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Paper 12
Date: July 15, 2024

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ERICSSON INC. and NOKIA OF AMERICA CORPORATION,
Petitioner,

v.

XR COMMUNICATIONS LLC,
Patent Owner.

IPR2024-00314
Patent 7,177,369 B2

Before BARBARA A. PARVIS, JAMES J. MAYBERRY, and NORMAN H. BEAMER, *Administrative Patent Judges*.

MAYBERRY, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

A. Background and Summary

Ericsson Inc. and Nokia of America Corporation (collectively, "Petitioner") filed a Petition requesting *inter partes* review of claims 1–7, 9, 10, 12–15, 19, 21, 28, 32, 33, 35–37, and 41 (the "Challenged Claims") of U.S. Patent No. 7,177,369 B2 (Ex. 1001, the "'369 patent"). Paper 3 ("Pet."), 1. XR Communications LLC ("Patent Owner") filed a Preliminary Response to the Petition. Paper 7 ("Prelim. Resp."). With our authorization,[1] Petitioner filed a Preliminary Reply ("Prelim. Reply," Paper 9) and Patent Owner filed a Preliminary Sur-reply ("Prelim. Sur-reply," Paper 10).

We have authority to determine whether to institute an *inter partes* review. 35 U.S.C. § 314 (2018); 37 C.F.R. § 42.4(a) (2024) (permitting the Board to institute trial on behalf of the Director). To institute an *inter partes* review, we must determine that the information presented in the Petition shows "a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." 35 U.S.C. § 314(a). For the reasons set forth below, we do not institute an *inter partes* review.

B. Real Parties-in-Interest

Petitioner identifies "Ericsson Inc., and corporate parent Telefonaktiebolaget LM Ericsson, and Nokia of America Corporation" as real parties-in-interest. Pet. 73. Additionally, Petitioner identifies

[1] *See* Paper 8, 3–4 ("[W]e authorize Petitioner to file a Preliminary Reply to address the propriety of Patent Owner's claim construction of the term 'pre-equalization parameter.' . . . We also authorize Patent Owner to file a Preliminary Sur-reply to respond to Petitioner's arguments.").

"T-Mobile USA, Inc., AT&T Services Inc., AT&T Mobility LLC, AT&T Corporation, and Cellco Partnership d/b/a Verizon Wireless because Petitioner's products provided to these entities have been accused of infringement" in related matters. *Id.*

Patent Owner identifies "XR Communications LLC d/b/a Vivato Technologies" as a real party-in-interest. Paper 4, 2.

C. Related Matters

The parties each identify the following litigations as matters related to the '369 patent: *XR Communications LLC v. AT&T Services Inc., AT&T Mobility LLC, and AT&T Corp.*, No. 2:23-cv-00202 (E.D. Tex.); *XR Communications LLC v. Verizon Communications, Inc. and Cellco Partnership d/b/a Verizon Wireless*, No. 2:23-cv-00203 (E.D. Tex.); and *XR Communications LLC v. T-Mobile USA, Inc.*, No. 2:23-cv-00204 (E.D. Tex). Pet. 73–74; Paper 4, 2.

D. The '369 Patent

The '369 patent, titled "Multipath Communication Methods and Apparatuses," issued February 13, 2007, from U.S. patent application 10/131,864. Ex. 1001, codes (54), (45), (21). The '369 patent claims priority to U.S. provisional application 60/287,163, filed on April 27, 2001. *Id.* at code (60).

The '369 patent relates to "wireless communication in a multipath signal propagation environment." Ex. 1001, 1:16–17. The '369 patent states that in wireless networks as users may move freely about a coverage area, "there will not always be a clear or otherwise unobstructed communication path between a transmitting network resource and the receiving device." *Id.* at 1:46–52. As a result, there may be multipath propagation of transmitted

signals due to "reflections and diffraction from objects in the coverage area." *Id.* at 3:10–14. "High data rate communication systems may be subject to detrimental intersymbol interference caused by such multi-path propagation or fading." *Id.* at 3:15–17. The '369 patent notes the shortcomings of prior modulation and antenna techniques for overcoming this problem (*see id.* at 3:33–7:4), and proposes equalization techniques "for use at a transmitting node and configured to perform pre-equalization that substantially reduces unwanted effects associated with multipath fading." *Id.* at 7:14–19. In particular, the described techniques employ "training sequences, which are contained within a reverse link received OFDM [(Orthogonal Frequency Division Multiplexing)] burst, to specifically adjust associated transmission signals/parameters applied to subsequent OFDM transmissions back towards that particular node." *Id.* at 8:4–8.

Figure 1, reproduced below, illustrates "a communication system operating in a multipath environment." Ex. 1001, 2:32–33.

