

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
Issue Date: April 9, 2013

**SUPPLEMENTAL DECLARATION OF JONATHAN WELLS, Ph.D.
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 8,416,862**

TABLE OF CONTENTS

1.	INTRODUCTION.....	4
2.	QUALIFICATIONS.....	4
3.	MATERIALS CONSIDERED.....	4
4.	LEGAL PRINCIPLES	7
5.	SUMMARY OF OPINIONS	8
6.	PERSON OF ORDINARY SKILL IN THE ART	8
7.	CLAIM CONSTRUCTION	9
7.1.	“preamble sequence”	10
8.	GROUND 1, 2, 3, AND 5 RENDER OBVIOUS CLAIMS 1 AND 9	14
8.1.	Dr. Cooklev’s Analysis Relies On An Incorrect Claim Construction	14
8.2.	The Prior Art References Disclose and Render Obvious a Preamble Sequence.....	15
8.2.1.	The Prior Art References	15
8.2.2.	Knowledge of a POSA	20
8.3.	The Prior Art References Disclose and Render Obvious Estimating a Channel Response Based Upon a Preamble Sequence	22
8.4.	No Inherency Opinions	24
8.5.	All Challenged Grounds are Rendered Obvious.....	25
9.	GROUND 1, 2, AND 4 RENDER OBVIOUS CLAIMS 2 AND 10	25
9.1.	Li ’748 in View of Tong Discloses Producing the V Matrix in Cartesian Coordinates and Converting to Polar Coordinates.....	25
9.2.	Tong Discloses Producing the V Matrix in Cartesian Coordinates and	

Converting to Polar Coordinates.....	31
9.3. Li '054 in View of Mao and Yang Discloses Producing the V Matrix in Cartesian Coordinates and Converting to Polar Coordinates	31
9.4. Dr. Cooklev Ignores My Analysis Regarding Motivation to Combine.....	33
10. SECONDARY CONSIDERATIONS.....	34
10.1. Applicability of Industry Standards	36

I, Jonathan Wells, Ph.D. of Scottsdale, Arizona, declare that:

1. INTRODUCTION

1. I have been retained as a technical expert by counsel on behalf of NXP USA, Inc., to which I refer as “NXP” or “Petitioner” herein. I have been asked by Petitioner’s counsel (“Counsel”) to consider whether certain prior art references teach or suggest the limitations recited in one or more of Claims 1-4 and 9-12 of U.S. Patent No. 8,416,862 (“the ’862 patent”) (EX1001).

2. I previously submitted a Declaration in this proceeding that I signed on September 25, 2023, and I understand that Declaration was marked as Exhibit 1003 in this proceeding. That Declaration contained my opinions and the bases for them. Since submitting my Declaration (EX1003) I have considered the Board’s institution decision (Paper 11), Patent Owner’s Response (Paper 24), the Declaration of Dr. Todor Cooklev (EX2001) in support of Patent Owner’s Response, and the transcript from the deposition of Dr. Cooklev (EX1024). My opinions from my previous declaration have not changed.

2. QUALIFICATIONS

3. My background and qualifications are set forth in my Declaration (EX1003). I incorporate that section of my previous declaration herein by reference. EX1003, ¶¶ 4-14.

3. MATERIALS CONSIDERED

4. In preparing this declaration, I have considered the materials discussed in this declaration and my prior declaration, including, for example, the '862 patent, the references cited by the '862 patent, the prosecution histories of the '862 patent and the application from which it derives (including the references cited therein), various background articles and materials referenced in this declaration and my prior declaration, and the prior art references identified in this declaration and my prior declaration. *See* EX1003, ¶¶ 25-27. In addition, my opinions are further based on my education, training, experience, and knowledge in the relevant field.

Exhibit No.	Description
EX1001	U.S. Pat. No. 8,416,862 to Aldana et al. ("the '862 patent")
EX1002	Prosecution History of the '862 patent (Serial No. 11/237,341)
EX1003	Declaration of Dr. Jonathan Wells
EX1004	U.S. Pat. No. 7,236,748 to Li et al. ("Li-748")
EX1005	U.S. Pub. No. 2008/0108310 to Tong et al. ("Tong")
EX1006	U.S. Pat. No. 7,312,750 to Mao et al. ("Mao")
EX1007	U.S. Pub. No. 2006/0092054 to Li et al. ("Li-054")
EX1008	Yang et al., Reducing the Computations of the Singular Value Decomposition Array Given by Brent and Luk, SIAM J. MATRIX ANAL. APPL., Vol. 12, No. 4, pp. 713-725, Oct. 1991 ("Yang")
EX1009	U.S. Pat. No. 7,710,925 to Poon ("Poon")

EX1010	U.S. Provisional Application Serial No. 60/673,451 (“451 provisional”)
EX1011	U.S. Provisional Application Serial No. 60/698,686 (“686 provisional”)
EX1012	U.S. Provisional Application Serial No. 60/614,621 (“621 Provisional”)
EX1013	U.S. Provisional Application Serial No. 60/619,461 (“461 Provisional”)
EX1014	U.S. Patent Application Serial No. 11/168,793 (“793 application”)
EX1015	Plaintiff Bell Northern Research, LLC’s Patent Rule 3-1 and 3-2 Disclosure of Asserted Claims and Infringement Contentions Against the Huawei Defendants in <i>Bell Northern Research, LLC, v. Huawei Device (Dongguan) Co., Ltd., Huawei Device (Shenzhen) Co., Ltd., and Huawei Device USA, Inc.</i> (Case No. 3:18-cv-1784) (S. D. Cal.)
EX1016	Defendants’ Invalidity Contentions in Bell Northern Research, LLC, v. Huawei Device (Dongguan) Co., Ltd., Huawei Device (Shenzhen) Co., Ltd., and Huawei Device USA, Inc. (Case No. 3:18-cv-1784) (S.D.Cal.)
EX1017	Defendants’ Joint Opening Claim Construction Brief in Bell Northern Research, LLC, v. Huawei Device (Dongguan) Co., Ltd., Huawei Device (Shenzhen) Co., Ltd., and Huawei Device USA, Inc. (Case No. 3:18-cv-1784) (S.D.Cal.)
EX1018	Plaintiff’s Opening Claim Construction Brief in Bell Northern Research, LLC, v. Huawei Device (Dongguan) Co., Ltd., Huawei Device (Shenzhen) Co., Ltd., and Huawei Device USA, Inc. (Case No. 3:18-cv-1784) (S.D.Cal.)
EX1019	Defendants’ Memorandum of Points and Authorities in Support of Their Joint Motion for Summary Judgement on Indefiniteness in Bell Northern Research, LLC, v. Huawei Device (Dongguan) Co.,

