

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 SUR-REPLY

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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

I. INTRODUCTION

In its Reply (“Rep.”), Petitioner fails to rebut dispositive arguments in the Patent Owner’s Response (“POR”). Instead, Petitioner makes a series of arguments that are either largely unsupported by the evidence or actually contradicted by the evidence.

As an initial matter, Petitioner’s proposed construction of the term “preamble sequence”—which it revised since its Petition—is hopelessly vague and unsupported by the intrinsic evidence. Petitioner does not argue that a POSITA would not have understood the term as proposed by Patent Owner. Instead, its criticisms overlook relevant disclosures in the Patent or, in one example, indicate agreement with Patent Owner.

Petitioner acknowledges that there is no explicit disclosure of a “preamble sequence” used for channel estimation in its cited art, and its arguments instead hinge on what a POSITA “would have understood” the actual disclosures to mean. But in making such an obviousness argument, Petitioner only pays lip service to the *Graham* factors. Importantly, Petitioner does not demonstrate an actual motivation for a POSITA to use the disclosures of its references—in combination or by modification—to achieve the claimed inventions. And its newly introduced exhibits fare no better; at best, those exhibits confirm that there were other ways to

use a preamble sequence or perform channel estimation, distinct from the methods described and claimed in the '862 patent.

Petitioner's analysis of dependent claims 2 and 10 fares no better, because Petitioner again fails to identify any teachings in its cited art of producing a matrix V in Cartesian coordinates, then converting it to polar coordinates. Critically, Petitioner overlooks the fact that the "producing" and "converting" steps must happen in the process of "determining" the matrix V , not in the subsequent step of "decomposing." Even under Petitioner's strained obviousness theories, its cited art all describes conversion to polar coordinates during the "decomposing" step. This error is fatal to Petitioner's arguments.

II. PERSON OF ORDINARY SKILL IN THE ART

Petitioner does not offer any substantive critique of Dr. Cooklev's opinion that "[t]he wireless communications and matrix algebra concepts described and claimed by the '862 patent would require at least a bachelor's degree to appreciate." (EX2001 ¶ 30.) Instead, Petitioner argues, quoting Dr. Wells, that "[t]his knowledge could also be gained from experience, including knowledge of the concepts included in prior 802.11 wireless communication standards." (Rep. at 1, quoting EX1030 ¶ 8.) Even if Petitioner purports to address the "wireless communications" aspect of Dr. Cooklev's opinion with this statement, it does not

explain how the complex matrix algebra concepts, including Singular Value Decomposition and Givens rotations, recited in the challenged claims could be gained from experience without a bachelor's degree.

III. CLAIM CONSTRUCTION

In the POR, Patent Owner relied on intrinsic evidence and the testimony of Dr. Cooklev to show why the terms “preamble” and “preamble sequence” should be construed to mean “a segment, at the beginning of a transmission, containing information that is expected (i.e., known *a priori*) by the receiver,” and “two or more training symbols in the preamble,” respectively. (POR at 20-21.)

In its Reply, Petitioner seeks to revise its construction to “a distribution of information, such as a set of training bits, that is sent before something else.” (Rep. at 2.) Petitioner therefore appears to assert that a “distribution of information” (as it previously proposed) need not be a “distribution of **information**” at all, but rather, a “distribution or set of training bits.”¹ (Rep. at 2.) Petitioner's shifting theories highlight the vagueness of its construction: no

¹ Notably, nowhere in its Reply does Petitioner attempt to analyze the prior art under its own proposed construction. For example, Petitioner does not identify any “distribution of information” in any reference or argue why it must “come before something else.” This oversight undermines Petitioner's claim construction arguments.