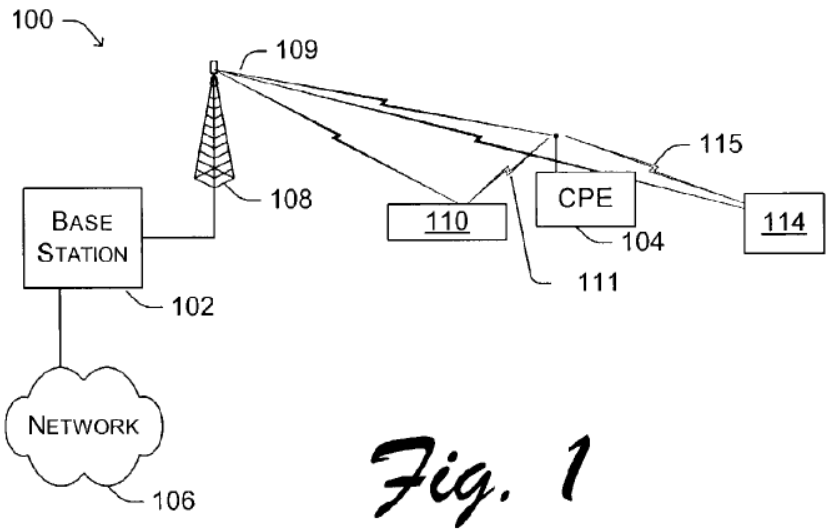


Fig. 1

As shown in Figure 1, system 100 includes base station 102 and customer premise equipment (CPE) device 104, which communicate with each other over a wireless communication link. *Id.* at 8:16–21. Transmission 109 from base station 102 takes a direct path to CPE device 104, but also "radiates and is reflected or diffused, for example, by one or more objects 110," causing "multipath propagation signal 111 to be directed towards CPE device 104." *Id.* at 8:32–39.

Figure 3, reproduced below, illustrates "certain functions within a transceiver functional block." Ex. 1001, 2:40–41.

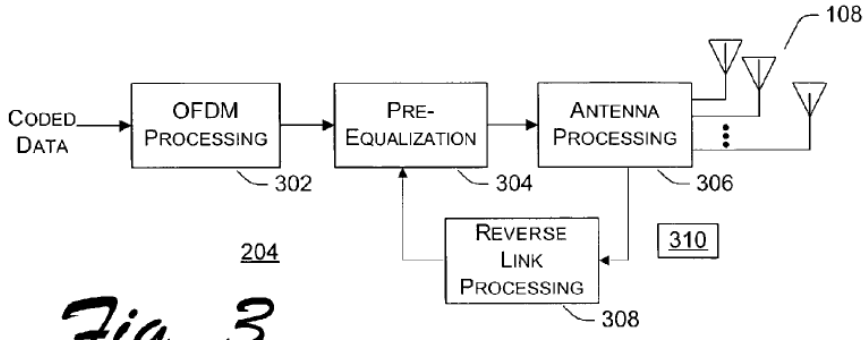


Fig. 3

As shown in Figure 3, in transceiver 204 "coded data to be transmitted from base station device 102 to CPE device 104" may be pre-equalized before being transmitted. *Id.* at 9:49–52. Transceiver 204 includes OFDM processing block 302 for generating "Quadrature Phase Shift Keying (QPSK) modulation values for each of forty-eight OFDM sub-carriers," which are output to pre-equalization block 304. *Id.* at 9:56–62. "Pre-equalization block 304 is configured to modify one or more of the OFDM modulated sub-carriers based on information from a reverse link processing block 308," which is "configured to identify multipath

propagation delays and/or problems for packets transmitted from CPE device 104 to base station device 102." *Id.* at 9:63–10:1.

E. Challenged Claims

The Petition challenges claims 1–7, 9, 10, 12–15, 19, 21, 28, 32, 33, 35–37, and 41. Pet. 13. Claim 1 is the sole independent claim, which we reproduce below.

1. A method comprising:

[1.0] identifying at least one multipath transmission delay within a reverse path data signal received from a receiving device;

[1.1] determining at least one forward path pre-equalization parameter based on said at least one transmission delay; and

[1.2] modifying a forward path data signal that is to be transmitted to the receiving device based on said at least one forward path pre-equalization parameter, where said modifying includes selectively setting different transmission power levels for at least two Orthogonal Frequency Division Multiplexing (OFDM) tones in said forward path data signal.

Ex. 1001, 16:57–17:3.[2]

[2] We provide labeling based on Petitioner and Patent Owner's numbering of the claim limitations. *See* Pet. 20, 35; Prelim. Resp. 4.

F. Prior Art and Asserted Grounds

Petitioner asserts that the Challenged Claims are unpatentable based on two grounds:

Claims Challenged	35 U.S.C. §	References/Basis
1–7, 9, 10, 12–15, 41	103(a)[3]	Wong[4], or Wong and Minn[5]
15, 19, 21, 28, 32, 33, 35–37	103(a)	Wong, or Wong and Minn, and Lehne[6]

Pet. 13.

Petitioner also relies on the declaration testimony of Dr. Kevin Negus. Ex. 1003.

The following subsections provide brief descriptions of the asserted prior art references.

