues decided adversely to Petitioner in any orders, decisions, rulings, and opinions underlying or supporting the Final Written Decision on Remand.

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.

Respectfully submitted,

Dated: May 25, 2022

/David L. Cavanaugh/
David L. Cavanaugh
Reg. No. 36,476
WILMER CUTLER PICKERING
HALE AND DORR LLP

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 Express Mail on this 25th day of May, 2022, 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 25th day of May, 2022, and the filing fee is being paid electronically using pay.gov.

I hereby certify that on May 25, 2022, 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, Reg. No. 39,142
dcochran@jonesday.com

Matthew W. Johnson, Reg. No. 59,108
mwjohnson@jonesday.com

Joseph M. Sauer, Reg. No. 47,919
jmsauer@jonesday.com

Joshua R. Nightingale, Reg. No. 67,865
jrnightingale@jonesday.com

David M. Maiorana, Reg. No. 41,449
dmaiorana@jonesday.com

By: /David L. Cavanaugh/
David L. Cavanaugh
Reg. No. 36,476

Exhibit A

Trials@uspto.gov
571.272.7822

Paper 46
Date: March 23, 2022

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INTEL CORPORATION,
Petitioner,

v.

QUALCOMM INCORPORATED,
Patent Owner.

IPR2018-01328
IPR2018-01330[1]
Patent 9,608,675 B2

Before MICHELLE N. WORMMEESTER, AMANDA F. WIEKER, and SCOTT B. HOWARD, *Administrative Patent Judges*.

WORMMEESTER, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision on Remand
Determining No Challenged Claims Unpatentable
35 U.S.C. §§ 144, 318

[1] This Decision addresses issues that are identical in each of the identified cases. We exercise our discretion to issue this Decision to be filed in each case. The parties may not use this style heading in subsequent papers.

I. INTRODUCTION

We address these two cases on remand after a consolidated decision for six related cases, including these two cases, by the U.S. Court of Appeals for the Federal Circuit in *Qualcomm Inc. v. Intel Corp.*, 6 F.4th 1256 (Fed. Cir. 2021).

As background, Intel Corporation[2] ("Petitioner") petitioned for six *inter partes* reviews challenging the validity of U.S. Patent No. 9,608,675 B2 (Ex. 1201,[3] "the '675 patent"). This Decision addresses only two of those *inter partes* reviews, namely, IPR2018-01328 and IPR2018-01330.[4] Petitioner filed petitions requesting *inter partes* review of claims 1–3, 5, 7–15, 17–21, 23–25, and 27–30 of the '675 patent across these two cases. Paper 2 ("Petition" or "Pet.") (requesting review of claims 1–3, 5, 7–15, 17–21, 23–25, and 27); 1330-Paper 3 (requesting review of claims 28–30). Qualcomm Incorporated ("Patent Owner") filed preliminary responses. Paper 7; 1330-Paper 7. Pursuant to 35 U.S.C. § 314, we instituted *inter partes* reviews as to all the challenged claims and all the grounds of unpatentability raised in the petitions. Paper 8 ("Institution Decision" or "Inst. Dec."); 1330-Paper 8.

During trial, Patent Owner filed responses. Paper 14 ("Response" or "PO Resp."); 1330-Paper 14. Petitioner filed replies. Paper 16 ("Reply" or

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[2] Intel Corporation identifies itself and Apple Inc. ("Apple") as real parties in interest. Paper 2, 1.

[3] Unless otherwise noted, papers and exhibits refer to IPR2018-01328. Papers and exhibits preceded by "1330-" refer to IPR2018-01330.

[4] We address the other four *inter partes* reviews, IPR2018-01326, IPR2018-01327, IPR2018-01329, and IPR2018-01340, in a separate decision on remand entered concurrently with this Decision.

"Pet. Reply"); 1330-Paper 16. Patent Owner filed sur-replies. Paper 19 ("Sur-reply" or "PO Sur-reply"); 1330-Paper 19. On October 9, 2019, we conducted a consolidated oral hearing for all six related cases, including the two cases addressed in this Decision. A copy of the transcript is included in the record. Paper 29 ("Tr."). With our authorization (*see* Paper 26), the parties subsequently filed additional briefs on the meaning of the claim term "generates the single power tracking signal based on a combination of the plurality of I and Q components." Paper 27 (Patent Owner's brief); Paper 28 (Petitioner's brief).

Pursuant to 35 U.S.C. § 318(a), we issued final written decisions in the two cases addressed here. Paper 30 ("Final Written Decision" or "Final Dec."); 1330-Paper 30. We determined that Petitioner demonstrated by a preponderance of the evidence that all challenged claims, namely, claims 1–3, 5, 7–15, 17–21, 23–25, and 27–30 of the '675 patent, are unpatentable. Final Dec. 79; 1330-Paper 30, 85. Patent Owner appealed our determinations that these challenged claims are unpatentable to the Federal Circuit. Paper 31; 1330-Paper 31.

In its remand decision, the Federal Circuit addressed Patent Owner's arguments that "it was not afforded notice of, or an adequate opportunity to respond to, the Board's construction of 'a plurality of carrier aggregated transmit signals,'" as well as Patent Owner's arguments "challeng[ing] the Board's construction of the power tracker limitation," which refers to the claim term "means for determining a single power tracking signal." *Qualcomm*, 6 F.4th at 1262. The power tracker limitation appears in just one of four challenged independent claims, namely, claim 28, and the Federal Circuit "s[aw] no error" in our construction of that limitation. *Id.* The

Federal Circuit, however, agreed that "the Board violated [Patent Owner's] procedural rights with respect to the 'plurality of carrier aggregated transmit signals' limitation," vacated our final written decisions, and remanded for further proceedings. *Id.* at 1262, 1267. Each of the four challenged independent claims includes the limitation "plurality of carrier aggregated transmit signals." The Federal Circuit's mandate issued on September 17, 2021. *Qualcomm Inc. v. Intel Corp.*, No. 20-1589 (Fed. Cir. Sept. 17, 2021) (Document No. 63).

We subsequently issued an order in each case authorizing post-remand briefing tailored narrowly to addressing whether we properly construed "plurality of carrier aggregated transmit signals," and to addressing the applicability of our construction of "plurality of carrier aggregated transmit signals" to the asserted prior art disclosures. Paper 32, 2. Petitioner filed opening briefs (Paper 33, "Pet. Remand Br."), Patent Owner filed responsive briefs (Paper 35, "PO Remand Resp."), Petitioner filed reply briefs (Paper 38, "Pet. Remand Reply"), and Patent Owner filed sur-reply briefs (Paper 45, "PO Remand Sur-reply").

We have considered the record anew by reviewing the parties' positions on remand. For the reasons that follow, we determine that Petitioner has *not* shown by a preponderance of the evidence that claims 1–3, 5, 7–15, 17–21, 23–25, and 27–30 of the '675 patent are unpatentable.

II. BACKGROUND

A. Related Proceedings

Prior to institution, the parties identified various matters involving the '675 patent, including a federal district court case, an International Trade

Commission ("ITC") investigation, as well as the six petitions for *inter partes* review identified above. Pet. 2; Paper 4, 2. Since the entry of our institution decisions, Patent Owner has asserted that "[t]he '675 patent is currently not involved in any litigation beyond the PTAB." PO Resp. 16. Petitioner has not stated otherwise.

The six *inter partes* review cases that the parties identified are IPR2018-01326, IPR2018-01327, IPR2018-01328, IPR2018-01329, IPR2018-01330, and IPR2018-01340. Pet. 2; Paper 4, 2. These cases can be divided into two sets of cases, where the first set of cases includes IPR2018-01326, IPR2018-01327, IPR2018-01329, and IPR2018-01340. These four cases involve prior art challenges based on Yu[5] as a primary reference. The second set of cases includes IPR2018-01328 and IPR2018-01330, which involve prior art challenges based on Chen[6] as a primary reference. As noted above, this Decision addresses only the second set of cases. The first set of cases is addressed in a separate decision on remand entered concurrently with this Decision.

B. The '675 Patent

The '675 patent describes power tracking for generating a power supply voltage for a circuit, such as an amplifier, that processes multiple transmit signals sent simultaneously. Ex. 1201, 1:8–10, 1:35–38. Figure 5,

[5] Yu, EP 2442440 A1, published Apr. 18, 2012 (IPR2018-01326, Ex. 1004).
[6] W. Chen et al., Hybrid Envelope Tracking for Efficiency Enhancement in Concurrent Dual-Band PAs, 54 Microwave & Optical Tech. Letters 662 (2012) (Ex. 1212).

which is reproduced below, illustrates a transmit module with power tracking for all transmit signals according to the '675 patent. *Id.* at 1:65–67.

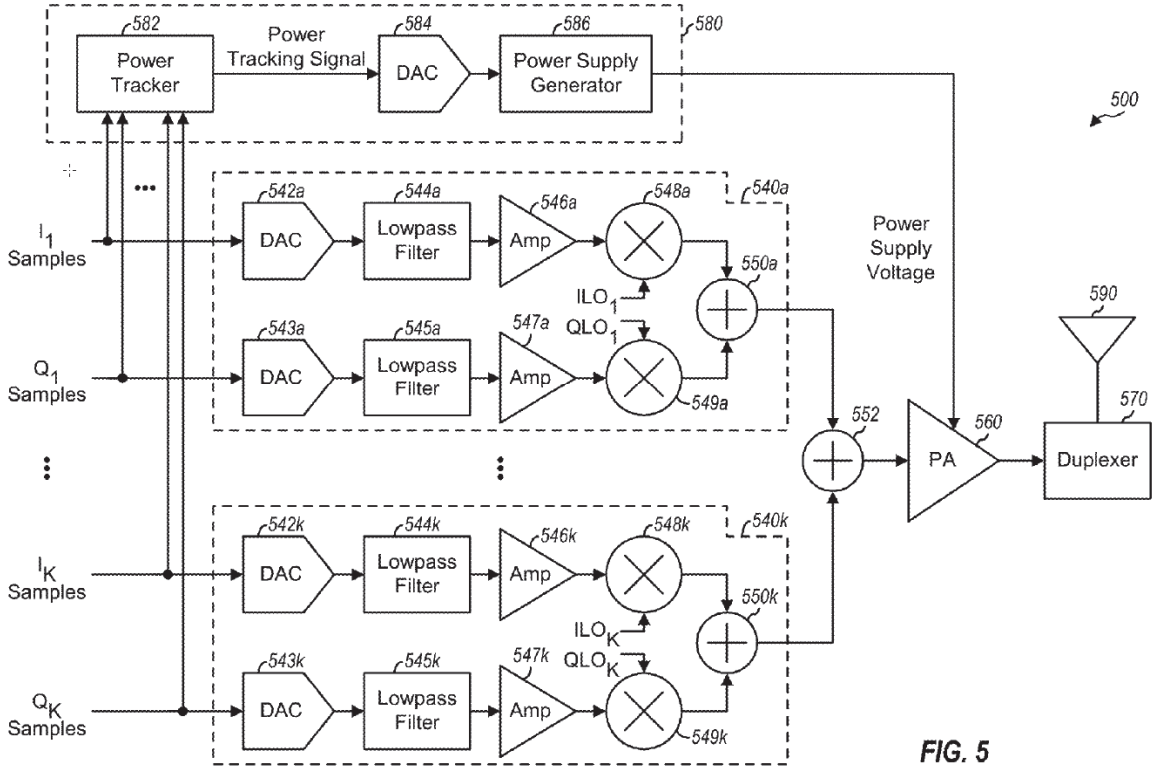

FIG. 5

In particular, Figure 5 shows transmit module 500, which includes K transmit circuits 540a to 540k that can simultaneously process K transmit signals, with each transmit circuit processing one transmit signal. *Id.* at 6:34–37. Transmit module 500 also includes summer 552, power amplifier ("PA") 560, duplexer 570, and power tracking supply generator (or voltage generator) 580. *Id.* at 6:37–39.

