UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MEDIATEK INC. and NXP USA, INC.,

Petitioner,

v.

BELL NORTHERN RESEARCH, LLC,
Patent Owner

Case: IPR2023-01414
U.S. Patent No. 8,416,862

PATENT OWNER'S RESPONSE

Under 37 C.F.R. § 42.120

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Exhibit	Description
2001	Declaration of Todor Cooklev, Ph.D.
2002	Deposition Transcript of Dr. Jonathan Wells
2003	Excerpts from IEEE 802.11-2016 standard
2004	Declaration of Srikant Cheruvu
2005	Declaration of Afzal Dean

Petitioners MediaTek Inc. and NXP USA Inc. filed a Petition for *Inter Partes* Review of U.S. Patent No. 8,416,862 ("the '862 patent") on September 25, 2023. (D.I. 1 ("Pet." or "Petition").) MediaTek Inc. was since terminated. (D.I. 21.) Only Petitioner NXP USA, Inc. ("NXP" or "Petitioner") remains active in this proceeding. Through the undersigned Counsel, Patent Owner, Bell Northern Research LLC ("BNR") submits the following Patent Owner Response ("Response") pursuant to 37 C.F.R. § 42.120.

I. INTRODUCTION

The present proceeding was instituted without any claim terms being explicitly construed. Institution Decision (Paper 11), 8-9. When properly construed, however, it is abundantly clear that claims 1-4 and 9-12 ("the challenged claims") of the '862 patent are patentable over the cited art because none of the cited art (alone or in the combinations proposed by Petitioner) discloses estimating a channel response based upon a "preamble sequence."

Additionally, claims 2 and 10 of the '862 patent are patentable over the cited art because none of the cited art (alone or in the combinations proposed by Petitioner) discloses producing the estimated transmitter beamforming unitary matrix (V) in Cartesian coordinates and converting the estimated transmitter beamforming unitary matrix (V) to polar coordinates.

Finally, the fact that the '862 patent's channel response estimation technology has been incorporated into industry standards and widely adopted by the industry are objective indicia of the non-obviousness of the claimed invention.

As such, the Board should find Petitioner has not shown by a preponderance of evidence that claims 1-4 and 9-12 of the '862 patent are unpatentable.

II. APPLICABLE LEGAL PRINCIPLES

A. Legal Standards

To prevail in its challenge to the patentability of the challenged claims, Petitioner must establish facts supporting its challenge by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d). "In an [inter partes review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable." *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring inter partes review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim")). This burden never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (citing *Tech. Licensing Corp. v. Videotek, Inc.*, 545 F.3d 1316, 1326-27 (Fed. Cir. 2008) (discussing the burden of proof in inter partes review)).

"[T]here is a significant difference between a petitioner's burden to establish a 'reasonable likelihood of success' at institution, and actually proving invalidity

by a preponderance of the evidence at trial." *Trivascular, Inc. v. Samuels*, 812 F.3d 1056, 1068 (Fed. Cir. 2016); *see also* 35 U.S.C. §§ 314(a), 316(e). At the institution phase, the "Board is considering the matter preliminarily [and] without the benefit of a full record," and thus "the Board is not bound by any findings made in its Institution Decision." *Trivascular*, 812 F.3d at 1068. Findings made during trial are rendered "under a qualitatively different standard" than the standard used when considering institution. *Id.*; *see also Samsung Elecs. Co., Ltd. v. Infobridge Pte. Ltd.*, IPR2017-00100, Paper 30 at 15 (PTAB Apr. 23, 2018) ("We are not persuaded by [the] argument that [PO] has not presented anything new to rebut our previous analysis and conclusion because we now must evaluate the evidence of record against a different, and higher, standard." (internal quotation marks omitted)).

To the extent that the petition relies on an expert declaration, it must be more than conclusory and disclose the facts underlying the opinion. *See* 37 C.F.R. § 42.65(a) ("Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight."); *Edmund Optics, Inc. v. Semrock, Inc.*, IPR2014-00583, Paper 50 at 8 (PTAB, Sep. 9, 2015) (affording little or no weight to "experts' testimony that does little more than repeat, without citation to additional evidence, the conclusory arguments of their respective counsel."). Nor may the petition rely on the expert declaration to remedy any gaps

in the petition itself. 37 C.F.R. § 42.6(a)(3) ("Arguments must not be incorporated by reference from one document into another document"); *see also Cisco Sys., Inc. v. C-Cation Techs., LLC*, IPR2014-00454, Paper 12 at 9 (PTAB, Aug. 29, 2014) ("This practice of citing the Declaration to support conclusory statements that are not otherwise supported in the Petition also amounts to incorporation by reference.").

B. Petition Based on Obviousness

Section 103 of the Patent Act provides that "[a] patent may not be obtained . . . 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." 35 U.S.C. § 103(a). The obviousness analysis requires several threshold inquiries: the level of ordinary skill in the art must be established; the scope and content of the prior art must be determined; and any differences between the prior art and the claims at issue must be ascertained. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

1. Claims Cannot be Found Obvious if an Element Is Absent

If a single element of the claim is absent from the prior art, the claim cannot be considered obvious. *See CFMT, Inc. v. YieldUp Int'l Corp.*, 349 F.3d 1333, 1342 (Fed. Cir. 2003) ("Obviousness requires a suggestion of all limitations in a

claim.") (citing *In re Royka*, 490 F.2d 981, 985 (C.C.P.A. 1974)); *In re Rijckaert*, 9 F.3d 1531, 1534 (Fed. Cir. 1993) (reversing obviousness rejection where prior art did not teach or suggest all claim limitations); *Mylan Pharm. Inc. v. Merck Sharp & Dohme Corp.*, IPR2020-00040, Paper 91, at 30 (PTAB May 7, 2021) ("With no express disclosure of all limitations . . . Petitioner cannot fill gaps by arguing a POSA would 'envisage' what is missing"), citing *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 851 F.3d 1270, 1274-75 (Fed. Cir. 2017); *Galderma Labs, L.P. v. Teva Pharm. USA, Inc.*, 799 F. App'x 838, 845 (Fed. Cir. 2020) (holding "the district court was not permitted to 'fill in missing limitations simply because a skilled artisan would immediately envision them.'").

Additionally, it is improper to use the challenged claim as a roadmap to piece together disparate disclosure using hindsight bias. *See InTouch Techs., Inc. v. VGo Comm'ns., Inc.*, 751 F.3d 1327, 1351 (Fed. Cir. 2014) (reversing obviousness where "[i]t appears that [the expert] relied on the [] patent itself as her roadmap for putting what she referred to as pieces of a 'jigsaw puzzle' together."); *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007) ("A factfinder should be aware, of course, of the distortion caused by hindsight bias and must be cautious of arguments reliant upon ex post reasoning.").

2. A Petition Must Address the *Graham* Factors

Obviousness is resolved on a number of factual determinations including (1) the scope and content of the prior art, (2) the differences between the claimed subject matter and the prior art, and (3) the level of ordinary skill in the art. *See Graham*, 383 U.S. at 17-18. Petitions for *inter partes* reviews "must address the *Graham* factors." *Eizo Corp. v. Barco N.V.*, IPR2014-00358, Paper 11 at 29-30 (PTAB July 23, 2014).

Petitions, like the present one, that "simply provide[] a summary of the reference's purported teachings do[] not adequately satisfy a proper *Graham* factors analysis, describe differences between the prior art and the claims at issue, or provide a substantive analysis of why or how a person of ordinary skill in the art would have modified the prior art to render the claims obvious." *Front Row Techs., LLC v. MLB Advanced Media, L.P.*, IPR2015-01932, Paper 7 at 19 (PTAB Mar. 25, 2016); *Kinetic Concepts, Inc. v. Smith & Nephew, Inc.*, 688 F.3d 1342, 1360 (Fed. Cir. 2012) (must address all four *Graham* factors including "the differences between the claims and the prior art"); *Apple Inc. v. Samsung Elecs., Co.*, 839 F.3d 1034, 1048 (Fed. Cir. 2016) (en banc) (error to not reach all *Graham* factors in obviousness analysis).

3. A Petition Must Provide Articulated Reasoning with Rational Underpinning to Combine and/or Modify References

The conclusion of obviousness based on a combination of references must also be supported with explicit analysis of a reason to combine those references.

KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 418 (2007). As part of that analysis, the Petition must show that a skilled artisan would have been motivated to combine the prior art references with a reasonable expectation of success. *Apotex Inc. v. Wyeth LLC*, IPR2014-00115, Paper 94, at *11 (PTAB Apr. 20, 2015) (citations omitted). The requirement for proving reasonable expectation of success refers to achieving what is claimed in the patent-at-issue. *Intelligent Bio-Sys. V. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1367 (Fed. Cir. 2016) ("[O]ne must have a motivation to combine accompanied by a reasonable expectation of achieving what is claimed in the patent-at-issue.").

The Federal Circuit has stated that such reasons must be more than "mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006); *accord Innogenetics, N.V. v. Abbott Labs.*, 512 F.3d 1363, 1374 (Fed. Cir. 2008) (agreeing with the district court's reasoning that "some kind of motivation must be shown from some source, so that the jury can understand why a person of ordinary skill would have thought of either combining two or more references or modifying one to achieve the patented method"); *see also LG Elecs., Inc. v. Cellular Commc'ns Equip. LLC*, IPR2016-00197, Paper 7 at 7-11 (PTAB April 29, 2016) (faulting a petition's obviousness

analysis for lack of sufficient articulated reasons with rational underpinnings for modifying references to achieve particular elements required in the claims).

