

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ZTE (USA) INC. AND COOLPAD TECHNOLOGIES, INC.,
Petitioners,

v.

BELL NORTHERN RESEARCH, LLC,
Patent Owner.

Case No. IPR2019-01437

Patent No. 7,990,842

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 7,990,842**

Claims 1-4, 8, 11, 14, and 19

TABLE OF CONTENTS

	Page
I. INTRODUCTION	1
II. MANDATORY NOTICES UNDER 37 C.F.R §42.8	3
A. Real Parties-In-Interest Under 37 C.F.R. §42.8(b)(1).....	3
B. Related Matters Under 37 C.F.R. § 42.8(b)(2)	3
C. Lead And Back-Up Counsel Under 37 C.F.R. §42.8(b)(3)	5
D. Service Information	6
III. PAYMENT OF FEES – 37 C.F.R. §42.103	7
IV. REQUIREMENTS FOR IPR UNDER 37 C.F.R. § 42.104.....	7
A. Grounds for Standing	7
B. Challenge Under 37 C.F.R. § 42.104(b) and Relief Requested	7
V. SUMMARY OF THE '842 PATENT	8
A. Background	8
B. Brief Description of the '842 Patent	11
C. Summary of the Prosecution History of the '842 Patent	14
D. Level of Ordinary Skill	16
VI. CLAIM CONSTRUCTION	17
A. “a standard wireless networking configuration for an Orthogonal Frequency Division Multiplexing scheme” (claim 1)	18
B. “a legacy wireless local area network device in accordance with a legacy wireless networking protocol standard” (claim 14).....	22
C. “extended long training sequence” (claims 1, 19)	23
D. “optimal extended long training sequence” (claims 1, 4, 14, 19)	25
VII. GROUND 1: CLAIMS 1, 2, 3, 4, 8, 11, 14, AND 19 ARE OBVIOUS OVER IEEE 802.11A IN VIEW OF POSITA KNOWLEDGE	26
A. Overview of IEEE 802.11a	26
B. Overview of POSITA knowledge	29

1.	POSITA Knew OFDM Systems and Methods Were Scalable to Additional Subcarriers	29
2.	POSITA Knew Peak-to-Average Power Ratio as a Known, Addressable Concept.....	33
C.	Obviousness in view of IEEE 802.11a and the knowledge of a POSITA	40
[1.P]	A wireless communications device, comprising:	42
[1.a]	a signal generator that generates an extended long training sequence; and.....	43
[1.b]	an Inverse Fourier Transformer operatively coupled to the signal generator, ...	45
[1.c]	wherein the Inverse Fourier Transformer processes the extended long training sequence from the signal generator and provides an optimal extended long training sequence with a minimal peak-to-average ratio, and.....	46
[1.d]	wherein at least the optimal extended long training sequence is carried by a greater number of subcarriers than a standard wireless networking configuration for an Orthogonal Frequency Division Multiplexing scheme.....	58
[2]	The wireless communications device according to claim 1, wherein at least the optimal extended long training sequence is carried by at least 56 active sub-carriers.	62
[3]	The wireless communications device according to claim 2, wherein the at least 56 active sub-carriers correspond to at least indexed sub-carriers -28 to $+28$	62
[4]	The wireless communications device according to claim 2, wherein the optimal extended long training sequence has a minimum peak-to-average power ratio of 3.6 dB.....	63
[8]	The wireless communications device according to claim 1, wherein a binary phase shift key encoding is used for each sub-carrier above the $+26$ indexed sub-carrier and below the -26 indexed sub-carrier.....	63
[11]	The wireless communications device according to claim 1, wherein the wireless communications device comprises a wireless mobile communications device.	64

[14]	The wireless communications device according to claim 1, wherein the optimal extended long training sequence is longer than a long training sequence used by a legacy wireless local area network device in accordance with a legacy wireless networking protocol standard.....	65
[19]	The wireless communications device according to claim 1, wherein the extended long training sequence or the optimal extended long training sequence is encoded using binary phase shift key encoding on each of the subcarriers.	66
VIII.	STATEMENT RESPONSIVE TO JULY 2019 TRIAL PRACTICE GUIDE UPDATE REGARDING PARALLEL <i>INTER PARTES</i> REVIEW PETITIONS.....	67
A.	The <i>Becton Dickinson</i> factors under § 325(d) favor institution.....	70
B.	The <i>General Plastic</i> factors suggest the Director/Board should not exercise discretion to deny this Petition under 35 U.S.C. § 316(b)	74
IX.	CONCLUSION.....	77

EXHIBIT LIST

Exhibit	Description
1101	U.S. Pat. No. 7,990,842 to Trachewsky et al. (“the ’842 patent”)
1102	Prosecution History of the ’842 patent (U.S. Patent Application No. 12/684,650)
1103	U.S. Provisional Patent Application No. 60/591,104 (“’104 Provisional”)
1104	U.S. Provisional Patent Application No. 60/634,102 (“’102 Provisional”)
1105	U.S. Patent No. 7,646,703 to Trachewsky et al. (“the parent patent”)
1106	Prosecution History of the parent patent (U.S. Patent Application No. 11/188,771)
1107	IEEE Std 802.11a-1999 (“IEEE”)
1108	Declaration of Dr. Paul Min
1109	Declaration of Jacob Robert Munford
1110	Plaintiff Bell Northern Research, LLC’s Patent Rule 3-1 and 3-2 Disclosure of Asserted Claims and Infringement Contentions in <i>Bell Northern Research, LLC v. ZTE Corporation</i> et al. (Case No. 3:18-cv-1786) (S.D. Cal.)
1111	Defendants’ Invalidity Contentions in <i>Bell Northern Research, LLC v. ZTE Corporation</i> et al. (Case No. 3:18-cv-1786) (S.D. Cal.)
1112	Defendants’ Joint Opening Claim Construction Brief in <i>Bell Northern Research, LLC v. ZTE Corporation</i> et al. (Case No. 3:18-cv-1786) (S.D. Cal.)
1113	Plaintiff’s Opening Claim Construction Brief in <i>Bell Northern Research, LLC v. ZTE Corporation</i> et al. (Case No. 3:18-cv-1786) (S.D. Cal.)
1114	Defendants’ Memorandum of Points and Authorities in Support of Their Joint Motion for Summary Judgment of Indefiniteness in <i>Bell Northern Research, LLC v. ZTE Corporation</i> et al. (Case No. 3:18-cv-1786) (S.D. Cal.)
1115	Supplemental Joint Claim Construction Hearing Statement Pursuant to P.L.R. 4.2 in <i>Bell Northern Research, LLC v. ZTE Corporation</i> et al. (Case No. 3:18-cv-1786) (S.D. Cal.)
1116	Defendants’ Joint Responsive Claim Construction Brief in <i>Bell Northern Research, LLC v. ZTE Corporation</i> et al. (Case No. 3:18-cv-1786) (S.D. Cal.)

Exhibit	Description
1117	Plaintiff's Responsive Claim Construction Brief in <i>Bell Northern Research, LLC v. ZTE Corporation et al.</i> (Case No. 3:18-cv-1786) (S.D. Cal.)
1118	Plaintiff's Opposition to Defendants' Joint Motion for Summary Judgment of Indefiniteness in <i>Bell Northern Research, LLC v. ZTE Corporation et al.</i> (Case No. 3:18-cv-1786) (S.D. Cal.)
1119	U.S. Patent Application Publication No. 2004/0093545 to Khandani et al. ("Khandani")
1120	U.S. Provisional Application No. 60/314,168 ("Khandani '168 Provisional")
1121	U.S. Provisional Application No. 60/314,169 ("Khandani '169 Provisional")
1122	U.S. Patent No. 7,318,185 to Khandani et al. ("Khandani patent")
1123	U.S. Patent No. 7,453,793 to Jones et al. ("Jones")
1124	U.S. Pub. No. 2005/0286474 to van Zelst et al. ("van Zelst")
1125	U.S. Pub. No. 2007/0060073 to Boer et al. ("Boer")
1126	IEEE 802.11-1999 ("IEEE 802.11-1999")
1127	VK Jones et al., <i>Interest for HDR extension to 802.11a</i> , IEEE 802.11-02/081r0, January 2001 ("Interest for HDR extension")
1128	Robert Gagliardi, <i>Introduction to Communications Engineering</i> , (2nd ed. 1988, Wiley) ("Gagliardi")
1129	H. Xue, A. Nix, M. Beach, M. Li, J. McGeehan, T. Wilkinson, I. Johnson, and S. Barton, <i>Air Interface Considerations for Wireless LANS</i> , Radio Relay Systems, 11–14 October 1993 ("Xue")
1130	Stuart J. Lipoff & Arthur D. Little, Tutorial: Implementation Issues for Wireless Spread Spectrum Data Communications Links for use in License Free Applications, IEEE Workshop on Wireless Local Area Networks (May 9, 1991) ("Lipoff")
1131	Samir S. Soliman and Mandyam D. Srinath, Continuous and Discrete Signals and Systems," (1990) ("Soliman and Srinath")
1132	M. L. Doelz, E. T. Heald, and D. L. Martin, <i>Binary Data Transmission Techniques for Linear Systems</i> , Proceedings of the IRE, Volume 45, May 1957, at 656 – 661 ("Doelz")
1133	E. T. Heald, R. G. Clabaugh, <i>A Predicted Wave-Signalling Phase-Shift Telegraph System</i> , AIEE Transactions (Electrical Engineering), Vol. 76, pt 1, July 1957, at 316-319 ("Heald")