Inphase (I) and quadrature (Q) samples for a transmit signal are provided to both a transmit circuit and voltage generator 580. Ex. 1201, 6:42–44. For example, transmit circuit 540a receives I_1 and Q_1 samples for a first transmit signal and generates a first upconverted radio frequency ("RF")

signal for the first transmit signal. *Id.* at 6:40–42. Within transmit circuit 540a, the I_1 and Q_1 samples are converted to I and Q analog signals by digital-to-analog converters (DACs) 542a and 543a. *Id.* at 6:44–46. The I and Q analog signals are then filtered by lowpass filters 544a and 545a, amplified by amplifiers 546a and 547a, upconverted from baseband to RF by mixers 548a and 549a, and summed by summer 550a to generate the first upconverted RF signal. *Id.* at 6:46–50.

The other transmit circuits operate similarly. Ex. 1201, 6:54–57. Summer 552 receives all upconverted RF signals from the transmit circuits, sums the upconverted RF signals, and provides a modulated RF signal to PA 560. *Id.* at 6:59–62.

Within voltage generator 580, power tracker 582 receives I_1 to I_K samples and Q_1 to Q_K samples for all transmit signals being sent simultaneously. Ex. 1201, 6:63–65. Power tracker 582 then computes a digital power tracking signal based on the I and Q samples for these transmit signals and provides the digital power tracking signal to DAC 584. *Id.* at 6:65–7:1, 8:6–32. DAC 584 converts the digital power tracking signal to analog and provides the analog power tracking signal to power supply generator 586. *Id.* at 7:1–4, Fig. 5. Power supply generator 586 generates a power supply voltage for PA 560. *Id.* at 7:6–8.

Once PA 560 receives both the modulated RF signal from summer 552 and the power supply voltage from power supply generator 586, PA 560 amplifies the modulated RF signal using the power supply voltage. Ex. 1201, 7:8–11. PA 560 then provides an output RF signal for all the transmit signals being sent simultaneously. *Id.* at 7:11–12.

The output RF signal is routed through duplexer 570 and transmitted via antenna 590. *Id.* at 7:12–14.

C. Illustrative Claim

Petitioner challenges claims 1–3, 5, 7–15, 17–21, 23–25, and 27–30 of the '675 patent, all for our consideration on remand. Claims 1, 18, and 28 are independent. Claim 1 is illustrative of the challenged claims and includes the subject matter the Federal Circuit instructed us to reconsider on remand:

> 1. An apparatus comprising:
>
> a power tracker configured to determine a single power tracking signal based on a plurality of inphase (I) and quadrature (Q) components of a plurality of carrier aggregated transmit signals being sent simultaneously, wherein the power tracker receives the plurality of I and Q components corresponding to the plurality of carrier aggregated transmit signals and generates the single power tracking signal based on a combination of the plurality of I and Q components, wherein the plurality of carrier aggregated transmit signals comprise Orthogonal Frequency Division Multiplexing (OFDM) or Single Carrier Frequency Division Multiple Access (SC-FDMA) signals;
>
> a power supply generator configured to generate a single power supply voltage based on the single power tracking signal; and
>
> a power amplifier configured to receive the single power supply voltage and the plurality of carrier aggregated transmit signals being sent simultaneously to produce a single output radio frequency (RF) signal.

D. Instituted Grounds of Unpatentability

As discussed above, we instituted *inter partes* review based on all grounds raised in the two petitions addressed here. Inst. Dec.; 1330-Paper 8. The instituted grounds are as follows.

Claims Challenged	35 U.S.C. §	References
1–3, 5, 7, 11, 17–21, 27[7]	103	Chen, Wang[8]
12[9]	103	Chen, Wang, Eliezer[10]
8–10, 28–30[11]	103	Chen, Wang, Choi[12]
13–15, 23–25[13]	103	Chen, Wang, Dahlman[14]

In support of its petitions, Petitioner relied on a declaration (Ex. 1203) as well as a reply declaration (Ex. 1231) of David Choi, Ph.D. Patent Owner submitted with its responses a declaration of Tim Williams, Ph.D. (Ex. 2002). The transcripts of the depositions of Dr. Choi are entered in the record as Exhibits 2006 and 2007, and the transcript of the deposition of Dr. Williams is entered in the record as Exhibit 1230.

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[7] Petitioner challenges claims 1–3, 5, 7, 11, 17–21, 27 in IPR2018-01328.
[8] Wang et al., *Design of Wide-Bandwidth Envelope-Tracking Power Amplifiers for OFDM Applications*, 53 IEEE Transactions on Microwave Theory & Techniques 1244 (2005) (Ex. 1205).
[9] Petitioner challenges claim 12 in IPR2018-01328.
[10] Eliezer, US 2009/0004981 A1, published Jan. 1, 2009 (Ex. 1211).
[11] Petitioner challenges claims 8–10 in IPR2018-01328, and claims 28–30 in IPR2018-01330.
[12] Jinsung Choi et al., *Envelope Tracking Power Amplifier Robust to Battery Depletion*, 2010 IEEE MTT-S Int'l Microwave Symposium Digest 1074 (2010) (Ex. 1208, at Ex. A).
[13] Petitioner challenges claims 13–15 and 23–25 in IPR2018-01328.
[14] Erik Dahlman et al., 4G LTE / LTE-ADVANCED FOR MOBILE BROADBAND 11–12, 19, 27, 103–104, 132–135, 205, 347–351, 355–358, 389 (2011) (Ex. 1206).

III. ANALYSIS

A. Final Written Decisions

Our discussion of the final written decisions focuses on our previous construction of the claim term "plurality of carrier aggregated transmit signals," as recited in challenged independent claims 1, 18, and 28. In the final written decisions, we began our analysis by addressing the parties' arguments regarding the construction of that term. Final Dec. 18–25. Based on our review of the claims and specification of the '675 patent, we disagreed with Patent Owner that the term "plurality of carrier aggregated transmit signals" requires signals comprising transmissions on *component* carriers. *Id.* at 20–21. We explained that the '675 patent explicitly defines "carrier aggregation" as "operation on multiple carriers," and that it also explicitly defines "[a] transmit signal" as "a signal comprising a transmission on one or more carriers, a transmission on one or more frequency channels, etc." *Id.* at 21 (citing Ex. 1201, 2:63–64, 3:60–62). We further determined that these definitions refer broadly to signals comprising transmissions on carriers. *Id.*

We also disagreed with Patent Owner that the term "plurality of carrier aggregated transmit signals" requires signals *from a single terminal*. Final Dec. 21–23. We explained that the claim language recites nothing about signals from a single terminal. *Id.* at 22. We additionally explained that although the '675 patent discloses examples and embodiments where signals are from a single terminal, the specification does not limit "carrier aggregated transmit signals" to those examples and embodiments. *Id.* (citing Ex. 1201, 14:21–25 (stating that the "disclosure is not intended to be limited to the examples and designs described")). We further noted that the

'675 patent teaches that a wireless device "'may send and/or receive transmissions' on multiple carriers according to various combinations of bands and band groups." *Id.* at 22–23 (citing Ex. 1201, 3:1–35). We found this to be consistent with Dahlman, extrinsic evidence regarding carrier aggregation, which Patent Owner cited as teaching that multiple carriers "are aggregated and jointly used for transmission *to/from* a single terminal." *Id.* at 23 (citing Ex. 1206, 104 (cited by PO Resp. 15)).

Lastly, we disagreed with Patent Owner that the term "plurality of carrier aggregated transmit signals" requires extended bandwidth for a user transmission from a single terminal. Final Dec. 23. We explained that the claim language recites nothing about extended transmission bandwidth, and that although the '675 patent discloses an example where carrier aggregation provides extended transmission bandwidth, it does not limit "carrier aggregated transmit signals" to that example. *Id.* (citing Ex. 1201, 2:65–67 ("Wireless device 110 *may* be configured with up to 5 carriers in one or two bands in LTE[15] Release 11.") (emphasis added)).

Turning to Petitioner's proposed construction for the term "plurality of carrier aggregated transmit signals," we noted its similar requirement of increasing the bandwidth for a user. Final Dec. 23. As with Patent Owner, we disagreed with Petitioner in this regard for the same reasons discussed above. *Id.* We additionally noted that Petitioner's counsel conceded during oral argument that this requirement "does not come specifically from the specification," and that Petitioner would not object to eliminating the requirement. *Id.* at 24 (citing Tr. 10:22–11:17).

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[15] LTE stands for Long Term Evolution. Ex. 1201, 2:21.

We also disagreed with Petitioner that the term "plurality of carrier aggregated transmit signals" requires "signals for transmission . . . at the same time." Final Dec. 24. We explained that the claim recites "a plurality of carrier aggregated transmit signals being sent simultaneously," and that requiring signals for transmission *at the same time* would render the claim language "being sent simultaneously" redundant and superfluous. *Id.*

In summary, we concluded that the broadest reasonable interpretation of the claim term "plurality of carrier aggregated transmit signals" is "signals for transmission on multiple carriers." Final Dec. 24. We stated that "[o]ur construction is consistent with the '675 patent, which defines the term 'carrier aggregation' as 'operation on multiple carriers' and the term '[a] transmit signal' as 'a signal comprising a transmission on one or more carriers, a transmission on one or more frequency channels, etc.'" *Id.* at 24–25 (citing Ex. 1201, 2:63–64, 3:60–62). We additionally noted that "[o]ur construction also encompasses, but is not limited to, Patent Owner's proposed construction." *Id.* at 25.