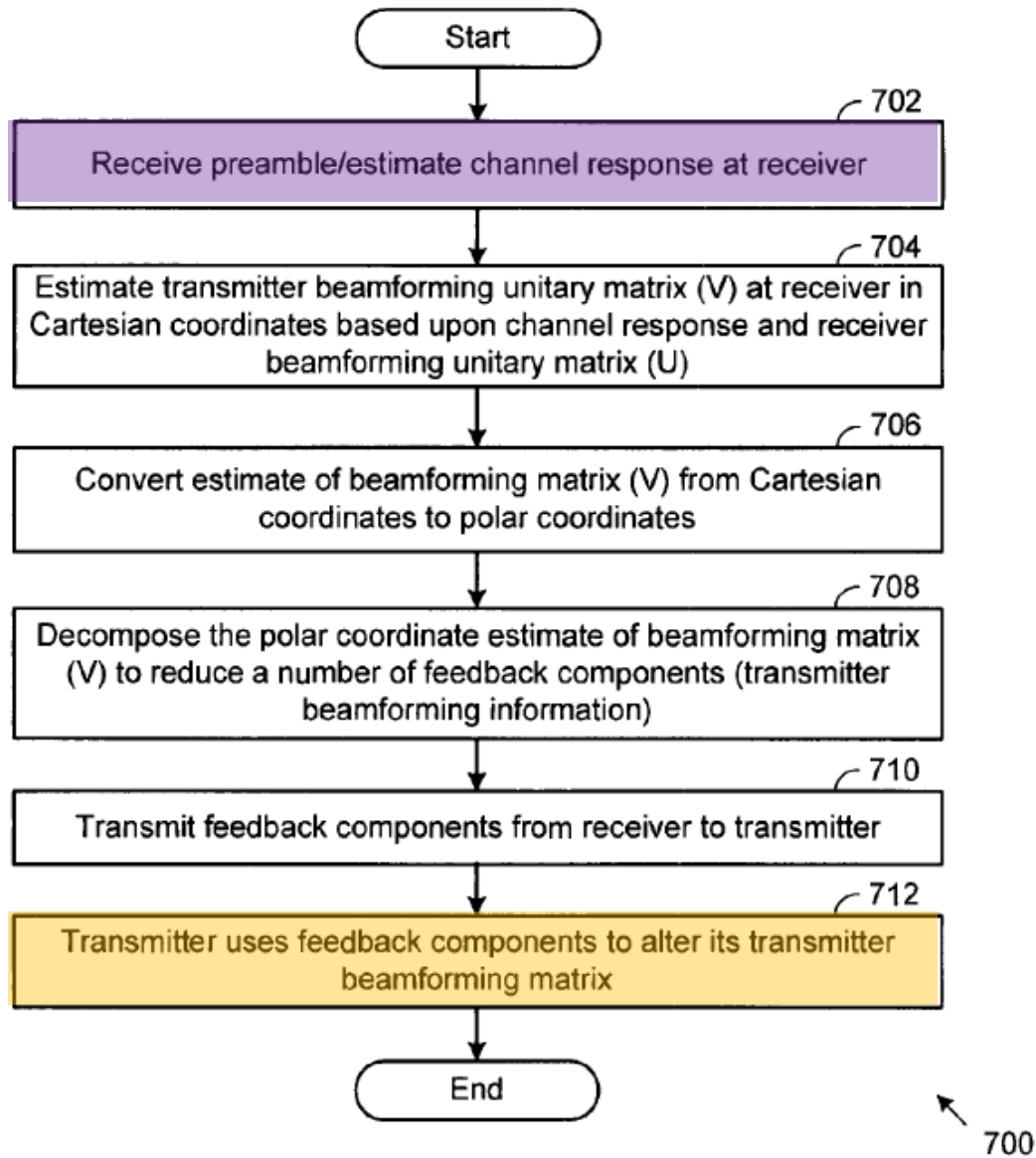
On the other hand, Patent Owner noted in the POR that none of the prior art references teach a segment, at the beginning of a transmission, containing information that is expected (i.e., known *a priori*) by the receiver. (POR at 25-35.)

POSITA (including Dr. Wells himself) could explain what a “distribution of information” is without further clarification and limitation. Adding to the confusion, Petitioner does not explain what the “something else” is that a preamble sequence must “come before.”

On the other hand, Patent Owner’s proposed construction is technically accurate, succinct, and reflects the use of these terms in the claims, specification, and as understood by a POSITA. Petitioner’s criticisms are meritless.

First, Petitioner is wrong that the phrases “two or more training symbols” and “a segment at the beginning of a transmission” do not appear in the ’862 patent specification. (Rep. at 4.) Patent Owner’s cited portions plainly refer to estimating the channel response by “comparing received **training symbols** of the preamble to corresponding expected **training symbols**.” (EX1001 at 3:40-44.) The specification does not contemplate the use of a single training symbol in a “preamble sequence.” Patent Owner’s construction merely clarifies this plain-language disclosure in the specification.

Moreover, figures 7 and 8 of the specification demonstrate that a preamble sequence must come “at the beginning of a transmission”:



(EX1001 Fig. 7 (annotated).)

