

Filed: September 22, 2023

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MEDIATEK INC. and NXP USA, Inc.
Petitioners,

v.

Bell Northern Research, LLC,
Patent Owner.

IPR2023-01414
U.S. Patent 8,416,862
Filing Date: September 28, 2005
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PETITIONER'S REPLY TO PATENT OWNER'S RESPONSE

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Table of Claims

Element	Claim Language
Claim 1	
[1.P]	1. A method for feeding back transmitter beamforming information from a receiving wireless communication device to a transmitting wireless communication device, the method comprising:
[1a]	[1a] the receiving wireless communication device receiving a preamble sequence from the transmitting wireless device;
[1b]	[1b] the receiving wireless device estimating a channel response based upon the preamble sequence;
[1c]	[1c] the receiving wireless device determining an estimated transmitter beamforming unitary matrix (V) based upon the channel response and a receiver beamforming unitary matrix (U);
[1d]	[1d] the receiving wireless device decomposing the estimated transmitter beamforming unitary matrix (V) to produce the transmitter beamforming information; and
[1e]	[1e] the receiving wireless device wirelessly sending the transmitter beamforming information to the transmitting wireless device.
Claim 2	
[2]	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.
Claim 3	
[3]	3. The method of claim 1 wherein the channel response (H), estimated transmitter beamforming unitary matrix (V), and the receiver beamforming unitary matrix (U) are related by the equation: $H=UDV^*$ where, D is a diagonal matrix.
Claim 4	
[4]	4. The method of claim 3, 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 performing a Singular Value Decomposition (SVD) operation.

Claim 9	
[9p]	9. A wireless communication device comprising:
[9a]	[9a] a plurality of Radio Frequency (RF) components operable to receive an RF signal and to convert the RF signal to a baseband signal; and
[9b]	[9b] a baseband processing module operable to:
[9c]	[9c] receive a preamble sequence carried by the baseband signal;
[9d]	[9d] estimate a channel response based upon the preamble sequence;
[9e]	[9e] determine an estimated transmitter beamforming unitary matrix (V) based upon the channel response and a receiver beamforming unitary matrix (U);
[9f]	[9f] decompose the estimated transmitter beamforming unitary matrix (V) to produce the transmitter beamforming information; and
[9g]	[9g] form a baseband signal employed by the plurality of RF components to wirelessly send the transmitter beamforming information to the transmitting wireless device.
Claim 10	
[10]	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.
Claim 11	
[11]	11. The wireless communication device of claim 9, wherein the channel response (H), estimated transmitter beamforming unitary matrix (V), and the receiver beamforming unitary matrix (U) are related by the equation: $H=UDV^*$ where, D is a diagonal matrix.
Claim 12	
[12]	12. The wireless communication device of claim 9, wherein in determining the estimated transmitter beamforming unitary matrix (V) based upon the channel response and the receiver beamforming unitary matrix (U), the baseband processing module performs Singular Value Decomposition (SVD) operations.

I. INTRODUCTION

Patent Owner ("BNR") identifies two alleged shortcomings within the Petition, both relying on mischaracterizations of the Petition and prior art, incomplete and speculative expert testimony, alleged requirements for the obvious analysis that are not required by law, and, in the case of the independent claims, an unnecessary and flawed claim construction proposal. In addition, BNR fails to establish a nexus between the challenged claims and any of its alleged objective indicia of non-obviousness. As such, the Board should find all challenged claims unpatentable.

II. PERSON OF ORDINARY SKILL IN THE ART

Patent Owner's proposed definition arbitrarily presumes that one could not understand the necessary concepts and knowledge of wireless communications and matrix algebra without finishing a four-year degree. POR at 10. BNR's definition cannot be correct. EX1030, ¶ 8. This knowledge could also be gained from experience, including knowledge of the concepts included in prior 802.11 wireless communication standards. EX1024, 34:9-20 (Dr. Cooklev asserting a POSITA would not have been aware of these standards.). Regardless, even under patent owner's proposed definition the challenged claims would still be obvious and unpatentable. *Id.*, ¶¶ 7, 9.

III. CLAIM CONSTRUCTION

A. "preamble sequence"

The term "preamble sequence" should be given its plain and ordinary meaning as understood by a person of ordinary skill at the time, which includes "a distribution of information, such as a set of training bits, that is sent before something else." EX1030, ¶ 14.