In performing this analysis, hindsight is inappropriate. Obviousness must be measured "*at the time the invention was made*." *Ortho-McNeil Pharm. v. Mylan Labs*, 520 F.3d 1358, 1364 (Fed. Cir. 2008) (emphasis in original). A petition must demonstrate a rationale to combine prior art references without relying on the patent disclosure itself. *Apple Inc. v. Contentguard*, Paper 9 at 15, 17; *see also P&G v. Teva Pharms. USA, Inc.*, 566 F.3d 989, 995 (Fed. Cir. 2009). In other words, the petitioner must not use the patent as a roadmap. *In re NTP, Inc.*, 654 F.3d 1279, 1299 (Fed. Cir. 2011) (internal citation omitted); *see also KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007).

4. Objective Indicia of Non-obviousness Cannot be Ignored

Another *Graham* factor is the consideration of relevant secondary considerations, also known as objective indicia of nonobviousness. *In re Depomed, Inc.*, 680 Fed. App'x 947 at *951 (Fed. Cir. 2017); *KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 406 (2007). Relevant objective indicia of non-obviousness include, *inter alia*, long felt but unmet need, the failure of others, acceptance by the industry, commercial success, and unexpected results. *In re Depomed, Inc.*, 680 Fed. App'x at *951; *Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc.*, 75 F.3d 1568, 1574 (Fed. Cir. 1996).

Objective indicia of nonobviousness (also referred to as secondary considerations) are accorded substantial weight when the proponent establishes a nexus between the evidence and the merits of the invention. *Lectrosonics, Inc. v. Zacsom, Inc.*, IPR 2018-00129, Paper No. 33 at 32 (PTAB Jan. 24, 2020) (precedential) (citing *ClassCo, Inc. v. Apple, Inc.*, 838 F.3d 1214, 1220 (Fed. Cir. 2016)). A patent owner may prove such a nexus by showing that the evidence of secondary considerations is the direct result of the unique characteristics of the claimed invention. *Id.* at 33 (quoting *Fox Factory, Inc. v. SRAM, LLC*, 944 F.3d 1366, 1373-74 (Fed. Cir. 2019)). A patent owner may show, for example, that the claimed combination as a whole serves as a nexus for the objective evidence; proof of nexus is not limited to circumstances where the objective evidence is tied to the "new" features. *Id.* at 33. The fact finder must weigh evidence of secondary considerations in the context of whether the claimed invention as a whole would have been obvious to a person of ordinary skill in the art at the time of invention. *Id.* at 33.

C. Person of Ordinary Skill in the Art

The Board preliminarily adopted a level of skill in the art based on the level of skill proposed by Petitioner. (D.I. 11 at 7-8.) Specifically, the Board determined that a person of ordinary skill in the art ("POSITA") at the time of invention would have had a Bachelor's degree in Electrical Engineering, Computer

Engineering, Computer Science, or a related field, and at least 2 years of experience in the field of wireless communication, or had equivalent education, work, or experience in this field.

For purposes of this Patent Owner's Response, Patent Owner adopts the Board's definition of a person of ordinary skill to the extent it does not purport to substitute experience for education. For example, it became evident during the deposition of Petitioner's expert, Dr. Wells, that his opinion as to the level of ordinary skill contemplates that "substantial experience could substitute for some of the educational background," ***including the requirement that a POSITA possess a Bachelor's degree***. (EX2002 at 26:6-17.) This definition is unworkable because, as Dr. Cooklev explains, the wireless communications and matrix algebra concepts described and claimed by the '862 patent would require at least a bachelor's degree to appreciate. (EX2001 at ¶ 30.) However, under either definition of the level of ordinary skill, Petitioner has failed to meet its burden.

III. TECHNOLOGY OVERVIEW

A. Beamforming

A beam is the main lobe of the radiation pattern of an antenna array. Beamforming is a method used to focus the radio signal in a given direction similar to a flashlight. The transmitting device is called a beamformer. The receiving device is called a beamformee. Without beamforming, power is transmitted in

many directions according to the properties of the antenna, so a signal intended for one user reaches other users. With beamforming, the power is transmitted mainly in the direction of the intended receiver. Beamforming involves multiple antennas and the ability to adjust the amplitudes and phases of the signals transmitted or received by the multiple antennas. (EX2001 at ¶ 38.)

Because the radio signal is focused in a certain direction, beamforming leads to a higher Signal-to-Interference Noise Ratio (SINR). In turn, a higher SINR allows higher-order modulation and/or higher-rate coding to be used, which, in turn, leads to higher throughput. (EX2001 at ¶ 39.)

Beamforming requires at least the beamformer to have multiple antennas and is generally implemented in multi-antenna systems like Multiple-Input Multiple-Output (MIMO) systems. Because beamforming is used in a multi-user (MU) environment, it is also described as MU-MIMO. Further, DL-MU-MIMO generally refers to beamforming in the downstream direction (from the access point to a client device) and UL-MU-MIMO refers to beamforming in the upstream direction (from a client device to the access point). Client devices may be referred to as stations (STA). (EX2001 at ¶ 40.)

B. Beamforming According to the 802.11 Standards

IEEE 802.11ac specifies an interoperable approach to beamforming by requiring a single method for sounding and feedback. This enables interoperable

beamforming among the products of different vendors. IEEE 802.11ac is also referred to as Very-High Throughput (VHT). (EX2001 at ¶ 41.)

The IEEE 802.11ac standard defines only explicit feedback, where beamformees transmit the results of channel estimation. In MIMO systems the channel is a matrix. The full matrix includes amplitude and phase for each pair of transmit and receive antennas, and each orthogonal frequency division multiplexing (OFDM) subcarrier. The standard defines compression as a way to reduce the amount of feedback. (EX2001 at ¶ 42.)

Transmit beamforming and DL-MU-MIMO require knowledge of the channel state to compute a steering matrix that is applied to the transmitted signal to optimize reception at one or more receivers. The STA transmitting using the steering matrix is called the VHT beamformer, and a STA for which reception is optimized is called a VHT beamformee. (EX2001 at ¶ 43.)

C. The ’862 Patent

The ’862 patent resulted from the pioneering efforts of Messrs. Aldana and Kim (hereinafter “the Inventors”) in the area of wireless communications systems using beamforming. (EX2001 at ¶ 44.) These efforts resulted in the development of a method and system for the efficient estimation of a channel response and for feedback of channel information in a closed loop beamforming wireless communication system. (EX2001 at ¶ 44.)

Channel estimation refers to the process of determining the characteristics or parameters of the wireless channel through which data is transmitted. (EX2001 at ¶ 45.) The wireless channel is subject to various impairments such as multipath fading, noise, and interference, which can distort the transmitted signal. (EX2001 at ¶ 45.)

Channel estimation in a wireless communication system may involve using known training symbols to analyze how the wireless channel affects the transmitted signals. (EX2001 at ¶ 46.) Training symbols are known sequences of symbols that are inserted into the transmitted signal specifically for the purpose of channel estimation. (EX2001 at ¶ 46.) These symbols are designed to have known properties at the transmitter. (EX2001 at ¶ 46.) At the receiver, these symbols are received after passing through the wireless channel, which introduces various effects. (EX2001 at ¶ 46.) The receiver uses the received training symbols to estimate the characteristics of the channel. (EX2001 at ¶ 46.) This typically involves comparing the known transmitted symbols with the received symbols. (EX2001 at ¶ 46.) By analyzing the differences and distortions (such as phase shifts, amplitude changes, and delay spreads), the receiver can estimate parameters such as its amplitude response, phase response, delay spread, and signal to noise ratio. (EX2001 at ¶ 46.)

The ’862 patent inventors recognized that using training symbols throughout the wireless transmission, such as interspersed with data symbols, increased the overhead associated with performing channel estimation. As the channel characteristics are constantly changing, the channel was being estimated every time training symbols were received. This had the effect of reducing channel throughput. (EX2001 at ¶ 47.)

To address this shortcoming in the prior art, the inventors proposed to incorporate a sequence of training symbols into the preamble of a wireless transmission, prior to the transmission of data carriers containing payload data. The inventors recognized that transmitting training symbols as a preamble sequence, rather than scattered throughout the data transmission, offered several advantages. First, by placing training symbols at the beginning of the transmission (in the preamble), the receiver can quickly synchronize its timing and frequency parameters with the transmitter. (EX2001 at ¶ 48.) This ensures that subsequent data symbols can be correctly interpreted and decoded without ambiguity. (EX2001 at ¶ 48.) Second, since the preamble is transmitted before the actual data, the receiver can use these known symbols to accurately estimate channel parameters such as amplitude and phase per subcarrier. This allows the receiver to adapt its reception techniques accordingly, mitigating the effects of channel impairments like multipath fading and noise. (EX2001 at ¶ 48.) Third, placing

training symbols in a dedicated preamble sequence makes the channel estimates less impacted by noise. (EX2001 at ¶ 48.) This leads to more accurate channel estimation and subsequently better reception performance for the data symbols that follow. (EX2001 at ¶ 48.) Finally, by concentrating training symbols in a preamble, the overall complexity is reduced, and the efficiency of the transmission process is improved by reducing the complexity of both transmission and reception processes and reducing overhead due from additional signaling and synchronization mechanisms. (EX2001 at ¶ 48.)

The inventors further recognized that the amount of beamforming feedback information was a significant problem. For instance, in a 2x2 MIMO OFDM wireless communication, the feedback per tone needs four elements that are all complex Cartesian coordinate values V_{11}, V_{12}, V_{21}, and V_{22}. (EX2001 at ¶ 49.) In general, $V_{ik}=a_{ik}+j*b_{ik}$, where a_{ik} and b_{ik} are values between -1, 1. (EX2001 at ¶ 49.) Thus, with 1 bit for each of the real and imaginary components, a_{ik} and b_{ik} can be either -1/2 or +1/2, which requires 4x2x1=8 bits per tone. (EX2001 at ¶ 49.) With 4 bits for the real and imaginary components the total number of bits required is 1728 (e.g., 4*2*54*4=1728, 4 elements per tone, each with real and imaginary components, 54 data tones per symbols, and 4 bits per element), which requires overhead for a packet exchange that is too large for practical applications. (EX2001 at ¶ 49.)