After providing a brief overview of Chen, we addressed whether Petitioner demonstrated by a preponderance of the evidence that the teachings in Chen account for the "plurality of carrier aggregated transmit signals," as recited in each of independent claims 1, 18, and 28. Final Dec. 32–37. In particular, consistent with our construction of the claim term "plurality of carrier aggregated transmit signals," we agreed with Petitioner that Chen's input signals 1 and 2 are transmitted on multiple carriers because the signals are "two single carrier wideband code division multiple access signals" that operate at different frequencies. *Id.* at 37 (citing Pet. 24 (citing Ex. 1212, 663)). We also credited the testimony of Petitioner's declarant

Dr. Choi on this particular issue. *Id.* (citing Pet. 24 (citing Ex. 1203 ¶ 103)). As to Patent Owner's argument challenging Petitioner's showing for the recited "plurality of carrier aggregated transmit signals," we disagreed because Patent Owner relied on its proposed construction, which we determined "is overly narrow and improperly requires signals from a single terminal as well as providing extended transmission bandwidth for a user transmission from a single terminal." *Id.* at 59–60 (citing PO Resp. 46).

B. The Federal Circuit's Remand Decision

Our discussion of the Federal Circuit's remand decision focuses only on the court's analysis regarding our construction of the recited "plurality of carrier aggregated transmit signals." On appeal to the Federal Circuit, Patent Owner argued that "it was not afforded notice of, or an adequate opportunity to respond to, the Board's construction of 'a plurality of carrier aggregated transmit signals.'" *Qualcomm*, 6 F.4th at 1262. The Federal Circuit agreed with Patent Owner that we "violated [Patent Owner's] procedural rights with respect to the 'plurality of carrier aggregated transmit signals' limitation." *Id.* The Federal Circuit explained that "the Board may adopt a claim construction of a disputed term that neither party proposes without running afoul of the [Administrated Procedure Act]." *Id.* As to the case here, however, the Federal Circuit pointed out that "the issue of whether increased bandwidth was a required part of the claim construction was not in dispute." *Id.* at 1262–63. That is, "[t]he Board's construction of 'a plurality of carrier aggregated transmit signals' diverged from the agreed-upon increased bandwidth requirement for the term." *Id.* at 1263. The Federal Circuit further noted that "[w]hile the Board did not change theories midstream or

depart from a construction it previously adopted, it is still difficult to imagine either party anticipating that this agreed-upon matter of claim construction was a moving target," and that "unlike with disputed terms, it is unreasonable to expect parties to brief or argue agreed-upon matters of claim construction." *Id.* at 1263. The Federal Circuit counseled that "the Board needed to provide notice of and an adequate opportunity to respond to its construction," which "departed from the agreed-upon increased bandwidth requirement." *Id.* at 1263, 1265.

The Federal Circuit disagreed with Petitioner that the oral hearing provided Patent Owner notice and an opportunity to respond. *Qualcomm*, 6 F.4th at 1263–64. The Federal Circuit explained that the panel's comment during the hearing that it would think about whether the increased bandwidth requirement is necessary "did not *provide* [Patent Owner] notice that the Board might depart from the increased bandwidth requirement," where "[t]he Board did not announce a construction, criticize the parties' agreed-upon requirement, ask any follow-up questions to [Petitioner], or ask any related questions to [Patent Owner]." *Id.* at 1264. The Federal Circuit further explained that "[t]he hearing also did not provide an adequate opportunity to respond" because the Board did not provide a theory or rationale for departing from the agreed-upon requirement to which Patent Owner could have responded, it did not ask Patent Owner questions about the requirement, and it did not request additional briefing after the hearing. *Id.* at 1264–65. The Federal Circuit added that Patent Owner did not have an opportunity to introduce evidence addressing why an ordinarily skilled artisan would have understood that the claim term "plurality of carrier

aggregated transmit signals" requires signals that increase bandwidth. *Id.* at 1265.

The Federal Circuit also disagreed with Petitioner that Patent Owner's option to seek rehearing after receiving notice through the final written decisions provided an adequate opportunity to respond. *Qualcomm*, 6 F.4th at 1263, 1265. The Federal Circuit explained that "a party need not seek rehearing in order to seek relief from a Board decision on appeal." *Id.* at 1265. The Federal Circuit acknowledged that "it may have been a more efficient use of resources had [Patent Owner] sought rehearing," but stated that Patent Owner "was not required to do so." *Id.*

Without deciding whether Patent Owner must show prejudice, as Petitioner argued, the Federal Circuit further reasoned that Patent Owner had made a sufficient showing. *Qualcomm*, 6 F.4th at 1263 & n.3. The Federal Circuit explained that Patent Owner "argued throughout the IPR proceedings that the prior art did not disclose the increased bandwidth requirement," and that "[b]y removing that requirement, the Board eliminated an element on which [Petitioner] bore the burden of proof." *Id.* The Federal Circuit additionally explained that "without notice of the Board's elimination of the increased bandwidth requirement, [Patent Owner] had no reason to brief that requirement or establish an evidentiary record supporting it, particularly given the limited word count and breadth of issues in these IPRs." *Id.* at 1263–64.

Accordingly, the Federal Circuit determined that we did not provide Patent Owner adequate notice of and opportunity to respond to our claim construction of "plurality of carrier aggregated transmit signals," vacated our

final written decisions, and remanded for further proceedings. *Qualcomm*, 6 F.4th at 1267.

C. Claim Construction

The claim construction standard applicable to these *inter partes* review proceedings is the broadest reasonable interpretation in light of the patent specification. *See* 37 C.F.R. § 42.100(b) (2018); *Cuozzo Speed Techs. LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016) (upholding the use of the broadest reasonable interpretation standard).[16] Under this standard, claim terms generally are given their ordinary and customary meaning, as would be 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). That is, we give words "their plain meaning" unless, however, it is "inconsistent with the specification and prosecution history." *Arista Networks, Inc. v. Cisco Sys., Inc.*, 908 F.3d 792, 796–98 (Fed. Cir. 2018) (rejecting construction as "overly broad, even under the broadest reasonable interpretation standard"); *see also Personalized Media Comm'cns, LLC v. Apple Inc.*, 952 F.3d 1336, 1340 (Fed. Cir. 2020) ("[T]he Board's interpretation must be reasonable in light of the specification, prosecution history, and the understanding of one skilled in the art.").

[16] The revised claim construction standard for interpreting claims in *inter partes* review proceedings as set forth in the final rule published October 11, 2018, does not apply to these proceedings because the new "rule is effective on November 13, 2018 and applies to all IPR, PGR and CBM petitions filed on or after the effective date." Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340 (Oct. 11, 2018) (codified at 37 C.F.R. § 42.100(b) (2019)). The petitions here were filed on July 3, 2018.

In view of the Federal Circuit's remand decision, we address the parties' arguments on remand as to whether we properly construed the claim term "plurality of carrier aggregated transmit signals" to mean "signals for transmission on multiple carriers."[17]

The term "plurality of carrier aggregated transmit signals" appears in each of challenged independent claims 1, 18, and 28, as well as several dependent claims. Petitioner originally proposed that we construe this term to mean "signals for transmission on multiple carriers at the same time to increase the bandwidth for a user." Pet. 12. On remand, however, Petitioner argues that we properly construed the term to mean, more broadly, "signals for transmission on multiple carriers." Pet. Remand Br. 7–12. As support, Petitioner contends that "the '675 patent provides explicit definitions for this

[17] Referring to Petitioner's opening briefs, Patent Owner asserts that, "[c]ontrary to the Board's Order dated November 1, 2021 (Paper 35 ('Order') in IPR2018-01326), Petitioner filed six substantively different briefs, which collectively exceed the 20-page limit set by the Order." PO Remand Resp. n.1. Patent Owner does not identify any differences. We have reviewed Petitioner's six opening briefs, and they appear to be substantively similar except for the discussions as to the applicability of our previous construction of "plurality of carrier aggregated transmit signals" to the asserted prior art disclosures. *Compare, e.g.*, Pet. Remand Br., *with, e.g.*, IPR2018-01326, Paper 36. In that regard, the briefs in IPR2018-01326, IPR2018-01327, IPR2018-01329, and IPR2018-01340 focus on Yu's disclosures, whereas the briefs in IPR2018-01328 and IPR2018-01330 focus on Chen's disclosures. Pet. Remand Br. 12–14; IPR2018-01326, Paper 36, 13–16. If the six briefs each included the discussions regarding both Yu and Chen, the briefs would be substantively the same, and the sum total of pages for each brief would be less than twenty. Pet. Remand Br. 1–14 (brief, including Chen discussion, comprising about fourteen pages); IPR2018-01326, Paper 36, 13–16 (Yu discussion comprising about four pages). Thus, it is harmless for us to consider Petitioner's opening briefs.

claim term, by stating that 'carrier aggregation . . . ***is*** operation on multiple carriers' and 'a transmit signal ***is*** a signal comprising a transmission on one or more carriers, a transmission on one or more frequency channels, etc.'" *Id.* at 7 (quoting Ex. 1201, 2:63–64, 3:60–62).[18] Petitioner asserts that "[t]he Federal Circuit has recognized that the use of the term 'is' or similar language can 'signify that a patentee is serving as its own lexicographer.'" *Id.* (quoting *Sinorgchem Co., Shandong v. USITC*, 511 F.3d 1132, 1136 (Fed. Cir. 2007)).

Petitioner also points to various other portions of the specification. Pet. Remand Br. 9. For example, Petitioner cites the teaching that "[c]arrier aggregation may also be referred to as multi-carrier operation." *Id.* (citing Ex. 1201, 2:64–65). Petitioner additionally cites the teaching that "[i]ntra-band [carrier aggregation] refers to operation on multiple carriers within the same band," and "[i]nter-band [carrier aggregation] refers to operation on multiple carriers in different bands." *Id.* (citing Ex. 1201, 3:1–5). According to Petitioner, these teachings "confirm[] the accuracy of the Board's construction under the broadest reasonable interpterion standard." *Id.*

Petitioner acknowledges that our previous construction is broader than the construction it originally proposed in the petitions. Pet. Remand Br. 10. In particular, our construction omits two requirements from Petitioner's

[18] There are instances in the parties' remand briefs where citations refer to IPR2018-01326, a related case not addressed here. *See, e.g.*, PO Remand Resp. n.1; Pet. Remand Reply n.1. Many of the same papers and exhibits have been filed in both IPR2018-01326 and IPR2018-01328. For purposes of this Decision, citations attributed to the parties refer to IPR2018-01328, unless noted otherwise.

originally-proposed construction, namely, signals for transmission *at the same time* and *increasing the bandwidth for a user*. *Id.* Petitioner explains that it originally "proposed its construction in an effort to minimize disputes," noting that its "construction was actually the Patent Owner's construction in the earlier ITC proceeding." *Id.* Petitioner contends, however, "[t]he Board properly omitted the limitation 'to increase the bandwidth for a user' because, as the Board explained, the claim language says nothing about increasing bandwidth for a user." *Id.* at 10 (citing Final Dec. 23). Petitioner further asserts that "while the '675 patent ***does*** include an example of carrier aggregation increasing bandwidth, it ***does not*** expressly limit carrier aggregation to this purpose." *Id.* at 11 (citing Ex. 1201, 2:65–67 ("Wireless device 110 ***may*** be configured with up to 5 carriers in one or two bands in LTE Release 11.") (emphasis added)).