BNR's objections confuse the issue and misrepresent Dr. Wells's testimony. POR, 20-21. Dr. Wells did not assert that the term "distribution of information" refers to probability theory distributions or the dissemination of information (i.e., to distribute) as Dr. Cooklev argues. EX2001, ¶¶ 62, 64. Rather the phrase "distribution of information," as used by Dr. Wells to explain the plain and ordinary meaning, refers to the claimed "sequence" within the term "preamble sequence" and would refer to a distribution or set of training bits. EX1030, ¶ 14.

Patent Owner's expert offers contradictory arguments regarding "***how long*** '***before*** something else'" and whether a preamble "***can come anywhere.***" POR 20-21. A POSITA would have understood that the term would be specific to each implementation and may not be a fixed interval. EX1030, ¶ 16. For example, the timing of a preamble sequence would be such as to provide appropriate results for its associated system. *Id.* While some systems might require specific intervals, the claim does not require that level of restriction. Dr. Wells, when asked questions in

the abstract, explained that in different systems a preamble may or may not come before payload data and added that he could not provide a specific answer to this hypothetical question. EX2002, 76:3-21 (“talk[ing] generally” and explaining that he would “have to analyze the system it is you’re talking about”). In the context of the '862 patent, Dr. Wells stated that the “preamble sequence” would be sent before something else. EX1030, ¶ 14. It was Dr. Cooklev—not Dr. Wells—that argued the claimed preamble sequence could “come anywhere” and be untethered to any subsequent data.

Q: In your opinion, ***a preamble may not be followed by any carriers at all?***

A: ***I think that's correct.*** There's -- as a special case there may not be any data.

Q: ***Even if the preamble is not followed by anything else it can still be a preamble . . .?***

A: ***Yes.***

EX1024, 13:14-14:19 (emphasis added); EX1030, ¶ 17. BNR's arguments against the plain meaning as explained by Dr. Wells should be given no weight.

The Board should reject BNR's construction of this term. POR, 17-18. BNR's Response offered, for the first time in numerous proceedings, an ultimately unnecessary and improper claim construction of “preamble sequence.” POR, 17-18. BNR's nested constructions do not reflect the plain and ordinary meaning of the term “preamble sequence” and improperly import limitations into the claims. EX1030, ¶¶ 12, 18; POR at 21.

Dr. Cooklev's Constructions	
"preamble sequence"	"two or more training symbols in the preamble"
"preamble"	"a segment, at the beginning of a transmission, containing information that is expected (i.e., known <i>a priori</i>) by the receiver"

BNR's limited citations to the patent specification fail to provide support for its proposed constructions. BNR cites to a single passage (EX1003, 13:40-44) and portions of two figures (EX1003, Fig. 7 (step 702) and Fig. 8 (step 802)) in support of its constructions. POR at 21. The phrases "two or more training symbols" and "a segment at the beginning of a transmission" do not appear in these citations or the broader specification. EX1030, ¶ 19.

A POSITA viewing these limited disclosures would not apply the wordy and narrow construction that BNR seeks. *Id.* A POSITA reading the full '862 patent would have understood the preamble sequence could include one or more training symbols. *Id.*, ¶ 20. Likewise, the preamble sequence need not be expected or known when received. *Id.*, ¶ 21. Rather, the expected training symbols would be those already on the receiving device to which the received preamble sequence would be compared. *Id.* So, while the preamble could include symbols already known to the receiver, it is not required, and the symbols ultimately received would likely include differences and distortions. *Id.* It is the differences between the received preamble symbols and the known symbols on the receiving device that allow it to estimate the channel characteristics. *Id.*

To the extent the Board would find an explicit definition necessary to resolving this Petition, it should adopt a plain and ordinary meaning that includes “a distribution of information, such as a set of training bits, that is sent before something else.” EX1030, ¶ 14.

Regardless, of the meaning adopted, the prior art renders the challenged claims obvious. *Id.*, ¶ 22.

Petitioner disagrees with Patent Owner's positions regarding whether BNR has adequately identified sufficient structure should “baseband processing module” be construed under §112, ¶6 (it has not) and whether “transmitter beamforming information” in Claim 9 has sufficient antecedent basis. EX1030, ¶¶ 10-11. Petition does not believe that these disagreements alter the conclusion that the prior art renders the challenged claims obvious.¹

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

BNR's only challenge to whether the prior art renders obvious claims 1 and 9 relies on an incorrect claim construction, a hyper technical (and ultimately

¹ BNR mentions an alleged lack of explicit constructions regarding the limitations of claims 2 and 10 but offers no arguments or opinions. POR, 19-20. As such, Petitioner understands this issue is moot but reserves all rights.

incorrect) view of the law regarding obviousness, and misrepresentations of Dr. Well's testimony. BNR contests whether the prior art discloses receiving a preamble sequence and estimating a channel response based on the preamble sequence, limitations 1[a], 1[b], 9[c], and 9[d] (the "preamble sequence limitations"). POR, 23-26.