The Inventors conceived of the invention claimed in the '862 patent as a way to reduce beamforming feedback information for wireless communications. (EX2001 at ¶ 50.)

For example, the Inventors developed a method for feeding back transmitter beamforming information from a receiving wireless communication device to a transmitting wireless communication device, the method comprising: the receiving wireless communication device receiving a preamble sequence from the transmitting wireless device; the receiving wireless device estimating a channel response based upon the preamble sequence; the receiving wireless device determining an estimated transmitter beamforming unitary matrix (V) based upon the channel response and a receiver beamforming unitary matrix (U); the receiving wireless device decomposing the estimated transmitter beamforming unitary matrix (V) to produce the transmitter beamforming information; and the receiving wireless device wirelessly sending the transmitter beamforming information to the transmitting wireless device. (EX2001 at ¶ 51.)

For example, a beamformer conforming to the 802.11ac standard initiates channel sounding (i.e., transmitting known signals to characterize the wireless channel) by transmitting a Null Data Packet Announcement ("NDPA") frame with a Null Data Packet ("NDP") frame. (EX2001 at ¶ 52.) A VHT beamformee conforming to 802.11ac calculates the channel response based on the NDP.

(EX2001 at ¶ 52.) The VHT beamformee sends back a transformed estimate of the channel state to the VHT beamformer. (EX2001 at ¶ 52.) The VHT beamformer then uses this estimate, perhaps combining estimates from multiple VHT beamformees, to derive a steering matrix and adapt its beamforming strategies. (EX2001 at ¶ 52.)

The Inventors further developed a method for producing the transmitter beamforming feedback matrix (V) in Cartesian coordinates, then converting the feedback matrix (V) to polar coordinates before sending it to the transmitter. This approach takes advantage of the unitary property of the matrix V and offers the advantage of reducing the amount of feedback information that is sent to the beamformer, thus fulfilling an important objective of the '862 patent. (EX2001 at ¶ 53.)

IV. CLAIM CONSTRUCTION

Claims in a post-grant review are construed using the same claim construction standard as in a civil action. 37 C.F.R. § 42.100(b). Under this standard, claims terms are generally given their ordinary and customary meaning as understood by a person of ordinary skill in the art ("POSITA") at the time of the invention. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-13 (Fed. Cir. 2005) (en banc). The POSITA is deemed to read the claim term in the context of the entire patent, including the specification and prosecution history. *Id. at* 1313-1316.

Courts depart from the plain and ordinary meaning in only two instances: (1) when a patentee acts as its own lexicographer, and (2) when the patentee disavows the full scope of the claim term in the specification or during prosecution. *Hill-Rom Servs. v. Stryker Corp.*, 755 F.3d 1367, 1371 (Fed. Cir. 2014).

With respect to the term "a baseband processing module operable to . . .," Petitioner correctly noted that both a district court and the Board found the term should not be interpreted under §112, ¶6. Pet. at 13. Patent Owner agrees with the district court and the Board that §112, ¶6 does not apply. Petitioner has not provided any argument to the contrary. In any event, Patent Owner submits that the Board need not construe this term in order to resolve the controversy because, for the sake of expediency, Patent Owner has chosen to focus on other limitations in this proceeding. However, if the Board decides this term is means-plus-function, Patent Owner identifies EX1001 at Figs. 2-5 (e.g., baseband processing modules 64 and 76 in Fig. 2, 100 in Fig. 3, 100-RX in Fig. 4, and 100-TX in Fig. 5), and 5:4-12:45, as examples of specific portions of the specification that describe the structure corresponding to the recited baseband processing. (EX2001 at ¶ 56.)

With respect to the term "a plurality of Radio Frequency (RF) components," Patent Owner agrees with Petitioner that the Board need not construe this term in

order to resolve the controversy, Pet. at 14, because, for the sake of expediency, Patent Owner has chosen to focus on other limitations in this proceeding.

With respect to the term "decompose the estimated transmitter beamforming unitary matrix (V) to produce the transmitter beamforming information," Petitioner noted that both a district court and the Board found that no construction was necessary. Pet. at 14. Patent Owner agrees with the district court and the Board that no construction is necessary. Petitioner has not provided any argument to the contrary. In any event, Patent Owner submits that the Board need not construe this term in order to resolve the controversy because, for the sake of expediency, Patent Owner has chosen to focus on other limitations in this proceeding.

By focusing on other limitations in this proceeding, Patent Owner is not conceding that the three terms discussed above are taught or suggested in the cited art or that they would have otherwise been obvious to a POSITA. Patent Owner reserves the right to argue patentability of the challenged claims in other proceedings based on one or more of the three terms.

Petitioner does not proffer a construction for any other terms of the challenged claims or, to the extent it relies on a plain and ordinary meaning, identify what that meaning would be.

For example, the Petition fails to specify what constitutes the plain and ordinary meaning of "preamble" or "preamble sequence" in independent claims 1

and 9, or of "produc[ing] the estimated transmitter beamforming unitary matrix (V) in Cartesian coordinates" and "converting the estimated transmitter beamforming unitary matrix (V) to polar coordinates" in dependent claims 2 and 10, which are relevant to the deficiencies in Petitioner's obviousness arguments.

At deposition, Petitioner's expert Dr. Wells offered, for the first time, a plain and ordinary meaning of the term "preamble sequence" to mean "a distribution of information that is sent before something else." (EX2002 at 52:24-53:4.) As Dr. Cooklev explains, "distribution of information" is not only vague, but not a proper technical term. (EX2001 at ¶¶ 61-64.) Moreover, Dr. Wells's definition does not specify what he means by "something else" or ***how long*** "***before*** something else" the preamble must be sent. Nor did he opine in his declaration or at deposition how the term "preamble" differs from a "preamble sequence." Consequently, Petitioner's expert is applying a technically incorrect and inadequate "plain and ordinary meaning." (EX2001 at ¶¶ 65-66.)

Moreover, Dr. Wells himself later contradicted the definition that he proffered. For example, he testified that "Preamble, if it was related to the data, it would come before. If the preamble has nothing to do with the data, ***it can come anywhere***." (EX2002 at 76:8-11.) But this latter statement directly contradicts his proffered "plain and ordinary" meaning that a preamble must be "sent ***before*** something else." As Dr. Cooklev explains, to be used for channel estimation, a

preamble sequence must be known to the receiver. (EX2001 at ¶ 68.) In other words, a preamble sequence is not itself actual (i.e., payload) data, but is sent before the payload data. (EX2001 at ¶ 68.) Dr. Wells does not provide any basis why, in the context of the claimed inventions, a preamble would have "nothing to do with data" or "come anywhere." (EX2001 at ¶ 68.) Because the testimony of Dr. Wells is at the same time self-contradictory and technically unreliable, it should be accorded little weight.

The plain and ordinary meaning of the term "preamble," as understood by a POSITA in the context of the '862 patent, is "a segment, at the beginning of a transmission, containing information that is expected (*i.e.*, known *a priori*) by the receiver." (EX2001 at ¶ 69.) The preamble is therefore distinct from payload data, which is not known in advance by the receiver. The plain and ordinary meaning of the term "preamble sequence," as understood by a POSITA, is "two or more training symbols in the preamble." (*Id.*, ¶ 69; EX1001 at Figs. 7, 8 and their descriptions.) The plain and ordinary meanings of the term "preamble" and "preamble sequence" are consistent with the disclosure of the '862 patent, in which it is explained how estimating channel response "from the preamble sequence" involves "comparing received *training symbols of the preamble* to corresponding *expected* [*i.e.*, known *a priori*] training symbols . . . ." (EX1001 at 13:40-44 (emphasis and parenthetical added); FIG. 7 (step 702); and FIG. 8 (step 802).)

Finally, with respect to the Board's question in the Institution Decision whether there is antecedent basis for the term "the transmitter beamforming information" in claim element [9f], Patent Owner submits that, when viewed in light of the claims as a whole and the specification, a POSITA would understand what is meant by the term "the transmitter beamforming information" with reasonable certainty. First, viewing claim 9 as a whole, a POSITA would understand that the term refers to the product of the mathematical decompositions of the estimated transmitter beamforming unitary matrix (V) recited in the claim. (EX2001 at ¶ 72.)

Second, comparing claims 1 and 9, a POSITA would understand that the term "the transmitter beamforming information" in claim 9 mirrors the term "the transmitter beamforming information" in claim 1, for which there is undeniably antecedent basis in the preamble. (EX2001 at ¶ 73.) The plain language of both claims is functionally identical,[1] with the difference being that claim 1 is a method claim for feeding back transmitter beamforming information from a wireless communication device, while claim 9 recites a "wireless communication device"

[1] The corresponding language in claim 1 recites: "the receiving wireless device decomposing the estimated transmitter beamforming unitary matrix (V) to produce the transmitter beamforming information." (EX1001 at cl. 1.)

operable to do the same thing. (EX2001 at ¶ 73.) A POSITA would therefore understand that the term "the transmitter beamforming information" in claim 9 means the same thing as the term "the transmitter beamforming information" in claim 1. (EX2001 at ¶ 73.)

Third, a POSITA, reading the '862 patent specification, would immediately understand that "the transmitter beamforming information" in claim 9 refers to the feedback information that is sent by a receiving device to a transmitting device and used by the transmitting device to generate a new beamforming matrix (V) that is used for subsequent transmissions. (*See, e.g.*, EX1001 at Figs. 7 and 8, 10:2-7, 12:56-60, 13:25-14:46; EX2001 at ¶ 74.) As the Federal Circuit has found, "lack of an antecedent basis does not render a claim indefinite as long as the claim 'apprises one of ordinary skill in the art of its scope and, therefore, serves the notice function required by [§ 112 ¶ 2]." *In re Robert E. Downing*, 754 F. App'x 988, 996 (Fed. Cir. 2018). That is precisely the situation here.