1. Wong (Ex. 1005)

Wong, titled "Multiuser OFDM with Adaptive Subcarrier, Bit, and Power Allocation." Ex. 1005, 1747.[7] Wong provides that it has been

[3] The Leahy-Smith America Invents Act ("AIA"), Pub. L. No. 112-29, 125 Stat. 284, 296–07 (2011), took effect on September 16, 2011. The changes to 35 U.S.C. §§ 102 and 103 in the AIA do not apply to any patent application filed before March 16, 2013. Because the '369 patent was filed before March 16, 2013, we refer to the pre-AIA version of the statute.
[4] *Multiuser OFDM with Adaptive Subcarrier, Bit, and Power Allocation*, IEEE Journal on Selected Areas in Communications, Vol. 17, No. 10, Oct. 1999 (Ex. 1005, "Wong").
[5] *An Investigation into Time-Domain Approach for OFDM Channel Estimation*, IEEE Transactions on Broadcasting, Vol. 46, No. 4, Dec. 2000 (Ex. 1006, "Minn").
[6] *An Overview of Smart Antenna Technology for Mobile Communications Systems*, IEEE Communications Surveys, Vol. 2, No. 4, 4th Quarter 1999 (Ex. 1010, "Lehne").
[7] We refer to Wong's article pagination, consistent with Petitioner's practice in discussing Wong.

"demonstrated that significant performance improvement can be achieved if adaptive modulation is used with OFDM," where "subcarriers with large channel gains employ higher order modulation to carry more bits/OFDM symbol, while subcarriers in deep fade carry one or even zero bits/symbol." *Id.* In a multiuser environment, however, "the subcarriers which appear in deep fade to one user may not be in deep fade for other users." *Id.* Wong thus describes "an adaptive multiuser subcarrier allocation scheme where the subcarriers are assigned to the users based on instantaneous channel information." *Id.* In this way, Wong aims "to minimize the overall transmit power by allocating the subcarriers to the users and by determining the number of bits and the power level transmitted on each subcarrier based on the instantaneous fading characteristics of *all* users." *Id.*

2. Minn (Ex. 1006)

Minn, titled "An Investigation into Time-Domain Approach for OFDM Channel Estimation," notes that OFDM "has recently achieved much popularity due to its desirable properties such as its robustness to multipath delay spread and impulse noise, its high data rate transmission capability with high bandwidth efficiency, and its feasibility in application of adaptive modulation and power allocation across the subcarriers according to the channel conditions." Ex. 1006, 1. Minn proposes "a time-domain approach for OFDM channel estimation." *Id.* In particular, Minn describes that "[f]or practical multipath wireless channels, there are not so many channel paths with significant energy," and so "among *N* samples (taps) of the channel impulse response estimate, many samples (taps) will have little or no energy at all except noise perturbation." *Id.* at 3. "[N]eglecting those nonsignificant channel estimate taps can improve the channel estimation

performance significantly and this fact is applied in the proposed method." *Id.* In one approach that involves selecting the most significant channel taps, Minn describes that "[i]f the channel path gains remain essentially the same over an OFDM symbol interval," "then the received samples corresponding to time-domain pilot samples contain *K* repeated version[s] of scaled channel impulse response." *Id.* at 4. "In order to choose most significant channel taps, those *K* parts can be averaged so that the noise variance is reduced by *K* times and more reliable most significant channel taps can be obtained." *Id.* Alternatively, Minn describes "selecting the channel taps whose energy is above a threshold." *Id.*

3. Lehne (Ex. 1010)

Lehne, titled "An Overview of Smart Antenna Technology for Mobile Communications Systems," relates to "smart or adaptive antennas for mobile communications." Ex. 1010, 1 (Abstract). In particular, Lehne describes that omnidirectional base station antennas in cellular systems can waste power or cause interference, but that "[s]mart antennas will lead to a much more efficient use of the power and spectrum, increasing the useful received power as well as reducing interference." *Id.* at 2.

II. ANALYSIS OF PETITIONER'S CHALLENGES

A. Applicable Law

Petitioner's asserted grounds of unpatentability are based on obviousness under 35 U.S.C. § 103(a). Under § 103(a),

> [a] patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would

> have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

35 U.S.C. § 103(a) (2004); *see 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) when available, objective evidence, such as commercial success, long felt but unsolved needs, and failure of others. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966); *see KSR Int'l Co.*, 550 U.S. at 407 ("While the sequence of these questions might be reordered in any particular case, the [Graham] factors continue to define the inquiry that controls."). The Court in *Graham* explained that these factual inquiries promote "uniformity and definiteness," for "[w]hat is obvious is not a question upon which there is likely to be uniformity of thought in every given factual context." 383 U.S. at 18.