A. BNR Addresses Arguments Petitioner Never Made

Petitioner did not advance arguments based on anticipation under § 102 or inherency. *See* Petition, 6-7 (identifying all grounds under § 103); EX2002, 40:6-10 (confirming he offered no opinions on anticipation); EX1030, ¶¶ 25, 46-47. BNR's arguments to the contrary are therefore irrelevant and should be ignored in their entirety. POR at 25-26 (arguing Petitioner failed to identify explicit teachings), 29 (arguing Petitioner advanced inherency arguments), 37-39 (same). Petitioner and its expert addressed the merits of how the references disclose and render obvious the disputed limitations.

B. BNR Relies On an Incorrect Claim Construction

BNR identifies, for the first time in this proceeding or any related proceeding, a term for construction and then faults Petitioner for not offering an anticipatory definition for the previously uncontested term. POR at 26-29.

"[C]laim terms need only be construed to the extent necessary to resolve the controversy." *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir.

2011). BNR did not identify any potential controversy regarding the meaning of this term prior to its current Response, including in any other proceeding or case involving the '862 patent. In this proceeding, BNR chose to waive its Patent Owner Preliminary Response (Paper 10 at 1) rather than raise this issue. In the related ITC investigation, Patent Owner and its expert, Dr. Cooklev, applied two criteria for determining whether a signal was a “preamble sequence”—whether it consisted of training sequences and whether it was used for beamforming—two criteria indisputably disclosed in the prior art asserted herein. EX1031 (Public Cooklev Tr.) at 99:18-101:7, 86:10-87:3. Until Patent Owner's response in July 2024, BNR did not contest the plain and ordinary meaning of “preamble sequence,” and the Petition and Dr. Wells applied the uncontested (and correct) meaning. See Petition, 13; EX1003, ¶ 22.

When asked at his deposition for the plain and ordinary meaning of “preamble sequence” Dr. Wells explained that his analysis applied the term as understood by a person of ordinary skill at the time, which would include “a distribution of information, such as a set of training bits, that is sent before something else.” EX1030, ¶ 14. As explained above in Section III.A, this meaning comports with the intrinsic evidence and the knowledge of a POSITA. *Id.*, ¶ 24. Further, Dr. Well's has consistently applied the plain and ordinary meaning in his analysis. BNR's attempts to find fault with Dr. Well's definition argue against a

narrower or different meaning than what Dr. Well's described. *See, supra*, Section III.A; EX1030, ¶¶ 15-17.

Regardless, the prior art identified in the Petition would render the challenged claims obvious under Dr. Cooklev's interpretation as well. *See* EX1030, ¶ 22. BNR does not identify or explain how Dr. Cooklev's proposed construction differs in a meaningful way from the definition applied by Dr. Wells. For example, BNR does not identify any limitation that that prior art purportedly lacks based on its construction. Patent Owner merely asserts that the prior art does not disclose a "preamble sequence" as required by the claim." *See, e.g.*, POR at 29. To the extent these definitions differ, it does not change the ultimate conclusion that the claims are unpatentable.

C. The Prior Art, Alone and In View of the Knowledge of a POSITA, Discloses and Renders Obvious the Preamble Sequence Limitations

Petitioner and its expert have identified a plethora of evidence within the prior art disclosing the receipt and use of the claimed preamble sequence. *See, e.g.*, EX1030, ¶¶ 26-40. Patent Owner initially argues the opposite—that Petitioner did "not identify any evidence . . . [of] a 'preamble sequence' as required by the claim"—while in the same paragraph acknowledging that Petitioner and its expert did in fact cite to evidence of the training symbols, pilot symbols, and training patterns in the prior art. POR at 29 (citing "Pet. at 32 (Li '748), 49 (Tong), 63-64

(Li '054), 75-76 (Poon); EX1003 at ¶¶ 82-83, 113-14, 150-51, 190-91"); *see also* EX1030, ¶¶ 28-36. While Patent Owner may disagree with Petitioner's view of the prior art disclosures, it is simply wrong to suggest that Petitioner did "not identify any evidence." POR, 29; *see* EX2002, 44:16-45:17, 45:22-48:2, 51:16-52:10, 61:13-61:2, 67:20-69:15, 71:15-72:3, 85:2-86:3.