V. PETITIONER HAS FAILED TO SATISFY ITS BURDEN UNDER 35 U.S.C. § 316(e)

For the following reasons, Petitioner has not demonstrated that the challenged claims of the '862 patent are invalid by a preponderance of the evidence.

A. Petitioner Fails to Show That The Cited Art Discloses Estimating a Channel Response Based Upon a Preamble Sequence (Grounds 1-5; Claims 1-4, 9-12)

All of the challenged claims in the ’862 patent require a channel response to be estimated based upon “a preamble sequence.” Independent claim 1 of the ’862 patent recites:

> 1. A method for feeding back transmitter beamforming information from a receiving wireless communication device to a transmitting wireless communication device, the method comprising:
>
> ***the receiving wireless communication device receiving a preamble sequence from the transmitting wireless device;***
>
> ***the receiving wireless device estimating a channel response based upon the preamble sequence;***
>
> the receiving wireless device determining an estimated transmitter beamforming unitary matrix (V) based upon the channel response and a receiver beamforming unitary matrix (U);
>
> the receiving wireless device decomposing the estimated transmitter beamforming unitary matrix (V) to produce the transmitter beamforming information; and
>
> the receiving wireless device wirelessly sending the transmitter beamforming information to the transmitting wireless device.

(EX1001 at cl. 1.)

Independent claim 9, the corresponding device claim, similarly recites:

> 9. A wireless communication device comprising:
>
> a plurality of Radio Frequency (RF) components operable to receive an RF signal and to convert the RF signal to a baseband signal; and
>
> a baseband processing module operable to:
>
> ***receive a preamble sequence carried by the baseband signal;***
>
> ***estimate a channel response based upon the preamble sequence;***

> determine an estimated transmitter beamforming unitary matrix (V) based upon the channel response and a receiver beamforming unitary matrix (U);
>
> decompose the estimated transmitter beamforming unitary matrix (V) to produce the transmitter beamforming information; and
>
> form a baseband signal employed by the plurality of RF components to wirelessly send the transmitter beamforming information to the transmitting wireless device.

(EX1001, cl. 9.) The rest of the challenged claims (claims 2-4 and claims 10-12) depend from independent claims 1 and 9, respectively.

In **Grounds 1, 2, 3-4,[2] and 5**, Petitioner relies on the disclosures of Li '748, Tong, Li '054, and Poon, respectively, for the "preamble sequence" limitations of independent claims 1 and 9 (emphasized above). (Pet. at 32 (Li '748), 49 (Tong), 63-64 (Li '054), 75-76 (Poon).) However, for each of these Grounds, Petitioner and its expert admit that their references do not explicitly teach receiving a "preamble sequence," much less estimating a channel response "based upon the preamble sequence." (EX2002 at 44:24-45:4, 51:19-21 (Li '748); 67:20-68:3 (Li

[2] In Ground 4, Petitioner challenges claims 2 and 10, which depend from independent claims 1 and 9, respectively, and relies on the analysis of Ground 3 (Li '054 and Mao) for the limitations of the independent claims (including the "preamble sequence" limitations).

'054); 85:2-10 (Poon); EX1003 at ¶ 114 (Tong).) Because this deficiency impacts all independent claims, none of the challenged claims are unpatentable.

1. Neither Petitioner Nor Its Expert Offered a Construction of "Preamble" or "Preamble Sequence" Other Than Plain and Ordinary Meaning

Petitioner does not assert that the terms "preamble" or "preamble sequence" must be construed to have any meaning other than their plain and ordinary meaning. However, Petitioner does not identify in the Petition what it contends is the plain and ordinary meaning of "preamble" or "preamble sequence."[3] Instead, in each Ground of the Petition, it simply resorts to citing the use of the term in the '862 patent specification, without construction. (*See, e.g.*, Pet. at 32, 64, 76.)

In his accompanying declaration, Petitioner's expert Dr. Wells similarly did not elaborate on the meaning of either term. Dr. Wells sidestepped this issue by focusing instead on the alleged "similarity" of the '862 patent and cited art in the

[3] In the Institution Decision, the Board likewise did not define the terms "preamble" or "preamble sequence." The Board merely adopted Petitioner's argument that a "preamble sequence" was present in Li-748, without identifying any specific teaching in Li-748 of a "preamble sequence" or explaining why it meets the term. (Paper 11 at 15.)

use of training symbols, etc., for estimating a channel response. For example, in Ground 1, Dr. Wells states:

> the "preamble" disclosed in the '862 patent includes essentially the same type of traditional "training symbols" (as disclosed in Li '748) to estimate the channel response and determine the beamforming matrix, and a POSITA would have recognized this similarity because it was a customary practice at the time in such wireless devices. Thus, Li '748 discloses receiving a preamble sequence carried by the baseband signal.

(EX1003 at ¶ 83.)

In Ground 2 Dr. Wells states:

> the "preamble" disclosed in the '862 patent include essentially the same type of traditional "pilot symbols" (as disclosed in Tong) to estimate the channel response and determine the beamforming matrix, and a POSITA would have recognized this similarity because it was a customary practice at the time in such wireless devices. Thus, Tong discloses receiving a preamble sequence carried by the baseband signal.

(*Id.* at ¶ 114.)

In Grounds 3 and 4, Dr. Wells states:

> the "preamble" disclosed in the '862 patent includes essentially the same type of traditional "training symbols" (as disclosed in Li '054) to estimate the channel response and determine the beamforming matrix, and a POSITA would have recognized this similarity because it was a customary practice at the time in such wireless devices. Thus, Li '054 discloses receiving a preamble sequence carried by the baseband signal

(*Id.* at ¶ 151.)

In Ground 5, Dr. Wells states:

> the "preamble" disclosed in the '862 patent includes traditional "training symbols," or a training pattern (as disclosed in Poon), to estimate the channel response (e.g., estimate the spatial channel) and determine the

> transmit beamforming matrix V, and a POSITA would have recognized this similarity because it was a customary practice at the time in such wireless devices. Thus, Poon discloses receiving a preamble sequence carried by the baseband signal.

(*Id.* at ¶ 191.)

Nowhere in Dr. Wells's declaration does he provide a plain and ordinary meaning of the terms "preamble" or "preamble sequence" nor does he explain how these terms are met by the cited art. Instead, Dr. Wells seems to be arguing that merely because the '862 patent and the cited art teach training symbols, etc., the cited art discloses a preamble sequence. When questioned at deposition, Dr. Wells stated, for the first time, that the plain and ordinary meaning of a "preamble sequence" was "a distribution of information that is sent before something else." (EX2002 at 52:24-53:4.) But as previously set forth, Dr. Wells's definition is technically incorrect and overly vague. As also noted previously, the proper definition of "a preamble sequence" is "two or more training symbols in a preamble," where the term "preamble" means "a segment, at the beginning of a transmission, containing information that is expected (*i.e.*, known *a priori*) by the receiver." Dr. Wells therefore lacks a proper framework by which to assess whether a prior art reference taught estimating a channel response based upon a "preamble sequence."

Dr. Wells nevertheless testified that Li '748 (**Ground 1**) "***certainly*** discloses" a "preamble sequence." (EX2002 at 44:16-45:9.) Dr. Wells similarly

testified that Li '054 (**Grounds 3-4**) "***certainly***" discloses a preamble. (*Id.* at 67:20-68:3.) In his declaration, Dr. Wells similarly opined that Tong (**Ground 2**) "***discloses*** receiving a preamble sequence," (EX1003 at ¶ 113), and that Poon (**Ground 5**) "***discloses*** or at least renders obvious receiving a preamble sequence." (*Id.* at ¶ 190.) The cited disclosures from Li '748, Tong, Li '054, and Poon are deficient, as will be explained below. Moreover, Dr. Wells's testimony shows that Petitioner's arguments for limitations 1.a, 1.b, 9.c, and 9.d are actually an inherency argument (i.e., implicit disclosure), not an argument that these references explicitly disclose the limitations. And as set forth below, even an inherency argument would fail.

2. Petitioner Has Failed to Show That Any of Its References Explicitly Disclose a Preamble Sequence or Render it Obvious

None of the references in the Petition Grounds explicitly teach a "preamble," much less a "preamble sequence," as those terms would have been understood by a POSITA. In each of their Grounds, Petitioner and its expert appear to rely on the teachings of "training symbols," "pilot symbols," "received signals," or a "training pattern," as teaching the claimed preamble sequence. (Pet. at 32 (Li '748), 49 (Tong), 63-64 (Li '054), 75-76 (Poon); EX1003 at ¶¶ 82-83, 113-14, 150-51, 190-91.) However, they do not identify any evidence that such "training symbols," "pilot symbols," "received signals," or a "training pattern" are a "preamble sequence" as required by the claim. Instead, in each Ground, they seek to compare

"training symbols," "pilot symbols," or a "training pattern" to the ***'862 patent specification's own teaching*** of "training symbols" in a preamble, and argue that it would ***therefore*** have been obvious to receive a preamble sequence and estimate a channel response based on it. (Pet. at 32 (Li '748), 49 (Tong), 63-64 (Li '054), 75-76 (Poon); EX1003 at ¶¶ 82-83, 113-14, 150-51, 190-91.)

But Petitioner does not offer any legal basis to demonstrate obviousness based solely on the teachings of the challenged patent. Nor did Dr. Wells identify any such legal basis in his declaration. (EX1003 at ¶¶ 18-20.)