Exhibit	Description
1134	R. W. Chang, <i>Synthesis of Band-Limited Orthogonal Signals for Multichannel Data Transmission</i> , Bell System Technical Journal, vol. 45, December 1966, at 1775-1796 (“Chang”)
1135	B. R. Saltzberg, <i>Performance of an Efficient Parallel Data Transmission System</i> ,” IEEE Transactions on Communication Technology, Vol. COM-15, Number 6, December 1967, at 805–811 (“Saltzberg”)
1136	R. W. Chang and R. A. Gibby, <i>A Theoretical Study of Performance of an Orthogonal Multiplexing Data Transmission Scheme</i> , IEEE Transactions on Communication Technology, Vol. COM-16, Number 4, August 1968, at Fig. 1 (“Gibby”)
1137	S. B. Weinstein and P. M. Ebert, “Data Transmission by Frequency-Division Multiplexing Using the Discrete Fourier Transform,” IEEE Transactions on Communication Technology, Vol. COM-19, Number 5, October 1971, at 628–634 (“Weinstein”)
1138	U.S. Patent No. 6,654,339 to Böhnke et al. (“Böhnke”)
1139	Richard van Nee, and Boer, Jan, <i>Scaleable OFDM Radio Parameters</i> , IEEE P 802.11-97/92, Sept. 23, 1997, available at http://www.ieee802.org/11/Documents/DocumentArchives/1997_docs/70923.pdf (“Scaleable OFDM”)
1140	Richard van Nee, <i>OFDM for High Speed Wireless Networks</i> , IEEE P 802.11-97/123, Nov. 1997, available at http://www.ieee802.org/11/Documents/DocumentArchives/1997_docs/71232.pdf (“OFDM for HSWN”)
1141	Naftali Chayat, and Tal Kaitz, <i>The Effect of the Number of Subcarriers in OFDM</i> , IEEE 802.11-99/020, Jan. 10, 1999, available at http://www.ieee802.org/11/Documents/DocumentArchives/1999_docs/90207A-Effect-of-number-of-carriers.doc (“Effect of OFDM Subcarriers”)
1142	Naftali Chayat, <i>OFDM for a Wideband Frequency Hopping PHY</i> , IEEE 802.11-00/310, Sept. 20, 2000, available at http://www.ieee802.org/11/Documents/DocumentArchives/2000_docs/03108W-OFDM-for-WBFH.doc (“OFDM for WBFH PHY”)
1143	Steve Halford, Mark Webster, and Jim Zyren, <i>Overview of OFDM for 802.11g</i> , IEEE 802.11-01/059, Jan. 2001, available at https://mentor.ieee.org/802.11/dcn/01/11-01-0059-00-000g-overview-of-ofdm-for-802-11g.ppt (“802.11g OFDM Overview”)

Exhibit	Description
1144	International Patent Application Publication WO 02/39598 to Crawford (“Crawford”)
1145	<i>Digital Audio Broadcasting – radio now and for the future</i> , EBU Technical Review, 1995. (“DAB Article”)
1146	ITU G.992.1 <i>Asymmetric Digital Subscriber Line (ADSL) Transceivers</i> , June 1999. (“ADSL Standard”)
1147	IEEE “IEEE Std 802.11n-2009” (“IEEE 802.11n”)
1148	IEEE Std 802.11ac-2013” (“IEEE 802.11ac”)
1149	Kaveh Pahlavan, <i>The First IEEE Workshop on Wireless LANS: Preface</i> , available at http://www.cwins.wpi.edu/wlans91/ , http://www.cwins.wpi.edu/wlans91/scripts/preface.html (“First IEEE WLAN Workshop Preface”)
1150	Plaintiff Bell Northern Research, LLC’s Patent L.R. 3.6 Amended Disclosure of Asserted Claims and Infringement Contentions in <i>Bell Northern Research, LLC v. ZTE Corporation et al.</i> (Case No. 3:18-cv-1786) (S.D. Cal.)
1151	Bell Northern Research LLC’s Notice of Subpoena to Broadcom Corporation
1152	Masahiro Morikura and Masato Mizoguchi, <i>Proposal for an improved long training symbol phase</i> , IEEE 802.11-99/115, May 1999 (“Proposal for improved LTS phase”)

I. INTRODUCTION

ZTE (USA) Inc. (“ZTE”) and Coolpad Technologies, Inc. (“Coolpad”) (collectively “Petitioners”) petition for *Inter Partes* Review (“Petition”) under 35 U.S.C. §§ 311-319 and 37 C.F.R. §42 of claims 1-4, 8, 11, 14, and 19 (“the Challenged Claims”) of U.S. Patent 7,990,842 (“the ’842 patent”) owned by Bell Northern Research, LLC (“BNR”).

On June 12, 2019, Huawei Technologies Co., Ltd. filed a petition (“Huawei IPR Petition”) on the ’842 patent under PTAB Case No. IPR2019-01174. On July 18, 2019, ZTE and Coolpad filed a petition (“ZTE/Coolpad follow-on IPR Petition”) on the ’842 patent under PTAB Case No. IPR2019-01345. The ZTE/Coolpad follow-on IPR Petition and the Huawei IPR Petition are identical in their invalidity grounds, prior art, analyses, and evidence. Both request review of the same claims, based on the same references in the same combinations, rely on the same expert, and the same expert declaration. At this time, the Huawei IPR Petition and ZTE/Coolpad follow-on Petitions are waiting for the Board’s institution decision.

Petitioners file this additional Petition in part to address a dispute about the priority date of the ’842 patent. In the corresponding district court case, the alleged Patent Owner asserted that the priority date of the ’842 patent is “[a]t least as early as July 27, 2004. In the district court litigation, BNR is contending an

earlier invention date on or after January 1, 2002 based on alleged early activities and documentation on the conception and reduction to practice of the claimed invention prior to July 27, 2004 and is collecting information from Broadcom that BNR contends will establish an earlier invention date for the claimed subject

5 matter prior to the effective date of one or more prior art references in the Huawei and ZTE/Coolpad IPR petitions. After filing of the Huawei IPR Petition on June 12, 2019, Patent Owner served confidential discovery responses consistent with its earlier amended infringement contentions asserting that earlier invention dates are expected to be: on or after January 1, 2002 for the '842 Patent. Ex. 1150.

10 On July 24, 2019, BNR informed Petitioners that it subpoenaed Broadcom for information related to the '842 patent and its inventors. Ex. 1151.

In light of the above newly developing contention of an early pre-filing invention dates by BNR and in consideration of the one-year deadline under § 315(b), Petitioners submit this Petition to resolve the validity of the '842 patent
15 claims using § 102(b) art that will not be impacted by any belated attempt to move the priority date of the '842 patent. In accordance with the AIA Trial Guide published on July 15, 2019, Petitioners discuss the parallel petitions in Section VIII.

This Petition shows, by a preponderance of the evidence, a reasonable
20 likelihood that Petitioners will prevail on at least one of the challenged claims of

the '842 patent based on prior art that the U.S. Patent Office did not have before it or did not fully consider during prosecution, and that renders these claims anticipated or obvious. Accordingly, Petitioners request the Board institute *inter partes* review of claims 1-4, 8, 11, 14, and 19.