	Ltd., Huawei Device (Shenzhen) Co., Ltd., and Huawei Device USA, Inc. (Case No. 3:18-cv-1784) (S.D.Cal.)
EX1020	Transcript of Claim Construction Hearing, Day Two, Volume Two, Pages 1-122 in Bell Northern Research, LLC, v. Huawei Technologies CO., LTD., Huawei Device (Hong Kong) CO., LTD., and Huawei Device USA, Inc. (Case No. 3:18-cv-1784) (S.D.Cal.)
EX1021	Declaration of Sylvia Hall-Ellis
EX1022	Claim Construction Order and Order on Motions for Summary Judgment, Bell Northern Research v. Huawei Techs. Co. et al. (Case No. 18-cv-1784-CAB-BLM) (S.D.Cal.)
EX1023	Joint Claim Construction and Prehearing Statement, Bell Northern Research LLC v. HMD North America, Inc. et al (Case No. 1:22-cv-22706-RNS) (S.D. Fla)
EX1024	Deposition Transcript of Todor Cooklev Ph.D.
EX1025	IEEE 802.11-2016 (excerpts)
EX1026	IEEE Standard 802.11, 1999 Ed. (R2003) (excerpts)
EX1027	IEEE Standard 802.11a-1999 supplement to 802.11-1999 (excerpts)
EX1028	Singh, et al., Wwise Proposal: High throughput extension to the 802.11 Standard (2004)
EX1029	Mujtaba, et al., TGn Sync Proposal Technical Specification (2005)

4. LEGAL PRINCIPLES

5. I set forth the relevant legal standards in my previous declaration, and I incorporate that section here by reference. EX1003, ¶¶ 15-22.

5. SUMMARY OF OPINIONS

6. I have been asked to consider whether the claims of the '862 patent are anticipated or obvious over certain prior art references. As explained in my previous declaration and in this declaration, it is my opinion that:

- Claims 1-4 and 9-12 are obvious in light of U.S. Patent No. 7,236,748 to Li et al. ("Li '748") in view of U.S. Pub. No. 2008/0108310 to Tong et al. ("Tong") and U.S. Pat. No. 7,312,750 to Mao et al. ("Mao").
- Claims 1-4 and 9-12 are obvious in light of Tong in view of Mao.
- Claims 1, 3-4, 9 and 11-12 are obvious in light of U.S. Pub. No. 2006/0092054 to Li et al. ("Li '054") in view of Mao.
- Claims 2 and 10 are obvious in light of Li '054, Mao, and Yang et al., Reducing the Computations of the Singular Value Decomposition Array Given by Brent and Luk, SIAM J. MATRIX ANAL. APPL., Vol. 12, No. 4, pp. 713-725, Oct. 1991 ("Yang").
- Claims 1, 3-4, 9 and 11-12 are obvious in light of U.S. Pat. No. 7,710,925 to Poon ("Poon") in view of Mao.
- Patent Owner has failed to show a nexus between the '862 patent and industry standards

6. PERSON OF ORDINARY SKILL IN THE ART

7. I provided my opinion about a person of ordinary skill in the art (POSA) in my previous declaration, and I incorporate that opinion here by reference. EX1003, ¶¶ 23-24. I note that the Board agreed with this opinion, stating that my opinion "comports with the qualifications a person would have needed to understand and implement the teachings of the '862 patent and the prior art." Paper No. 11, p. 8.

8. I understand that Dr. Cooklev primarily agreed with my opinion (the same opinion that was preliminarily adopted by the board), but disagreed that experience could substitute for educational background. Specifically, Dr. Cooklev asserts that this is somehow “unworkable” as the POSA must have at least a bachelor’s degree to understand and appreciate the wireless communications and matrix algebra concepts relevant to the ’862 patent. EX2001, ¶ 30. I disagree. As I stated during my prior deposition, “substantial experience could substitute for some of the educational background,” including the concepts identified by Dr. Cooklev. *Id.* (quoting EX2002, 26:6-17).

9. Regardless, under either definition, the prior art references and the knowledge of the POSA render the ’862 patent obvious.

7. CLAIM CONSTRUCTION

10. I understand that Dr. Cooklev agrees that the Board need not construe the terms “a plurality of Radio Frequency (RF) components” or “decompose the estimated transmitter beamforming unitary matrix (V) to produce the transmitter beamforming information.” EX2001, ¶ 57-58.

11. I also understand that Dr. Cooklev agrees with a prior Board finding that the term “a baseband processing module operable to” should not be interpreted under § 112, ¶ 6. EX2001, ¶ 56. But if this Board finds this term to be a means-plus-function term, then I disagree with Dr. Cooklev’s analysis and identification

of the alleged structure. Dr. Cooklev cites to over eight (8) columns of continuous text within the specification as “examples of specific portions of the specification that describe the structure corresponding to the recited baseband processing” without identifying any specific language or discussion EX2001, ¶ 56. Dr. Cooklev’s blanket citation does not adequately identify which elements allegedly provide the required structure and which do not. Dr. Cooklev also cites to various figures, but these are merely generic box-diagrams and do not convey any specific structure corresponding to this limitation.

7.1. “preamble sequence”

12. I disagree with Dr. Cooklev’s opinions regarding the plain and ordinary meaning of “preamble” and “preamble sequence.” EX2001, ¶¶ 59-71.