The Supreme Court made clear that we apply "an expansive and flexible approach" to the question of obviousness. *KSR Int'l Co.*, 550 U.S. at 415. Whether a patent claiming the combination of prior art elements would have been obvious is determined by whether the improvement is more than the predictable use of prior art elements according to their established functions. *Id.* at 417. To support this conclusion, however, it is not enough to show merely that the prior art includes separate references covering each separate limitation in a challenged claim. *Unigene Labs., Inc. v. Apotex, Inc.*, 655 F.3d 1352, 1360 (Fed. Cir. 2011). Rather, obviousness additionally requires that a person of ordinary skill at the time of the

invention "would have selected and combined those prior art elements in the normal course of research and development to yield the claimed invention." *Id.*

"[O]bviousness must be determined in light of *all the facts*, and . . . a given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine" teachings from multiple references. *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006) (emphasis added); *see also PAR Pharm., Inc. v. TWI Pharms., Inc.*, 773 F.3d 1186, 1196 (Fed. Cir. 2014) ("The presence or absence of a motivation to combine references in an obviousness determination is a pure question of fact."). As a factfinder, we also must be aware "of the distortion caused by hindsight bias and must be cautious of arguments reliant upon *ex post* reasoning." *KSR Int'l Co.*, 550 U.S. at 421.

For institution, "[t]he 'reasonable likelihood' standard is a somewhat flexible standard that allows the Board room to exercise judgment." Patent Trial and Appeal Board Consolidated Trial Practice Guide 53 (Nov. 2019), *available at* https://www.uspto.gov/TrialPracticeGuideConsolidated.

B. Level of Ordinary Skill in the Art

The level of skill in the art is "a prism or lens" through which we view the prior art and the claimed invention. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). Petitioner contends that

> a [person having ordinary skill in the art] in April 2001 would have been familiar with wireless communications networks, equipment and integrated circuit chips, and would have had at least a working knowledge of the design of physical layer signal processing for Orthogonal Frequency Division Multiplexing (OFDM) wireless communications including the use of multiple antennas. A [person having ordinary skill in the art] would have

> had at least a Bachelor's degree in Electrical Engineering or an equivalent field, and at least two years of work experience in developing OFDM-based wireless communications. Alternatively, a [person having ordinary skill in the art] would have had a more advanced degree, such as a Master's degree in Electrical Engineering or an equivalent field, combined with at least one year of work experience in developing OFDM-based wireless communications.

Pet. 10 (referencing Ex. 1003 ¶¶ 22–27). Patent Owner does not dispute the level of ordinary skill in the art. Prelim. Resp. 7.

We apply Petitioner's definition of the level of ordinary skill in the art. We determine that this definition is consistent with the prior art of record and the skill reflected in the Specification of the '369 patent, based on our review of the limited record.

C. Claim Construction

In *inter partes* reviews, we interpret a claim "using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b)." 37 C.F.R. § 42.100(b). Under this standard, we construe the claim "in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent." *Id.*; *see Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–14 (Fed. Cir. 2005) (en banc) ("We have frequently stated that the words of a claim 'are generally given their ordinary and customary meaning.'" (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)).

Petitioner "proposes that each claim term be given its plain and ordinary meaning." Pet. 9. "Patent Owner agrees that the terms of claim 1 of the '3[69] patent carry their plain and ordinary meaning" and that "formal claim constructions may be unnecessary." Prelim. Resp. 8. Patent Owner

adds, however, that "the plain and ordinary meaning of 'pre-equalization parameter' is parameter used to perform pre-equalization," and that "the plain and ordinary meaning of 'pre-equalization' in the '369 patent is modifying a signal to reduce unwanted effects associated with multipath fading between the transmitter and the receiver." *Id.* (referencing Ex. 1001, 7:15–20); *see also id.* at 12–16. We address the "pre-equalization parameter" term below.

1. "Pre-equalization parameter"

As we indicate above, Patent Owner expressly construes the term "pre-equalization" to mean a parameter that modifies a signal to reduce unwanted effects associated with multipath fading between the transmitter and the receiver. Prelim. Resp. 8. Patent Owner adds that it "believes that the[] plain meaning interpretation[] [is] correct and helpful, but Patent Owner does not believe that formally adopting [it] is necessary to deny institution." *Id.* at 9.

Petitioner responds that "[t]he claim already recites that 'pre-equalization' performs a very specific action." Prelim. Reply 1. Petitioner argues that Patent Owner's express construction is improper, as it imports Patent Owner's intended purpose into the claim term. *Id.*; *see also id.* at 2 ("[Patent Owner's] intended purpose improperly reads an 'intent' element into the claims.").

Patent Owner replies that "'[p]re-equalization' is a technical term of art and has a plain meaning." Prelim. Sur-reply 1. Patent Owner adds that, "in the context of [the] '369 patent, is modifying a signal to reduce unwanted effects associated with multipath fading between the transmitter

and the receiver." *Id.* Patent Owner argues that Petitioner reads the work "pre-equalization" out of the claim term. *Id.* at 1–2.