More generally, neither the Petition nor Dr. Wells's opinions contain any actual obviousness analysis—which is a fatal flaw for each Ground. *Kranos Corp. v. Riddell, Inc.*, IPR2016-01646, Paper No. 10 at 68 ("[O]bviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.") (internal citations omitted). In the Petition, there is no articulated reasoning with any rational underpinning supporting the legal conclusion of obviousness with respect to limitations 1.a, 1.b, 9.c, or 9.d—just a bare assertion that because the cited art teaches "training symbols," "pilot symbols," "received signals," or a "training pattern," it discloses a "preamble sequence" as claimed.

For example, whereas Dr. Wells's declaration contains a discussion of obviousness at paragraphs 18-20 in the "Legal Principles" section, Dr. Wells did not apply any such obviousness analysis for limitations 1.a, 1.b, 9.c, or 9.d. (EX1003 at ¶¶ 82-83, 113-14, 150-51, 190-91.) It is well established in patent law that:

> 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 skill in the art; and (4) where in evidence, so-called secondary considerations.

Apple Inc. v. Yu, IPR2019-01258, Paper No. 29 at 39 (PTAB Jan. 5, 2021) (citing *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966)).

Dr. Wells agreed that he was required to "take into account 'the differences between the prior art and the claims.'" (EX2002 at 40:19-41:1; EX1003 at ¶ 18.) However, when asked if he had identified any such differences in his declaration, he inexplicably stated: "I don't think there is a difference. That's why I think that Li '748 renders the '862 patent invalid. Because to a person of ordinary skill in the art, Li discloses everything that is in the patent, the '862 patent. There are no differences," (EX2002 at 41:12-20), thereby undercutting any attempt by Petitioner to say that the Petition actually contains an obviousness argument and obviousness analysis. **Ground 1** fails for this reason alone.

Dr. Wells's opinions as to the remaining Grounds are similarly hollow: nowhere in his declaration does he purport to identify any differences between any of the prior art and the claims of the '862 patent, particularly as to limitations 1.a, 1.b, 9.c, or 9.d. (EX1003 at ¶¶ 82-83, 113-14, 150-51, 190-91.) Therefore, Petitioner cannot win on any of its obviousness Grounds for the independent claims when Petitioner and its expert have not even addressed any obviousness analysis or what is missing from any of the references that Petitioner is using obviousness to bridge. The Board should therefore reject Petitioner's attempt to weave together obviousness grounds that Petitioner's own expert shows are lacking in obviousness analysis. *Johns Manville Corp. v. Knauf Insulation, Inc.*, IPR2015-01402, Paper 18 at 13 (PTAB Oct. 21, 2015) ("[I]t was not Patent Owner's responsibility . . . to identify differences . . . [t]hat responsibility falls on a petitioner and in this case Petitioner did not explicitly identify any difference.") The Board likewise cannot fill the gap in the analysis for Petitioner because the Supreme Court has held that "the petitioner's contentions, not the Director's discretion, define the scope of the litigation all the way from institution through to conclusion." *SAS Inst. Inc.*, 138 S. Ct. at 1357.

When questioned about the factual basis for his obviousness opinions as to these elements, Dr. Wells stated only that it was "customary practice" for training symbols to be included in a preamble. (EX2002 at 44:24-45:9.) But when pressed

to identify any evidence of such a "customary practice," he simply cited his "years" of experience. (*Id.* at 51:24-52:10; 66:4-9; 71:24-72:3.) This testimony is plainly insufficient to demonstrate, by a preponderance of the evidence, that any of Li '748, Tong, Li '054, or Poon teach or suggest a "preamble sequence" as recited by the challenged claims. *Xerox Corp. v. Bytemark, Inc.*, IPR2022-00624, Paper 12, at 2-5 (Feb. 10, 2023) (rejecting as "conclusory" an expert declaration that did not "provide any technical detail, explanation, or statements supporting why the expert determines that the feature in question was required or would have been obvious based on the prior art disclosure."), citing *TQ Delta, LLC v. Cisco Sys.*, 942 F.3d 1352, 1359 (Fed. Cir. 2019). As in *Xerox*, Dr. Wells's declaration "sets forth Petitioner's conclusory assertions as though they are facts, rather than setting forth facts and evidence in support of Petitioner's assertions." *Xerox*, IPR2022-00624, Paper 12, at 5. Specifically, the declaration merely restates Petitioner's assertion that "it was customary at the time for purposes of estimating a channel response (H)" to use "training symbols" within the preamble of the '862 patent. (*Compare* Pet. at 32; EX1003 at ¶¶ 83, 114, 151, 191.) Because Dr. Wells repeats this analysis for **Grounds 1-5**, each of the Grounds fails. (Pet. at 32, 49-50, 63-64, 75-76.)

Nor does Dr. Wells identify any evidence that the "training symbols," "pilot symbols," or "training pattern" in the corresponding references are "sent before"

any other sequence or information under his own stated definition of a "preamble." For example, Tong—which Petitioner relies on in **Ground 2** for the preamble sequence limitations—teaches that "pilot symbols . . . are ***scattered among*** the data symbols throughout the OFDM sub-carriers" and therefore cannot "come before" any other sequence or symbols. (EX1003 at ¶ 115, citing EX1005 at [0090].) When questioned on this point at deposition, Dr. Wells did not have an explanation for how pilot symbols could be "scattered among the data symbols" and yet be transmitted within a preamble. (EX2002 at 61:23-63:2.) A POSITA would understand that the "data symbols" referenced in Tong are not a preamble sequence and instead constitute payload data. (EX2001 at ¶ 91.) Therefore, Tong's pilot symbols are not transmitted within a preamble as they are transmitted amidst data symbols, and not as a segment ***before*** the data symbols. (EX2001 at ¶ 91.)

Ground 2 therefore fails for this additional reason.

3. Because Petitioner Has Failed to Show That Any of Its References Explicitly Disclose a Preamble Sequence, Petitioner Has Also Failed to Show That Any of Its References Explicitly Disclose Estimating a Channel Response Based Upon a Preamble Sequence

Each of the challenged claims requires that the receiving terminal estimate a channel response based upon the preamble sequence (elements 1[b] and 9[d]). Because the references underlying each Ground do not teach a "preamble

sequence," they also do not teach using the preamble sequence to estimate a channel response.

Li '748 (**Ground 1**) and Li '054 (**Grounds 3-4**) only teach, at best, that the receiver estimates a channel response based on "received signals." (EX1004 at Fig. 2; EX1007 at Fig. 3.) There is no disclosure in either of the Li references that the "received signals" are "training symbols," much less "a preamble sequence." Nor does Dr. Wells offer any evidence that Li '748 and Li '054 teach estimating a channel response based on training symbols. (EX1003 at ¶¶ 82-84, 152.) When questioned on this point at deposition, Dr. Wells merely stated that the "received signals" must be training symbols, but did not provide any evidence in support of that opinion. (EX2002 at 57:8-21, 58:8-18 (Li '748); 68:10-22, 70:20-72:20 (Li '054).) Because this is another conclusory opinion, it must be disregarded. *Xerox*, IPR2022-00624, Paper 12, at 5. Grounds 1 and 3 fail for this additional reason.

The other Grounds are similarly deficient. With respect to **Ground 2**, at best, Dr. Wells opines that Tong teaches "compar[ing] the received pilot symbols with the pilot symbols that are expected in certain sub-carriers at certain times to determine a channel response." (EX1003 at ¶ 115, citing EX1005 at [0090].) But as set forth above in Section V.A.2, Tong's pilot symbols are scattered throughout the data subcarriers and are not transmitted within a preamble sequence.

Therefore, any channel estimation Tong purportedly teaches is not based upon a preamble sequence. Ground 2 fails for this additional reason.

With respect to **Ground 5**, Dr. Wells also opines that Poon teaches that the "receiving station receives a training pattern" and separately that "the receiving station estimates N spatial channels." (EX1003 at ¶ 192, citing EX1009 at 3:20-60; Fig. 2.) But Dr. Wells does not provide any evidence that Poon teaches "estimating N spatial channels" based on a "***preamble sequence***." (EX1003 at ¶ 192.) Therefore, Ground 5 fails for this additional reason.

As such, Petitioner has not established by a preponderance of evidence that it would have been obvious to include "training symbols," "pilot symbols," or a "training pattern" in a "preamble sequence," as recited by the challenged claims. Furthermore, Petitioner has not established that it would have been obvious to estimate a channel response based on a preamble sequence. Each of Petitioner's Grounds fails for these reasons.

Petitioner's obviousness assertions as to limitations 1.a, 1.b, 9.c, and 9.d are based entirely on the unsupported testimony of their expert and disclosures from the challenged patent, which is tantamount to using the '862 patent as a roadmap. These assertions, which are nothing more than hindsight analysis, must therefore be rejected. *In Touch Techs., Inc. v. VGO Communs., Inc.*, 751 F.3d 1327, 1352 (Fed. Cir. 2014) (noting that obviousness must be assessed at the time the

invention was made) (citing *In re Cyclobenzaprine Hydrochloride Extended-Release Capsule Patent Litig.*, 676 F.3d 1063, 1073 (Fed. Cir. 2012)); *see also KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007) (warning against reliance on *ex post facto* reasoning.)

4. Petitioner Has Not Established That Any of Its References Inherently Discloses Estimating a Channel Response Based Upon a Preamble Sequence

Apparently recognizing that its references do not explicitly disclose receiving a preamble sequence or estimating a channel response based upon the preamble sequence, Petitioner and its expert advance an argument that is vaguely worded as part inherency and part obviousness. (EX2002 at 52:4-9 ("And in my 35 years of working with wireless systems, I can't think of any other system that I've ever seen that doesn't send -- when training symbols are sent when they're not sent in a preamble."); id. at 66:4-9, 72:1-3.)