13. I understand that any claim term not explicitly construed should be given its plain and ordinary meaning as understood by a person of ordinary skill. I also understand from Counsel that, absent an actual dispute between the parties regarding the proper scope of a term, it is not necessary to construe every limitation present or to provide an explicit definition for terms that would otherwise be given their plain and ordinary meaning. I further understand that prior to Patent Owner’s Response in this current matter, it had not contested or argued for a construction of the “preamble sequence” term.

14. The term “preamble sequence” should be given its plain and ordinary meaning. A POSA, reading this term in the context of the ’862 patent, would have understood that the claimed sequence is merely a distribution of information, such as a set of training bits, that is sent before something else. Likewise, “preamble” should be given its plain and ordinary meaning, which a POSA would have understood as something that comes before something else.

15. Dr. Cooklev’s analysis misunderstands and misrepresents my prior testimony. The term “distribution” is not limited to a “Gaussian distribution” or a “uniform distribution” as known from probability theory. EX2001, ¶¶ 62, 64. Dr. Cooklev is also wrong to assume that “distribution . . . means how the information is spread.” EX2001, ¶ 63. In the context of the ’862 patent, the claimed sequence within preamble sequence would refer to a distribution of training bits.

16. Dr. Cooklev’s analysis is also wrong to suggest that the plain meaning of this term requires an explicit time increment or span between transmissions. *See* EX2001, ¶ 65 (suggesting that the plain and ordinary meaning should “specify how long ‘before something else’ the preamble must be sent.”). A POSA would have understood that the timespan between sending the preamble sequence and sending additional information would be implementation dependent and would have understood how to determine an appropriate timing for sending the preamble sequence.

17. During his deposition, Dr. Cooklev further confused his temporal argument by stating that nothing need follow the preamble sequence. For example, he explained that the preamble sequence is “a segment at the beginning of a transmission just prior to the transmission of data carriers.” EX1024, 16:5-24. In the very next sentence, he stated that “in some cases there may not be any data.” *Id.* Dr. Cooklev stated that “[e]ven if the preamble is not followed by anything else it can still be a preamble . . .” *Id.*, 16:25-17:10. Dr. Cooklev also asserted that “a standalone transmission of a preamble sequence without anything else is within the scope of the claimed preamble.” *Id.*, 18:21-19:1, 19:17-20:10. It is contradictory to argue that the preamble sequence must be received during some timespan before later data transmissions if, by Dr. Cooklev’s own admission, nothing need follow the preamble sequence.

18. Dr. Cooklev’s constructions do not reflect the plain and ordinary meaning of these terms. Dr. Cooklev provides the following two constructions as the plain and ordinary meaning as understood by a POSA. EX2001. ¶¶ 69-70.

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”

19. Dr. Cooklev’s constructions do not comport with the patent specification. The only support Dr. Cooklev identifies for his positions consists of

four lines from the specification and limited portions of two related figures. *See* EX2001, ¶ 71 (citing EX1001, 13:40-44, Figs. 7 (step 702) and 8 (step 802)). The phrases “two or more training symbols” and “a segment at the beginning of a transmission” do not appear in these sections or anywhere else in the patent. Nor do these sections require the narrow interpretation put forth by Dr. Cooklev.

20. The ’862 patent does not require a plurality of training symbols in the preamble sequence. The ’862 patent describes estimating a channel response by “comparing received training symbols of the preamble to corresponding expected training symbols using any of a number of techniques that are known in the art.” EX1001, 13:40-44 (describing step 702 in Fig. 7). A POSA would have understood that the phrase “received training symbols of the preamble” could refer to one or more training symbols (i.e., one or more sets of training bits).

21. The “received training symbols of the preamble” need not, and often do not, contain known information. A POSA would have understood the “corresponding expected training symbols” of the ’862 patent to already be present on the receiving device. The received training symbols would be distorted and different from the known, expected symbols. Dr. Cooklev acknowledges that the receiver device utilizes the identified differences between the received and existing symbols to estimate characteristics of the channel. EX2001, ¶ 46.

22. In conclusion, Dr. Cooklev's new constructions do not convey the plain and ordinary meaning of these terms nor are they necessary. The claim language should be given the full scope of their meaning, which is broader than Dr. Cooklev's assertions. Regardless, even under Dr. Cooklev's interpretation, the prior art references and the knowledge of the POSA render the '862 patent obvious.

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

23. Dr. Cooklev identifies only the "preamble sequence" as allegedly missing from the prior art disclosures corresponding to independent claims 1 and 9. Specifically, Dr. Cooklev asserts that the prior art does not disclose receiving "a preamble sequence (limitations 1[a] and 9[c]) and "estimating a channel response based upon the preamble sequence" (limitations 1[b] and 9[d]). *See* EX2001, Section VI.A (section header).

8.1.Dr. Cooklev's Analysis Relies On An Incorrect Claim Construction

24. I disagree with Dr. Cooklev's analysis's reliance on his incorrect claim construction of the term "preamble sequence." EX2001, ¶¶ 80-86. A POSA determining the plain and ordinary meaning of the claim language, would have looked to the language and examples given by the '862 patent, including its description of estimating a channel response by comparing received training symbols to expected training values. The prior art discloses estimating a channel

response based upon a preamble sequence, including sending and comparing training symbols, training patterns, and pilot symbols, to at least the same extent as disclosed in the '862 patent itself.

25. Further, I disagree with Dr. Cooklev's mischaracterization of my opinions as inherency arguments or implicit disclosures. EX2001, ¶ 86. As laid out in my prior declaration, it is my opinion that Grounds 1, 2, 3 and 5 disclose the challenged claims, including by rendering them obvious. EX1003, ¶ 57.

8.2. The Prior Art References Disclose and Render Obvious a Preamble Sequence

26. As explained in my prior declaration, the prior art references of Grounds 1, 2, 3, and 5 disclose a "preamble sequence" as well as "estimating[/estimate] a channel response based upon the preamble sequence," at least when discussing limitations 1.a, 1.b, 9.c, and 9.d, and I incorporate those sections here by reference. EX1003, ¶¶ 82-85, 113-116, 150-153, and 190-193.