5 **II. MANDATORY NOTICES UNDER 37 C.F.R §42.8**

A. Real Parties-In-Interest Under 37 C.F.R. §42.8(b)(1)

 All real parties in interest for this Petition are identified below:

 For Petitioner ZTE (USA) Inc., all real parties in interest are: ZTE Corporation, ZTE (USA) Inc., and ZTE (TX), Inc.

10 For Petitioner Coolpad Technologies, Inc., all real parties in interest are: Coolpad Technologies, Inc., Coolpad Group, Ltd., Yulong Computer Telecommunication Technology (Shenzhen) Co., Ltd. (identified as Yulong Computer Communications), Digital Tech Inc. (BVI), and Yulong Infotech Inc. (BVI).

15 No other parties had access to or control over the present Petition and no other parties funded the present Petition.

B. Related Matters Under 37 C.F.R. § 42.8(b)(2)

 BNR—the alleged Patent Owner—filed a complaint on August 1, 2018 in the U.S. District Court for the Southern District of California against both Coolpad
20 (Case No. 3:18-cv-1783) and ZTE (Case No. 3:18-cv-1786). The Coolpad

complaint asserted 5 patents, including the '842 patent.¹ The ZTE complaint asserted 6 patents, including the '842 patent. BNR filed a first amended complaint against ZTE on October 15, 2018 asserting two additional patents. Both original complaints were served on Coolpad and ZTE on August 3, 2018.

5 BNR also filed complaints in the Southern District of California alleging infringement of the '842 patent by other parties: Huawei Device (Dongguan) Co., Ltd., Huawei Device (Shenzhen) Co., Ltd., and Huawei Device USA, Inc. (3:18-cv-1784); Kyocera Corporation and Kyocera International Inc. (3:18-cv-1785); and
10 LG Electronics, Inc., LG Electronics U.S.A. Inc., and LG Electronics Mobile Research U.S.A., LLC (3:18-cv-2864). Neither Coolpad nor ZTE is a real party-in-interest to any of these above-listed district court proceedings. Also, none of the parties in these district court proceedings is a real party-in-interest in the proceedings involving Coolpad or ZTE or in privity with Coolpad or ZTE.

The '842 patent is in the same family as U.S. Patent No. 7,646,703 and U.S.
15 Patent No. 8,477,594. Petitioners previously filed a petition related to the '842 patent in IPR2019-1345. Other petitioners have filed petitions related to the '842 patent in IPR2019-1174.

¹ U.S. Patent No. 8,792,432 was dismissed on November 29, 2018. (3:18-cv-01783-CAB-BLM Doc. No. 42).

C. Lead And Back-Up Counsel Under 37 C.F.R. §42.8(b)(3)

Petitioners provide the following designation of counsel.

Lead Counsel	Back-Up Counsel
Amol A. Parikh USPTO Reg. No. 60,671 McDERMOTT WILL & EMERY 444 West Lake Street, Suite 4000 Chicago, IL 60606-0029 Phone: 312-984-6477 Fax: 312-984-7700 amparikh@mwe.com jrbaker@mwe.com	Charles M. McMahon USPTO Reg. No. 44,926 McDERMOTT WILL & EMERY 444 West Lake Street, Suite 4000 Chicago, Illinois 60606-0029 Phone: 312-984-7641 Fax: 312-984-7700 cmcMahon@mwe.com Thomas M. DaMario USPTO Reg. No. 77,142 McDERMOTT WILL & EMERY 444 West Lake Street, Suite 4000 Chicago, Illinois 60606-0029 Phone: 312-984-7527 Fax: 312-984-7700 tdamario@mwe.com Jiaxiao Zhang USPTO Reg. No. 63,235 McDERMOTT WILL & EMERY 18565 Jamboree Road, Suite 250 Irvine, California 92612-2565 Phone: 949-757-6398 Fax: 949-851-9348 jiazhang@mwe.com Counsel for Petitioner ZTE (USA) Inc.

Additional Back-Up Counsel	
Thomas N. Millikan, Reg. No. 72,316 PERKINS COIE LLP 11452 El Camino Real, Suite 300 San Diego, CA 92130-2080 Tel.: 858.720.5723 Fax: 858.720.5799 millikan-ptab@perkinscoie.com	Joseph P. Reid, Reg. No. 72,317 PERKINS COIE LLP 11452 El Camino Real, Suite 300 San Diego, CA 92130-2080 Tel.: 858.720.5764 Fax: 858.720.5799 reid-ptab@perkinscoie.com
Bing Ai, Reg. No. 43,312 PERKINS COIE LLP 11452 El Camino Real, Suite 300 San Diego, CA 92130-2080 Tel.: 858.720.5707 Fax: 858.720.5799 ai-ptab@perkinscoie.com	John P. Schnurer, Reg. No. 52,196 PERKINS COIE LLP 11452 El Camino Real, Suite 300 San Diego, CA 92130-2080 Tel.: 858.720.5705 Fax: 858.720.5799 schnurer-ptab@perkinscoie.com
Yun (Louise) Lu, Reg. No. 72,766 PERKINS COIE LLP 11452 El Camino Real, Suite 300 San Diego, CA 92130-2080 Tel.: 858.720.5732 Fax: 858.720.5799 lu-ptab@perkinscoie.com	James Young Hurt, (<i>pro hac vice</i> to be submitted) PERKINS COIE LLP 11452 El Camino Real, Suite 300 San Diego, CA 92130-2080 Tel.: 858.720.5780 Fax: 858.720.5799 JHurt@perkinscoie.com Counsel for Petitioner Coolpad Technologies, Inc.

D. Service Information

Please address all correspondence to the address above. Petitioners consent to electronic service by email at ZTEBNR-PTAB@mwe.com (referencing No. IPR2019-01437) and PerkinsServiceCoolpad-BNR@perkinscoie.com (referencing No. IPR2019-01437 and cc'ing docketipr@perkinscoie.com).

III. PAYMENT OF FEES – 37 C.F.R. §42.103

Petitioners authorize the Office to charge Deposit Account No. 50-0417 for the petition fee set in 37 C.F.R. §42.15(a) and for any other required fees.

IV. REQUIREMENTS FOR IPR UNDER 37 C.F.R. § 42.104

5 A. Grounds for Standing

Petitioners certify that the '842 patent is available for IPR and that
Petitioners are not barred or estopped from requesting IPR.

B. Challenge Under 37 C.F.R. § 42.104(b) and Relief Requested

10 Petitioners request an IPR of claims 1-4, 8, 11, 14, and 19 on the grounds
listed below, and requests that each of the Challenged Claims be found
unpatentable. In support, this petition includes a declaration of Paul Min (Ex.
1108).

Ground	'842 Patent Claims	Basis for Rejection
1	1-4, 8, 11, 14, 19	§103 – “IEEE Std 802.11a-1999” (“IEEE 802.11a”)

The '842 patent claims priority to U.S. Provisional Application No.
60/634,102, filed December 8, 2004, and U.S. Provisional Application No.
15 60/591,104, filed July 27, 2004. As noted above, Patent Owner has asserted an
invention date of January 1, 2002. Accordingly, for purposes of this petition,
Petitioners treat January 1, 2002 as the earliest possible priority date of the '842
patent.

The evidence here confirms that IEEE 802.11a published on December 30, 1999, and thus qualifies as prior art under at least 35 U.S.C. §102(b). Ex. 1109, ¶¶5-8.

V. SUMMARY OF THE '842 PATENT

5 A. Background

The '842 patent explains that wireless communication devices include “a built-in radio transceiver (i.e., receiver and transmitter)” or are “coupled to an associated radio transceiver.” Ex. 1101, 1:24-28. A transmitter usually includes a data modulation stage, where raw data is converted into baseband signals;
10 intermediate frequency stages, where baseband signals are mixed with local oscillations to produce RF signals; and a power amplifier that amplifies the RF signals prior to transmission via an antenna. *Id.*, 1:28-36.

The '842 patent explains that “[d]ifferent wireless devices in a wireless communication system may be compliant with different standards or different
15 variations of the same standard,” such as 802.11a, 802.11b, 802.11g, and 802.11n, which are all extensions of the 802.11 standard. *Id.*, 1:50-60. A wireless local area network (WLAN) may include devices that are compliant with different standards. *Id.*, 1:60-62. Devices that are “compliant with older versions are considered to be legacy devices.” *Id.*, 1:62-65.