Petitioner's obviousness argument never relied "solely on the teachings of the challenged patent" as BNR attempts to argue. POR, 30. The Petition and Dr. Wells "do[] not rely on the '862 patent to demonstrate obviousness." EX1030, ¶ 40. Dr. Well's obviousness analysis relies on the disclosures within the prior art ("training symbols," "pilot symbols," "training patterns") and how a POSITA would have understood those terms to disclose the claimed preamble sequence. *See* EX1030, ¶¶ 26, 37-40. For example, a POSITA would have readily understood these disclosures to explicitly teach a preamble sequence at least because training and pilot symbols used in a beamforming system, such as those in the prior art, would precede subsequent transmissions at least because they would be used to first calculate and determine the beamforming feedback information used in the later transmissions. EX1030, ¶¶ 27, 37. The '862 patent merely confirms and underscores the ubiquity and obviousness of these understandings in the prior art. Petition, 32, 50, 64, 76; *see also* EX1030, ¶ 38; EX2002, 59:3-10 ("I think

preamble is a widely used term. Training sequences, pilot sequences, pilot symbols are sent as preambles. The '862 patent concedes that.”).

The Petition contains “articulated reasoning . . . supporting the legal conclusion of obviousness,” rather than “bare assertion[s]” Patent Owner suggests. POR at 30, 32-33. For each prior art reference, Petitioner identified evidence disclosing the preamble limitations as well as explained why a POSITA would have found the limitations obvious. *See, e.g.*, Petition, 32-34 (Li '748), 33-34 (Tong), 49-50 (same), 63-64 (Li '054), and 75-76 (Poon); EX1003, ¶¶ 82-85 (Li '748), 113-116 (Tong), 150-153 (Li '054), 190-193 (Poon); EX1030, ¶¶ 26-36.² Dr. Wells pointed to his thirty-five years of experience to explain why a POSITA would have found the plain teachings of the prior art describing sending training or pilot symbols in a beamforming system to both disclose and render obvious the use of a preamble sequence. *See* POR at 32-33 (incorrectly suggesting Dr. Wells relied *only* on his experience for his opinions).

²Patent Owner's Response acknowledges portions of the same evidence when arguing that the Petition relies only on comparison to the '862 patent. *See* POR, 30.

The plain language of the prior art also teaches and renders obvious estimating a channel response based on the received preamble sequences (training symbols, pilot symbols, and training patterns). See EX1030, ¶¶ 41-45; POR at 34-37. The prior art describes receiving training and pilot symbols and estimating a channel matrix based on the received signals. Dr. Wells explained that a POSITA reading these beamforming references would understand that the received training symbols would be the same received signals used in estimating the channel response to provide beamforming feedback. See EX1030, ¶¶ 41-45.

Q: Can you point me to the explicit statement in Li '748 that the receiver evaluates H based on training symbols that it receives?

A: Yes, I can. So in paragraph 84, I talk about how channel state information is estimated from received signals. This channel state information includes the matrix H. And in paragraph 82 I talk about the training symbols that are sent to the receiver and the receiver may evaluate H. ***I think that that is a disclosure of the training symbols being the received signals that the wireless device uses to estimate a channel response.***

EX2002, 56:10-57:21 (emphasis added).

Q: Isn't it possible that Li '748 is referring to something else when it talks about received signals?

A: I think given those two paragraphs that I cited . . . , ***a POSITA would find it obvious that the training symbols are being sent to the receiver and the receiver uses those training symbols . . . to estimate a channel response.***

EX2002, 58:8-18 (emphasis added).

The current record and analysis do not compare to the issues identified in IPR2022-00624 (*Xerox Corp. v. Bytemark Inc.*). POR at 33. In *Xerox*, the Petitioner did not allege that the prior art “expressly” disclosed the limitation “store in a data record associated with the user account a data value indicating the fraudulent activity.” *Xerox Corp. v. Bytemark, Inc.*, IPR2022-00624, Paper 9 at 14 (Aug. 24, 2022). Instead, the Petitioner relied on teachings that “the purchaser of the ticket could be blocked from further use of the system” to assert that the limitation was disclosed or rendered obvious. *Id.* The Board did not credit the testimony of Petitioner’s expert, finding that he “did not cite to any additional supporting evidence or provide any technical reasoning to support his statement,” but merely repeated, *verbatim*, the conclusory assertion he sought to support.” *Id.* Dr. Wells analysis differs in nearly every respect from that in *Xerox*. First, Dr. Wells opined that the references disclosed the preamble references as well as rendered them obvious. In doing so, Dr. Wells’s obviousness analysis examined the teachings of the prior art and its context (i.e., beamforming). Under that lens, Dr. Wells explained that the training and pilot symbols disclosed in the references explicitly disclose and would be understood to disclose a preamble sequence as commonly used in beamforming systems at the time. *See, e.g.*, Petition, 32-34 (Li ’748), 33-34 (Tong), 49-50 (same), 63-64 (Li ’054), and 75-76 (Poon); EX1003, ¶¶ 82-85 (Li ’748), 113-116 (Tong), 150-153 (Li ’054), 190-193 (Poon); EX1030, ¶¶

26-36. Dr. Wells's noted that both his own experience and the admissions of the '862 patent confirm the known and common use of sending the disclosed symbols in a preamble sequence. Dr. Wells provided the evidentiary support, technical detail, and explanation found lacking in *Xerox*.