But any such argument would fail under an inherency theory. As an initial matter, Dr. Wells acknowledged that he was not relying on inherency (or anticipation generally) for any of his opinions. (EX2002 at 40:6-15.) Consequently, the Board should not accept any arguments by Dr. Wells that are based on inherency. And even if the Board were inclined to credit Dr. Wells's testimony above as directed to an inherency theory, it is well established in patent law that inherency is only applicable "when 'prior art ***necessarily*** functions in

accordance with, or includes, the claimed limitations.'" *Bettcher Indus. v. Bunzl USA, Inc.*, 661 F.3d 629, 639 (Fed. Cir. 2011) (quoting *In re Cruciferous Sprout Litig.*, 301 F.3d 1343, 1349 (Fed. Cir. 2002)). Inherency should not be established "by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient." *Id.* (internal citations omitted). In essence, to show that a particular function is inherently the result of an operation disclosed in an alleged prior art reference, it should be shown that "the natural result flowing from the operation as taught would result in the performance of the questioned function[.]" *Id.* Petitioner has not attempted to make such a showing, other than relying on the say-so of Dr. Wells, at best.

Moreover, the testimony of Dr. Wells is also self-contradictory to the extent it suggests that training symbols must necessarily be transmitted within a preamble sequence. For example, Dr. Wells did not disagree that in Tong (**Ground 2**), pilot symbols are scattered throughout a data transmission. (EX2002 at 61:23-63:2.) This alone eliminates the necessity required for inherency. Dr. Wells also did not rule out that "training symbols" (in Petitioner's **Ground 1, Ground 3, and Ground 4** references) could be "scattered among data symbols throughout OFDM sub-carriers like the pilot symbols in Tong." (EX2002 at 84:1-19.) Similarly, Dr. Wells did not rule out that the "training pattern" in Poon (**Ground 5**) could likewise be "scattered among the data symbols." (*Id.* at 83:2-7.)

Indeed, Dr. Wells sought to sidestep these deficiencies in his analysis by "arguing obviousness." (*Id.* at 85:6-7.) But as detailed above, Dr. Wells's (and Petitioner's) primary basis for asserting that it would have been obvious to include training symbols, pilot symbols, and/or a training pattern within a preamble sequence was that he "[could not] think of any other system" where they were not. (EX2002 at 52:4-9; 66:4-9; 72:1-3.)[4] But because this basis is uncorroborated and contradicted by the cited art itself (e.g., Tong), Dr. Wells's "obviousness" theory also fails.

Each of the Grounds fails for this additional reason.

5. Petitioner Fails To Show That The Dependent Claims Are Unpatentable

Claims 2-4 depend from independent claim 1, and claims 10-12 depend from independent claim 9. Petitioner asserts under **Ground 1** that dependent claims 2-4 and 10-12 are obvious in view of Li '748, Tong, and Mao. However, as explained in Section V.A.3-4, neither Li '748 nor Tong discloses estimating a channel response based upon a preamble sequence. Mao is relied on for allegedly teaching the "radio frequency (RF) components" and "form a baseband signal" limitations of the claims, (Pet. at 23-24, 25, 40), and therefore fails to remedy the deficiencies

[4] The only other basis relies on the '862 patent's own specification, which is improper.

of Li '748 and Tong. Accordingly, Ground 1 of the Petition fails to show by a preponderance of evidence that claims 2-4 and 10-12 are unpatentable.

Petitioner asserts under **Ground 2** that claims 2-4 and 10-12 are obvious in view of Tong and Mao. However, as explained above in Section V.A.3-4, Tong does not disclose estimating a channel response based upon a preamble sequence and Mao is relied on for allegedly teaching the "radio frequency (RF) components" and "form a baseband signal" limitations of the claims, (Pet. at 23-24, 53), and therefore fails to remedy the deficiencies of Tong. Accordingly, Ground 2 of the Petition fails to show by a preponderance of evidence that claims 2-4 and 10-12 are unpatentable.

Petitioner asserts under **Ground 3** that claims 3, 4, 11, and 12 are obvious in view of Li '054 in view of Mao. However, as explained above in Section V.A.3-4, Li '054 fails to disclose estimating a channel response based upon a preamble sequence and Mao is relied on for allegedly teaching the "radio frequency (RF) components" and "form a baseband signal" limitations of the claims, (Pet. at 23-24, 61-62, 66), and therefore fails to remedy the deficiencies of Li '054. Accordingly, Ground 3 of the Petition fails to show by a preponderance of evidence that claims 3, 4, 11, and 12 are unpatentable.

Petitioner asserts under **Ground 4** that claims 2 and 10 are obvious over Li '054, Mao, and Yang. However, as noted above in Section V.A.3-4, Li '054 fails

to disclose estimating a channel response based upon a preamble sequence. Mao is relied on for allegedly teaching the "radio frequency (RF) components" and "form a baseband signal" limitations of the claims, (Pet. at 23-24, 71), and Yang is relied on for allegedly teaching the "converting the estimated transmitter beamforming unitary matrix (V) to polar coordinates" limitation. (Pet. at 67-70.) Therefore, Mao and Yang fail to remedy the deficiencies of Li '054 with respect to claims 1 and 9, from which claims 2 and 10 depend. Accordingly, Ground 4 of the Petition fails to show by a preponderance of evidence that claims 2 and 10 are unpatentable.

Petitioner asserts under **Ground 5** that claims 3, 4, 11, and 12 are obvious in view of Poon and Mao. However, as explained above in Section V.A.3-4, Poon fails to disclose estimating a channel response based upon a preamble sequence. Mao is relied on for allegedly teaching the "radio frequency (RF) components" and "form a baseband signal" limitations of the claims, (Pet. at 23-24, 78), and therefore Mao fails to remedy this deficiency. Accordingly, Ground 5 of the Petition fails to show by a preponderance of evidence that claims 3, 4, 11, and 12 are unpatentable.

For at least the reasons set forth above, Petitioner has not shown by a preponderance of evidence that claims 1-4 and 9-12 are unpatentable.

B. Petitioner Fails to Show That Producing the Estimated Transmitter Beamforming Unitary Matrix (V) in Cartesian Coordinates and Converting the Matrix (V) to Polar Coordinates Would Have Been Obvious (Grounds 1, 2, 4; Claims 2, 10)

Claims 2 and 10 are also patentable over the cited references because of the additional limitations they recite. Claim 2 of the '862 patent recites:

> 2. The method of claim 1 wherein the receiving wireless device determining an estimated transmitter beamforming unitary matrix (V) based upon the channel response and a receiver beamforming unitary matrix (U) comprises:
>
> the receiving wireless device ***producing the estimated transmitter beamforming unitary matrix (V) in Cartesian coordinates***; and
>
> the receiving wireless device ***converting the estimated transmitter beamforming unitary matrix (V) to polar coordinates***.

(EX1001, cl. 2 (emphasis added).)

Claim 10 of the '862 patent—the corresponding device claim—similarly recites:

> 10. The wireless communication device of claim 9, wherein in determining an estimated transmitter beamforming unitary matrix (V) based upon the channel response and a receiver beamforming unitary matrix (U), the baseband processing module is operable to:
>
> ***produce the estimated transmitter beamforming unitary matrix (V) in Cartesian coordinates***; and
>
> ***convert the estimated transmitter beamforming unitary matrix (V) to polar coordinates***.

(EX1001, cl. 10 (emphasis added).)

Petitioner asserts that only three of its Grounds (namely, **Grounds 1, 2, and 4**) render claims 2 and 10 obvious. (Pet. at i-iii.) In Ground 4, Petitioner relies exclusively on Yang (EX1008) for the additional limitations of claims 2 and 10. (Pet. at 67-70.) In Grounds 1 and 2, Petitioner appears to rely on Yang only as a backup reference for the additional limitations of these claims. (Pet. at 42-44, 67-70.) As explained below, to the extent Yang can be considered by the Board, Yang does not teach producing a beamforming matrix V in Cartesian coordinates and converting it to polar coordinates. Moreover, Li '748 in view of Tong, relied on by Petitioner as separately rendering claims 2 and 10 obvious in Ground 1, does not teach producing a beamforming matrix V in Cartesian coordinates and converting the matrix V to polar coordinates.

1. Petitioner Fails to Show That Li '748, Alone or in View of Tong, Renders Claims 2 and 10 Obvious (Ground 1)

In **Ground 1**, Petitioner and Dr. Wells rely on Li '748 for the element "produc[ing] . . . (V) in Cartesian coordinates." Here, Dr. Wells first cites the following excerpt of Li '748:

> In some embodiments of the present invention, the beamforming matrix V is represented by n^2-1 real numbers instead of $2n^2$ real numbers. By sending n^2-1 real numbers instead of $2n^2$ real numbers to represent the beamforming matrix, the feedback bandwidth may be reduced.

(EX1003 at ¶ 98, citing EX1004 at 2:63-67.)

At deposition, Dr. Wells explained that the "n^2-1 real numbers" of Li '748 were the "Cartesian coordinates" recited by the claims. (EX2002 at 98:1-10; 98:22-99:7.) However, Dr. Wells is mistaken that the "n^2-1 real numbers" are elements of the matrix V in Cartesian coordinates.

As Dr. Cooklev explains, Li '748 purports to reduce feedback bandwidth by using "n^2-1 real numbers ***instead of*** $2n^2$ real numbers," for example, via compression or decomposition techniques. (EX2001 at ¶ 116.) But the resulting "n^2-1 real numbers" are no longer elements of the matrix V and are instead, coefficients in front of Hermitian generator matrices. (EX2001 at ¶ 116.) Therefore, Dr. Wells and Petitioner have not established that Li '748 actually teaches a matrix V produced with n^2-1 Cartesian coordinates. (EX2001 at ¶ 116.)