Devices that are compliant with “both the 802.11a and the 802.11g standard use an orthogonal frequency divisional multiplexing (OFDM) encoding scheme,” a technique for “transmitting large amounts of digital data over a radio wave” by “spreading a single data stream over a band of sub-carriers.”² *Id.*, 2:8-14. In both
5 802.11a and 802.11g compliant devices, the band includes 64 sub-carriers, where only 52 are used, or active. *See id.*, 2:14-16. Four of the 52 active sub-carriers are used “as a reference to disregard frequency or phase shifts of the signal during transmission.” *Id.*, 2:16-18. The remaining 48 sub-carriers are used to provide pathways for sending information in parallel. *Id.*, 2:19-20. All 52 active sub-
10 carriers are modulated, for example, using binary phase shift key (BPSK) encoding. *Id.*, 2:20-23. Additionally, 802.11a and 802.11g-compliant devices “use sub-carriers -26 to +26, with the 0-index subcarrier set to 0, where the 0-index subcarrier is the carrier frequency.” *Id.*, 2:23-27. Data packets used in 802.11a and 802.11g compliant devices start with “a preamble which includes a short training
15 sequence followed by a long training sequence,” where the long training sequence

² The '842 patent uses “sub-carriers” and “subcarriers” interchangeably, whereas IEEE 802.11a uses “subcarriers.” There is no difference in meaning attributed to the hyphenation. Ex. 1108 at n. 4.

is “defined such that each of sub-carriers -26 to +26 has one BPSK constellation point, either +1 or -1. *Id.*, 2:29-35.

The annotated image below shows a “long training sequence L_1 that is used to generate the signal representing the long training symbol in a conventional

802.11a preamble.” Ex. 1123, 2:14-16, FIG. 2. The L_1 sequence “represents values [] used for each of the 64 subcarriers,” with the first value corresponding to the 0-index subcarrier (*e.g.*, DC subcarrier), followed by values for subcarrier indices +1 to +31, followed by values for subcarrier indices -32 to -1. *Id.*, 2:16-27; *see also* Ex. 1108, ¶¶39-45. In the L_1 sequence, the DC value and the values at subcarrier indices +27 to +31 and -32 to -27 (highlighted in yellow) are zero. Ex. 1101, FIG. 2. For illustrative purposes, index numbers are annotated here in red:

$$L_1 = \{ \begin{matrix} 0^0 & 1^1 & -1^2 & -1^3 & 1^4 & 1^5 & -1^6 & 1^7 & -1^8 & 1^9 & -1^{10} & -1^{11} & -1^{12} & -1^{13} & -1^{14} & 1^{15} \\ 1^{16} & -1^{17} & -1^{18} & 1^{19} & -1^{20} & 1^{21} & -1^{22} & 1^{23} & 1^{24} & 1^{25} & 1^{26} & 0^{27} & 0^{28} & 0^{29} & 0^{30} & 0^{31} \\ 0^{-32} & 0^{-31} & 0^{-30} & 0^{-29} & 0^{-28} & 0^{-27} & 1^{-26} & 1^{-25} & -1^{-24} & -1^{-23} & -1^{-22} & -1^{-21} & -1^{-20} & -1^{-19} & -1^{-18} & 1^{-17} \\ 1^{-16} & 1^{-15} & 1^{-14} & 1^{-13} & 1^{-12} & -1^{-11} & -1^{-10} & 1^{-9} & 1^{-8} & -1^{-7} & 1^{-6} & -1^{-5} & 1^{-4} & 1^{-3} & 1^{-2} & 1^{-1} \end{matrix} \}$$

FIG. 2
(PRIOR ART)

Id. (color added, annotated).

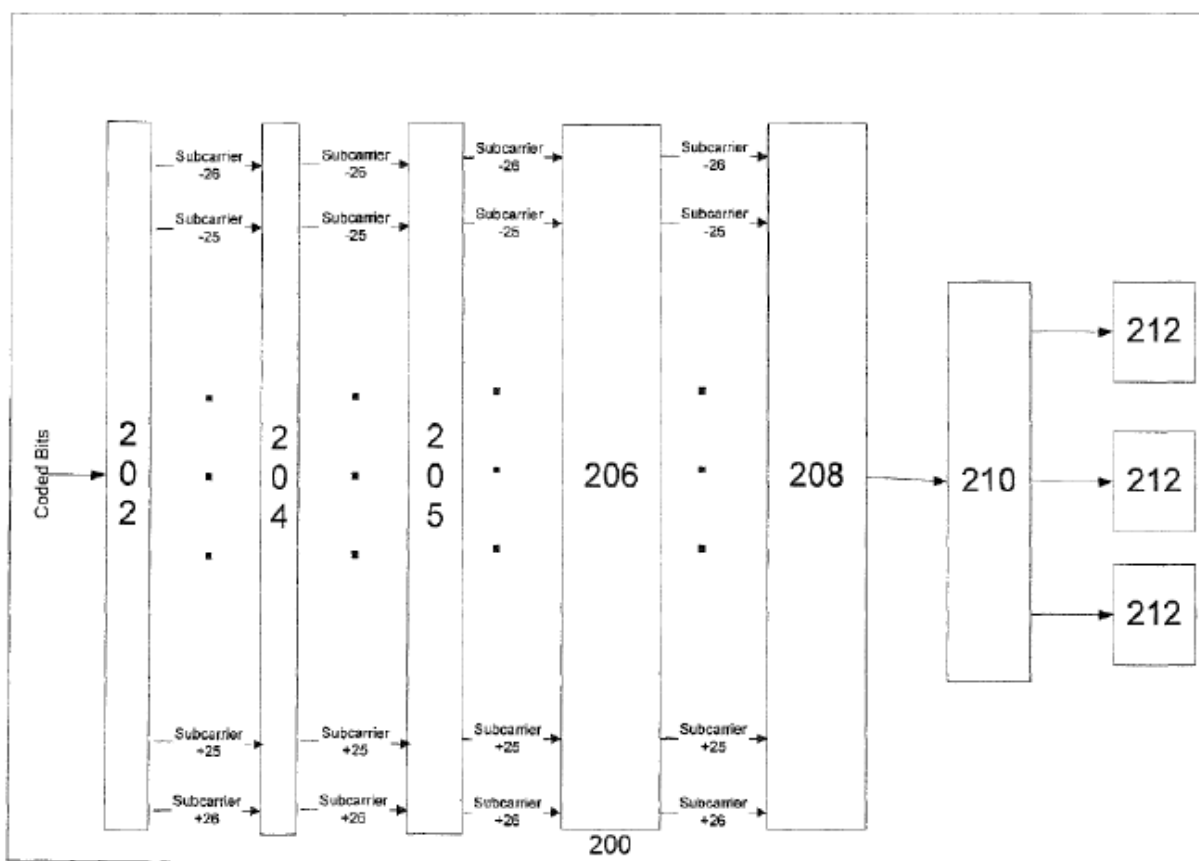
According to the '842 patent, there existed “a need to create a long training sequence of minimum peak-to-average ratio that uses more sub-carriers without interfering with adjacent channels” where the long training sequences (LTSs) are

“usable by legacy devices in order to estimate channel impulse response and to estimate carrier frequency offset between a transmitter and a receiver.” Ex. 1101, 2:36-43.

B. Brief Description of the '842 Patent

5 Generally, the '842 patent purportedly describes a “network device for generating an expanded long training sequence with a minimal peak-to-average ratio.” Ex. 1101, Abstract. Providing such an expanded long training sequence (expanded LTS) “thereby decreases power back-off.” *Id.*, 4:4-6. The expanded LTS is “usable by 802.11a or 802.11g systems only if the values at sub-carriers
10 –26 to +26 are identical to those of the current long training sequence used in 802.11a and 802.11g systems,” so “+1 or –1 binary phase shift key (BPSK) encoding [is used] for each new subcarrier and the long training sequence of 802.11a or 802.11g systems is maintained.” *Id.*, 4:10-18.

Figure 2 shows a block diagram of a processor configured to generate an
15 expanded LTS, where the processor includes a symbol mapper 202, a frequency domain window 204, a signal generating circuit 205, an inverse fast Fourier transform (IFFT) module 206, a serial to parallel module 208, a digital transmit filter and/or time domain window module 210, and digital to analog converters 212. *Id.*, FIG. 2, 4:30-37.