8.2.1. The Prior Art References

27. The prior art references each disclose a preamble sequence as explained below. Each reference discloses beamforming techniques including receiving training or pilot symbols that are subsequently used for estimating the channel response. By virtue of its discussion of their use in beamforming, the prior art at least teaches that the training and pilot symbols are sent *before* subsequent

transmissions in order to allow the system to calculate and determine the beamforming feedback information used in the later transmissions.

28. For example, Li '748 teaches that “[t]o obtain V at the transmitter, *the transmitter may send training symbols to the receiver; the receiver may evaluate H* , compute the matrix V ’; and the receiver may feedback parameters representing V to the transmitter.” EX1004, 3:31-34 (emphasis added). “[T]he feedback angles are computed by *the receiver that received channel training symbols.*” *Id.* 4:20-24 (emphasis added). In Li '748 “*channel state information* [including channel state matrix H] *is estimated from received signals.*” *Id.*, 8:4-7.

29. Based upon Li '748's teachings, a POSA would have recognized that the “training symbols” of Li '748 are signals within a preamble sequence that the receiver uses to determine a channel response (e.g., matrix H) and beamforming matrix V .

30. Tong teaches that “[t]he mobile terminal 16, which is discussed in detail, will use the pilot signals for channel estimation.” EX1005, [0087]. “MIMO channel H is measured as indicated at 208. *There are many existing methods of measuring the channel.* This may for example be done *using pilot symbols transmitted at known locations in time and/or frequency*, possibly using one of the formats introduced previously and performing interpolation if necessary.” *Id.*,

[0211]. A POSA would understand that the “known locations in time” taught by Tong would include transmitting the pilot symbols as part of a preamble sequence.

31. Dr. Cooklev’s analysis incorrectly limits Tong to only pilot symbols that “are scattered among the data symbols.” EX2001, ¶¶ 91 (citing EX1005, [0090]), 92. Rather, Tong teaches a variety of pilot symbol formats, including formats in which a pilot symbol or null pilot symbol are sent prior to other data. *See, e.g.*, EX1005, 0211 (referring to pilot symbols “formats introduced previously”). For example, figures 47 and 48 of Tong depict different variations of such a format.

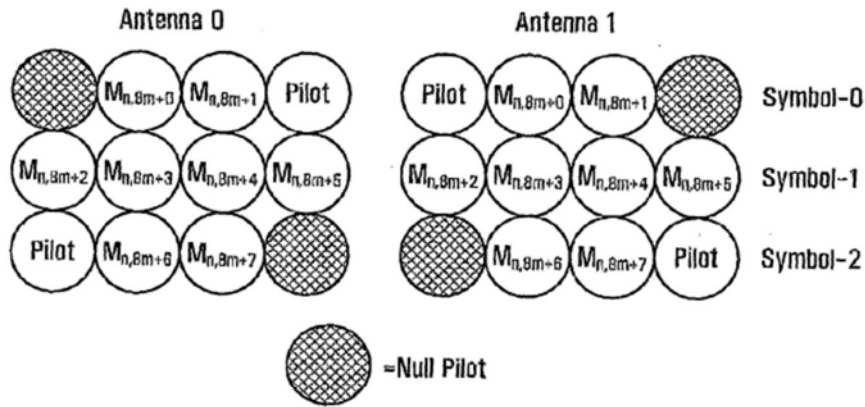


FIG. 47

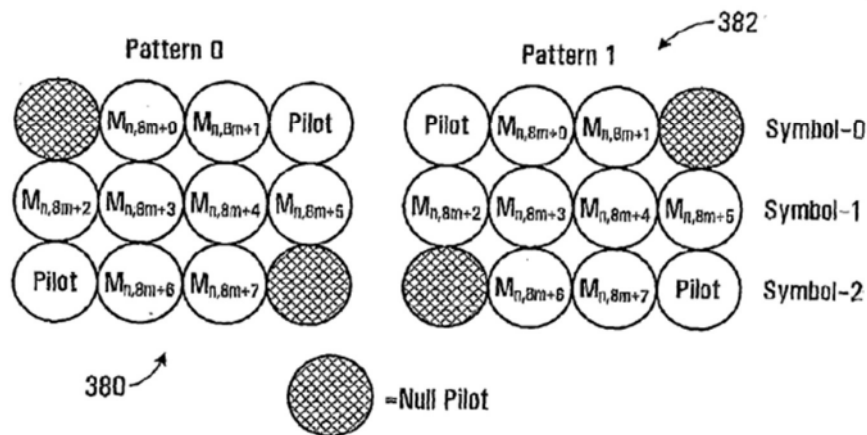


FIG. 48

EX1005, Figs. 47-48, [0282-0283]. A POSA would have understood these formats to be examples of receiving the pilot symbols of Tong within a preamble sequence.

32. Based upon Tong's teachings, a POSA would have recognized that the "pilot symbols" of Tong may be signals received within a preamble sequence that the receiver uses to determine a channel response (e.g., matrix H) and beamforming matrix V.

33. Li '054 teaches “[t]he receiver receives training symbols and computes the beamforming matrix, V ” EX1007, [0022]. More specifically, “channel state information is estimated from received signals. The channel state information may include the channel state matrix H .” *Id.*, [0093], Fig. 3. A POSA would have understood that the “received signals” used to estimate the channel state refers to the received training symbols.

34. Based upon Li '054's teachings, a POSA would have recognized that the “training symbols” of Li '054 may be signals received within a preamble sequence that the receiver uses to determine a channel response (e.g., matrix H) and beamforming matrix V .

35. Poon teaches “receiving station receives a training pattern from a transmitting station. For example, station 102 may transmit a training pattern, and station 104 may receive the training pattern.” EX1009, 3:20-60. “[T]his may correspond to station 104 computing a current channel matrix describing the current state of the N spatial channels.” *Id.*, 3:20-28, Fig. 2. A POSA would understand that Poon's station 104 computes the channel state matrix using the received training pattern.