Dr. Well's analysis properly applied the *Graham* factors, including (1) considering the scope and content of the prior art and (2) identifying any differences between the claimed subject matter and the prior art references. *See* POR, 31-33. Dr. Wells's considered and accounted for the scope and content of the prior art (EX1003, ¶ 18), including pre-existing IEEE 802.11 Wi-Fi standards on which the 802.11ac standard was built. EX1030, ¶ 39; *see also* EX1001, 4:63-67 (acknowledging existing "IEEE 802.11 [standards] and versions thereof").

Conversely, BNR's expert offered no opinions on these standards except to argue that a POSITA would have been unaware of them. *See* EX1024, 31:18-32:-14, 35:10-18, 38:11-23, 42:13-24, 45:1-9. Dr. Wells also identified the relevant prior art disclosures and explained why a POSITA would have found the claim limitations obvious in light of such teachings. EX1003, ¶¶ 82-85 (Li '748), 113-116 (Tong), 150-153 (Li '054), and 190-193 (Poon). BNR's objections ignore Dr. Wells's opinions, which were offered in the alternative for various limitations. Dr. Wells appropriately analyzed how the explicit teachings of each ground disclosed the limitations, how those same teachings coupled with the knowledge of a

POSITA would render the claims obvious, and, for specific limitations, where he relied on the teachings of a second reference to support his obviousness opinions. For example, when questions about Li '748, Dr. Wells explained that "Li '748 renders the '862 patent invalid [b]ecause to a person of ordinary skill in the art, Li discloses everything that is in the [] '862 patent." EX2002, 41:12-43:2. When asked for a specific limitation that was not explicitly disclosed by Li '748, Dr. Wells provided one. *Id.* ("with regards to . . . the limitation about decomposing the matrix V . . . Li discloses that. . . [T]o the extent Li doesn't explicitly use the word decomposition, I've shown that the Tong reference [does]"). BNR is simply wrong when asserting that "Petitioner and its expert have not even addressed any obviousness analysis or what is missing from any of the references." POR, 32.

Patent Owner's objections to Ground 2 (Tong) improperly narrow and mischaracterize Dr. Wells's opinions. EX1030, ¶¶ 30-32. Tong teaches "many existing methods" of using pilot symbols, including transmitting those signals at known locations in time or frequency. *Id.* Tong does not limit its teachings to embodiments in which the pilot symbols "are scattered among the data symbols" as BNR contends. POR, 33-34. Rather, Tong teaches numerous different formats for transmitting pilot symbols, including sending pilot symbols prior to other data, as shown in figures 47 and 48 of Tong. EX1030, ¶ 31. Dr. Wells further opined

that a POSITA would have understood these teachings to disclose utilizing the pilot symbols of Tong within a preamble sequence. *Id.*, ¶ 32.

D. The Prior Art Disclose and Render Obvious the Challenged Dependent Claims

Patent Owner's arguments regarding the preamble limitations fail for all the reasons explained and cannot save the challenged dependent claims. EX1030, ¶ 48. BNR does not raise any arguments specific to claims 3-4 and 11-12, which should be found unpatentable alongside claims 1 and 10.

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

A. Ground 1 - Li '748 in View of Tong Discloses and Renders Obvious Claims 2 and 10

Patent Owner again misstates Dr. Wells analysis rather than directly address his opinions. EX1030, ¶¶ 49-60. When discussing the Li '748 reference, BNR asserts that "Dr. Wells is mistaken that ' n^2-1 real numbers' are elements of the matrix V in Cartesian coordinates." POR at 44. But Dr. Wells's analysis notes that Li '748 teaches generating a V matrix comprising $2n^2$ real numbers, and that "the feedback bandwidth may be reduced" by producing the V matrix in n^2-1 real numbers. EX1030, ¶ 51. 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), and it provides a clear rationale for the conversion: to reduce complexity and bandwidth. *Id.*