Ex. 1101, FIG. 2.

The '842 patent discloses the signal generating circuit generating the expanded LTS, so that if 56 active sub-carriers are being used, the expanded LTS is stored in sub-carriers -28 to +28, except the 0-index sub-carrier, which is set to 0. *Id.*, 5:14-19. Figure 4 (reproduced below) shows an LTS with a minimum peak-to-average power ratio (PAPR) that is used in 56 active sub-carriers. *Id.* The '842 patent states that “[o]ut of the 16 possibilities [2^4 permutations] for the 4 new sub-carrier positions, the sequence illustrated in Figure 4 has the minimum [PAPR] of 3.6 dB.” *Id.*, 5:16-19. As shown in Figure 4, the values at subcarrier indices

+27 and +28 and -28 and -27 (annotated below), which were previously set to 0 in LTSs that used only 52 active subcarriers, have non-zero values:

+1	+1	1	1	-1	-1	1	1	-1	1	-1	1	1	1
-28	-27	26	-25	-24	-23	-22	-21	-20	-19	-18	-17	-16	-15

Sub-carrier index

1	1	1	-1	-1	1	1	-1	1	-1	1	1	1	1	0
-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0

Sub-carrier index

+1	-1	-1	1	1	-1	1	-1	1	-1	-1	-1	-1	-1
1	2	3	4	5	6	7	8	9	10	11	12	13	14

Sub-carrier index

1	1	-1	-1	1	-1	1	-1	1	1	1	1	-1	-1
15	16	17	18	19	20	21	22	23	24	25	26	27	28

Sub-carrier index

LONG TRAINING SEQUENCE FOR 56 ACTIVE
FIGURE 4

Ex. 1101, FIG. 4 (annotated red boxes added).

- 5 The '842 patent also discloses the signal generating circuit generating the expanded LTS, so that if 63 active sub-carriers are being used, the expanded LTS is stored in sub-carriers -32 to +31, except the 0-index sub-carrier, which is set to 0. *Id.*, 4:45-50. Figure 5 (reproduced below) shows an LTS with a minimum peak-to-average power ratio (PAPR) that is used in 63 active sub-carriers. *Id.*,
- 10 5:20-22. The '842 patent states that “[o]ut of the 2,048 $[2^{11}]$ permutations] for the 11 new sub-carriers, the sequence illustrated in Figure 5 has the minimum [PAPR] of 3.6 dB.” *Id.*, 5:22-25. As shown in Figure 5, the values at subcarrier indices

+27 to +31 and -32 to -27 (highlighted below), which were previously set to 0 in LTSs that used only 52 active subcarriers, have non-zero values:

-1	-1	+1	+1	+1	+1	1	1	-1	-1	1	1	-1	1	-1	1	1	1
-32	-31	-30	-29	-28	-27	-26	-25	-24	-23	-22	-21	-20	-19	-18	-17	-16	-15

Sub-carrier index

1	1	1	-1	-1	1	1	-1	1	-1	1	1	1	1	0
-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0

Sub-carrier index

+1	-1	-1	1	1	-1	1	-1	1	-1	-1	-1	-1	-1
1	2	3	4	5	6	7	8	9	10	11	12	13	14

Sub-carrier index

1	1	-1	-1	1	-1	1	-1	1	1	1	1	-1	-1	-1	+1	-1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

Sub-carrier index

Ex. 1101, FIG. 5 (color added).

5 C. Summary of the Prosecution History of the '842 Patent

The application that led to the '842 patent was filed on January 9, 2010, and claimed priority to a parent application that was filed on July 26, 2005, a provisional application that was filed on December 8, 2004, and a provisional application that was filed on July 27, 2004. See Ex. 1101 at 1; Ex. 1105; Ex. 1104; Ex. 1103.

In the parent application, the USPTO issued only one office action, on June 22, 2009. Ex. 1106 at 56. The office action indicated claims 1-10 were allowed,

and provided the following statement of reasons for the indication of allowable subject matter:

Re Claims 1, 9 and 10, prior art fails to teach s [sic] signal processing circuit that generates expanded long train sequence and inverse fast Fourier transform (IFFT) module processes the expanded sequence and produces optimal expanded long train sequence with minimal peak-to-average power ratio whereby the expanded and optimal long train sequences are stored on multiple sub-carriers than standard configuration for orthogonal frequency division multiplexing scheme.

Ex. 1106 at 58. The office action also rejected claims 11-15 under 35 U.S.C. § 101 “as not falling within one of the four statutory categories of invention.” The office action referenced “the May 15, 2018 memorandum issued by Deputy Commissioner for Patent Examining Policy John J. Love, titled ‘Clarification of “Processes” under 35 U.S.C. 101’),” and stated that “[t]he instant claims neither transform underlying subject matter nor positively tie to another statutory [sic] category that accomplishes the claimed method steps, and therefore do not qualify as a statutory process.”

In response, the applicant amended the claims on July 29, 2009 to recite “Inverse Fourier Transformer” (instead of “Inverse Fourier Transform”), to recite that the method was performed “in a wireless communication device,” and added new claims reciting specific examples of the network device. Ex. 1106 at 44. The examiner issued a Notice of Allowance on November 17, 2009. *Id.* at 34.

The claims of the '842 patent were allowed after a brief examination that included only double patenting rejections. The '842 patent was filed as a continuation application, using the parent application. Ex. 1102 at 62-79. A concurrently-filed preliminary amendment canceled all but original claim 1. *Id.* at 5 60, 71-72. In the first Office Action, the examiner rejected claim 1 based on “same invention”-type double patenting over the parent patent. *Id.* at 48. Applicant responded by canceling claim 1 and adding claims 16-35. *Id.* at 37-43. In the second Office Action, the examiner rejected claims 16-35 under obviousness-type double patenting over the parent patent. *Id.* at 32-36. In response, Applicant filed 10 a terminal disclaimer. *Id.*, 23-27. The '842 patent was then allowed on April 18, 2011. *Id.*, 14.

D. Level of Ordinary Skill

For purposes of this IPR, Petitioners submit that a person of ordinary skill in the art at the time of the alleged invention (a “POSITA”) would have had at least a 15 Bachelor’s degree in Electrical Engineering, or some similar technical field, along with two to three years of experience with wireless networks, such as experience with wireless local area or mobile networks. Additional education could substitute for some of the experience, and substantial experience could substitute for some of the educational background. As discussed by Petitioners’ expert Dr. Min, this 20 level of ordinary skill in the art is supported by the state of the art of wireless

communication systems and networks at that time, the related types of problems, solutions, and standards, and then-existing technology. Dr. Min also considered the education and experience of those working in the field at that time, which included the inventors, and their level of education and experience. Ex. 1108,

5 ¶¶29-32. Dr. Min was at least a person of ordinary skill in the art during the relevant time period. Ex. 1108, ¶33.

VI. CLAIM CONSTRUCTION

All claim terms are construed according to the *Phillips* standard. *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005); 37 C.F.R. § 42.100. The following
10 construction is provided to assist the Board in assessing the plain and ordinary meaning of the claims under the *Phillips* standard.

Petitioners notify the Board here that the claim terms discussed below are subject to alternative interpretations,³ as described below. For each term, the claim

³ The Board has previously authorized the use of alternative constructions in IPR petitions, and Petitioners should be treated no differently here. *General Electric Co. v. Vestas Wind Systems A/S*, IPR2018-00928, Paper 9, 12-16 (PTAB Nov. 5, 2018); *Intel Corp. v Qualcomm Inc.*, IPR2018-01340, Paper 8, 11-13 (PTAB Jan. 15, 2019); *Hologic, Inc. v Enzo Life Sciences, Inc.*, IPR2018-00019, Paper 21, 7 (PTAB Nov. 28, 2018).

scope encompasses the prior art in Ground 1 under both alternatives, so Petitioners recognize the Board may decide no formal construction is necessary at the institution stage. *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011) (“claim terms need only be construed to the extent necessary to resolve the controversy”). In other words, the Ground cited here applies to the challenged claims—regardless of whether the Board adopts a formal construction of these four terms—due to the straightforward overlap between the cited prior art examples and the preferred embodiment of the ’842 patent.