36. Based upon Poon's teachings, a POSA would have recognized that the “training pattern” of Poon may be signals received within a preamble sequence that

the receiver uses to determine a channel response (e.g., matrix H) and beamforming matrix V .

8.2.2. Knowledge of a POSA

37. To the extent the prior art teachings do not explicitly disclose that the training or pilot symbols are received prior to sending later beamformed transmissions, a POSA would have found it obvious to implement the prior art teachings in such a manner. A POSA would have understood that training and pilot symbols used in a beamforming system would precede the later beamformed transmissions, at least because the prior art teaches using the prior signals to calculate beamforming feedback used in later transmissions. While the prior art uses different terms—training or pilot symbols instead of a preamble sequence—a POSA would have understood that these symbols could, and very likely would, be implemented as preamble sequences.

38. The '862 patent acknowledges that sending training symbols within a preamble was already known in the art, as well as using received training symbols to estimate a channel response. EX1001, 13:40-44. The '862 patent also acknowledges existing standards for wireless communications, such as the "IEEE 802.11" standards. *See* EX1001, 5:67-6:3; EX1003, ¶ 31. A POSA would have understood that sending training symbols withing a preamble sequence is a conventional practice and would have been aware of these techniques. The same

POSA would have understood that the training symbols, training patterns, and pilot symbols taught by the prior art references would be received within a preamble sequence. *See* EX1004, 1:61-2:5 (referencing IEEE 802.11 standards as background knowledge); EX1007, 0112 (same), EX1009, 1:63-2:4 (same); *see also* EX1005, 0186. Further, based on my knowledge and experience from over 35 years of working with wireless systems, I understand that a POSA would have found it to be a customary to transmit and receive training symbols using a preamble sequence. Every system I am aware of and have worked with over that time has utilized a preamble sequence when sending training symbols.

39. Dr. Cooklev's analysis relies on contradictory levels of knowledge of a POSA. First, Dr. Cooklev states that a POSA would have understood that the '862 patent improves on the prior art and prior methods, including the definition, use, and benefits of the claimed "preamble sequence." *See, e.g.*, EX1024, 13:5-14:2, 17:11-19. At the same time, Dr. Cooklev alleges that a person of ordinary skill in the art would not have been aware of the IEEE 802.11 standards and proposals that preceded the '862 patent (and were referenced in the prior art). EX1024, 33:22-34:20. I understand that an obviousness analysis must take into account several factors, including the scope and content of the prior art. I also understand that BNR claims that the '862 patent is essential to the IEEE 802.11ac and later standards. A POSA would have understood the content of the IEEE

802.11 standards and proposals that preceded the '862 patent to be relevant to the obviousness analysis. A POSA would have understood that IEEE 802.11 is the technical name given to the Wi-Fi specifications first standardized in 1997, which were known and used ubiquitous by the time of the earliest priority date of the '862 patent. *See e.g.*, “Wi-Fi,” available at <https://www.britannica.com/technology/Wi-Fi>. Dr. Cooklev admits that he did not opine or had no recollection of whether the 802.11 standards and proposals disclosed the use of preamble sequences. *See* EX1024, 34:21-35:5 (802.11ac), 38:1-9 (802.11-1999), 41:2-14 (802.11a), 45:10-16 (WWISE proposal), 47:18-48:1 (TGN Sync Proposal). In my opinion, a POSA, having the knowledge of the technology described by the '862 patent, including preamble sequences, OFDM signals, training symbols, etc., would have been aware of the related technology standards and the prior use of preamble sequences.

40. My analysis does not rely on the '862 patent to demonstrate obviousness, as Dr. Cooklev suggests. EX2001, ¶¶ 87-88. The prior art teaches receiving training symbols and estimating a channel response based upon those received training symbols. The '862 patent merely confirms that these processes were known in the art prior to the '862 patent.

8.3. The Prior Art References Disclose and Render Obvious Estimating a Channel Response Based Upon a Preamble Sequence

41. As explained in my prior declaration, the prior art references of Grounds 1, 2, 3, and 5 disclose “estimating[/estimate] a channel response based

upon the preamble sequence,” at least when discussing limitations 1.a, 1.b, 9.c, and 9.d, and I incorporate those sections here by reference. EX1003, ¶¶ 82-85, 113-116, 150-153, and 190-193.

42. Dr. Cooklev incorrectly states that I did not provide any evidence in support of my opinion that the Li ’748 and Li ’054 grounds (Grounds 1, 3, 4) disclose estimating a channel response based on received signals where those received signals are the described training symbols. EX2001, ¶ 94. He is wrong. For example, I show how the Li ’748 reference describes “how you send training symbols to the receiver. If you send something to a receiver, it is a received signal. And then [Li ’748] says that the receiver may evaluate H” based on those received signals. EX2002, 56:10-57:21, EX1003, ¶ 82. I also explained that, to the extent this commonsense connection is not explicit enough, a POSA reading the prior art would have found 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.

43. Dr. Cooklev does not contest that Tong teaches estimating a channel response based on the received pilot symbols. EX2001, ¶ 95. Rather, his opinion rests on his incorrect understanding that Tong’s pilot symbols are not transmitted in a preamble sequence.

44. On a related note, Dr. Cooklev argues that Ground 1 (Li '748 in view of Tong and Mao) does not disclose estimating a channel response based on a preamble sequence. Dr. Cooklev offers no opinion regarding whether the combination of Li '748 and Tong disclose this limitation. For example, a POSA would have understood they could combine the training symbol implementation of Li '748 with the pilot symbol implementation of Tong in order to estimate a channel response.

45. Ground 5 (Poon) provides evidence of first receiving a training pattern and then using it to estimate a channel matrix. *See* EX1009, 3:20-28, Fig. 2. For example, Figure 2 of Poon depicts receiving the training sequence at step 210 immediately followed by performing channel estimation at step 220.