The specification explains that in Fig. 7 (reproduced above and annotated), “[t]he method 700 **commences with** the receiving wireless transmitter communication device receiving a preamble sequence from the transmitting

wireless device and estimating a channel response from the preamble sequence (step 702).” (EX1001 at 13:36-40.) After the receiver estimates a beamforming matrix V, decomposes it, and transmits the decomposed matrix as feedback information to the transmitter, the transmitter then “uses the feedback components . . . **for subsequent transmissions** (step 712).” (*Id.* at 14:11-13.) These disclosures demonstrate that the preamble sequence must be sent “at the beginning of a transmission.”

Petitioner’s statement that “the preamble sequence need not be expected or known when received,” (Rep. at 4), is a red herring. Patent Owner’s proposed construction requires only that preamble sequence be “expected (i.e., known *a priori*),” not “known *when received*.” Indeed, in the very next sentence, Petitioner agrees with Patent Owner that “the expected training symbols would be ***those already on the receiving device to which the received preamble sequence would be compared***.” (Rep. at 4.) This is precisely the point: the expected preamble sequence must be known to the receiving device prior to being received, otherwise a comparison would be meaningless.

Besides the above criticisms, Petitioner does not meaningfully explain why Patent Owner’s proposed construction is wrong or inconsistent with the intrinsic evidence. Instead, Petitioner merely proposes a needlessly vague and fluid

alternative of its own. Because its proposal is unsupported by anything in the intrinsic evidence, it should be rejected.

IV. GROUNDS 1, 2, 3, AND 5 FAIL TO RENDER CLAIMS 1 AND 9 OBVIOUS

A. Petitioner Fails to Identify an Explicit Teaching in the Prior Art of a Preamble Sequence Used for Channel Estimation

Petitioner's analysis in its Reply is misleading as it again appears to conflate the obviousness inquiry under § 103 with anticipation under § 102. First, Petitioner acknowledges that its arguments are not “based on anticipation under § 102 or inherency.”² (Rep. at 6.) Petitioner nevertheless goes on to assert that “the disclosures [of the prior art] **explicitly** teach a preamble sequence” (Rep. at 9.) But Petitioner fails to identify such “explicit” disclosures of a preamble sequence anywhere in the art, and therefore provides no basis to disagree with Patent Owner. (*Compare* POR at 29 *with* Rep. at 9.)

At best, Petitioner appears to argue that the teachings of “training symbols, pilot symbols, and training patterns” **explicitly** disclose a “preamble sequence.” (Rep. at 8.) But this is insufficient, at least because Petitioner does not identify an explicit teaching that such “training symbols, pilot symbols, and training patterns”

² Inherency is simply another basis for anticipation under § 102. *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)).

are “sent before something else,” even under its own strained construction of the phrase “preamble sequence.” Indeed, Petitioner does not identify any teachings of the timing of such “training symbols, pilot symbols, and training patterns” relative to any other transmission.

For example, Petitioner does not meaningfully rebut the fact that in Tong, “pilot symbols” are “*scattered among the data symbols* throughout the OFDM sub-carriers” and therefore cannot “come before” any other sequence or symbols. (POR at 34, citing EX1005 at [0090].) Petitioner merely cites, without explanation, Figs. 47 and 48 of Tong (reproduced below) in asserting that “Tong teaches numerous different formats for transmitting pilot symbols, including sending pilot symbols prior to other data.” (Rep. at 14.) But nothing in those figures shows pilot symbols in a “preamble sequence” or otherwise sent at the beginning of a transmission, prior to payload data:

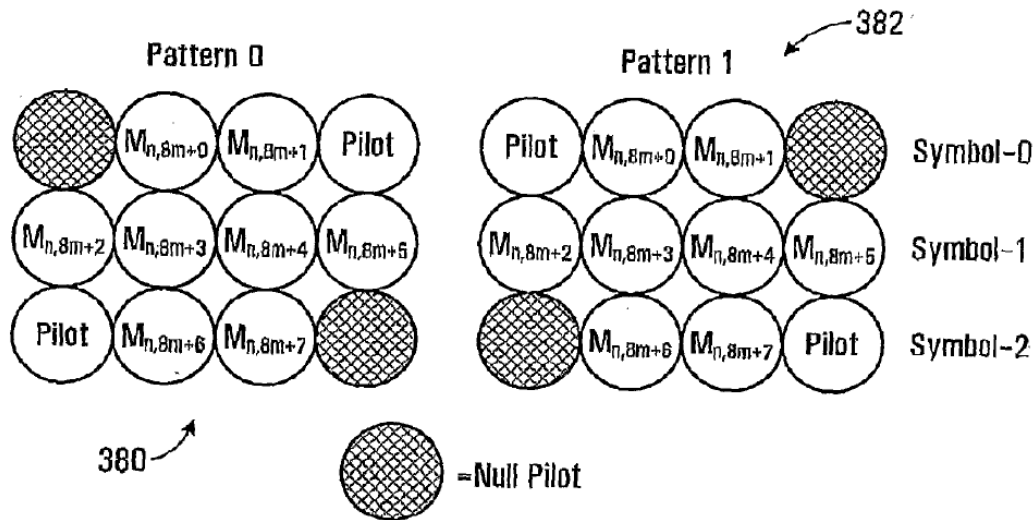


FIG. 48

(EX1005 Fig. 48.)