A. “a standard wireless networking configuration for an Orthogonal Frequency Division Multiplexing scheme” (claim 1)

According to a first interpretation, the phrase “a standard wireless networking configuration for an Orthogonal Frequency Division Multiplexing scheme” means “a standard issued by a Standard Setting Organization (for example, IEEE or 3GPP) utilizing an Orthogonal Frequency Division Multiplexing scheme.” Under this interpretation, the claim term encompasses the preferred embodiment of the ’842 patent, which states that “[d]evices implementing both the 802.11a and 802.11g standards use an orthogonal frequency division multiplexing (OFDM) encoding scheme” and that “[i]n 802.11a and 802.11g compliant devices, only 52 of the 64 active subcarriers are used.” Ex. 1101, 2:8-10, 2:14-16. As detailed below, the IEEE 802.11a standard, modified by the knowledge of a

POSITA, teaches this same LTS with more than the 52 subcarriers used in the 802.11a or 802.11g standard. *Infra*, Sections VII.A–VII.C (analysis of element [1.d]); Ex. 1108, ¶¶207-210.

According to a second interpretation, the claim phrase plainly encompasses
5 at least the preferred embodiment in the specification, but the outermost
boundaries of this claim term are ambiguous for purposes of determining
infringement. There is no dispute that, according to the preferred embodiment, the
claim scope would encompass 802.11a or 802.11g standards of the inventors’
preferred embodiment: “The inventive expanded long training sequence may be
10 used by 802.11a or 802.11g devices...” Ex. 1101, 4:6-8. 4:10-19. Under this
interpretation, although a POSITA would recognize that 802.11a and 802.11g
standards fall within the scope of the claim (and are readily comparable to the prior
art examples cited below), the outermost boundaries of “a standard wireless
networking configuration ...” are not defined for purposes of determining
15 infringement⁴—the same scenario in which the Board has recently confirmed that a

⁴ POSITA would know that the number of subcarriers for carrying the training sequence is configured differently for different standards (*e.g.*, 52 subcarriers for

PTAB trial was proper. *Mylan Pharm. Inc. v. Horizon Pharma USA, Inc.*, IPR2018-00272, Pap. 20, 6-8 (PTAB March 28, 2019) (“we need not necessarily determine the outer boundaries of a claim in reaching a conclusion as to whether the asserted prior art anticipates a claim or renders it obvious”). As detailed below, 802.11a, as modified by the knowledge of a POSITA, teaches LTSs with more subcarriers than used in 802.11a or 802.11g systems, and the evidence here confirms this recognizable overlap with the preferred embodiment of the ’842 patent. *Infra*, Sections VII.A-VII.C (analysis of element [1.d]); Ex. 1108, ¶¶53, 134-188.

Regardless of which interpretation of this term is used here, the ’842 patent is ripe for review in a full PTAB trial, especially where the prior art teaches essentially the same disclosure as the preferred embodiment of the ’842 patent.⁵

802.11a / 802.11g; 56 subcarriers for 802.11n). The intrinsic record is unclear as to whether, for example, the 802.11n system would be considered a “standard wireless networking configuration” under this claim. See Ex. 1108, ¶208.

⁵ To be clear, the Petition sets forth alternative interpretations for this phrase along with an ample demonstration of the unpatentability of claims under each

alternative interpretation, which is sufficient for institution of review. *General Electric*, Paper 9, 12-16; *Intel*, Paper 8, 11-13. Also, in cases where the outermost boundary of the claim scope is ambiguous, but the same preferred embodiment is recognized both in the specification and the prior art, the Board has held it is not paralyzed against assessing whether the claim encompasses the strikingly similar prior art structure for purposes of an anticipation/obviousness inquiry. *Mylan*, IPR2018-00272, Pap. 20, 6-8 (PTAB March 28, 2019) (“we need not necessarily determine the outer boundaries”). Indeed, this exact tribunal has compared ambiguous claims to the prior art for purposes of considering unpatentability. *Chicago Mercantile Exchange, Inc. v. 5th Market, Inc.*, CBM2013-00027, Paper 33, 3 (PTAB 2014) (claims were both indefinite and obvious); *SAP America, Inc. v. Lakshmi Arunachalam*, CBM2013-00013, Paper 61, 29 (PTAB 2014). Also, the Federal Circuit does not forbid the Board from doing so. *In re Gee*, 614 Fed. Appx. 495, 497 (Fed. Cir. 2015) (finding no error in the PTAB decision, which compared the indefinite claims to the prior art for purposes of an obviousness analysis).

B. “a legacy wireless local area network device in accordance with a legacy wireless networking protocol standard” (claim 14)

According to a first interpretation, the phrase “a legacy wireless local area network device in accordance with a legacy wireless networking protocol

5 standard” means “wireless local area network device using an earlier version of a standard issued by a Standard Setting Organization (SSO) (for, example, IEEE or 3GPP).” Under this interpretation, the claim term encompasses the preferred embodiment of the ’842 patent, which states that the “inventive expanded long training sequence may be used by 802.11a or 802.11g devices.” Ex. 1101, 4:6-8.

10 As detailed below, IEEE 802.11a, as modified by the knowledge of a POSITA, teaches optimal extended long training sequences (ELTSs) that are longer than those used by at least one of 802.11a or 802.11g devices. *Infra*, Sections VII.A-VII.C (analysis of claim 14); Ex. 1108, ¶¶53, 78-81, 117, 134-188, 222-226.

According to a second interpretation, the “legacy” claim phrase plainly
15 encompasses at least the preferred embodiment in the specification, but the outermost boundaries of “legacy” are ambiguous for purposes of determining infringement. There is no dispute that, according to the preferred embodiment, the claim scope would encompass 802.11a- or 802.11g-compliant devices: “The inventive expanded long training sequence may be used by 802.11a or 802.11g
20 devices...” Ex. 1101, 4:7-9. 4:11-19, 1:50-2:7. Under this interpretation, although

a POSITA would recognize that 802.11a and 802.11g-compliant devices fall within the scope of the claim (and are readily comparable to the prior art examples cited below), the outermost boundaries of a “legacy” wireless local area network device are neither defined nor clarified in the intrinsic record—the same scenario

5 in which the Board has recently confirmed that a PTAB trial was proper. *Mylan*, IPR2018-00272, Pap. 20 at 6-8. As detailed below, IEEE 802.11a, as modified by the knowledge of a POSITA, teaches optimal ELTSs that are longer than those used by 802.11a or 802.11g compliant devices, and the evidence here confirms this noticeable overlap with the preferred embodiment of the ’842 patent. *Infra*,

10 Sections VII.A-VII.C (analysis of claim 14); Ex. 1108, ¶¶53, 78-81, 117, 134-188, 222-226.. For these reasons, the ’842 patent is ripe for review in a full PTAB trial regardless of which alternative interpretation is used here.⁶

C. “extended long training sequence” (claims 1, 19)

According to a first interpretation, the phrase “extended long training

15 sequence” means “training sequence that uses more active subcarriers than an earlier version of the same standard.” Under this interpretation, the claim term is described at least by the preferred embodiment of the ’842 patent, which states that the “expanded long training sequence and the optimal expanded long training

⁶ *Supra*, footnote 5.

sequence are stored on more than 52 sub-carriers.” Ex. 1101, Abstract. As detailed below, IEEE 802.11a, as modified by the knowledge of a POSITA, teaches ELTSs that are stored on more than 52 subcarriers. *Infra*, Sections VII.A-VII.C (analysis of claims 1, 19); Ex. 1108, ¶¶53, 78-81, 117, 151-154, 180, 227, 5 228.

According to a second interpretation, “extended long training sequence” plainly encompasses at least the preferred embodiment in the specification, but the outermost boundaries of the claim phrase are ambiguous for purposes of determining infringement. There is no dispute that, according to the preferred 10 embodiment, the claim scope would encompass the LTS shown in Figure 4 of the ’842 patent. Ex. 1101, 5:20-25. Under this interpretation, although a POSITA would recognize that the LTS shown in Figure 4 falls within the scope of the claim (and is readily comparable to the same sequence cited in the prior art examples below), the outermost boundaries of an “extended long training sequence” are not 15 defined or clarified in the intrinsic record—the same scenario in which the Board has recently confirmed that a PTAB trial was proper. *Mylan*, IPR2018-00272, Pap. 20 at 6-8. As detailed below, IEEE 802.11a, as modified by the knowledge of a POSITA, teaches ELTSs carried on 56 subcarriers using identical ELTSs as shown in Figure 4 of the ’842 patent. *Infra*, Sections VII.A- VII.C (analysis of claims 1, 20 19); Ex. 1108, ¶¶53, 78-81, 117, 151-154, 180.