Petitioner adds that "the Board properly omitted the limitation 'at the same time'" because claim 1 recites "a plurality of carrier aggregated transmit signals being sent simultaneously," and requiring signals for transmission *at the same time* "would render superfluous the claim language 'being sent simultaneously.'" Pet. Remand Br. 11–12; *see id.* at 9 n.6.

Patent Owner responds that the term "carrier aggregated transmit signals" instead carries its ordinary and customary meaning, which Petitioner originally proposed in its petitions: "signals for transmission on multiple carriers at the same time to increase the bandwidth for a user." PO Remand Resp. 2, 9; *see also* Pet. 12. Patent Owner contends that "[w]hile it is true that transmission of signals on multiple carriers is an attribute of carrier aggregation, the [person having ordinary skill in the art] would have further understood the term to mean that the multiple component carriers are

aggregated (*i.e.*, combined) to increase the bandwidth for a user." PO Remand Resp. 9 (internal citation omitted). As support, Patent Owner relies on the '675 patent, its prosecution history file, as well as extrinsic evidence.

Starting with the '675 patent, Patent Owner asserts that the specification "specifically describes an example of a user device (*i.e.*, wireless device 110) that 'supports carrier aggregation' by being 'configured with up to 5 carriers in one or two bands [in LTE Release 11].'" PO Remand Resp. 10 (quoting Ex. 1201, 2:63–67). To illustrate, Patent Owner asserts that "user devices of earlier LTE systems were limited to the 20 MHz bandwidth of a single channel," whereas "the carrier aggregation introduced in LTE Release 11 enables a user device to aggregate up to five of these 20 MHz channels as component carriers of a single virtual channel having a bandwidth of up to 100 MHz." *Id.* (citing Ex. 1201, 2:59–60, 65–67, Figs. 2A–2D). Patent Owner notes that "[t]he '675 patent further explains that LTE carriers may be aggregated from frequency bands listed in 3GPP TS (Technical Specification) 36.101," a 3GPP[19] technical report that Patent Owner points to specifically for describing carrier aggregation as "[a]ggregation of two or more component carriers in order to support wider transmission bandwidths." *Id.* at 11 (citing Ex. 1201, 2:58–62; quoting Ex. 2011, 14 (3GPP technical report)).

Moving on to the prosecution history of the '675 patent, Patent Owner asserts that the Examiner applied a U.S. publication, namely, the Chen

[19] 3GPP stands for 3rd Generation Partnership Project. Ex. 2011 (cover).

publication,[20] in an Office action because it "discloses a plurality of carrier aggregated transmit signals." PO Remand Resp. 11 (quoting Ex. 1202, 266–279 (Office action, July 2, 2015)). According to Patent Owner, the Chen publication "makes clear that its multi-carrier aggregation provides increased bandwidth." *Id.* Patent Owner relies on the Chen publication's teaching that the "bandwidth of a signal constantly increases due to multi-carrier applications." *Id.* (quoting Ex. 2012 ¶ 4).

As to extrinsic evidence, Patent Owner points to teachings across various patents and publications to support its proposed construction on remand. PO Remand Resp. 12–13 (citing Ex. 2015, 6; Ex. 2016; Ex. 2017, 3:20–22; Ex. 2018, 3:27–62). For example, Patent Owner asserts that "U.S. Patent No. 9,161,254 teaches that carrier aggregation is a 'technique for providing additional bandwidth capacity to wireless devices' by 'aggregat[ing] . . . multiple smaller bandwidths to form a virtual wideband channel at a wireless device (e.g., UE).'" *Id.* at 12 (quoting Ex. 2017, 3:19–22[21]). Patent Owner also asserts that "a 2013 Qualcomm document states that '[c]arrier aggregation, as the name suggests, combines multiple carriers (a.k.a. channels) at the device to provide a bigger data pipe to the user.'" *Id.* (quoting Ex. 2015, 6).

With respect to our previous construction (which is Petitioner's proposed construction on remand), Patent Owner contends that it "is wrong because it reads 'aggregated' out of the term 'carrier aggregated transmit

[20] Chen, U.S. Publication No. 2012/0321018 A1, published Dec. 20, 2012 (Ex. 2012). The Chen publication is different than Chen, which is an asserted reference in the petitions.
[21] Patent Owner cites Exhibit 2017, lines 20 through 22, but the quoted language appears at lines 19 through 22.

signals.'" PO Remand Resp. 13. Patent Owner asserts that "[a]ggregation refers to the process of combining constituent parts into a single thing." *Id.* (citing Ex. 2029 (dictionary defining "aggregation" as "the collecting of units . . . into a mass or whole")). Patent Owner further asserts that an ordinarily skilled artisan "would not have understood 'carrier aggregation' to be equivalent to any generic 'transmission on multiple carriers' because nothing is being aggregated when disparate signals are transmitted on different carriers to separate destinations." *Id.* at 14.

Patent Owner further contends "there is no lexicography" here, contrary to Petitioner's position. PO Remand Resp. 2 (capitalization and emphasis omitted); *see also* Pet. Remand Br. 7. Patent Owner asserts that "[w]hen the '675 patent sought to define a term, it used a very specific format, *i.e.*, putting the defined term in quotations marks, followed by the phrase 'is used herein to mean,' followed by the definition in quotation marks." PO Remand Resp. 3. For example, Patent Owner directs us to where the specification states, "The word 'exemplary' is used herein to mean 'serving as an example, instance, or illustration.'" *Id.* (citing Ex. 1201, 2:10–11). Patent Owner further asserts that "[n]one of the statements [Petitioner] relies on for the term 'carrier aggregated transmit signals' resembles this format" because "neither of [Petitioner's] citations employs the phrase 'is used herein to mean'" or "uses quotation marks for the term or its purported definition." *Id.* at 4 (citing Ex. 1201, 2:63–54, 3:60–62). As discussed above, Petitioner cites the '675 patent's statement that "carrier aggregation . . . is operation on multiple carriers" as well as its statement that "[a] transmit signal is a signal comprising a transmission on one or more carriers, a transmission on one or more frequency channels,

etc." Pet. Remand Br. 7 (quoting Ex. 1201, 2:63–64, 3:60–62). According to Patent Owner, "[t]hese departures from the '675 patent's distinctive definitional format show that the patentee did not intend these statements to redefine the plain and ordinary meaning of 'carrier aggregated transmit signals.'" PO Remand Resp. 4; *see also id.* at 8 (characterizing "the '675 patent's statement 'carrier aggregation . . . is operation on multiple carriers' [a]s nothing more than a generalized introduction to carrier aggregation, highlighting one aspect of it").

Patent Owner also urges that, "[t]aken together, the [person having ordinary skill in the art] would recognize that neither statement is definitional" because they additionally are inconsistent. PO Remand Resp. 5–6 (citing Ex. 1201, 2:63–64, 3:60–62); PO Remand Sur-reply 6–7. Patent Owner points out in particular that one statement "has a broader scope than the [other statement], encompassing transmission on *one or more* general frequencies rather than *multiple carriers*," and "is open-ended via its use of the word 'etc.'" PO Remand Resp. 6; *see also* PO Remand Sur-reply 6 ("For example, . . . 'transmit signals' includes transmission on ***one*** carrier, while 'carrier aggregation' is limited to implementations utilizing ***multiple*** carriers."). *Compare* Ex. 1201, 2:63–64 ("carrier aggregation . . . is operation on multiple carriers"), *with* Ex. 1201, 3:60–62 ("[a] transmit signal is a signal comprising a transmission on one or more carriers, a transmission on one or more frequency channels, etc.").

Lastly, Patent Owner directs our attention to another Board decision in a different case, IPR2019-00128, in which, according to Patent Owner, the parties "litigated nearly the same issue that is now before the Board," namely, "the correct construction of the term 'carrier aggregation.'" PO

Remand Resp. 14 (citing Ex. 2026). In that decision, the Board determined that "carrier aggregation" requires, in part, providing higher bandwidth. Ex. 2026, 24–26. The Board relied on intrinsic evidence in that case, including a technical report cited in the patent specification and a reference relied on during prosecution. *Id.* Patent Owner asserts that the technical report cited there is the same 3GPP technical report cited in the '675 patent regarding LTE Release 11. PO Remand Resp. 17 (citing Ex. 1201, 2:60–67; Ex. 2026, 24).

In reply, Petitioner addresses Patent Owner's arguments regarding Petitioner's reliance on the '675 patent's two statements that "carrier aggregation . . . is operation on multiple carriers" and "[a] transmit signal is a signal comprising a transmission on one or more carriers, a transmission on one or more frequency channels, etc." Ex. 1201, 2:63–64, 3:60–62. Petitioner reiterates that "the Federal Circuit ***has*** found that 'is' can signal lexicography," and has further "held that specific or even explicit definitional formats are ***not*** required." Pet. Remand Reply 2; *see also id.* at 4 (asserting that "Patent Owner's argument . . . is contradicted by the Federal Circuit's holdings that the word 'is' may define a term"). Petitioner also asserts that "operation on multiple carriers" is a "definition [that] is in the 'Detailed Description' of the purported invention," rather than "a generalized introduction to carrier aggregation," contrary to Patent Owner's position. *Id.* at 4. As to Patent Owner's emphasis on the way the '675 patent defines "exemplary," Petitioner counters that "the alleged 'definitional format' . . . is merely a legal boilerplate definition of 'exemplary,'" a word that "is not a technical claim term." *Id.* at 3.