A closer look at the Tong specification confirms this point. Tong teaches only that pilot symbols are sent using any of four **subcarriers** in a “tile.” The subcarrier pattern may vary from one antenna to another, but varying subcarriers **within a symbol** has nothing to do with transmitting pilot symbols before symbols containing payload data. (EX1005 at [0281]-[0283], Fig. 46.) Rather, these “different locations within the tile” are intended only to “not interfere with the other users pilots.” (*Id.* at [0283].) Petitioner does not address these actual disclosures of Tong, and its arguments fail for this additional reason.

Petitioner is similarly mistaken that Li '748 “discloses **everything** that is in the [] '862 patent.” (Rep. at 14.) Here, too, Petitioner does not address the substance of Patent Owner's argument that Li '748 does not include any explicit

teaching of a preamble sequence used for channel estimation. (See POR at 25-35.)

Instead, Petitioner's arguments turn on obviousness, which, as Patent Owner has repeatedly explained, is based on a deficient analysis.

Nor does Petitioner's reliance on its expert's "thirty-five years of experience" address these deficiencies. (Rep. at 9.) Petitioner simply assumes that Dr. Wells' experience is sufficient to find obviousness, but this assumption is belied by the actual teachings of the prior art he relies on. Neither Petitioner nor Dr. Wells identify any further teachings from its references as teaching a preamble sequence, beyond those cited in the Petition, nor do they dispute Patent Owner's cited evidence.

Petitioner's attempt to distinguish the *Xerox* case fails. Petitioner argues that unlike the expert in that case, "Dr. Wells explained that the training and pilot symbols disclosed in the references explicitly disclose . . . a preamble sequence" (Rep. at 12.) But as explained above and in the POR, there is no such "explicit" disclosure anywhere in the prior art relied on for any Ground.³ To the extent Dr. Wells opines that the teachings "**would be understood**" to disclose a preamble

³ If there were such an explicit disclosure, Petitioner would have alleged anticipation under § 102. Because it did not, this argument contradicts its previous representation that it is not alleging anticipation. (See Rep. at 6.)

sequence,” (Rep. at 12), he fails to identify a legally sufficient basis to show inherency or obviousness. (POR at 29-39.)

Moreover, Dr. Wells again fails to apply the *Graham* factors with specificity. For example, Petitioner asserts that Dr. Wells “considered and accounted for . . . pre-existing IEEE 802.11 Wi-Fi standards,” but only cites Dr. Wells’ new opinions offered for the first time on Reply. (Rep. at 6, citing EX1030 ¶ 39.)⁴ And in any event, those opinions are insufficient. Dr. Wells merely criticizes Dr. Cooklev for not considering “the IEEE 802.11 standards and proposals that preceded the ’862 patent.” (EX1030 ¶ 39.) But he does not explain how such unidentified “standards”—which do not form the basis for any of Petitioner’s Grounds—are relevant to his obviousness analysis or why Dr. Cooklev should have “considered them” to disprove obviousness. As Dr. Wells is aware, Petitioner bears the burden to establish obviousness by a preponderance of the evidence. 35 U.S.C. § 316(e). Dr. Cooklev was under no obligation to consider any such materials, and that is why when he was presented at deposition with documents never previously submitted, he testified that he had “no recollection” of their specific teachings. (EX1030 ¶ 39, citing EX1024 at 45:10-16, 47:18-48:1.)

⁴ Dr. Wells does not rely on the reference to “IEEE 802.11 [standards] and versions thereof” in the ’862 patent specification for any of his obviousness analyses, so this cite is a red herring. (See Rep. at 6, citing EX1001 4:63-67.)

Indeed, the exemplary documents Petitioner (and Dr. Wells) now seek to rely on were improperly filed, and Patent Owner expects to move to strike them under the Federal Rules of Evidence. (See EX1024 at 35:16-36:1; 38:15-25; 43:19-44:8; 45:23-46:8; *see also* Paper No. 28.)