We start with the words of the claim. *See, e.g.*, *Phillips*, 415 F.3d at 1314 ("[T]he context in which a term is used in the . . . claim [at issue] can be highly instructive."). As an initial point, the term recites more than just a parameter. Instead, it recites a *pre-equalization* parameter. *See Wasica Fin. GmbH v. Cont'l Auto. Sys., Inc.*, 853 F.3d 1272, 1288 n.10 (Fed. Cir. 2017) ("It is highly disfavored to construe terms in a way that renders them void, meaningless, or superfluous."); *see also Bicon, Inc. v. Straumann Co.*, 441 F.3d 945, 950 (Fed. Cir. 2006) ("[C]laims are interpreted with an eye toward giving effect to all terms in the claim."); *cf.* Prelim. Sur-reply 2 (referencing Dr. Negus's declaration, Ex. 1003 ¶ 285); Ex. 1003 ¶ 285 ("[T]he plain, ordinary meaning of the term '**forward path pre-equalization parameter**' for wireless communications systems at the time of the alleged invention of the '369 [p]atent is then simply a 'parameter' used for any part in performing '**forward path pre-equalization**.'"). As Dr. Negus testifies, pre-equalization "in some way . . . accounts for the properties of the propagation path(s) between" a transmitter and a receiving device. Ex. 1003 ¶ 284; *see* Prelim. Sur-reply 1 ("'Pre-equalization' is a technical term of art and has a plain meaning."); *cf.* Ex. 2001 (defining "pre-equalization" in general as "[a] process in a system designed to . . . reduce adverse effects, such as noise, in subsequent parts of the system").

In determining the pre-equalization parameter, claim 1 first recites the step of "identifying at least one multipath transmission delay within a reverse path data signal received from a receiving device." Ex. 1001, 16:58–60. Then, claim 1 recites the step of "determining at least one

forward path pre-equalization parameter based on said at least one transmission delay." *Id.* at 16:61–62. So, the pre-equalization parameter (or, more completely, the forward path pre-equalization parameter) is based on a multipath transmission delay identified from a reverse path signal sent from a receiving device. The final step recites "modifying a forward path data signal that is to be transmitted to the receiving device based on said at least one forward path pre-equalization parameter." *Id.* at 16:64–66. So, the forward path pre-equalization parameter is applied to a forward path data signal being sent to the receiving device to modify the signal. We also know from claim 1 that modifying of the signal "includes selectively setting different transmission power levels for at least two Orthogonal Frequency Division Multiplexing (OFDM) tones in said forward path data signal." *Id.* at 16:66–17:3.

Accordingly, we understand the term pre-equalization parameter to encompass a parameter used for pre-equalization, that is, to account for properties of a propagation path between a transmitter and a receiving device, where the parameter is based on at least one multipath transmission delay identified from a reverse path data signal received from the receiving device and where a forward path data signal is modified based on the parameter.

This understanding is consistent with the Specification. *Cf. Phillips*, 415 F.3d at 1315 ("[T]he specification 'is always highly relevant to the claim construction analysis.'"). For example, the '369 patent states that "[t]he exemplary OFDM pre-equalization technique basically acts within the frequency band of OFDM sub-carriers to pre-equalize the multipath channel to handle multipath delay spread greater than the delay protection provided

by conventional signal processing techniques." Ex. 1001, 7:63–81; *see also id.* at 9:63–65 ("Pre-equalization block 304 is configured to modify one or more of the OFDM modulated sub-carriers based on information from a reverse link processing block 308."), 10:1–10 (explaining how a base station may use a known sequence of tones from a user device to determine differences between a received signal and the known signal, such that "[t]he differences, or information derived from such differences can . . . be used within pre-equalization block 304 to modify, in some manner, as applicable, the OFDM modulated sub-carriers"); *cf.* Ex. 1003 ¶ 284 ("Although the '369 [p]atent does not explicitly define the term '**pre-equalization**,' a [person having ordinary skill in the art] would [have] under[stood] that usage of the term . . . within the '369 [p]atent is consistent with th[e] plain, ordinary meaning.").

We agree with Petitioner that Patent Owner's inclusion of the phrase "associated with multipath fading between the transmitter and the receiver" goes beyond the plain and ordinary meaning, as pre-equalization is not so limited. *See, e.g.*, Ex. 1003 ¶¶ 284–285 (discussing the meaning of "pre-equalization parameter"); Ex. 2001 (providing an IEEE definition of "pre-equalization").

We need not construe the term "pre-equalization parameter" beyond our above-stated understanding of the term's scope, as this understanding is sufficient to resolve the parties' dispute. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) ("The Board is required to construe 'only those terms that . . . are in controversy, *and only to the extent necessary to resolve the controversy*.'" (emphasis added)) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

2. Other terms

We determine that we need not expressly construe any other claim terms to resolve the parties' disputes on the current record. *See Realtime Data, LLC*, 912 F.3d at 1375. To the extent that the scope of any other claim term requires discussion, however, we provide it in our assessment of the challenges, which we turn to next.