For these reasons, the '842 patent is ripe for review in a full PTAB trial regardless of which alternative interpretation is used here.⁷

D. “optimal extended long training sequence” (claims 1, 4, 14, 19)

According to a first interpretation, the phrase “extended long training sequence” means “training sequence with a minimal peak to average ratio.” Under this theory, the claim term is described at least by the preferred embodiment of the '842 patent, which states that “FIG. 4 illustrates the long training sequence with a minimum peak-to-average power ratio that is used in 56 active sub-carriers.” Ex. 1101, 5:20-25. As detailed below, IEEE 802.11a, as modified by the knowledge of a POSITA, teaches LTSs with a minimal peak-to-average ratio. *Infra*, Sections VII.A-VII.C (analysis of claims 1, 4, 14, 19); Ex. 1108, ¶¶146-153, 164-180, 205-206. Indeed, IEEE 802.11a, as modified by the knowledge of a POSITA, teaches the same “training sequence with a minimal peak to average ratio” that the '842 patent discloses in its preferred embodiment in Figure 4. Ex. 1108, ¶¶53, 117.

According to a second interpretation, “optimal extended long training sequence” plainly encompasses at least the preferred embodiment in the specification, but the outermost boundaries of the claim phrase are ambiguous for purposes of determining infringement. There is no dispute that, according to the

⁷ *Supra*, footnote 5.

preferred embodiment, the claim scope would encompass the ELTS of Figure 4 of the '842 patent “with a minimum peak-to-average power ratio.” Ex. 1101, 5:14-

19. Under this interpretation, although a POSITA would recognize that the optimal ELTS of Figure 4 falls within the scope of the claim (and is readily

5 comparable to the identical sequence cited in the prior art examples below), the outermost boundaries of an “optimal extended long training sequence” are not

defined or clarified in the intrinsic record—the same scenario in which the Board has recently confirmed that a PTAB trial was proper. *Mylan*, IPR2018-00272,

Paper 20 at 6-8. As detailed below, IEEE 802.11a, as modified by the knowledge

10 of a POSITA, teaches LTSs with minimal PAPR. *Infra*, Sections VII.A-VII.C (analysis of claims 1, 4, 14, 19); Ex. 1108, ¶¶146-153, 164-180, 205-206.

For these reasons, the '842 patent is ripe for review in a full PTAB trial regardless of which alternative interpretation is used here.⁸

15 **VII. GROUND 1: CLAIMS 1, 2, 3, 4, 8, 11, 14, AND 19 ARE OBVIOUS OVER IEEE 802.11A IN VIEW OF POSITA KNOWLEDGE**

A. Overview of IEEE 802.11a

IEEE 802.11a (Ex. 1107) is a publication titled “IEEE Std 802.11a-1999” that published on December 30, 1999, and the evidence here confirms that IEEE 802.11a was sufficiently and publicly accessible to interested members of the

⁸ *Supra*, footnote 5.

public no later than March 20, 2000. Ex. 1101, 1; Ex. 1109, ¶¶5-8 (“from the Michigan State University library”); *Ericsson v. Intellectual Ventures*, IPR2014-00527, Pap. 41, 10–11 (PTAB May 18, 2015) (“IEEE is a well-known, reputable compiler and publisher of scientific and technical publications, and we take

5 Official Notice that”). IEEE 802.11a.

IEEE 802.11a is generally directed to wireless OFDM network systems, including an OFDM transmitter with various components. Ex. 1107, 11, 32, FIG. 118. FIG. 118 (below) shows a transmitter, including an FEC encoder, an interleaving and mapping block, and IFFT block. Ex. 1108, ¶136.

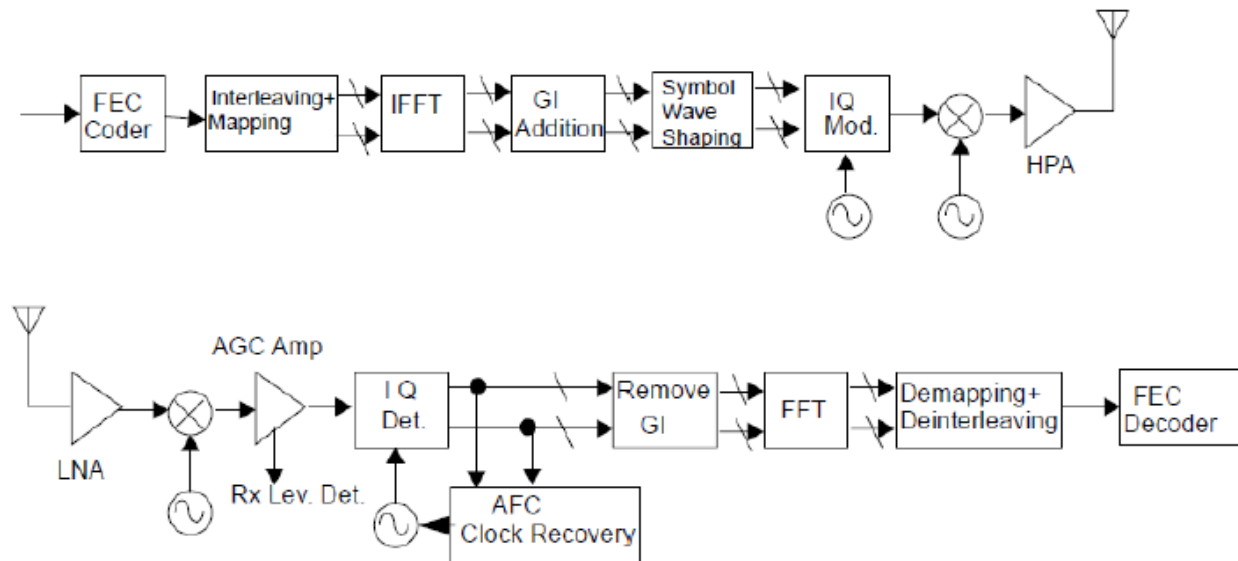


Figure 118—Transmitter and receiver block diagram for the OFDM PHY

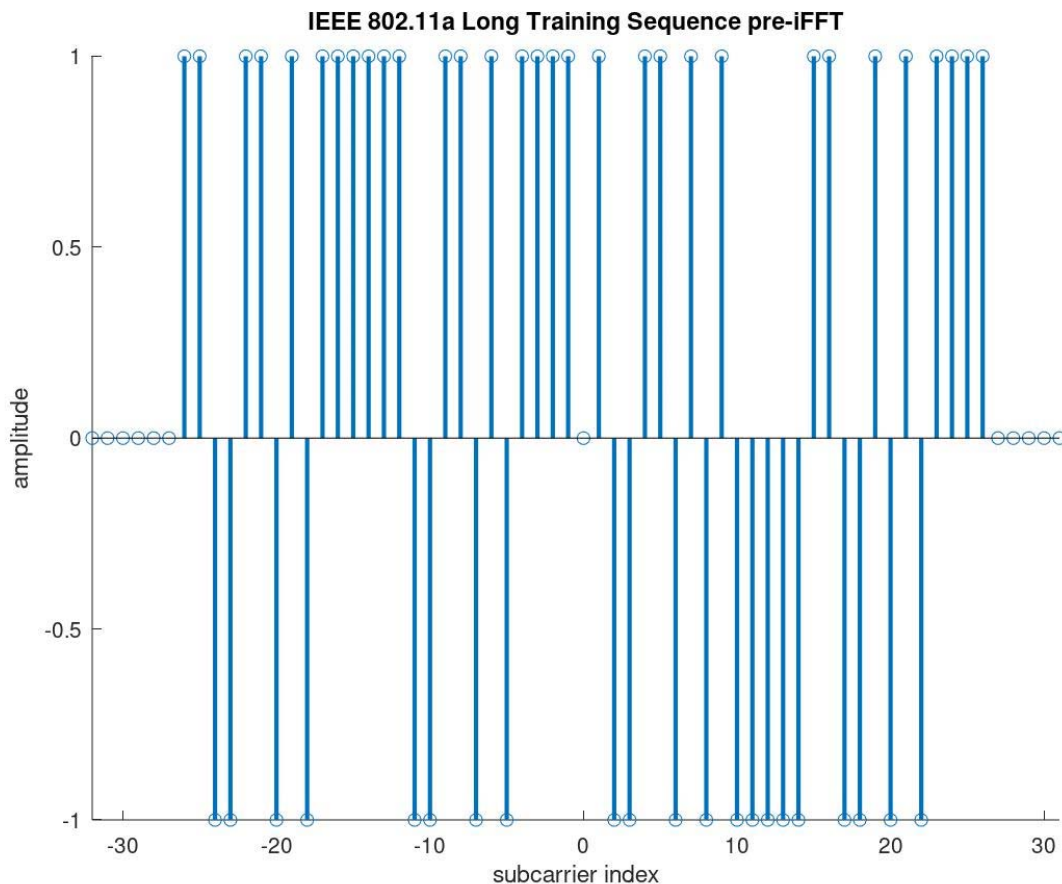
Ex. 1107, FIG. 118.