BNR and its expert agree. Dr. Cooklev acknowledged “that each of these N square elements has a real part in the imaginary part” which “will have been understood as Cartesian coordinates” by a POSITA. EX1024, 27:4-13; EX2001, ¶¶ 115 (acknowledging the real and imaginary components of the complex numbers), 135-136 (“a POSITA would have known that in beamforming applications of the type addressed in the ’862 patent, the estimated transmitter beamforming unitary matrix V would be complex-valued”); EX1030, ¶ 52. Patent Owner also agrees that Li ’748 discloses applying “compression or decomposition techniques” to reduce the $2n^2$ matrix to n^2-1 real numbers to reduce feedback bandwidth. POR, 44. A POSITA would have understood this disclosure to refer to converting the V matrix from cartesian to polar coordinates to reduce complexity. EX1030, ¶¶ 54-55. Thus, BNR is silent as to whether the $2n^2$ matrix represents a V matrix in Cartesian coordinates, and its arguments regarding the n^2-1 real numbers are not relevant.

Dr. Cooklev's changing testimony should be given no weight. During his deposition, Dr. Cooklev acknowledged that a POSITA would understand the complex numbers of Li ’748 to represent Cartesian coordinates. EX1024, 27:4-13 (the “real and imaginary parts will have been understood as Cartesian coordinates”); *see also* EX2001, ¶¶ 115, 135-136. Then, after a twenty-four-minute break during which Dr. Cooklev had discussions with his counsel, Dr. Cooklev

returned and offered wildly different testimony. EX1024, 49:19-21. Dr. Cooklev reversed course and stated that the complex numbers of Li '748 "do not necessarily reflect that the matrix V is in Cartesian Coordinates" at least because "Li '748 doesn't say that the elements of V are in the form of A plus jB ." EX1024, 46:2-47:13. When questioned regarding whether he discussed the substance of his testimony with counsel, Dr. Cooklev was instructed (and agreed) not to respond based on privilege. EX1024, 49:19-50:4 ("Objection, that's privileged. I'm directing the witness not to divulge any, any information about the substance of our discussion."). Regardless, Dr. Cooklev's new statements do not contradict his prior ones. EX1030, ¶ 53. Li '748 need not explicitly state that its complex numbers are in the form A plus jB for a POSITA (including Dr. Cooklev) to understand that Li '748's complex numbers are a reflection of Cartesian coordinates in a beamforming system. EX1030, ¶ 53.

Patent Owner's single sentence objection to the combination of Li '748 and Tong also relies on the wrong matrix. BNR argues only a lack of evidence showing that "a POSITA reading Li '748 and Tong would have been motivated to convert a matrix of n^2-1 real numbers (as in Li '748) to polar coordinates." POR, 47. But Dr. Wells identified the $2n^2$ matrix as a V matrix in Cartesian coordinates. See EX1030, ¶ 51. BNR offers no opinions regarding converting the $2n^2$ matrix of Li '748 to polar coordinates as shown in Tong. EX1030, ¶ 59-60. This mistake alone

dooms its opposition to Ground 1. Further, a POSITA reading Tong would have understood that, prior to Tong's decomposition into polar coordinates, the V matrix could be generated in Cartesian coordinates, as taught in Li '748 and acknowledged by Dr. Cooklev. EX1030, ¶¶ 56-58. Further, Li '748 describes reducing feedback bandwidth via compression or decomposition techniques, and Tong describes decomposing the V matrix into n^2-n polar coordinates with parameters θ and C. EX1030, ¶ 59. 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. EX1030, ¶ 60.

B. Ground 2 – Tong Discloses and Renders Obvious Claims 2 and 10

BNR's sole argument regarding the Tong reference fails. Patent Owner does not dispute that Tong discloses converting the V matrix to polar coordinates. Rather, it argues that "nothing in the cited disclosures describes that the V matrix itself is first *produced in Cartesian coordinates*." POR at 47 (emphasis in original); EX1030, ¶ 56. But a POSITA would have found it obvious that the existing pre-conversion V matrix could be produced using Cartesian coordinates. EX1030, ¶ 57. Li '748 (and Dr. Cooklev's testimony regarding the same) demonstrates that generating a V matrix using Cartesian coordinates was known. *Id.* ¶¶ 57-58. Further, the '862 patent admits that producing V matrices in Cartesian coordinates was known in the prior art at least because it alleges to solve known

problems in the art that involved the use of such matrices. *Id.* Thus Tong, alone or in view of a POSITA, discloses claims 2 and 10. *Id.* ¶ 61.