Regarding Patent Owner's characterization of the two statements as inconsistent with each other, Petitioner responds that Patent Owner "relies on a misquote of the definition of 'transmit signals'" and "omits the word 'channels.'" Pet. Remand Reply 3–4. Petitioner asserts that "[t]he actual phrases in that definition—'transmission on one or more carriers' and 'transmission on one or more frequency channels'—which Patent Owner's own expert confirmed is 'reasonable'—are consistent and closely related because a carrier is transmitted on a frequency *channel*." *Id.* at 4 (citing Ex. 1201, 3:60–62; Ex. 1244 ¶¶ 10–17; Ex. 1241, 15:8–16:4). Petitioner further asserts that "Patent Owner also cites the 'etc.' in the definition but fails to identify what else is signaled by that language." *Id.*

Turning to Patent Owner's proposed construction of "plurality of carrier aggregated transmit signals," Petitioner argues that "Patent Owner seeks to import 'to increase the bandwidth for a user.'" Pet. Remand Reply 5. Petitioner contends that the "added language is improper because it imports an ***objective*** or potential ***result or benefit*** of carrier aggregation, not what carrier aggregation ***is***." *Id.* (citing *Braintree Labs., Inc. v. Novel Labs., Inc.*, 749 F.3d 1349, 1355 (Fed. Cir. 2014)). Petitioner adds that "increased signal bandwidth is only a ***potential*** result of carrier aggregation which may not occur." *Id.* at 6. As support, Petitioner relies on Dr. Choi's testimony in his reply declaration on remand. *Id.* at 6 n.5 (citing Ex. 1244 ¶¶ 18–29). To illustrate, Dr. Choi testifies,

> So, for example, . . . one component carrier from each of Band 1 and Band 18 can be carrier aggregated. . . . [I]n Band 1, carriers with 5, 10, 15, and 20 MHz bandwidths are available for aggregation . . . , while in Band 18, carriers with 5, 10, or 15 MHz are available for aggregation . . . .

> As one example where carrier aggregation would not result in increased bandwidth, ***aggregating a 5 MHz carrier from Band 1 . . . with a 5 MHz carrier from Band 18 . . . would only result in 10 MHz, which does not result in increased bandwidth compared with the bandwidth of a single, non-aggregated, carrier***, for instance, a single 20 MHz carrier in Band 1 . . . a single 15 MHz carrier in Band 1, or a single 15 MHz carrier in Band 18, etc.

Ex. 1244 ¶¶ 24–25.

Petitioner further contends that neither the specification, the prosecution history, nor the extrinsic evidence of record supports Patent Owner's proposed construction. Pet. Remand Reply 6–7. Referring to the specification, Petitioner asserts that it "states that multiple transmissions on different carriers '***may*** have increased envelope bandwidth,'" its "discussion of Figures 2A–2D, cited by Patent Owner . . . does not mention increasing bandwidth," its "discussion of the LTE specification . . . mentions only that frequency bands may cover up to 200 MHz and 35 bands are supported in Release 11," and it "does not incorporate the statement in 3GPP TS 36.101 about 'carrier aggregation' quoted by Patent Owner." *Id.* at 6 (citing Ex. 1201, 2:58–62, 6:10–12). As for the prosecution history, Petitioner asserts that "[n]either the Examiner nor the applicant made ***any*** such argument or suggestion" about understanding "that increasing bandwidth for a user is a required part of the construction of 'carrier aggregated transmit signals.'" *Id.* at 6–7. Petitioner also notes that the Examiner never cited paragraph 4 of the Chen publication on which Patent Owner relies. *Id.* at 7. With respect to the extrinsic evidence, Petitioner asserts that it was not cited or considered during prosecution. *Id.* Petitioner adds that "[w]here, as here, the claim term is defined in the patent, reliance on such extrinsic evidence is

improper." *Id.* (citing *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1584–85 (Fed. Cir. 1996)).

Also, Petitioner contends that "Patent Owner wrongly criticizes the Board's construction for allegedly 'read[ing] "aggregated" out of the term'" because "the claims already state that the claimed apparatus 'produce[s] a single output radio frequency (RF) signal.'" Pet. Remand Reply 7 (citing Ex. 1244 ¶¶ 30–33).

Lastly, Petitioner contends that the Board's construction of "carrier aggregation" in the other decision, in IPR2019-00128, should not dictate our decision here because the construction there "***excludes*** 'for a user,' and relies on several prior art references not relevant here." Pet. Remand Reply 8. Petitioner also submits, "More importantly, [the] Board's construction here is consistent with the ALJ's construction of the same term in the associated ITC investigation as 'simultaneous operation on multiple carriers,' whereas the [other] construction—currently on appeal—is not." *Id.* (citing Ex. 1242, 37–42). Petitioner asserts that "[t]he ALJ's construction and reasoning expressly rejected the inclusion of 'to increase the bandwidth for a user.'" *Id.* (citing Ex. 1242, 37–42).

Patent Owner counters that "increased user bandwidth is the necessary purpose of carrier aggregation," and that "Dr. Choi fails to show that carrier aggregation does not always increase the bandwidth of a user." PO Remand Sur-reply 2. Referring to Dr. Choi's example discussed above (*see also* Ex. 1244 ¶ 25), Patent Owner asserts that "[a]ggregating *two 5-MHz carriers* necessarily increases the bandwidth for a user as compared to a *single 5-MHz carrier* allocated to the user and Dr. Choi admits this." PO Remand Sur-reply 2 (citing Ex. 2030, 28:2–24 ("So I think you're asking me if you

were to aggregate these two 5-megahertz carriers for a resultant total aggregated bandwidth of 10 megahertz, would that be greater than if you were just to have a single 5-megahertz carrier. And the answer's, obviously, yes because ten is greater than five.")). Patent Owner adds that during prosecution "[t]he applicant amended the claims based on the prior art to recite 'carrier ***aggregated*** transmit signals' (Ex. 1[2]02 at 237), and the increased bandwidth requirement gives meaning to the explicitly recited 'aggregat[ion].'" *Id.* at 2–3. Patent Owner states that "[p]ointing to other language in the claim as allegedly establishing the 'aggregating' concept," as Petitioner does, "would cause the word 'aggregated,' where it is recited in the claim, to be superfluous." *Id.* at 5 (citing *Bicon, Inc. v. Straumann Co.*, 441 F.3d 945, 950 (Fed. Cir. 2006)).

With respect to Petitioner's contention that Patent Owner's proposed construction on remand is unsupported by the specification, the prosecution history, and the extrinsic evidence, Patent Owner responds that Petitioner "point[s] to no counter-examples where increased bandwidth for a user is not present." PO Remand Sur-reply 3. Patent Owner also notes Petitioner "does not even attempt to show" that the statement in the 3GPP technical report describing carrier aggregation as "[a]ggregation of two or more component carriers in order to support wider transmission bandwidths" is "wrong or inconsistent with the [person having ordinary skill in the art's] understanding of the term." *Id.*; *see also id.* at 4 (stating "[Petitioner's] only counter to [Patent Owner's] evidence that the Examiner understood 'carrier aggregation' to increase the bandwidth of a user is that [Patent Owner] cited Chen paragraph [0004], whereas the Examiner specifically cited paragraph [0007]"); *id.* at 4 (stating "[Petitioner's] further criticism that [Patent

Owner's] 'external documents' were not 'cited or considered during prosecution' just means that they are extrinsic evidence" (internal citation omitted)).

Patent Owner further maintains its position that there is no lexicography in this case. PO Remand Sur-reply 6–8. Patent Owner adds that Petitioner "cites no authority for the proposition that two alleged definitions can be combined to yield lexicography for a disputed claim term." *Id.* at 7. Lastly, Patent Owner notes that "there is no rule forbidding generalized introductions in a patent's detailed description." *Id.* at 8.

On the record now before us, we determine that our previous construction of "plurality of carrier aggregated transmit signals" (i.e., "signals for transmission on multiple carriers") is overly broad. As Petitioner points out, the '675 patent "stat[es] that 'carrier aggregation . . . ***is*** operation on multiple carriers' and 'a transmit signal ***is*** a signal comprising a transmission on one or more carriers, a transmission on one or more frequency channels, etc.'" Pet. Remand Br. 7 (quoting Ex. 1201, 2:63–64, 3:60–62). Read together in isolation, we agree with Petitioner that these statements in the specification say "carrier aggregated transmit signals" means "signals for transmission on multiple carriers." Our construction, however, must also take into account the prosecution history. *See Personalized Media*, 952 F.3d at 1340. The prosecution history "facilitates 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) (citing *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 804 (Fed. Cir. 1999)). 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 at 1340. Thus, "like the specification, the prosecution history can act like a dictionary." *Hemphill v. McNeil-PPC, Inc.*, 25 F. App'x 915, 918 (Fed. Cir. 2001) (non-precedential).

Here, during prosecution of the '675 patent, the applicant amended independent claim 1 to recite "a plurality of different transmit signals" as well as "a power amplifier to receive . . . the plurality of different transmit signals . . . and to produce a single output RF signal." Ex. 1202, 189 (Amendment, Nov. 12, 2014). The applicant later amended claim 1 again solely to replace "a plurality of *different* transmit signals" with "a plurality of *carrier aggregated* transmit signals," and remarked to the Examiner that "[i]t is Applicant's understanding that the above amendments place all claims in a condition for allowance." *Id.* at 237, 246 (Amendment, March 6, 2015). The applicant similarly amended the other independent claims during prosecution. *Id.* at 191–194, 240–241, 243–244.

Based on the applicant's amendments, we agree with Patent Owner that maintaining our previous construction of "plurality of carrier aggregated transmit signals" as "signals for transmission on multiple carriers" would ignore the word "aggregated." *See* PO Remand Resp. 13–14. The amendment limiting the recited signals to "carrier aggregated" signals indicates that the claims require something more than just signals for transmission on multiple carriers; otherwise, the claims would encompass signals that are *not* carrier aggregated. *See, e.g.*, Ex. 1201, 6:10–12 ("Multiple transmit signals may be sent on different frequencies (e.g., different carriers) and hence *may* have increased envelope bandwidth."

(emphasis added)) (cited by Pet. Remand Reply 6); Ex. 1202, 189, 237 (application claims reciting *different* transmit signals before being amended to recite *carrier aggregated* transmit signals). Thus, our previous construction of "plurality of carrier aggregated transmit signals," though consistent with the specification language, is broader than the applicant's intended meaning and scope of the term as illuminated by the prosecution history.

We note Petitioner's contention that the claim limitation "produc[ing] a single output radio frequency (RF) signal" accounts for the claim term "aggregated." Pet. Remand Reply 7. As discussed above, however, that limitation was already included in the claims before the applicant amended them to require "carrier aggregated" signals. *Compare* Ex. 1202, 189 (Amendment, Nov. 12, 2014), *with id.* at 237 (Amendment, March 6, 2015). Thus, if producing a single output RF signal were to account for "aggregated," as Petitioner urges, then "aggregated" would be rendered superfluous. *See Dig.-Vending Servs. Int'l, LLC v. Univ. of Phx., Inc.*, 672 F.3d 1270, 1275 (Fed. Cir. 2012) (noting "the importance of construing claim terms in light of the surrounding claim language, such that words in a claim are not rendered superfluous").