B. Petitioner's New Exhibits Only Confirm that the Challenged Claims Were Not Obvious

Recognizing that the evidence cited in the Petition was deficient, Petitioner seeks to bolster its obviousness arguments by introducing—both via Dr. Cooklev's deposition and with its Reply—several documents that it alleges “disclosed the use of preamble sequences.” (Rep. at 23, citing EX1024-29.) To the extent the Board is inclined to consider this untimely evidence, it nevertheless does not support Petitioner's obviousness arguments.

Exhibit 1029 (*TGn Sync Proposal Technical Specification* (2005) (“TGn Sync”)), which Petitioner questioned Dr. Cooklev on, (*see* EX1024 at 45:17-48:1), teaches channel estimation and computation of a feedback matrix in an entirely different manner from that recited by the challenged claims. Specifically, TGn Sync describes an ***implicit*** feedback mechanism by which a “non-beamforming STA [such as a terminal device] sends a sounding PPDU to the beamforming STA [such as an access point], ***which enables the beamforming STA to estimate the channel from the non-beamforming STA to the beamforming STA.***” (EX1029 at

53.)⁵ TGn Sync clarifies that the **beamformer** itself estimates the channel “using implicit feedback and **channel reciprocity**,” wherein “the downlink channel (the channel from the AP to the STA) is the transpose of the uplink channel (the channel from the STA to the AP).” (*Id.* at 54.)

Stated differently, TGn Sync does not teach or suggest the use of training symbols or pilot symbols transmitted to a STA within a preamble sequence **that is then used by the STA to estimate the channel**, as the challenged claims require. Specifically, there is no disclosure in TGn Sync that the “HT PCLP Preamble” that Dr. Cooklev was questioned about, (EX1024 at 46:19-48:2, citing EX1029 at 22), has any role in the implicit feedback-based channel estimation process described on pp. 53-54. Therefore, even to the extent Petitioner suggests that TGn Sync taught the use of a preamble for channel estimation in the context of the challenged claims, TGn Sync did not teach the use of such a preamble to compute a feedback matrix using Singular Value Decomposition (SVD), decompose the feedback matrix, and transmit the decomposed matrix to the AP, as each challenged claim requires.

⁵ Citations within EX1029 are to the Bates-stamped page numbers inserted by Petitioner.

The teachings of EX1028 (*WWiSE Proposal: High throughput extension to the 802.11 Standard* (“WWise”)) are similarly inapposite. At deposition, Dr. Cooklev was questioned about a section titled “PLCP preamble (SYNC)” in Section 20.3.3 of WWise. (EX1024 at 45:2-16.) However, there is no teaching or suggestion in this section or in WWise generally of using such a “PLCP preamble” to compute a feedback matrix using Singular Value Decomposition (SVD), decompose the feedback matrix, and transmit the decomposed matrix to the AP, as each challenged claim requires.

Presumably, Petitioner recognizes these deficiencies in TGn Sync and WWise, because neither Petitioner nor its expert identify any motivation to combine TGn Sync or WWise with any other reference to achieve the claimed inventions.

Therefore, even if the Board were inclined to consider TGn Sync and WWise for its obviousness analysis, these documents are not evidence of any motivation a POSITA would have had to achieve the claimed inventions and instead teach, at best, other distinct approaches for performing channel estimation.

C. Petitioner's Remaining Arguments as to Secondary Considerations Fail

Petitioner's attempts to expose inconsistencies between Patent Owner's claim construction arguments and its infringement theories fail. Here, Petitioner

argues that Patent Owner's claim construction "requiring the preamble be at the beginning of a transmission clearly and unequivocally disavows any scope of the claims it alleges might cover the 802.11ac standard." (Rep. at 24, citing EX1025 (IEEE 802.11-2016 (excerpts)) at Figs. 10-52 and 21-28.)

Specifically, Petitioner purports to cite Fig. 10-52 in arguing that "[t]he VHT Long Training field within the VHT NDP preamble format preamble neither stands alone nor comes at the beginning of the transmission":

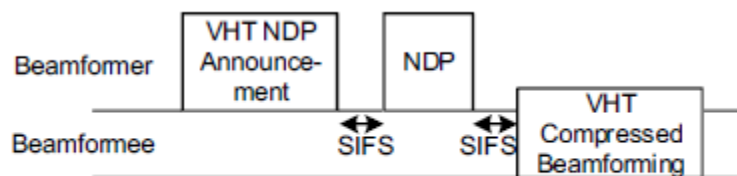


Figure 10-52—Example of the sounding protocol with a single VHT beamformee

(Rep. at 24, citing EX1025 at 99 (annotated by Petitioner).)