8.4.No Inherency Opinions

46. Dr. Cooklev disingenuously suggests that my testimony “advance[s] an argument that is vaguely worded as part inherency and part obviousness.” EX2001, ¶ 99. My prior opinions and testimony did not advance an inherency argument and Dr. Cooklev has not pointed to any such argument. To the contrary, Dr. Cooklev admits that I “acknowledged that [I] was not relying on inherency.” *Id.*, ¶ 100. For that reason alone, I find the entirety of section IV.A.4 of Dr. Cooklev’s declaration irrelevant.

47. Rather, my testimony has described the ubiquitous use of preamble sequences in the prior art as support for the conclusion that the prior art renders the challenged claims obvious. A POSA would have found systems using formats other than preamble sequences to be the exception, if not a rarity.

8.5.All Challenged Grounds are Rendered Obvious

48. As explained in my prior declaration, the prior art references of Grounds 1-5 disclose and render obvious the challenged claims, including the dependent claims, and I incorporate those sections here by reference. EX1003, ¶¶ 58-205. As explained above, the prior art references within each ground render the obvious the limitation of estimating a channel response based upon a preamble sequence.

9. GROUND 1, 2, AND 4 RENDER OBVIOUS CLAIMS 2 AND 10

49. Dr. Cooklev incorrectly states that “In Grounds 2 and 4, Petitioner relies exclusively on Yang (EX1008) for the additional limitations of claims 2 and 10.” EX2001, ¶ 112. Ground 2 identifies relevant evidence and support from both Tong and Yang references. Petition at 54-56. Ground 4 identifies relevant evidence from Li '054 and Yang. Petition at 67-70.

9.1.Li '748 in View of Tong Discloses Producing the V Matrix in Cartesian Coordinates and Converting to Polar Coordinates

50. As explained in my prior declaration, the prior art references of Grounds 1, 2, and 4 disclose and render obvious claims 2 and 10 and I incorporate those sections here by reference. EX1003, ¶¶ 98-101, 126-128, 169-171.

51. Dr. Cooklev's disagreement relies on the false premise that my opinion relies on identifying the n^2-1 matrix of Li '748, rather than the $2n^2$ matrix, as representing the matrix V in cartesian coordinates. EX2001, ¶¶ 114 ("Dr. Wells is mistaken that the ' n^2-1 real numbers' are elements of the matrix V in Cartesian coordinates), 116 ("Dr. Wells and Petitioner have not established that Li '748 actually teaches a matrix V produced with n^2-1 Cartesian coordinates"). Li '748 teaches that in some embodiments "the beamforming matrix V is represented by n^2-1 real numbers instead of $2n^2$ real numbers" such that "the feedback bandwidth may be reduced." EX1003, ¶ 98; EX1004, 2:63-67. Thus, 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. Dr. Cooklev's analysis argues against a position that I did not take and as such, the entirety of Section VI.B.1 of this declaration is irrelevant.

52. Dr. Cooklev agreed that the $2n^2$ complex unitary matrix of Li '748 discloses generating the V matrix in Cartesian coordinates. Indeed, he admits that the Li '748 patent teaches transmitting a "unitary matrix V" involving "sending

information related to the $2n^2$ real numbers for any n by n complex unitary matrix.” EX1004, 2:52-67. Dr. Cooklev acknowledged that Li ’748 “establishes that V is an N by N complex matrix that has . . . N square elements” and “that each of these N square elements has a real part in the imaginary part.” EX1024, 26:25-27:13 .

Further, Dr. Cooklev agreed the “real and imaginary parts will have been understood as Cartesian coordinates” by a POSA. *Id.*; 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”). Dr. Cooklev also asserts that the V matrix of Li ’748 may be represented by generator matrices in Cartesian coordinates. EX2001, ¶¶ 118-119.

53. I understand that Dr. Cooklev later stated, after a break and discussion with counsel for Patent holder (EX1024, 49:19-21), 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, 48:19-49:14. But it is not necessary for Li ’748 to explicitly state that Li ’748’s complex numbers are in the form A plus jB for a POSA (including Dr. Cooklev) to understand that Li ’748’s complex numbers are a reflection of cartesian coordinates. These later statements do not contradict his earlier

statements that a POSA would have understood that Li '748's complex matrix was in Cartesian coordinates. My opinions regarding Li '748 are not limited to the references describing complex numbers that *must* take the form of Cartesian coordinates. Rather, my opinion was that a POSA would have understood that the complex numbers of Li '748 *could* comprise Cartesian coordinates and further that a POSA would have understood as much, as Dr. Cooklev had previously and consistently acknowledged, and would have found it obvious to generate the complex numbers of Li '748's V matrix using complex cartesian coordinates.

54. Dr. Cooklev also agrees that "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, ¶ 116. A POSA would have understood this teaching to refer to converting the V matrix from cartesian coordinates to polar coordinates to reduce complexity.

55. Further, I disagree with Dr. Cooklev that 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, ¶ 116. Li '748 discloses that the generator matrices "may be utilized to represent the beamforming matrix." EX1004, 2:67-3:11. Li '748 continues and explains that feedback numbers within the matrices "are also angles from $-\pi$ to π of an (n^2-1) -dimension *polar coordinate*." *Id.* (emphasis added). A POSA would have understood Li '748 to

disclose and render obvious converting a V matrix from cartesian coordinates to polar coordinates.

56. Dr. Cooklev does not contest that Tong discloses decomposing a V matrix into polar coordinates using a Givens transform. EX2001, ¶ 122. His analysis of the Tong reference, with regard to claims 2 and 10, complains only that Tong does not “describe[] that the V matrix itself is first *produced in Cartesian coordinates* and subsequently converted to polar coordinates.” *Id.* (emphasis added).

57. As an initial matter, a POSA with knowledge of wireless device technology and wireless communication standards would have understood that the V matrix could be produced using cartesian coordinates. Li '748 discloses as much, as acknowledged by Dr. Cooklev. *See supra*. Further, when describing the problem to be solved in the prior art, the '862 patent explains that Singular Value Decomposition of cartesian coordinate matrices alone is not sufficient to reduce the feedback size to practical levels. EX1001, 3:26-48. In other words, the '862 patent acknowledges that producing V matrices in cartesian coordinates was known in the prior art at least because the alleged problems associated with them were also known.