D. Ground 1: Claims 1–7, 9, 10, 12–15, and 41 as Obvious over Wong, or Wong and Minn

Petitioner contends that Wong alone, or the combination of Wong and Minn,[8] renders obvious claims 1–7, 9, 10, 12–15, and 41. Pet. 16–47. We address Petitioner's contentions, and Patent Owner's counter-arguments, below.

1. Independent claim 1

We turn to analyzing the scope and content of the prior art, and any differences between the prior art and the claimed invention, on a limitation-by-limitation basis.

[8] Petitioner states that, "[t]o the extent that [Patent Owner] asserts that Wong does not expressly recite using 'multipath transmission delay' as the channel information, Minn expressly teaches the details for calculating the channel information using a time-domain approach which identifies multipath transmission delay." Pet. 27. Because Patent Owner did not dispute that Wong teaches or suggests multipath transmission delay, we do not address Petitioner's contentions with respect to Minn. *Cf.* Prelim. Resp. 17 ("For claim element [1.1], the Petition asserts that 'channel gain magnitude' is the claimed 'forward-path pre-equalization parameter.'" This assertion is the same regardless of whether the Petition relies on Wong or Minn or a combination of both.").

a) Petitioner's Contentions: Limitations [1.0] and [1.1]

Claim 1 recites "[a] method comprising: identifying at least one multipath transmission delay within a reverse path data signal received from a receiving device." Ex. 1001, 16:57–60 (limitation [1.0], the identifying step). Claim 1 also recites "determining at least one forward path pre-equalization parameter based on said at least one transmission delay." *Id.* at 16:61–62 (limitation [1.1], the determining step). Petitioner contends that Wong, alone or in combination with Minn, teaches or suggests the subject matter of these limitations.

Petitioner contends that these two method steps "recite the well-known 'reciprocity' concept." Pet. 20. Petitioner continues that a base station "measures 'channel information' about the 'reverse' channel[,] . . . then uses this 'channel information' to calculate one or more parameters to adjust transmissions from the [base station] to the device on the 'forward' channel." *Id.*; *see also id.* at 22 ("Element 1.1 recites . . . the well-known principle of using reverse channel information to calculate a parameter used to modify the signals transmitted on the forward path." (referencing Ex. 1003 ¶ 290)).

Petitioner contends that a person having ordinary skill in the art would have "understood that Wong teaches the concept of determining a forward path pre-equalization parameter based on multipath transmission delay for several reasons." Pet. 22 (referencing Ex. 1003 ¶¶ 290–298). First, Petitioner contends that Wong discloses that its system estimates instantaneous channel characteristics based on a received uplink

transmission. *Id.* (referencing Ex. 1005, 1748). Petitioner contends that multipath transmission delay was a well-known channel characteristic. *Id.*

Second, Petitioner contends that "Wong expressly identifies the problem of multipath interference as a 'major problem' that Wong and the '369 [p]atent both address." Pet. 22 (referencing Ex. 1003 ¶¶ 117, 291); *see id.* ("One of the main requirements on the modulation technique is the ability to combat **intersymbol interference (ISI)**, a major problem in wideband transmission over **multipath fading channels**." (quoting Ex 1005, 1747) (emphasis added in Petition)).

Third, Petitioner contends that a person having ordinary skill in the art would have "understood that using multipath transmission delays was one of a few known techniques to solve Wong's 'major problem,'" based on Wong's teachings. Pet. 23 (referencing Ex. 1003 ¶¶ 296–326). Petitioner contends that Wong teaches a base station that communicates with multiple users. Petitioner states that "Wong 'denote[s] by the magnitude of the channel gain . . . of the *n*th subcarrier as seen by the *k*th user' based on the 'received uplink transmissions' for a 'time division duplex (TDD) wireless communication system' that uses 'OFDM.'" *Id.* (alterations in original) (referencing Ex. 1005, 1747–1748; Ex. 1003 ¶¶ 306, 307, 313, 321, 371).

Petitioner concludes that "within the known time-domain option, identifying and using the multipath transmission delay would have either been known or obvious to a" person having ordinary skill in the art. Pet. 24 (referencing Ex. 1003 ¶¶ 145, 167–176, 188–190, 213–216, 307–312); *see also id.* at 24–26 (providing an explanation of measuring multipath transmission delay using channel impulse response for different time-domain indexes). Petitioner contends that a person having ordinary skill in

the art would have known that a subsequent step in processing the determined time delay for a time-domain approach is to estimate the channel frequency response for each subcarrier, such as by performing DFT (discrete Fourier transform) or FFT (fast Fourier transform) operations on the estimated channel impulse response. *Id.* at 26 (referencing Ex. 1003 ¶¶ 310–312).