Dr. Wells also states that Li '748's teachings of "hermitian generator matrices" shows that the matrix V is converted to polar coordinates. (EX1003 at ¶ 98.) That excerpt from Li '748 is reproduced below in its entirety:

> Various embodiments of the present invention exploit the structure of unitary matrixes and represent the unitary matrices by a combination of n^2-l orthogonal generator matrices, where the feedback numbers are the projections on the generator bases. For example, multiple hermitian generator matrices known to both the transmitter and receiver may be utilized to represent the beamforming matrix. Further, ***the numbers are also angles from $-\pi$ to π of an (n^2-l)-dimension polar coordinate***, which facilitate a fine control of quantization error.

(EX1004 at 2:67-3:11.)

Again, Li '748 does not teach ***converting the matrix V*** to polar coordinates as the claims require. Dr. Wells does not identify any disclosure of "converting" in Li '748. Nor does Dr. Wells identify the specific disclosure in Li '748 he considers "polar coordinates." To the extent he considers the "angles from –π to π" as meeting this element, those numbers are "angles . . . ***of an (n^2-1)-dimension polar coordinate***," (EX1004 at 3:7-10), not polar coordinate elements of the matrix V as the claims require. (EX2001 at ¶ 118.) Moreover, Li '748 teaches using a plurality of (i.e., n^2-l) "orthogonal generator matrices," such as "hermitian generator matrices," to represent V. (EX1004 at 2:67-3:11.) Specifically, rather than convert V to polar coordinates, Li '748 teaches that V is represented in terms of a hermitian generator matrix G_k and the angle a_k of the k-th rotation, as follows:

$$V = \exp\left(i \sum_{k=1}^{n^2} a_k G_k\right)$$

> where G_k is the k-th hermitian generator matrix; a_k is the angle of the k-th rotation and it is between −π and π; and i is the square root of −1. Example generator matrices for n=2, 3, and 4 are provided at the end of this description.

(EX1004 at 3:45-54.)

The above excerpts (which Dr. Wells did not consider or address) confirm that the matrix V is never converted to polar coordinates. Indeed, even the

exemplary generator matrices G_k are in Cartesian coordinates and do not contain ***any*** polar coordinates:

Generator Matrices

For U(2) group, the generator matrices are:

$$G_1 = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}, G_2 = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}, G_3 = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}, G_4 = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

For U(3) group, the generator matrices are:

$$G_1 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}, G_2 = \begin{pmatrix} 0 & -i & 0 \\ i & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}, G_3 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 0 \end{pmatrix},$$

$$G_4 = \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix} G_5 = \begin{pmatrix} 0 & 0 & -i \\ 0 & 0 & 0 \\ i & 0 & 0 \end{pmatrix}, G_6 = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix},$$

$$G_7 = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & -i \\ 0 & i & 0 \end{pmatrix}, G_8 = \frac{1}{\sqrt{3}} \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & -2 \end{pmatrix} G_9 = \sqrt{\frac{2}{3}} \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

(EX1004 at 11:1-12:5; EX2001 at ¶ 119.)

Therefore, Dr. Wells is plainly mistaken that "angles from –π to π" in Li '748 teach "conversion" of V to polar coordinates. (EX2001 at ¶ 120.) Dr. Wells does not identify any specific disclosures from Li '748 showing a polar coordinate representation of V, or even the claimed conversion.

Therefore, Li '748 does not render obvious claims 2 and 10.

2. Petitioner Fails to Show That Tong Renders Claims 2 and 10 Obvious (Grounds 1, 2)

Petitioner and Dr. Wells similarly miss the mark with Tong (**Grounds 1 and 2**). Tong teaches merely that "the V matrix is decomposed by the Givens transform 330 to produce a series of matrices," each of which can be "uniquely represented by two parameters Θ and C." (EX1005 at [0223].) Even if the resultant matrices following the Givens transforms are in polar coordinates, nothing in the cited disclosures describes that the V matrix itself is first ***produced in Cartesian coordinates*** and subsequently converted to polar coordinates. (EX2001 at ¶ 122.) Nor does Dr. Wells identify what such a Cartesian-coordinate representation of V would look like at all, other than a conclusory opinion that it was "common at the time" to "convert from Cartesian coordinate[s]." (EX2002 at 106:18-107:12.) Further, in connection with **Ground 1**, Dr. Wells does not provide any evidence that a POSITA reading Li '748 and Tong would have been motivated to convert a matrix of n^2-l real numbers (as in Li '748) to polar coordinates. Tong does not even contemplate such a situation. (EX2001 at ¶ 122.)

Therefore, Tong alone, or in combination with Li '748 (**Ground 1**) or Mao (**Ground 2**) does not render obvious claims 2 and 10.

3. To the Extent it Can be Considered, Yang Does Not Render Claims 2 and 10 Obvious (Grounds 1, 2, 4)

Ground 4 is the only Ground where Petitioner explicitly purports to rely on Yang for the additional limitations of claims 2 and 10. (Pet. at i-iii.) In **Grounds 1 and 2**, Petitioner and Dr. Wells characterize the teachings of Yang as "demonstrat[ing] the well-known technique of converting Cartesian coordinates to polar coordinates," and thereby seek to incorporate the teachings of Yang in their obviousness combinations. (EX1003 at ¶¶ 100, 128; Pet. at 43-44, 55-56.) But Petitioner does not provide any authority for trying to backdoor the ***explicit*** disclosures from a reference outside its stated Grounds. Yang should be disregarded in Grounds 1 and 2 on this basis alone.

In its Institution Decision, the Board did not indicate whether it considered the teachings of Yang in any Ground. (Paper 11 at 18.) To the extent the Board is inclined to consider the teachings of Yang in any of the Grounds, the reference nevertheless is not relevant because its teachings are inapposite to the specific limitations of claims 2 and 10.

Dr. Wells's reliance on Yang is limited to the following teachings:

> Yang describes a "method for computing two-sided rotations involved in singular value decomposition (SVD)" that "leads to significantly reduced computations." EX1008, Abstract.
>
> Yang explains that there was "massive interest in parallel architectures for computing SVD" and discloses the use of "coordinate rotation digital computer (CORDIC) processors" to avoid the "computational overhead" of previous computational methods. EX1008, 1, Abstract.

> Yang discloses a "***CORDIC algorithm***" for computing "Cartesian-to-polar coordinates conversions." Id., 4. Yang explains that SVD, which arises in beam-forming, has a "high computational complexity," but that the CORDIC algorithm reduces the complexity in part because of its Cartesian-to-polar coordinates conversions Id., 1, 5, Abstract.
>
> Using ***this algorithm***, Yang explains "the Cartesian coordinate (x0, y0) of a plane vector is converted to its polar representation." Id., 6.

(EX1003 at ¶ 128.)

In other words, Dr. Wells relies solely on Yang's teachings of a "CORDIC algorithm" (i.e., "this algorithm") for "Cartesian to polar coordinates conversions." However, these opinions disregard the context of the "CORDIC algorithm." Specifically, Dr. Wells disregards the fact that Yang does not teach or suggest "Cartesian to polar coordinates conversions" on a beamforming unitary matrix V and, instead, teaches at best operations performed on a real-valued matrix M (Yang's counterpart to the matrix H).

First, Yang describes that its "CORDIC algorithm" follows from its teachings of a "TPR-method" (two plane rotation method) involving the matrix M:

> 4. The CORDIC algorithm. In the previous section, we have seen that the main operations of the TPR-method are plane rotations and Cartesian-to-polar coordinates conversions.

(EX1008 at 5.) (EX2001 at ¶ 128.)

Specifically, Yang teaches that M is a real-valued matrix of dimension N, and represents the left hand side of a Jacobi SVD method:

2. Jacobi SVD method. In this paper, we consider real, square, and nonsymmetric matrices. Let $M \in \mathbb{R}^{N\times N}$ be a matrix of dimension N. The SVD is given by

$$M = U\Sigma V^T, \quad (1)$$

(EX1008 at 2.) (EX2001 at ¶ 129.)

Dr. Wells confirmed that the notation $M \in \mathbb{R}^{N\times N}$ means that M is a real valued matrix of dimension N. (EX2002 at 30:11-24.) He also testified that M in equation (1) of Yang corresponds to H, the channel state matrix described in the '862 patent and claimed as "H=UDV*" in, for example, claim 11. (EX2002 at 39:17-21.) But Dr. Wells did not opine that M is a channel state matrix. As Dr. Cooklev explains, while equation (1) of Yang represents an exemplary SVD operation, M is not itself a channel state matrix. (EX2001 at ¶ 130.)

Yang then goes on to describe the two-plane rotation method. First, "the matrix M is partitioned into 2 X 2 submatrices," A and B:

(Fig. 1). To do this, the matrix M is partitioned into 2×2 submatrices. Each PE contains one submatrix and performs a two-sided rotation

$$B = R(\theta_1)^T A R(\theta_2), \quad (4)$$

where

$$A = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \quad \text{and} \quad B = \begin{pmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{pmatrix} \quad (5)$$

denote the submatrix before and after the two-sided rotation, respectively, and

$$R(\theta) = \begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix} \quad (6)$$

describes a plane rotation through the angle θ. At first, the diagonal PEs (symbolized by

(EX1008 at 3.) (EX2001 at ¶ 131.)

Here, $R(\theta_1)$ and $R(\theta_2)$ are elements of M^{rot}, while A_2 belongs to M^{ref}. (*Id.* at 4.) (EX2001 at ¶ 132.) Yang further teaches that the two-sided rotation in equation (4) is computed through a series of "two plane rotations, ten additions, and four scalings by ½." (*Id.* at 3-4.) (EX2001 at ¶ 132.) Yang specifically explains that "If the 2 X 2 matrix A is given, we can diagonalize A and calculate the corresponding rotation angles θ_1 and θ_2 by two Cartesian-to-polar coordinates conversions, eight additions, and four scalings by ½." (*Id.* at 4.) (EX2001 at ¶ 132.) At deposition, Dr. Wells either agreed with the aforementioned description of these mathematical operations or did not have an opinion on them. (EX2002 at 32:15-35:1; 35:2-20; 37:6-39:9.)