C. Ground 4 – Li '054 in View of Mao and Yang Discloses and Renders Obvious Claims 2 and 10

Patent Owner ignores arguments and evidence within Ground 4 and mischaracterizes the use of Yang in Grounds 1, 2, and 4. First, BNR does not dispute whether Li '054 discloses the limitations of claims 2 and 10. BNR also incorrectly claims that Dr. Wells's opinions regarding Yang under Ground 4 are limited to a single paragraph discussing his analysis of Ground 2. *See* POR at 48-49; EX1030, ¶ 62. BNR ignores Dr. Wells's additional analysis regarding Li '054 and Yang. *Id.*

BNR again rebuts arguments that Petitioner did not offer. EX1030, ¶ 63. Regarding Grounds 1 and 2, Patent Owner first admits that the Petition describes Yang as “demonstrate[ing] the well-known technique of converting Cartesian coordinates to polar coordinates,” before then accusing Petitioner of “trying to backdoor” Yang's disclosures into these grounds. POR at 48. In both Grounds, Petitioner identified the explicit disclosures within the named references (other than Yang) and explained how and why a POSITA would have found those disclosures to render the claims obvious. The mention of Yang in Grounds 1 and 2 merely provides further evidence that techniques for performing the same the type

of conversion (cartesian to polar) for the same reasons (unitary matrices used in singular value decomposition) was known and well within the knowledge of a POSITA. EX1030, ¶¶ 65-66. Neither the Petition nor Dr. Wells relied on an unidentified combination of Grounds 1 or 2 with the Yang reference.

Likewise, fails to understand or address the actual use of Yang within Ground 4. The Petition and Dr. Wells identified Yang for the general teaching that converting a unitary matrix within an SVD process from cartesian to polar coordinates was a known method for reducing complexity and bandwidth in the beamforming feedback. EX1030, ¶¶63-66. BNR's arguments are more narrowly focused—whether Yang discloses performing “‘Cartesian to polar coordinates conversions’ on a beamforming unitary matrix V .” POR at 49. BNR does not address the broader impact of Yang or its applications to other unitary matrices within an SVD calculation. For example, Li '054 teaches reducing feedback bandwidth and a POSITA would have understood that the teachings of Yang (cartesian to polar coordinate conversions of unitary matrices in an SVD method) could be employed to achieve such reductions. EX1030, ¶ 64-65. BNR focuses on a specific SVD process (the Jacobi method), but Yang explicitly describes using its techniques on multiple different SVD methods. POR at 49-50; EX1008, at 1, 12 (“This results in significantly reduced computations of various SVD and SD

methods”). Patent Owner’s incorrect analysis renders its arguments incomplete and should be ignored.

D. BNR Fails to Address the Motivations to Combine Within the Petition

As an initial matter, Patent Owner’s Response does not identify which combination or combinations its arguments purport to address. POR, 53-55. Patent Owner identifies only the Li ’748 and Yang references, but no Ground advanced attempts to combine these references. POR 54; EX1030, ¶¶ 67-69. Thus, BNR has failed to rebut any actual combination at issue and its arguments regarding motivation to combine should be ignored.

BNR also fails to identify the full analysis regarding motivations to combine. For example, Patent Owner alleges that Petitioner mentions a “‘reasonable expectation of success’ (or similar language)” only in limitation 9a of Ground 2. POR, 53-54. But similar language regarding motivations to combine (and expected success) exist throughout the Petition. EX1030, ¶ 68. Ground 4, describes implementing Yang into Li ’054, which “would merely have been the application of a known technique . . . to a known system . . . ready for improvement to yield predictable results.” Petition, 69-70; *see also id.* 44 (Li ’748 and Tong). Specifically, “POSITA would have been prompted to modify Li ’054’s wireless device (based on features suggested by Yang) to achieve such known

benefits and as a matter of predictable and ordinary engineering design.” EX1003, ¶¶ 168, 170 (“POSITA would have recognized that . . . [combining Li '054 and Yang] would have led to predictable results”). The discussions of Yang in Grounds 1, 2, and 4 further detail the motivations and benefits provided by Yang's teachings if implemented in those systems. Petition, 43-44, 55-56, 69-70.

VI. SECONDARY CONSIDERATIONS

A. Applicability of Industry Standards

BNR identifies no nexus between the '862 patent claims and the 802.11ac and later standards. EX1030, ¶¶ 73-81. Patent Owner immediately admits that “the aforementioned standards may not require practicing all of the limitations” of the challenged claims. POR at 57; *see also* EX1030, ¶ 74; EX1025, 2497. In other words, a device may enjoy the benefits of being 802.11ac compliant without practicing the claims. EX1030, ¶¶ 73-74. This simple, uncontested fact dooms BNR's nexus arguments.