Petitioner contends that the channel frequency response "is exactly the information that Wong uses for adjusting the power levels of each tone." Pet. 26. Petitioner adds that "Wong uses the term 'magnitude of the channel gain' to reflect the channel estimation." *Id.* (referencing Ex. 1005, 1748; Ex. 1003 ¶¶ 311, 320–321); *see id.* (identifying $\alpha_{k,n}$ as "the magnitude of the channel gain of the n^{th} subcarrier as seen by the k^{th} user" (emphasis omitted)); *id.* at 27 (contending that the channel frequency response is a function of the magnitude of the channel gain). Petitioner concludes that

> in the context of Wong, using the time-domain approaches to estimate the "***channel frequency response***" in the form of "$H[k]$" or "$\hat{H}[k]$" discloses the claimed . . . [determining step] because it discloses the "channel gain" magnitude (the claimed "parameter") that Wong uses to modify the forward path signals and it is "based on" the measured transmission delays (the "channel impulse response" discussed above).

Id. That is, Petitioner contends that the channel gain magnitude in Wong corresponds to the recited pre-equalization parameter.

b) Petitioner's Contentions: Limitation [1.2]

Claim 1 also recites "modifying a forward path data signal that is to be transmitted to the receiving device based on said at least one forward path pre-equalization parameter, where said modifying includes selectively setting different transmission power levels for at least two Orthogonal

Frequency Division Multiplexing (OFDM) tones in said forward path data signal." Ex. 1001, 16:64–17:3 (limitation [1.2], the modifying step).

Petitioner contends that "using the channel characteristics, Wong's [base station] will modify the forward link transmissions (to the mobile devices) by changing the power levels for different OFDM tones (*i.e.*, 'subcarriers')." Pet. 35. Petitioner adds that "Wong's 'power allocation algorithm' 'assign[s] each user a set of subcarriers and by determining the number of bits and the transmit power level for each subcarrier.'" *Id.* at 35–36 (alteration in original) (referencing Ex. 1005, 1747 (abstract)). Petitioner contends that Wong's system "adaptively assign[s] subcarriers to the users along with the number of bits and power level to each subcarrier." *Id.* at 36 (referencing Ex. 1005, 1757). Petitioner further contends that "Wong's repeated reference to 'adaptive' or 'adaptively' setting OFDM power levels teaches that such settings are 'based on' the reverse channel information (the information to which the power levels are being 'adapted')." *Id.*

c) Patent Owner's Counter Arguments

Patent Owner argues that "[t]he Petition provides no argument or evidence that channel gain magnitude would itself be considered a pre-equalization parameter. Nor does the Petition present any argument or evidence that channel gain magnitude is used to perform pre-equalization." Prelim. Resp. 18. Patent Owner argues that, at best, Petitioner implies that some parameter is used in Wong's system. *Id.*

Patent Owner argues that to satisfy its burden, Petitioner must demonstrate that the channel gain magnitude is used to modify the forward path signal for pre-equalization. Prelim. Resp. 18. Patent Owner argues that

"Wong is directed to a power minimization algorithm and there is no evidence it is directed to pre-equalization or that it performs pre-equalization." *Id.* at 20. Patent Owner adds that "Wong's total power minimization algorithm [does not] suggest that it is a pre-equalization algorithm [n]or show it is performing pre-equalization." *Id.*

Patent Owner acknowledges that Wong cites to references addressing equalization techniques in discussing intersymbol interference as background, but argues that Wong does not discuss those references further. Prelim. Resp. 21. Patent Owner argues that Wong is not concerned with pre-equalization or addressing that problem. *Id.*

Patent Owner argues that Dr. Negus's declaration does not cure the deficiency in the Petition. Prelim. Resp. 22. Patent Owner argues that Petitioner's citation to "broad swaths" of the declaration amounts to incorporation by reference. *Id.* Patent Owner also argues that Dr. Negus's testimony is "unsupported and conclusory" and "vague and ambiguous." *Id.*

d) Analysis

We have reviewed Patent Owner's arguments and determine that they demonstrate a deficiency in Petitioner's contentions sufficient to weigh against instituting trial.

We agree with Patent Owner that Petitioner fails to demonstrate, sufficient for institution, that Wong's channel gain magnitude corresponds to the recited pre-equalization parameter. Petitioner first walks through an analysis as to how, employing a time-domain option, a channel input response based on multipath transmission delay can be determined, and how this channel input response would be converted to a channel frequency response. Pet. 23–26. Petitioner contends that uplink channel characteristics

can be determined by one of two ways—a time-domain option or a frequency domain option—"the epitome of 'obvious to try.[9]'" *Id.* at 23. Petitioner then employs the time-domain approach, eventually getting to a relationship between channel gain and channel frequency response, apparently contending that the amplitude of the channel frequency is the same as the magnitude of the channel gain. *See id.* at 26–27; Ex. 1003 ¶ 311 ("[T]hus the '***magnitude of the channel gain***' as used in the methods described in Wong is simply this **amplitude term** within this estimated '**channel frequency response**.'" (emphasis in original)).

We are not persuaded that Petitioner has shown that Wong teaches the recited pre-equalization parameter because Petitioner's analysis does not address the term "pre-equalization" sufficiently. As Patent Owner argues, Wong discloses that it uses the magnitude of the channel gain in its iterative process of assigning bits to subcarriers in an OFDM system to minimize the total amount of power used for a transmission. The magnitude of the channel gain is used to calculate the required transmit power for a k^{th} user over an n^{th} subcarrier, as seen in Equation 1 in Wong. Ex. 1005, 1749.