Yang is therefore inapposite to claims 2 and 10. (EX2001 at ¶ 133.) First, it is undisputed that Yang teaches, at best, mathematical operations performed on matrix M. (EX2001 at ¶ 133.) While matrix M may "correspond to" H, it is a real-valued matrix (unlike H, which is complex-valued) and therefore is not a channel state matrix. (EX2001 at ¶¶ 133-34.) Consequently, because M is real-valued, all matrices in its SVD will necessarily be real, including V. (EX2001 at ¶ 133.)

Indeed, Yang does not describe or even contemplate operations performed on complex-valued elements of a matrix, unlike the specification of the '862

patent. (EX2001 at ¶ 135.) The '862 patent explicitly describes that the matrix V is complex-valued:

> For instance, in a 2×2 MIMO wireless communication, the feedback needs four elements that are all complex Cartesian coordinate values $[V_{11}\ V_{12}; V_{21}\ V_{22}]$. In general, $V_{ik}=a_{ik}+j*b_{ik}$, where a_{ik} and b_{ik} are values between [−1, 1].

(EX1001 at 3:35-39; see also EX1001 at 12:64-67.) In fact, a POSITA would have kown that in beamforming applications of the type addressed in the '862 patent, the estimated transmitter beamforming unitary matrix V would be complex-valued. (EX2001 at ¶ 136.)

While Yang references a matrix V (*see* EX1008 at 2, equation (1)), none of the teachings of Yang describe any mathematical operations performed on V or suggest that V is complex-valued or converted from Cartesian to polar coordinates. Instead, Yang is concerned with solving a different problem altogether: "A ***new, efficient, two-plane rotation (TPR) method*** for computing two-sided rotations," (EX1008 at Abstract), thereby reducing computational complexity of the SVD operation. (*Id.* at 1-2.) Yang's subsequent explanation of the "CORDIC algorithm" is therefore also limited to the M matrix and rotations performed to the M matrix, not the V matrix. (EX2001 at ¶ 137.) Indeed, other than the reference to V in equation (1), nothing in Dr. Wells's cited sections of Yang mentions the matrix V at all.

Therefore, Grounds 2 and 4, and 1 (to the extent it relies on Yang) fail as to claims 2 and 10.

Petitioner's assertions that a POSITA could not only produce the unitary beamforming matrix V in Cartesian coordinates and convert the matrix V to polar coordinates is therefore based on the unsupported testimony of their expert and various disparate teachings from the prior art that are not relevant to the challenged claims. These assertions, which are again nothing more than hindsight analysis, must be rejected. *In Touch Techs., Inc. v. VGO Communs., Inc.*, 751 F.3d 1327, 1352 (Fed. Cir. 2014) (noting that obviousness must be assessed at the time the invention was made) (citing *In re Cyclobenzaprine Hydrochloride Extended-Release Capsule Patent Litig.*, 676 F.3d 1063, 1073 (Fed. Cir. 2012)); *see also KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007) (warning against reliance on *ex post facto* reasoning.)

4. Petitioner Has Not Demonstrated that a POSITA Would Have Had a Reasonable Expectation of Success With Its Proposed Combinations

The Petition lacks sufficient discussion or facts to support a reasonable expectation of success with any of its proposed combinations to meet the limitations of claims 2 and 10 of the '862 patent. The only mention of a "reasonable expectation of success" (or similar language) is for a different claim

element altogether (9a) and in connection with Ground 2. (*See* Pet. at 30.) Therefore, Petitioner ignores the requirement in its entirety.

At best, Petitioner asserts that a POSITA "would have understood" disclosures from Yang, that it would have been a "predictable combination," (Pet. at 44; *see also* Pet. at 56), that a POSITA "would have implemented" the combination as proposed, (Pet. at 68), that "the combination would have advantageously resulted in a station using less processor bandwidth to determine matrix V." (Pet. at 69.) However, even in these instances—which, in any event, do not encompass all Grounds—Petitioner fails to address ***how*** one would reconfigure the circuitry or algorithms in any of the primary references to incorporate the teachings of Yang. As set forth above, Yang is inapplicable to the teachings of the primary references and the '862 patent itself. Specifically, while Yang is limited to operations on a real-valued matrix M (analogous to H)—the claims and the primary references all involve operations on a complex-valued matrix V. For example, as previously set forth, Li '748 explicitly teaches that the matrix V is complex-valued. (EX1004 at 2:52-62.) Instead of addressing these issues or describing how Yang would actually be combined with Li '748 or other references, Petitioner again makes a conclusory assertion that it would be "predictable" to arrive at its proposed combinations. (Pet. at 44, 56, 68-69.) For example, Petitioner fails to address how the reconfigured circuitry or algorithms

would work if they were to incorporate the teachings of Yang. Accordingly, Petitioner has failed to show by a preponderance of evidence that a POSITA would have been motivated to combine the prior art references as proposed with a reasonable expectation of success.

VI. OBJECTIVE INDICIA OF NON-OBVIOUSNESS WARRANT AGAINST A FINDING OF OBVIOUSNESS

Objective indicia of non-obviousness weigh against a finding of unpatentability here because, as explained below, the inventions of claims 1 and 9 of the ’862 patent are widely adopted within the industry and enjoy significant commercial success due to their merits.

1. Applicability of Industry Standards

An industry standard refers to a set of criteria or specifications that have been widely accepted and adopted by a particular industry for ensuring compatibility, interoperability, and consistency among products and systems. (EX2001 at ¶ 143.) For example, the 802.11ac standard is a wireless networking standard that operates in the 5 GHz frequency band. (EX2001 at ¶ 143.) It is a part of the IEEE 802.11 family of standards, which define the specifications for implementing wireless local area networking (WLAN) communication. (EX2001 at ¶ 143.) 802.11ac is designed to provide higher data rates, increased capacity, and improved performance compared to its predecessors, such as 802.11n. (EX2001 at ¶ 143.)

The 802.11ac standard is developed and maintained by the Institute of Electrical and Electronics Engineers (IEEE). (EX2001 at ¶ 144.) The IEEE is an international organization that sets standards for a variety of technologies, including networking. (EX2001 at ¶ 144.) Compliance with 802.11 standards benefits device manufacturers by ensuring interoperability with other devices, meeting user expectations, facilitating global adoption, adhering to regulatory requirements, streamlining development, and enhancing the overall quality and marketability of their products. (EX2001 at ¶ 144.)

Moreover, a patent is deemed a Standards Essential Patent (SEP) if the technology the patent covers is considered essential for compliance with a particular industry standard. (EX2001 at ¶ 145.) SEPs are often associated with standard-setting organizations (SSOs) such as the IEEE, and participants may agree to incorporate certain technologies into industry standards, and patent holders may commit to licensing their SEPs on fair, reasonable, and non-discriminatory (FRAND) terms. (EX2001 at ¶ 145.)

If a patented invention becomes widely adopted within the industry and gains recognition from industry experts or peers, it serves as evidence of non-obviousness. Industry standards—such as the 802.11 standards—often reflect the accepted practices and solutions to common problems within a particular field and therefore a patent's status as an SEP reflects the fact that the patented invention has

become widely adopted and gained recognition from industry experts and peers, such as those who participate in the standard setting process within the IEEE. (EX2001 at ¶ 146.)

The inventions of claims 1 and 9 of the ’862 patent are highly relevant to the 802.11ac and later 802.11 standards because, among other things, the aforementioned standards adopted estimating a channel response based upon a received preamble sequence. (EX2001 at ¶ 147; EX2003 (802.11-2016) at 2542, 2548, 2580.) The adoption of this aspect of the claimed invention into industry standards is an objective indicia of non-obviousness. (EX2001 at ¶ 147.) And while the aforementioned standards may not require practicing all of the limitations of claims 1 and 9 of the ’862 patent, a majority of the 802.11-compliant products on the market today do practice all of the limitations of claims 1 and 9 of the ’862 patent. (EX2001 at ¶ 147.)

2. Prior Licenses

Given the incorporation of the claimed channel estimating methodology of the ’862 patent technology into the 802.11ac and later 802.11 standards, and widespread adoption of the claimed ’862 patent technology into 802.11ac-compliant devices, it should not be surprising that Patent Owner has successfully concluded patent license negotiations for licenses involving the ’862 patent. The ’862 patent has played a key role in Patent Owner’s successful licensing efforts.

The ’862 patent licensees include several major industry players and technology providers including, among others, Samsung Electronics Co., Ltd., LG Electronics Inc., Huawei Technologies Co., Ltd., Kyocera International, Inc., BLU Products, Inc., and TCL Electronics Holding Co. Ltd. (EX2005, ¶ 4.) The ’862 patent has played a key role in Patent Owner’s successful licensing efforts. (EX2005, ¶ 4.) Today, most 802.11ac-compliant devices, including “smart” televisions and phones, sold in the United States incorporate the channel estimating technology claimed in the ’862 patent. (EX2001 at ¶ 148.)

The incorporation into industry standards of the ’862 patent channel estimation technology and the key role the ’862 patent has played in Patent Owner’s licensing efforts demonstrates the nexus between the ’862 patent claims 1 and 9 and the apparent commercial success of the technology.

VII. CONCLUSION

As Petitioner has failed to meet its burden of proof under 35 U.S.C. § 316(e), Patent Owner respectfully requests the Board find the challenged claims to be patentable for the reasons stated herein.

Dated: July 3, 2024

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CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), the undersigned certifies that there are 13,068 words in this paper, excluding any table of contents, table of authorities, mandatory notices under 37 C.F.R. § 42.8, certificate of word count, certificate of service, or appendix of exhibits. This certification relies on the word count of the word-processing system used to prepare this paper.

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), the undersigned certifies that on July 3, 2024 the foregoing document is being served via electronic mail upon the following counsel of record for Petitioner:

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