But a closer look at EX1025 disproves Petitioner's argument that the VHT preamble does not come "at the beginning of the transmission." The 802.11-2016 standard explains that a transmitter appends a SIGNAL field and a DATA field (i.e., the payload data) to an OFDM PHY preamble to create a physical layer protocol data unit (PPDU) for transmission to a receiver:

Kohler Co., 829 F.3d 1317, 1332 (Fed. Cir. 2016) (“Commercial success, for example, may be linked to an individual element [not known in the prior art].”).

With respect to the specific claim limitations at issue here, Patent Owner has provided expert testimony explaining that “[t]he 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.) Petitioner does not dispute this fact. Dr. Cooklev explained that adoption of these particular claimed features “serves as evidence of non-obviousness,” because such adoption “reflect[s] the accepted practices and solutions to common problems within a particular field.” (EX2001 ¶ 146.) Petitioner is therefore wrong that there is no nexus merely because the 802.11ac standard may not require practicing ***other*** limitations of the claims.

The same is true for Patent Owner’s licenses involving the ’862 patent. Dr. Cooklev has explained that because the 802.11ac standard requires the channel estimating technology claimed in the ’862 patent, it is used in most 802.11ac-compliant devices, including “smart” televisions and phones, sold in the United States. (EX2001 ¶ 148.) It is therefore unsurprising that “[t]he ’862 patent has played a key role in Patent Owner’s successful licensing efforts,” as sworn

testimony from the President of Patent Owner demonstrates. (EX2005 ¶ 4.) These facts, taken together, establish the requisite nexus between the challenged claims and the apparent commercial success of the technology.

V. GROUNDS 1, 2, AND 4 FAIL TO RENDER CLAIMS 2 AND 10 OBVIOUS

A. Ground 1 – Li '748 in View of Tong Fails to Render Obvious Claims 2 and 10

Petitioner's Reply fails to establish that claims 2 and 10 would have been obvious over Li '748 in view of Tong. First, Petitioner fails to show that Li '748 discloses producing the beamforming matrix V in Cartesian coordinates as set forth in claims 2 and 10. Second, Petitioner fails to show that either Li '748 or Tong discloses converting the beamforming matrix V from Cartesian to polar coordinates as set forth in claims 2 and 10.

With regard to the first point, Petitioner argues in its Reply that Patent Owner and its expert agree with Petitioner that “Li '748 discloses producing the beamforming matrix V in Cartesian coordinates (the $2n^2$ matrix) and then converting that matrix to polar coordinates (n^2-1).” (Rep. at 15-16.) This is untrue. Patent Owner never agreed with either proposition in the POR. On the contrary, when discussing Grounds 1 and 2, Patent Owner stated: “Dr. Wells and Petitioner have not established that Li '748 actually teaches a matrix V produced with n^2-1

Cartesian coordinates,” (POR, 44), and “. . . nothing in the cited disclosures [of Grounds 1 and 2] describes that the V matrix itself is first ***produced in Cartesian coordinates*** and subsequently converted to polar coordinates.” (POR, 47 (emphasis in original).)

None of the citations offered by Petitioner in its Reply indicate agreement with Petitioner's argument. For instance, the fact that the beamforming matrix V may be complex-valued is not proof that it was produced in Cartesian coordinates ($A + jB$) because complex numbers may also be expressed in ***polar*** coordinate form as $(r \cdot e^{j\theta})$. Dr. Cooklev clarified his testimony on this point during his deposition. EX1024, 48:19-49:14 (“. . . Li '748 doesn't say that the elements of V are in the form of $A + jB$.”). Dr. Cooklev also offered testimony during his deposition directly rebutting Petitioner's implication that the $2n^2$ matrix of Li '748 is necessarily in Cartesian coordinates. EX1024, 49:5-14 (“. . . these $2n^2$ yield numbers are not necessary—do not necessarily reflect that the matrix V is in Cartesian coordinates.”). This is because $A + jB$ (Cartesian) and $r \cdot e^{j\theta}$ (polar) each contain two real numbers: A and B in the case of $A + jB$, and r and θ in the case of $r \cdot e^{j\theta}$. Thus, the amount of real numbers in an $n \times n$ matrix would be $2n^2$ regardless of whether the matrix was in Cartesian or polar coordinates.