We turn now to Patent Owner's proposed construction on remand, namely, "signals for transmission on multiple carriers at the same time to increase the bandwidth for a user," which can be divided into three parts: (1) "signals for transmission on multiple carriers," (2) "at the same time," (3) "to increase the bandwidth for a user." PO Remand Resp. 9. The parties' dispute in this regard addresses primarily the third part of Patent Owner's proposed construction, centering on whether the broadest

reasonable interpretation of "plurality of carrier aggregated transmit signals" requires increasing bandwidth.[22] *See* Pet. Remand Br. 10–12; PO Remand Resp. 9–18; Pet. Remand Reply 5–8; PO Remand Sur-reply 1–5. We determine that the intrinsic evidence supports this aspect of Patent Owner's proposed construction.

"[P]rior art cited in a patent or cited in the prosecution history of the patent constitutes intrinsic evidence," and "when prior art that sheds light on the meaning of a term is cited by the patentee, 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 Grp. SpA*, 401 F.3d 1307, 1311 (Fed. Cir. 2005) (quoting *Arthur A. Collins, Inc. v. N. Telecom Ltd.*, 216 F.3d 1042, 1045 (Fed. Cir. 2000)) (other citations omitted). Thus, for the third part of Patent Owner's proposed construction, we rely on the 3GPP technical report cited in the '675 patent, as well as the Chen publication, which was cited in the prosecution history of the '675 patent. The 3GPP technical report defines "[c]arrier

[22] Petitioner does not dispute the first part of Patent Owner's proposed construction. *See* Pet. Remand Br. 7 ("The Board construed the claim term 'plurality of carrier aggregated transmit signals' to mean 'signals for transmission on multiple carriers.' This construction is correct." (internal citation omitted)). With respect to the second part of the construction, we note Petitioner's contention that our previous construction properly omitted "at the same time." *See id.* at 11–12. Determining whether "plurality of carrier aggregated transmit signals" requires this aspect of Patent Owner's proposed construction, however, is not necessary to resolve any controversy here. *See Vivid Techs.*, 200 F.3d at 803 (explaining that "only those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy").

aggregation" as "[a]ggregation of two or more component carriers in order to *support wider transmission bandwidths*." Ex. 2011, 14 (emphasis added) (cited by Ex. 1201, 2:60–62 ('675 patent)). The Chen publication additionally states that the "*bandwidth of a signal constantly increases* due to multi-carrier applications." Ex. 2012 ¶ 4 (emphasis added) (cited by Ex. 1202, 270 (Office Action, July 2, 2015)).

The teachings in both the 3GPP technical report and the Chen publication are consistent with contemporaneous extrinsic evidence introduced into the record on remand. For example, as discussed above, Patent Owner directs us to U.S. Patent No. 9,161,254, which states that "[o]ne technique for providing additional bandwidth capacity to wireless devices is through the use [of] carrier aggregation of multiple smaller bandwidths to form a virtual wideband channel at a wireless device (e.g., UE)." Ex. 2017, 3:19–22 (quoted in PO Remand Resp. 12); *see also id.* at 3:49–51 ("Carrier aggregation . . . enable[es] more bandwidth to be obtained.") (cited by PO Remand Resp. 12). The application for that patent was filed in May 2013, just three months after the application for the '675 patent was filed. Ex. 1201, code (22); Ex. 2017, code (22). Similarly, Patent Owner draws our attention to a 2013 Qualcomm paper, which states that "[c]arrier aggregation, as the name suggests, combines multiple carriers . . . at the device to provide a bigger data pipe to the user." Ex. 2015, 6 (quoted in PO Remand Resp. 12).

We note Petitioner's contention that the passage in the Chen publication on which Patent Owner relies was never cited by the Examiner. *See* Pet. Remand Reply 7. That passage provides additional support for the definition of carrier aggregation that is provided in the 3GPP technical

report, however, and is therefore relevant to our analysis here. *See V-Formation*, 401 F.3d at 1311; *see also* Ex. 1202, 278 (the Examiner advising the applicant during prosecution "to fully consider the [cited] references in their entirety as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the Examiner"). Moreover, contrary to Petitioner's position, that neither the Examiner nor the applicant explicitly expressed an understanding that carrier aggregation requires increasing bandwidth does not change what is taught in the 3GPP technical report or in the Chen publication, both part of the intrinsic evidence. *See* Pet. Remand Reply 6–7 (Petitioner arguing that "the file history does not support Patent Owner's argument that the Examiner 'understood' that increasing bandwidth for a user is a required part of the construction of 'carrier aggregated transmit signals'" because "[n]either the Examiner nor the applicant made ***any*** such argument or suggestion").

We further note Petitioner's contention that the third part of Patent Owner's proposed construction, increasing bandwidth, "is improper because it imports an objective or potential result or benefit of carrier aggregation, not what carrier aggregation is." Pet. Remand Reply 5 (emphases omitted). Petitioner relies on *Braintree*, a Federal Circuit case in which the court rejected the argument that "purgation" means cleansing, even though "the specification . . . indicates that a dosage amount is 'effective' only if it produces a clean colon in preparation for a colonoscopy." *Braintree*, 749 F.3d at 1354–55. The court explained that "while cleansing is the goal specifically articulated in the specification, it is not a claim requirement," where the claims "only require that the compositions 'induce' (i.e., bring about or start) diarrhea," rather than "achiev[e] a fully cleansed colon." *Id.*

Petitioner's reliance on *Braintree* is misplaced. The facts here are different. Specifically, the claims of the '675 patent require *carrier aggregated* transmit signals. The 3GPP technical report noted above, which is part of the intrinsic evidence, defines "carrier aggregation" as "[a]ggregation of two or more component carriers in order *to support wider transmission bandwidths*." Ex. 2011, 14 (emphasis added); *see also* Ex. 2012 ¶ 4 (Chen publication, also part of the intrinsic evidence, stating that the "*bandwidth of a signal constantly increases* due to multi-carrier applications" (emphasis added)). Thus, carrier aggregation *is* the aggregation of two or more carriers in order *to support wider transmission bandwidths*. As discussed above, the extrinsic evidence supports this definition. *See* Ex. 2015, 6 ("Carrier aggregation, as the name suggests, combines multiple carriers . . . at the device to provide a bigger data pipe to the user."); Ex. 2017, 3:19–22 ("One technique for providing additional bandwidth capacity to wireless devices is through the use [of] carrier aggregation of multiple smaller bandwidths to form a virtual wideband channel at a wireless device (e.g., UE)."), 49–51 ("Carrier aggregation . . . enable[es] more bandwidth to be obtained.").

Dr. Choi's example about aggregating two 5 MHz carriers from different bands also supports this definition. *See* Ex. 1244 ¶¶ 24–25 (cited by Pet. Remand Reply 6 n.5). Dr. Choi states that the aggregation of two 5 MHz carriers, which would provide a bandwidth of 10 MHz, "does not result in increased bandwidth compared with the bandwidth of a single, non-aggregated, carrier, for instance, a single 20 MHz carrier." *Id.* ¶ 25 (emphasis omitted). As Patent Owner points out, however, such aggregation "necessarily increases the bandwidth for a user as compared to a *single 5-*

MHz carrier allocated to the user." PO Remand Sur-reply 2. We agree with Patent Owner's reasoning in this regard. *See* Ex. 2011, 14 (defining "[c]arrier aggregation" as "[a]ggregation of two or more *component* carriers in order *to support wider transmission bandwidths*" (emphases added)). Indeed, Dr. Choi testified at his deposition on remand, "So I think you're asking me if you were to *aggregate these two 5-megahertz carriers for a resultant total aggregated bandwidth of 10 megahertz*, would that be greater than if you were just to have a single 5-megahertz carrier. And the answer's, obviously, yes because ten is greater than five." Ex. 2030, 28:2–24 (emphasis added) (cited by PO Remand Sur-reply 2). Consistently, Dr. Choi also previously testified in his reply declaration during trial,

> LTE explicitly allows for transmission of *two aggregated 1.4 MHz signals*, even though the standard can also transmit a single 20 MHz carrier, which provides much higher bandwidth than the *combined bandwidth of 2.8 MHz*. . . . [C]arrier aggregation can achieve higher data rates and can increase the overall capacity of wireless networks by allowing network operators to exploit fragmented spectrum allocations. . . . *Aggregating two narrow band signals could do precisely that—increasing bandwidth by using fragmented spectrum allocations*.

Ex. 1231 ¶ 25 (emphases added) (cited by PO Remand Sur-reply 2).

In view of the foregoing, we adopt Patent Owner's proposed construction of "plurality of carrier aggregated transmit signals" on remand (which is the same construction that Petitioner originally proposed in its petitions), namely, "signals for transmission on multiple carriers at the same

time to increase the bandwidth for a user."[23] *See* PO Remand Resp. 9; Pet. 12. For the reasons given above, our construction is supported by the intrinsic evidence. *See, e.g.*, Ex. 1201, 2:60–67, 3:60–62 ('675 patent); Ex. 1202, 189, 237, 246 (prosecution history file); Ex. 2011, 14 (3GPP technical report); Ex. 2012 ¶ 4 (Chen publication). Our construction also is consistent with relevant extrinsic evidence. *See, e.g.*, Ex. 2015, 6; Ex. 2017, 3:19–22, 3:49–51. Further, our construction reflects Petitioner's proposed language on remand, "signals for transmission on multiple carriers," as well as portions of the specification cited by Petitioner. *See* Pet. Remand Br. 7 (citing Ex. 1201, 2:63–64, 3:60–62).

D. Obviousness Based on Chen

Petitioner asserts that claims 1–3, 5, 7, 11, 17–21, and 27 would have been obvious over Chen and Wang; claims 8–10 and 28–30 would have been obvious over Chen, Wang, and Choi; claim 12 would have been obvious over Chen, Wang, and Eliezer; and claims 13–15 and 23–25 would have been obvious over Chen, Wang, and Dahlman. Pet. 15–81; 1330-Paper 3, 22–75. Patent Owner opposes. PO Resp. 21–53. For the reasons explained below, we determine that Petitioner has *not* demonstrated by a

[23] As previously noted, determining whether "plurality of carrier aggregated transmit signals" requires the second part of Patent Owner's proposed construction, "at the same time," is not necessary to resolve any controversy here. *See Vivid Techs.*, 200 F.3d at 803. We explain below it is undisputed that the asserted prior art teaches this aspect of Patent Owner's proposed construction. *See infra* Part III.D.2.a.ii. The outcome of our obviousness analysis would thus be the same whether or not our construction requires "at the same time."

preponderance of the evidence that claims 1–3, 5, 7–15, 17–21, 23–25, and 27–30 would have been obvious over the asserted grounds.