[9] To the extent that Petitioner contends that employing the time-domain option would have been "obvious to try" under obviousness case law merely because there are only two options, this contention shortcuts the obvious to try analysis. *See, e.g.*, *Grunenthal GmbH v. Alkem Labs. Ltd.*, 919 F.3d 1333, 1345 (Fed. Cir. 2019) ("To prove obviousness under an obvious to try theory, [the challenger] must show (1) a design or market need to solve a particular problem, and (2) that 'there are a finite number of identified, predictable solutions' that would lead to an expectation of success." (quoting *KSR Int'l Co.*, 550 U.S. at 421)).

Wong's process iterates over the k users and n subcarriers such that the sum of the transmit power is minimized. *Id.* Nowhere in Wong does it explain that its power minimization approach pre-equalizes the transmit signal. Accordingly, we agree with Patent Owner that Petitioner's unpatentability analysis reads out the term "pre-equalization" from claim 1. *See* Prelim. Sur-reply 1–2.

We find unpersuasive Petitioner's argument that Wong addresses the same "major problem" as the '369 patent. Pet. 22–23. Wong does state that the ability to combat intersymbol interference is a major problem in wideband transmission, but Wong goes on to state that "[m]ulticarrier modulation techniques, including orthogonal frequency division multiplex (OFDM), (e.g., [4]) are among the more promising solutions to this problem." Ex. 1005, 1747. Wong explains that an OFDM system that employs adaptive modulation can have "significant performance improvement, but suffers from the problem of unused subcarriers." *Id.* It is this problem of unused subcarriers in an OFDM system that employs adaptive modulation that Wong seeks to solve. *Id.* Specifically, Wong states that its "objective is to minimize the overall transmit power by allocating the subcarriers to the users and by determining the number of bits and the power level transmitted on each subcarrier based on the instantaneous fading characteristics of *all* users." *Id.*

Dr. Negus defines a forward path pre-equalization parameter as a parameter used in forward path pre-equalization were a signal to be transmitted in a forward path is modified to account for the properties of the propagation paths between the transmitter at a base station and the receiver at a user. Ex. 1003 ¶¶ 284–285. We do not discern any testimony from

Dr. Negus or contentions from Petitioner as to how Wong's channel gain magnitude is a parameter used in forward path *pre-equalization*. And, first and foremost, independent claim 1 requires the application of a *pre-equalization* parameter.

It appears that the required power value determined in Wong for each user-subcarrier combination is determined, at least in part, on uplink information. *See, e.g.*, Ex. 1005, 1747 ("This motivates us to consider an adaptive multiuser subcarrier allocation scheme where the subcarriers are assigned to the users based on instantaneous channel information."), 1748 ("[T]he base station (BS) can estimate the instantaneous channel characteristics of all the BS-to-mobile links based on the received uplink transmissions."). And this power value is used in Wong's power minimization algorithm. *See id.* at 1749 ("The goal of the combined subcarrier, bit, and power allocation algorithm is then to find the best assignment of $c_{k,n}$ so that the overall transmit power, the sum of $P_{k,n}$ over all subcarriers and all users, is minimized for given transmission rates of the users and given QoS requirements."). But this teaching is not enough. Neither Petitioner nor Dr. Negus explains persuasively how Wong's total power minimization process performs *pre-equalization*, so as to modify the transmission signal *to account for* the properties of the propagation paths between the base station and the receiver.

e) Conclusion

For the reasons discussed above, we determine that the information presented in the Petition does not sufficiently demonstrate for institution that Wong alone, or in combination with Minn, renders claim 1 obvious under 35 U.S.C. § 103(a).

2. Dependent claims 2–7, 9, 10, 12–15, and 41

Petitioner also contends that dependent claims 2–7, 9, 10, 12–15, and 41, which depend ultimately from independent claim 1, are rendered obvious by Wong, or Wong and Minn. Pet. 37–47. We have reviewed Petitioner's contentions directed to these dependent claims and do not discern anything that remedies the deficiency we identify in our analysis of claim 1.

E. Ground 2: Claims 15, 19, 21, 28, 32, 33, and 35–37 as Obvious over Wong, or Wong and Minn, and Lehne

Petitioner contends that the combined teachings of either Wong, or Wong and Minn, and Lehne render obvious the subject matter of claims 15, 19, 21, 28, 32, 33, and 35–37, all of which depend ultimately from independent claim 1. Pet. 48–69. We have reviewed Petitioner's contentions directed to this ground and do not discern anything that remedies the deficiency we identify in our analysis of claim 1.

III. CONCLUSION

Based on the information presented, we determine Petitioner has not established a reasonable likelihood that it would prevail with respect to at least one of the Challenged Claims. Accordingly, we do not institute an *inter partes* review on all challenges.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that an *inter partes* review is not instituted.

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