Furthermore, with regard to the second point, neither Patent Owner nor its expert ever agreed that Li '748 or Tong discloses converting the matrix V to polar coordinates. On the contrary, Patent Owner provided a lengthy explanation why “Li '748 does not teach converting the matrix V to polar coordinates as the claims require,” (POR, 45-47), and how “. . . nothing in the cited disclosures [of Grounds 1 and 2] describes that the V matrix itself is first produced in Cartesian coordinates and subsequently converted to polar coordinates.” (POR, 47.).

Petitioner argues in its Reply that “[a] POSITA would have understood [Li '748's disclosure of decomposition techniques to reduce the $2n^2$ matrix to n^2-1 real numbers to reduce feedback bandwidth] to refer to converting the V matrix from cartesian [sic] to polar coordinates.” (Rep. at 16 (citing to EX1030, ¶¶54-55).) In support of this proposition, Petitioner's expert cites to teachings in Li '748 that allegedly show that the beamforming matrix V may be represented by Hermitian generator matrices containing feedback numbers in polar coordinates. (EX1030, ¶¶54-55 (citing EX1004, 2:67-3:11).) However, even if this is true, Petitioner's argument still fails for the following reasons.

Claims 2 and 10 depend respectively from independent claims 1 and 9. Independent claim 1 recites a method comprising, among other things, “determining an estimated transmitter beamforming unitary matrix (V) based upon

the channel response and a receiver beamforming unitary matrix (U)” (the “determining” step) and “decomposing the estimated transmitter beamforming unitary matrix (V) to produce the transmitter beamforming information” (the “decomposing” step). Claim 2 depends from claim 1 and calls for the “**determining**” step to comprise:

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.

Similarly, independent claim 9 recites a wireless communication device comprising, among other things, a baseband processing module operable to “determine an estimated transmitter beamforming unitary matrix (V) based upon the channel response and a receiver beamforming unitary matrix (U)” (the “determining” step) and “decompose the estimated transmitter beamforming unitary matrix (V) to produce the transmitter beamforming information” (the “decomposing” step). Claim 10 depends from claim 9 and calls for, “in determining an estimated transmitter beamforming unitary matrix (V)” (i.e., in performing the “**determining**” step), 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.

Thus, in claims 2 and 10, the conversion from Cartesian to polar coordinates must take place when “determining” a beamforming matrix V—not when “decomposing” the matrix V to produce feedback information. This is an important distinction that is completely overlooked by Petitioner, who conflates the two steps without acknowledging that they are two distinct steps and without providing any justification for doing so.

In the case of Li '748, Petitioner argues in its Reply that the “decomposition” of the beamforming matrix V into a plurality of orthogonal generator matrices to produce feedback information, (EX1004, 2:67-3:5), reads on the claimed conversion of the beamforming matrix V from Cartesian to polar coordinates. (*See, e.g.*, Rep. at 16.) However, as noted above, claims 2 and 10 call for the beamforming matrix V to first be converted from Cartesian to polar coordinates and for the same beamforming matrix V to then be decomposed in a separate step to produce feedback information. Petitioner has not shown how Li '748 meets both steps.

Similarly, in the case of Tong, Petitioner argues in its Reply that “[a] POSITA would have understood and been motivated to use the decomposition techniques of Tong to convert the Cartesian matrix of Li '748 to polar

coordinates.” (Rep. at 18 (citing EX1030, ¶¶ 56-60).) Specifically, Petitioner cites to teachings in Tong that show that Givens rotations can be used to decompose a beamforming matrix V into matrices having n^2-n complex parameters. (EX1030, ¶¶ 56-60 (citing EX1005, ¶¶ [0222]-[0224]).) According to Petitioner’s theory, the n^2-n complex parameters obtained by decomposing the beamforming matrix V using Givens rotations are the transmitter beamforming information that is fed back to the transmitter. (See, e.g., EX1005, ¶ [0222] (“ . . . an $n \times n$ V matrix can be decomposed into Givens matrices containing n^2-n complex parameters. The parameters can be fed back directly”).) However, as noted above, claims 2 and 10 call for the conversion from Cartesian to polar coordinates to be performed when “determining” the beamforming matrix V , not when “decomposing” the beamforming matrix V to produce the transmitter beamforming information. Thus, even if a POSITA would have been motivated to combine Li ’748 and Tong, the combination would not result in the invention of claims 2 and 10 because neither reference teaches converting from Cartesian to polar coordinates when determining the matrix V .