58. Dr. Cooklev's own testimony contradicts his position. For example, he admitted that a POSA would have understood that a V matrix comprising

complex numbers could comprise cartesian coordinates. *See supra*. Tong describes complex channel matrices comprising complex numbers, including those with “an I and Q component.” EX1005, [0218]. Thus, a POSA would have understood Tong to disclose producing a V matrix in cartesian coordinates.

59. The combination of Li '748 and Tong renders these claims obvious. For example, Li '748 discloses producing the V matrix in cartesian coordinates. Tong discloses decomposing the V matrix into polar coordinates with parameters θ and C. EX1005, [0223]-[0224]. Specifically, Tong explains that “an $n \times n$ V matrix can be decomposed into Givens matrices containing $n^2 - n$ complex parameters.” EX1005, [0222], [0227] (using Givens rotations “the V matrix can be represented by $n^2 - n$ independent complex parameters”), [0228] (“ $2(n^2 - n)$ bits (one bit for I and Q of each parameter) are used for the differential quantization of the unitary V matrix”). Tong goes on to describe exemplary givens rotations comprising complex parameters including parameters θ (an angle from $-\pi$ to π) and C (a scalar of 0 or 1). EX1005, [0230]-[0231].

60. A POSA would have found it obvious to convert the cartesian coordinate V matrix of Li '748 to polar coordinates using the Givens rotation of Tong. Li '748 teaches the goal of reducing the feedback bandwidth by using $n^2 - 1$ real numbers instead of $2n^2$ real numbers via compression or decomposition techniques. EX2001, ¶ 116. Tong teaches methods of compression and

decomposition, such as decomposing the V matrix into n^2-n parameters, θ and C. EX1005, [0222]. A POSA would have found it obvious to combine these two V matrix operations to reduce the feedback bandwidth and improve the system.

9.2. Tong Discloses Producing the V Matrix in Cartesian Coordinates and Converting to Polar Coordinates

61. As explained above, Tong discloses these limitations. In my prior declaration, Ground 2 discloses and renders obvious claims 2 and 10 and I incorporate those sections here by reference. EX1003, ¶¶ 126-128.

9.3. Li '054 in View of Mao and Yang Discloses Producing the V Matrix in Cartesian Coordinates and Converting to Polar Coordinates

62. Dr. Cooklev offers no opinion regarding whether the Li '054 patent teaches these claims. His analysis also ignores the various teachings of Yang cited in my declaration. For example, Dr. Cooklev states that “Dr. Wells’s reliance on Yang is limited to the following teachings,” listing citations from a single paragraph related to Ground 2. EX2001, ¶ 126 (citing EX1003, ¶ 128). His analysis ignores other discussions and citations to Yang, including in Ground 4, which discussed the combination of Li '054 and Yang. *See* EX1003, ¶¶ 100 (Ground 1) and 166-171 (Ground 4). As such, his analysis is incomplete and unreliable, particularly with regard to Ground 4.

63. Dr. Cooklev again focuses his analysis on an argument that I did not make, namely whether Yang teaches cartesian to polar coordinate conversions on a

beamforming unitary matrix V . EX2001, ¶ 127. Rather, Yang merely shows a known technique (converting cartesian to polar coordinates) that may be utilized on unitary matrices in beamforming singular value decomposition calculations to reduce complexity and feedback bandwidth. Li '054 discloses or renders obvious generating a matrix V in cartesian coordinates using singular value decomposition of the channel state matrix. EX1003, ¶ 169.

64. Li '054 explicitly identifies reducing feedback bandwidth as a goal in its system. “When feedback bandwidth is reduced in closed loop MIMO systems, more bandwidth is available for data communications.” EX1007, [0015].

65. A POSA would have been motivated to employ Yang’s teachings (cartesian to polar coordinate conversion) on the unitary matrix V of Li '054 to reduce computational complexity. A POSA would have had a reasonable expectation of success in doing so at least because both references are related to matrix and SVD operations in beamforming technology. EX1003, ¶ 170.

66. Dr. Cooklev’s objections to the Yang reference miss the point and use of Yang within the Grounds. Yang teaches a method for converting cartesian to polar coordinates. EX1008, 1, 5, Abstract. Yang teaches that its method may be used on unitary matrices within different SVD methods. EX1008, Abstract, 1, 12 (“This results in significantly reduced computations of various SVD and SD methods”). Lastly, Yang explains that implementing its algorithm will reduce

complexities in these methods. EX1008, Abstract, 12 (“This results in significantly reduced computations of various SVD and SD methods”). A POSA, seeking to improve their beamforming system (such as in Li ’748, Tong, or Li ’054) and reduce feedback bandwidth would have found it obvious to implement cartesian to polar coordinate conversion on unitary matrices in SVD calculations as taught by Yang.

9.4.Dr. Cooklev Ignores My Analysis Regarding Motivation to Combine

67. Dr. Cooklev’s discussion of the motivations to combine is incomplete and incorrect. EX2001, ¶¶ 140-141. First, he makes no attempt to identify to which combination his arguments apply, Grounds 1, 2, or 4. This fails to provide the necessary information to support his conclusion. For example, Dr. Cooklev identifies only the Li ’748 and Yang, but no Ground proposes combining these two references. *See* EX2001, ¶ 141. Both references appear only in Ground 1, but that ground merely discusses how Li ’748 discloses the claim limitations and identifies Yang as evidence of the knowledge of a POSA to illustrate what would have been found obvious. Ground 1 does not attempt to combine Li ’748 and Yang.

68. Second, Dr. Cooklev misstates the record. His analysis asserts that “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.” EX2001, ¶ 140. But the Petition, under Ground 4, explained that implementing

Yang into Li '054 “would merely have been the application of a known technique . . . to a known system . . . ready for improvement to yield predictable results.”