BNR also ignores the plain truth that the only limitations it contests are lacking in the prior art (“receiving a preamble sequence” and “estimating a channel response based upon a received preamble”) were adopted by other 802.11 standards long before the '862 patent. EX1030, ¶¶ 70, 75. The 802.11-2016 standard, which describes the optional Very-High Throughput (VHT) functionality on which Patent Owner relies, acknowledges that the VHT techniques are based on

prior uses of preamble sequences, including the earlier HT (High Throughput) and OFDM-based functionality. EX1030, ¶ 75; EX1025, 2346-2358 and 2283-2284. Earlier standards, such as the 802.11-1999 and 802.11a standards, also disclosed the use of preambles containing long training sequences. EX1030, ¶¶ 76-77. Likewise, the IEEE proposals that preceded the '862 patent and the 802.11ac standard disclosed the use of preambles containing long training symbols. EX1030, ¶¶ 78-79.

BNR's expert never considered this information or offered an opinion regarding its effect on whether a nexus exists between the standards and the '862 patent. Dr. Cooklev did not believe a POSITA would have been aware of the prior 802.11 standards, despite acknowledging that the '862 patent identified these same standards. EX1024, 33:22-34:20; EX1001, 2:30-32 (identifying "IEEE 802.11, 802.11a, 802.11b, [and] 802.11g"). Dr. Cooklev had no opinion when asked whether any prior IEEE 802.11 standard or related proposal disclosed the use of preamble sequences. EX1024, 35:1-5 (EX1026), 38:1-9 (same), 41:2-14 (EX1027), 45:10-16 (EX1028), 47:18-48:1 (EX1029); EX1030, ¶¶ 76-79.

Further, Dr. Cooklev's assertion that "a majority of the 802.11-compliant products on the market today [] practice all of the limitations of claims 1 and 9" lacks any basis in fact or evidence. EX2001, ¶ 147-148; POR, 57. He cites to no

evidence or rationale supporting this assertion rendering it wholly inadequate.

EX1030, ¶ 81.

Moreover, BNR'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. The preamble in that standard is a standalone Null Data Packet (NDP) or NDP announcement frame. EX1025, 1488-1493 (VHT Sounding Protocol).

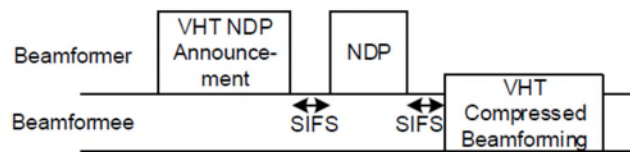


Figure 10-52—Example of the sounding protocol with a single VHT beamformee

EX1025, 1490. The VHT Long Training field within the VHT NDP preamble format preamble neither stands alone nor comes at the beginning of the transmission.

21.3.12 VHT preamble format for sounding PPDU

NDP is the only VHT sounding format.

The format of a VHT NDP PPDU is shown in Figure 21-28.



Figure 21-28—VHT NDP format

EX1025, 2580; EX2001, ¶ 147 (citing to the same). BNR's disclaimer is "binding on later proceedings, whether before the PTO or in court" and contradicts BNR's positions. *CUPP Computing AS v. Trend Micro Inc.*, 53 F.4th 1376, 1383. If BNR's claim construction is correct, then the 802.11ac does not practice the claims.

Patent Owner has failed to show that that the alleged industry adoption exists or is the direct result of unique characteristics of the claimed invention.

B. Prior Licenses

BNR fails to establish a nexus between any prior license and the '862 patent. BNR asserts that "the '862 patent has played a key role in Patent Owner's successful licensing efforts" without providing any context or explanation. POR, 57-58. Patent Owner admits that the patent license negotiations on which it relies involved licenses for "its patent portfolio" and not the '862 patent specifically. EX2005, ¶ 4. Dr. Cooklev baldly alleges that "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" but offers no evidence or explanation for his conclusion. POR, 58; EX2001, ¶ 148; EX1030, ¶ 81. BNR fails to tie its alleged licenses to the technology claimed by the '862 patent.

VII. CONCLUSION

Accordingly, all challenged claims should be found unpatentable.

Respectfully submitted,

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CERTIFICATION UNDER 37 CFR § 42.24

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petitioner's Reply to Patent Owner's Response totals, 5,553 words, which is less than the 5,600 allowed under 37 CFR § 42.24.

Date: October 2, 2024

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that a copy of the foregoing **PETITIONER'S REPLY TO PATENT OWNER'S RESPONSE** was served on October 2, 2024, via email, to counsel of record for Patent Owner at the following:

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