We start with an overview of Chen. As the issues in dispute all turn on the teachings and suggestions of Chen, we do not address the substance of Wang, Choi, Eliezer, or Dahlman.

1. Overview of Chen

Chen is a paper that proposes a hybrid envelope tracking scheme. Ex. 1212, 662. Figure 1 of Chen, which is reproduced below, illustrates the proposed scheme. *Id.*

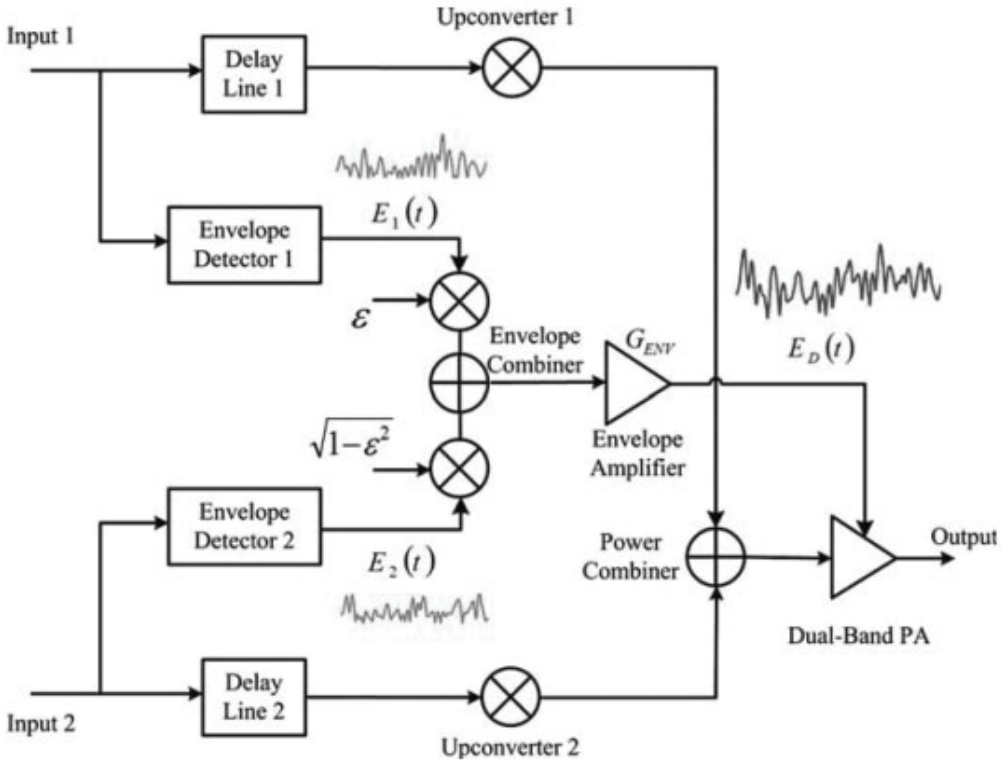

Figure 1 Proposed hybrid ET scheme for concurrent dual-band PAs.

In particular, Figure 1 of Chen shows the proposed hybrid envelope tracking architecture for concurrent dual-band power amplifiers. *Id.* Input signals 1

and 2 are provided at different frequencies (*id.* at 662), and each signal follows two paths (*see id.*, Fig. 1). Along one path, input signals 1 and 2 are fed separately to respective envelope detectors 1 and 2, where the envelopes of the signals are detected. *Id.* at 662, Fig. 1. The signals are then weighted using power weighting factor Ɛ. *Id.* Next, the signals are added together by the envelope combiner and injected into the envelope amplifier. *Id.* The output of the envelope amplifier is used to modulate the supply voltage of the target dual-band power amplifier (PA). *Id.* at 662. Chen indicates that $E_1(t)$ and $E_2(t)$ represent the signal envelopes in dual bands, and $E_D(t)$ represents the final modulated supply of the power amplifier. *Id.*

Along the other path, Figure 1 of Chen shows input signals 1 and 2 also being fed separately to respective delay lines 1 and 2. *See* Ex. 1212, Fig. 1. The signals are then upconverted by upconverters 1 and 2 and added together by the power combiner. *See id.* The power combiner outputs a signal that is provided to the dual-band PA. *See id.*

After receiving signals from both the envelope amplifier and the power combiner, the dual-band PA generates an output signal. Ex. 1212, Fig. 1.

2. Analysis

As discussed above, the Federal Circuit explained in its remand decision that we "needed to provide notice of and an adequate opportunity to respond to [our] construction" of the claim limitation "plurality of carrier aggregated transmit signals," and then it remanded for further proceedings. *Qualcomm*, 6 F.4th at 1263, 1267. Our analysis here thus focuses on

whether the asserted prior art teaches or suggests the limitation "plurality of carrier aggregated transmit signals" in view of our construction on remand.

a. Independent Claims 1, 18, and 28

Each of independent claims 1, 18, and 28 recites, in relevant part, "plurality of carrier aggregated transmit signals." As discussed above, we construe "plurality of carrier aggregated transmit signals" to mean "signals for transmission on multiple carriers at the same time to increase the bandwidth for a user." *Supra* Part III.C. This construction can be divided into three parts: (1) "signals for transmission on multiple carriers," (2) "at the same time," (3) "to increase the bandwidth for a user." We address each part of the construction in turn.

i. "signals for transmission on multiple carriers"

In its opening brief on remand, Petitioner maintains its position set forth in the petitions that Chen teaches signals for transmission on multiple carriers. *Compare* Pet. 23–24, *with* Pet. Remand Br. 12–14. Petitioner identifies Chen's input signals 1 and 2 as "carrier aggregated transmit signals." Pet. Remand Br. 13–14 (citing Pet. 23–24); *see also* Pet. 23–24 ("Chen's Input 1 and Input 2 are signals for transmission on multiple carriers . . . ."). As support, Petitioner directs us to where Chen states that it "propose[s] for the first time a hybrid ET [envelope tracking] scheme for concurrent dual-band PAs, which combines the signal envelopes in dual bands." Pet. Remand Br. 13 (citing Ex. 1212, 662); *see also* Pet. 24. According to Petitioner, "[t]he validation prototype in Chen uses '[t]wo single carrier wideband code division multiple access signals' at two

different frequencies[,] 900 MHz and 2000 MHz," which "indicates that they are from different (i.e., 'multiple') carriers." Pet. Remand Br. 13–14 (quoting Ex. 1212, 663); *see also* Pet. 24. Petitioner contends that Chen's teachings satisfy the first part of our construction of "plurality of carrier aggregated transmit signals," namely, "signals for transmission on multiple carriers." Pet. Remand Br. 14; *see also* Pet. 23–24. Petitioner relies on Dr. Choi's testimony from his declaration submitted in support of the petitions. Pet. Remand Br. 13 (citing Ex. 1203 ¶ 103); *see also* Pet. 24.

Patent Owner does not dispute Petitioner's showing for this aspect of our construction. *See* PO Remand Resp. 18–19; PO Resp. 46–47.

Based on the record before us, we are persuaded that Chen teaches signals for transmission on multiple carriers.

ii. "at the same time"

As discussed above, Petitioner argues on remand that the claim term "plurality of carrier aggregated transmit signals" does not require the second part of our construction, "at the same time." Pet. Remand Br. 7, 11–12. Petitioner nonetheless asserts that its petitions "explained that the prior art disclosed this claim term even under a narrower construction." *Id.* at 13 (citing Pet. 23–24). In the petitions, Petitioner "applie[d] the construction 'signals for transmission on multiple carriers at the same time to increase the bandwidth for a user,'" which is the same as our construction on remand. Pet. 23. Petitioner argued that "Chen's power tracking signal is based on a plurality of carrier aggregated transmit signals being sent *simultaneously*," and, more specifically, that "Input 1 and Input 2 are signals for transmission on multiple carriers *at the same time* . . . ." *Id.* at 23–24 (emphases added)

(citing Ex. 1212, 662–663). This is supported by Chen's teaching that, "[t]o investigate the performance of the ET scheme, two continuous wave signals have been fed into the dual-band PA *simultaneously*." Ex. 1212, 663 (emphasis added).

Patent Owner does not dispute Petitioner's showing for this aspect of our construction. *See* PO Remand Resp. 18–19; PO Resp. 46–47.

Based on the record before us, we are persuaded that Chen teaches signals for transmission on multiple carriers *at the same time*.

iii. "to increase the bandwidth for a user"

Petitioner also argues on remand that "plurality of carrier aggregated transmit signals" does not require the third part of our construction, "to increase the bandwidth for a user." Pet. Remand Br. 7, 10–11. In its petitions, however, Petitioner "applie[d] the construction, 'signals for transmission on multiple carriers at the same time to increase the bandwidth for a user.'" Pet. 41–43. As noted above, this construction is the same as our construction on remand. We thus consider the parties' arguments during trial.

In the petitions, Petitioner contends that Chen's "method of aggregating multiple signals on different frequencies increases the bandwidth for a user, allowing more information to be transmitted per unit of time." Pet. 24. Petitioner relies on the declaration testimony of Dr. Choi. Pet. 24 (citing Ex. 1203 ¶ 103).

In its responses, Patent Owner counters that "Chen describes base station technology that is processing signals provided by different users." PO Resp. 46; *see also id.* at 24–27 (providing reasons why Chen is directed

to base station technology (citing Ex. 2002 ¶¶ 76–78)). According to Patent Owner, "when two signals from two users are sent simultaneously, neither user gets an increased bandwidth." *Id.* Patent Owner relies on the declaration testimony of Dr. Williams. *Id.* (citing Ex. 2002 ¶¶ 112–113).

Petitioner replies that "Patent Owner's argument relies entirely on the assumptions that (1) 'user' in this claim construction refers only to an individual mobile device owner, and (2) Chen is inapplicable because it is directed to transmissions by base stations," both of which Petitioner says "are wrong." Pet. Reply 21. Regarding the first assumption, Petitioner contends that "[i]f a base station is processing two signals, then it is undisputed that the bandwidth for that user, i.e., the base station, is increased." *Id.*

As to the second assumption, Petitioner contends that carrier aggregation "is not, in ordinary usage, limited to the transmission of signals by a wireless device to a base station, *i.e.*, it is not limited [to] 'uplink' transmissions." Pet. Reply 21–22. As support, Petitioner directs us to where Dahlman describes carrier aggregation as "multiple component carriers [that] are aggregated and jointly used for *transmission to/from a single terminal*." Ex. 1206, 104 (emphasis added & original emphasis omitted) (cited by Pet. Reply 22). In other words, according to Dahlman, "component carriers can be aggregated for the downlink and uplink." *Id.* (cited by Pet. Reply 22). Petitioner also notes that Patent Owner stated at the ITC *Markman* hearing that "carrier aggregation . . . can be used in both the uplink and downlink a[s] it exists in systems, and the patent is really agnostic as to that." Pet. Reply 22 (quoting Ex. 1229, 143:17–19); *see also*

Ex. 1230, 45:5–12 (Dr. Williams's deposition transcript) (cited by Pet. Reply 22).