B. Ground 2 –Tong Fails to Render Obvious Claims 2 and 10

Petitioner’s Reply fails to establish that claims 2 and 10 would have been obvious over Tong. Without providing any support, Petitioner claims in its Reply

that “Patent Owner does not dispute that Tong discloses converting the V matrix to polar coordinates.” (Rep. at 18.) This is simply untrue. For example, Patent Owner distinguished Tong’s decomposition of the V matrix into a series of matrices from converting the V matrix to polar coordinates, noting that “[e]ven if the resultant matrices following the Givens transforms [of Tong] are in polar coordinates, nothing in the cited disclosures [of Grounds 1 and 2] describes that the V matrix itself is first produced in Cartesian coordinates and subsequently converted to polar coordinates.” (POR at 47.) As noted previously, in claims 2 and 10, the conversion from Cartesian to polar coordinates takes place as part of the step of “determining” a beamforming matrix V—not when “decomposing” the matrix V to produce feedback information. This is an important distinction that is completely overlooked by Petitioner. Ground 2 fails for this reason alone.

Ground 2 also fails because Petitioner has not shown that Tong produces a beamforming matrix V in Cartesian coordinates. Petitioner appears to concede this point in its Reply, arguing instead that “a POSITA would have found it obvious that the existing pre-conversion V matrix ***could be produced*** using Cartesian coordinates,” based on Li ’748 and alleged admissions in the ’862 patent (Rep. at 18-19.) However, as discussed above in Section V.A. and incorporated by reference here, none of the evidence presented by Petitioner proves that Li ’748

produces a beamforming matrix in Cartesian coordinates. And, with regard to the alleged admissions in the '862 patent, Petitioner has provided only a conclusory allegation and no evidence that the problems discussed in the '862 patent were known in the art. "While valid prior art may be created by the admissions of a party, these admissions are generally characterized by statements made during prosecution describing certain work as 'prior art.'" *Abbott Lab. v. Baxter Pharmaceutical*, 334 F.3d 1274, 1279 (Fed. Cir. 2003). Here, there is no statement in the '862 patent that the problems were known in the prior art, and Petitioner has not presented any evidence in support of its allegation. Thus, Petitioner's argument that it would have been obvious to produce Tong's beamforming matrix V in Cartesian coordinates lacks evidentiary support.

C. Ground 4 –Li '054 in view of Mao and Yang Fails to Render Obvious Claims 2 and 10

Petitioner's Reply fails to establish that claims 2 and 10 would have been obvious over Li '054 in view of Mao and Yang. First, Petitioner's bizarre claim that "BNR does not dispute whether Li '054 discloses the limitations of claims 2 and 10," (Rep. at 19), is completely irrelevant because Petitioner never argued that Li '054 discloses the limitations of claims 2 and 10. (Pet. at 68-70.) The closest suggestion is a conclusory statement made for the first time in Petitioner's *supplemental* expert declaration that "Li '054 discloses or renders obvious

generating a matrix V in Cartesian coordinates using singular value decomposition of the channel state matrix.” (EX1030, ¶63.) While Petitioner’s expert cites to his earlier declaration for alleged support, (*id.*), his earlier declaration is silent as to whether Li ’054 discloses generating a matrix V in Cartesian coordinates (much less whether Li ’054 discloses converting a matrix V from Cartesian to polar coordinates). The argument is therefore new, and improper at this late stage in the proceeding, and should not be considered. In any event, Patent Owner disputes that Li ’054 discloses the limitations of claims 2 and 10, for at least the same reasons as discussed above with respect to Li ’748, which also generates a matrix V using singular value decomposition of the channel state matrix H .

Second, Petitioner’s Reply fails to rebut the evidence presented in the POR that Yang, at best, teaches Cartesian to polar conversion of a real-valued matrix (i.e., M). (POR at 51-55.) Patent Owner explained that “because M is real-valued, all matrices in its [Yang’s] SVD will necessarily be real, including V .” (POR at 51.) Patent Owner also explained that, unlike the real-valued matrix V in Yang, the estimated transmitter beamforming unitary matrix V in the primary references and the ’862 patent itself is a complex-valued matrix. (POR at 51- 55.) Therefore, Yang is inapplicable to the teachings of the primary references and the ’862 patent itself because it is limited to operations on a real-valued matrix, whereas the claims

and the primary references all involve operations on a complex-valued matrix.

Petitioner has not explained how Yang would actually be combined with Li '054

and the other references. (POR at 54.) These arguments are un rebutted by

Petitioner. Therefore, Petitioner has failed to show by a preponderance of

evidence that a POSITA would have been motivated to combine Yang with Li '054

as proposed with a reasonable expectation of success.

VI. 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: November 6, 2024

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CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), the undersigned certifies that there are 5,341 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

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