Petition, 69-70. Likewise, my discussion of Yang in Grounds 1, 2, and 4 detail the motivations and benefits that a POSA would understand in implementing the teachings of Yang. EX1003, ¶¶ 100, 128, 166-171. 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 applying Yang . . . to the wireless device of Li '054 would have led to predictable results without significantly altering or hindering the functions performed by Li '054's wireless device”).

69. For at least these reasons, Dr. Cooklev's analysis regarding motivation to combine is unreliable and should be given no weight.

10. SECONDARY CONSIDERATIONS

70. I understand from Counsel that in analyzing the question of obviousness, one may consider what are called “secondary considerations” of nonobviousness. I understand from counsel that secondary considerations of nonobviousness may include: (1) a long felt but unmet need in the prior art that was satisfied by the invention of the patent; (2) commercial success of processes covered by the patent; (3) unexpected results achieved by the invention; (4) praise

of the invention by others skilled in the art; (5) taking of licenses under the patent by others; (6) deliberate copying of the invention; (7) failure of others to find a solution to the long felt need; and (8) skepticism by experts. For example, when considering whether there existed a long felt but unmet need in the prior art, one would analyze the scope and content of the prior art at the time. In this matter, that would include the IEEE 802.11 family of standards and related proposals that predate the '862 patent. *See* POR at 56 (“Industry standards—such as the 802.11 standards—often reflect the accepted practices and solutions to common problems within a particular field”).

71. I also understand from counsel that there must be a relationship (called a “nexus”) between any such secondary considerations and the merits of the alleged invention (that is, the merits of the challenged claims). I have been informed by counsel that nexus may be presumed if the patent owner shows the asserted objective evidence is tied to a specific product and that product embodies the claimed features and is coextensive with them. However, if the patented invention is only a component of a commercially successful machine or process, I have been informed that the patent owner is not entitled to a presumption of nexus.

72. I have also been informed that, even where a presumption of nexus is inappropriate, the patent owner is still afforded an opportunity to prove nexus by showing that the evidence of secondary considerations is the ***direct result*** of the

unique characteristics of the claimed invention. However, where the offered secondary consideration actually results from something other than what is both claimed and novel in the claim, I have been informed there is no nexus to the merits of the claimed invention. In other words, there must be a nexus to some aspect of the claim not already in the prior art.

10.1. Applicability of Industry Standards

73. Dr. Cooklev does not establish a nexus between the claims of the '862 patent and the alleged success of the 802.11ac and later standards. EX2001, ¶¶ 142-148.

74. The functionality identified by Dr. Cooklev is not required for a product to be compliant with the standard. Dr. Cooklev admits that the “standards may not require practicing all of the limitations of claims 1 and 9 of the '862 patent.” EX2001, ¶ 147. For that reason alone, Dr. Cooklev has failed to show that that the alleged secondary consideration (industry adoption) is the direct result of the claimed invention. 802.11ac-compliant devices need not implement or utilize the VHT functionality identified by Dr. Cooklev. Even within the VHT (Very High Throughput) functionality, a number of features, including the use of VHT NDP sounding, are optional and not required to be implemented. EX1025 (802.11-2016) at 2497.

75. Further, the identified functionality (“estimating a channel response based upon a received preamble”) was adopted long before the 802.11-2016 standard and is not specific or unique to the VHT functionality. The 802.11-2016 standard explains that the VHT techniques are based on prior techniques, including the earlier HT (High Throughput) and OFDM-based functionality. EX1025, 2497. The HT PPDU format includes long training fields used in channel estimation. EX1025, 2346-2358. The OFDM PPDU format includes “two repetitions of a ‘long training sequence’ []used for channel estimation.” EX1025, 2283-2284. Legacy formats that predate VHT allowed for estimating a channel response based upon a received preamble, including received training symbols or sequences.

76. Other standards that predate 802.11 also included preamble sequences when transmitting data to the receiver. For example, the 802.11-1999 standard includes a PLCP preamble used for synchronization of data transmissions. EX1026, 151-152. Dr. Cooklev confirmed that he has no opinion regarding whether the previous 802.11-1999 standard defines a preamble sequence. EX1024, 38:1-9.

77. The 802.11a standard describes a PLCP frame format that includes a PCLP preamble field including “two repetitions of a ‘long training sequence’ []used for channel estimation.” EX1027, 7-8. Dr. Cooklev confirmed that he has no

opinion regarding whether the 802.11a standard defines a preamble sequence that included two training sequences used for channel estimation. EX1024, 41:2-14.

78. The WWISE proposal regarding a High Throughput extension to the 802.11 standard describes a PCLP frame format that includes a MIMO-OFDM PLCP Preamble sequence that “consists of a sequence of short symbols and long symbols.” EX1028, 31 and 37. The PCLP preamble transmits “two periods of the long symbol . . . for improved channel estimation accuracy.” *Id.*, 37.

79. The TGn Sync Proposal describes a PPDU format including short and long training sequences (STF and LTF). EX1029, 93-94. The document proposes an HT PCLP preamble that includes “a concatenation of the legacy preamble (identical to 802.11a/g) and a HT-specific preamble. *Id.*, 94. “There are two legacy long training symbols in the legacy long training field . . . to ensure channel estimation accuracy.” *Id.*, 103.

80. For all these reasons, Dr. Cooklev has failed to show that that the alleged secondary consideration (industry adoption) is the direct result of unique characteristics of the claimed invention.

81. Dr. Cooklev’s analysis also included the unfounded and unsupported assertions that “[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” and “most 802.11ac-compliant devices, including ‘smart’ televisions and phones, sold in the

United States incorporate the channel estimation technology claimed in the '862 patent.” EX1024, ¶¶ 147-148. Dr. Cooklev offers no evidence or support for these statements, nor does he explain how he came to these conclusions. These assertions are unreliable and irrelevant at least because they are untethered to any objective information.

Dated: Oct. 1, 2024

By:

A handwritten signature in dark ink, appearing to read 'J Wells', written over a horizontal line.

Jonathan Wells, Ph.D.
Scottsdale, Arizona