Petitioner adds that "[a]lthough the authors of Chen validated their envelope-tracking structure for transmitting multiple signals with a single amplifier by using a base-station implementation, nothing in Chen limits its structure to base stations, and Patent Owner's Response makes no real argument that it is so limited." Pet. Reply 23.

With respect to Petitioner's user argument, Patent Owner responds that it "is inconsistent with the plain and ordinary meaning of 'user' and contradicted by the '675 patent and other evidence of record." PO Sur-reply 20. As support, Patent Owner asserts that "the '675 patent uses the term 'user equipment (UE)' to refer to a wireless device 110, as depicted in Fig. 1," whereas "the base stations 130, 132 of Fig. 1 are only referred to as 'base stations,'" never as "users" or "user equipment." *Id.* at 20–21 (citing Ex. 1201, 2:28–34, Fig. 1). In particular, the '675 patent teaches that its "[w]ireless device 110 may also be referred to as a user equipment (UE), a mobile station, a terminal, an access terminal, a subscriber unit, a station, etc." Ex. 1201, 2:32–34. Patent Owner also directs us to a 2010 3GPP technical paper that distinguishes between user equipment and base stations. PO Sur-reply 21 (citing Ex. 1236, 6 (listing technical reports titled "User Equipment (UE) radio transmission and reception" and "Base Station (BS) radio transmission and reception")).

Turning to Petitioner's uplink/downlink argument, Patent Owner counters that "in both the uplink and downlink scenarios, the bandwidth must be extended for a single user terminal." PO Sur-reply 22. According to Patent Owner, "Chen does not disclose downlink carrier aggregation—

i.e., using a base station to simultaneously transmit multiple signals to a single terminal to increase the bandwidth for that terminal." *Id.* Patent Owner asserts that "Chen discloses using its base station to transmit the two input signals Input 1 and Input 2 to multiple, different destination terminals simultaneously." *Id.* Patent Owner further asserts that "[d]ownlink carrier aggregation had not yet been implemented as of January 2018—much less as of Chen's 2012 publication date—and Chen contains no teaching or suggestion of this theoretical system." *Id.*

Patent Owner further contends that Petitioner's "argu[ment] that 'nothing in Chen limits its structure to base stations' . . . is an improper new reply argument." PO Sur-reply 22. Patent Owner adds that the belief that Chen is not limited to base stations is an insufficient "reason why the [person of ordinary skill in the art] would allegedly be motivated to modify the embodiment of this reference." *Id.* at 23.

On the record before us, we agree with Patent Owner that "user," in the construction applicable here, does not encompass a base station. As Patent Owner points out, the '675 patent distinguishes between wireless device 110 (which may be referred to as a *user* equipment) and base stations 130 and 132. PO Sur-reply 20–21 (citing Ex. 1201, 2:32–34, Fig. 1). To illustrate, Figure 1 of the '675 patent is reproduced below.

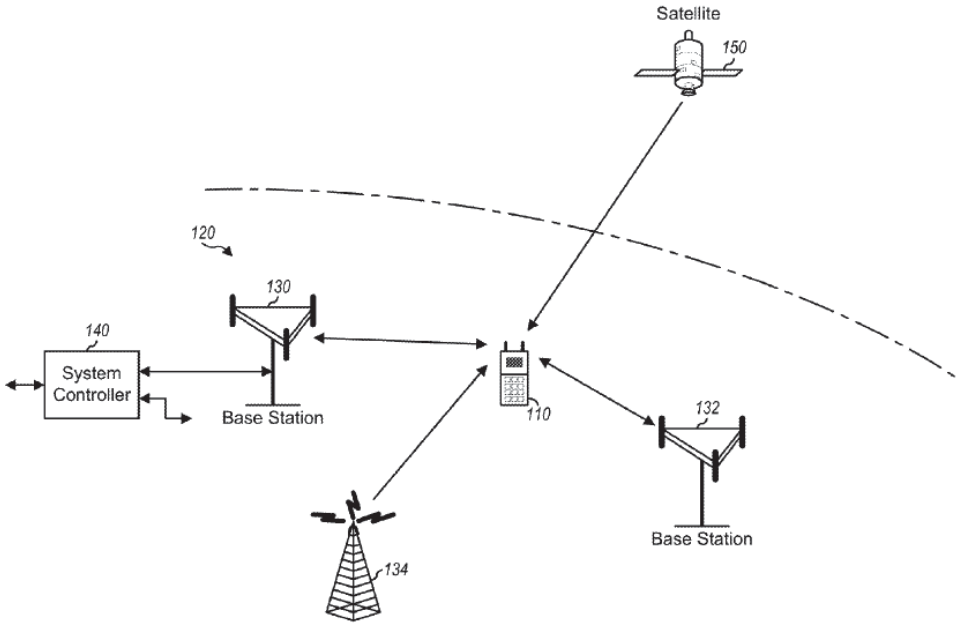

FIG. 1

Figure 1 shows a wireless device communicating with a wireless system. Ex. 1201, 1:56–57. Specifically, Figure 1 shows wireless device 110 communicating with wireless system 120 that includes base stations 130 and 132. *Id.* at 2:19–20, 28–30. Extrinsic evidence supports this distinction between wireless device 110 (e.g., user equipment) and a base station. *See* Ex. 1236, 6 (cited by PO Sur-reply 21). Accordingly, the third part of our construction, "to increase the bandwidth for a user," does not encompass increasing the bandwidth for a base station.

Petitioner does not dispute that Chen is directed to base stations, acknowledging that "the authors of Chen validated their envelope-tracking structure for transmitting multiple signals with a single amplifier by using a base-station implementation." Pet. Reply 23. Although Petitioner argues that Chen is not limited to base stations, Petitioner points to nothing in the record as support. *See id.* We note Petitioner's contention that Patent Owner "makes no real argument that [Chen] is so limited." *Id.* Yet the

burden is not on Patent Owner to show that Chen is limited to base stations; rather, the burden is on Petitioner to show that Chen satisfies the requirement of increased bandwidth for a user, and that Chen's disclosure of base stations is applicable. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) ("In an *inter partes* review, the burden of persuasion is on the petitioner to prove 'unpatentability by a preponderance of the evidence,' 35 U.S.C. § 316(e), and that burden never shifts to the patentee."). Petitioner does not meet its burden. Chen's silence as to whether its concurrent dual-band PA is limited to base station implementations does not adequately show that Chen's teachings also extend to user equipment. *See* Pet. Reply 23 ("[N]othing in Chen limits its structure to base stations."); *Dynamic Drinkware*, 800 F.3d at 1379 ("[I]f the fact trier of the issue is left uncertain, the party with the burden loses.").

Even if Chen were not limited to base stations, however, we note that Petitioner does not proffer any reason as to why an ordinarily skilled artisan would have considered modifying Chen's base station implementation of the concurrent dual-band PA to provide a user device implementation of the concurrent dual-band PA. *See* Pet. 23–24; *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) ("[T]here must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness."); *see also Perfect Web Techs., Inc. v. InfoUSA, Inc.*, 587 F.3d 1324, 1330 (Fed. Cir. 2009) ("[T]o invoke 'common sense' or any other basis for extrapolating from prior art to a conclusion of obviousness, a district court must articulate its reasoning with sufficient clarity."). Petitioner's declarant likewise fails to discuss any potential modification of Chen for implementation in a user device.

For the reasons given above, we are not persuaded that Chen teaches or suggests the third part of our construction, "to increase the bandwidth for a user."

b. Dependent Claims 2, 3, 5, 7–15, 17, 19–21, 23–25, 27, 29, and 30

The dependent claims include the limitation "plurality of carrier aggregated transmit signals" by virtue of their dependency from claims 1, 18, or 28. In its analysis of the dependent claims, Petitioner does not provide argument or evidence overcoming the deficiencies noted above as to the independent claims. *See* Pet. 42–81; 1330-Paper 3, 60–75.

3. Summary

In view of the foregoing, we determine that Petitioner has *not* demonstrated by a preponderance of the evidence that claims 1–3, 5, 7–15, 17–21, 23–25, and 27–30 would have been obvious over the asserted prior art. We determine in particular that Petitioner has *not* demonstrated by a preponderance of the evidence that claims 1–3, 5, 7, 11, 17–21, and 27 would have been obvious over Chen and Wang; claims 8–10 and 28–30 would have been obvious over Chen, Wang, and Choi; claim 12 would have been obvious over Chen, Wang, and Eliezer; and claims 13–15 and 23–25 would have been obvious over Chen, Wang, and Dahlman.

IV. CONCLUSION

On remand, we determine that Petitioner has *not* shown by a preponderance of the evidence that claims 1–3, 5, 7–15, 17–21, 23–25, and 27–30 of the '675 patent are unpatentable.

Claims	35 U.S.C. §	References	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–3, 5, 7, 11, 17–21, 27	103	Chen, Wang		1–3, 5, 7, 11, 17–21, 27
8–10, 28–30	103	Chen, Wang, Choi		8–10, 28–30
12	103	Chen, Wang, Eliezer		12
13–15, 23–25	103	Chen, Wang, Dahlman		13–15, 23–25
Overall Outcome				1–3, 5, 7–15, 17–21, 23–25, 27–30

V. ORDER

In consideration of the foregoing, it is hereby

ORDERED that claims 1–3, 5, 7–15, 17–21, 23–25, and 27–30 of the '675 patent have not been shown to be unpatentable; and

FURTHER ORDERED that, because this Decision on Remand amounts to a final written decision, parties to the proceeding seeking judicial review of our decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

For PETITIONER:

David Cavanaugh
Richard Goldenberg
Theodoros Konstantakopoulos
Louis Tompros
Kathryn Zalewski
WILMER CUTLER PICKERING HALE & DORR LLP
David.cavanaugh@wilmerhale.com
Richard.goldenberg@wilmerhale.com
Louis.tompros@wilmerhale.com
Theodoros.konstantakopoulos@wilmerhale.com
Kathryn.zalewski@wilmerhale.com

For PATENT OWNER:

Matthew Johnson
Joseph Sauer
David Cochran
David Maiorana
Richard Graham
Joshua Nightingale
JONES DAY
mwjohnson@jonesday.com
jmsauer@jonesday.com
dcochran@jonesday.com
dmaiorana@jonesday.com
ragraham@jonesday.com
jrnightingale@jonesday.com