IEEE 802.11a discloses generating a “long OFDM training symbol” and “long OFDM training sequence of 53 subcarriers (including a zero value at dc)”:

$$L_{-26,26} = \{1, 1, -1, -1, 1, 1, -1, 1, -1, 1, 1, 1, 1, 1, -1, -1, 1, 1, -1, 1, -1, 1, 1, 1, 0, 1, -1, -1, 1, 1, -1, 1, -1, 1, -1, -1, -1, -1, -1, 1, 1, -1, -1, 1, -1, 1, -1, 1, 1, 1\}$$

Id., 21; Ex. 1108 ¶134-137. This is the same frequency domain training sequence

5 discussed in the Background section of the '842 patent. Ex. 1101 at 2:29-36. A graphical depiction of the IEEE802.11a OFDM training symbol is shown below.



B. Overview of POSITA knowledge

As discussed by Dr. Min, by the time of the purported invention of the '842 patent, a POSITA was very familiar with mathematical operations, Wi-Fi technology, and 802.11, including OFDM systems and methods, how to scale
5 OFDM systems to add subcarriers, how to determine possible training sequences, how to perform FFT and IFFT functions, how to construct and insert a cyclic prefix in an OFDM symbol, how to calculate PAPR values, and how to determine and choose one or more sequences in consideration of PAPR values and other characteristics. Ex. 1108, ¶¶37-112, 133-180.

10 The knowledge of a POSITA at the time the alleged invention occurred is exemplified by contemporary and prior art references of this time period, as discussed below.

1. POSITA Knew OFDM Systems and Methods Were Scalable to Additional Subcarriers

15 As discussed by Dr. Min, a POSITA would have known that OFDM systems and methods were easily scalable, including (I)FFT size, the number of subcarriers, the guard time, the clock rate, the coding rate, and the constellation size. Ex. 1108, ¶29. Adjustments to such parameters would influence the resulting characteristics of the OFDM system, with regard to for example, data rate, channel bandwidth,
20 delay spread tolerance, interference, sensitivity characteristics, power requirements, noise performance, and/or the link budget. A POSITA would

understand how to design and adjust an OFDM system to account and vary such parameters and resulting characteristics. An increase in the number of subcarriers may result in slightly more complex hardware, but this would be a tradeoff that could be well worth it, and relatively easy to address, given the well-known and understood operation of an IFFT block, which is commonly used by the transmitter to transform the modulated sub-carriers from the frequency domain into the time domain. Similarly, the FFT block (which could be shared with the IFFT) is commonly used by a receiver to transform the time-domain received waveform into its frequency domain representation to enable demodulation on a sub-carrier by sub-carrier basis. Optimized hardware solutions could be achieved for various numbers of sub-carriers, by considering the corresponding computational complexity under the equation $\frac{1}{2} N \log_2 N$, *butterflies*. Ex. 1139 at 2.

Scaleable OFDM confirms that at least by September 1997 POSITAs understood various numerology considerations for OFDM, including FFT size and number of subcarriers. Scaleable OFDM contemplates an FFT size of up to 1024, and provides specific examples of 43, 86, and 345 subcarriers. Ex. 1139 at 2, 3, 6-11.

Scaleable OFDM used the term “carrier” synonymously with the term “subcarrier.” Scaleable OFDM stated that “[t]he scaleable parameters of OFDM that will be discussed are the (I)FFT size or the number of subcarriers, the guard

time, the clock rate, the coding rate and the constellation size.” Ex. 1139 at 2.

With “the (I)FFT size or the number of subcarriers” as one of the parameters that defines a particular OFDM, Scaleable OFDM further states that “OFDM deals with delay spread by transmitting the data in parallel, over a large number of

5 narrowband channels, called carriers,” and that “[t]o retain the same bit rate we must increase the number of carriers” when increasing the symbol time to tolerate a larger delay spread. Ex. 1139 at 2.

Scaleable OFDM presented several examples for OFDM performance by varying the number of carriers/subcarriers that the data can be carried on –

10 Example 1 of Scaleable OFDM shows the performance for 43 data carriers/subcarriers with a designed delay spread tolerance of 200 ns (Ex. 1139 at 6), Example 2 shows for 86 data carriers/subcarriers with a designed delay spread tolerance of 500 ns (Ex. 1139 at 10), and Example 3 shows for 345 data carriers/subcarriers for a fixed wireless system with a designed delay spread

15 tolerance of 2 μ s. (Ex. 1139 at 10). Although the examples given were not intended to be a proposal for a specification, they were a basis to begin specification, and thus were not only indicative of the knowledge of a POSITA in the relevant time period, but also of what was contemplated by a POSITA in terms of modifying 802.11a.

A POSITA would have recognized the benefits of increasing the number of subcarriers. Ex. 1108, ¶33. As exemplified in *Effect of OFDM Subcarriers*, published in January 1999, a POSITA would have known about the benefits of increasing the number of subcarriers. Ex. 1141. *Effect of OFDM Subcarriers* specifically compares a 48 subcarrier system with 3 pilot subcarriers against a 52 subcarrier system with 4 pilot subcarriers. *Effect of OFDM Subcarriers* discussed that the increased 52 subcarrier system had an advantage of 0.4 and 0.7 dB (in 24 Mb/s and 36 Mb/s data transmission modes, respectively). Ex. 1141 at 2. The authors attributed the “advantage [as] related to the increase in code rate and to the improved SNR of the carrier tracking.” The improved SNR of the carrier tracking is directly related to the use of more subcarriers and additional pilot subcarriers to facilitate tracking the channel during the data phase of the packet after performing initial channel estimation on the preamble portion of the packet. Ex. 1108 at 144.

The scalability of OFDM was also well known and “common knowledge” to POSITA. Ex. 1108, ¶34. For example, *OFDM for HSWN* (Ex. 1140) discussed that “[a]nother attractive property of OFDM is its easy scalability to different environments, bandwidths or bit rates, by simply changing parameters like the number of subcarriers, guard time, coding rate or constellation size. This gives the possibility to use one modulation technique for various applications.” Ex. 1140 at 1, 2. Thus, at least as early as November 1997, persons of ordinary skill in the art

contemplated scaling OFDM by increasing the number of subcarriers, for at least the benefit of “us[ing] one modulation technique for various applications.” As confirmed by Dr. Min, persons of ordinary skill in the art would have recognized that increasing the number of subcarriers would have provided cost and resource savings from utilizing a single modulation technique across various applications.

2. POSITA Knew Peak-to-Average Power Ratio as a Known, Addressable Concept

Dr. Min also stated that by at least 1997, POSITAs understood how to address and mitigate peak-to-average power ratio (PAPR) and other concerns. Ex. 1108, ¶35.

For example, as discussed in OFDM for HSWN, in comparing the implementation complexity of an OFDM modem and a comparable single carrier system for high speed (>20 Mbps) wireless networks, “[c]ommonly quoted disadvantages or concerns about OFDM are the peak-to-average power ratio, sensitivity to phase noise and the amount of training overhead when using a large [≥32] number of subcarriers. This document shows that neither of these concerns provides a real disadvantage for OFDM.” Ex. 1140 at 2. Thus, at least as early as November 1997, PAPR was regarded as a mitigatable disadvantage in OFDM operations or systems, including, for example the block diagram of an OFDM

transceiver shown in OFDM for HSWN below (Ex. 1140 Figure 1):

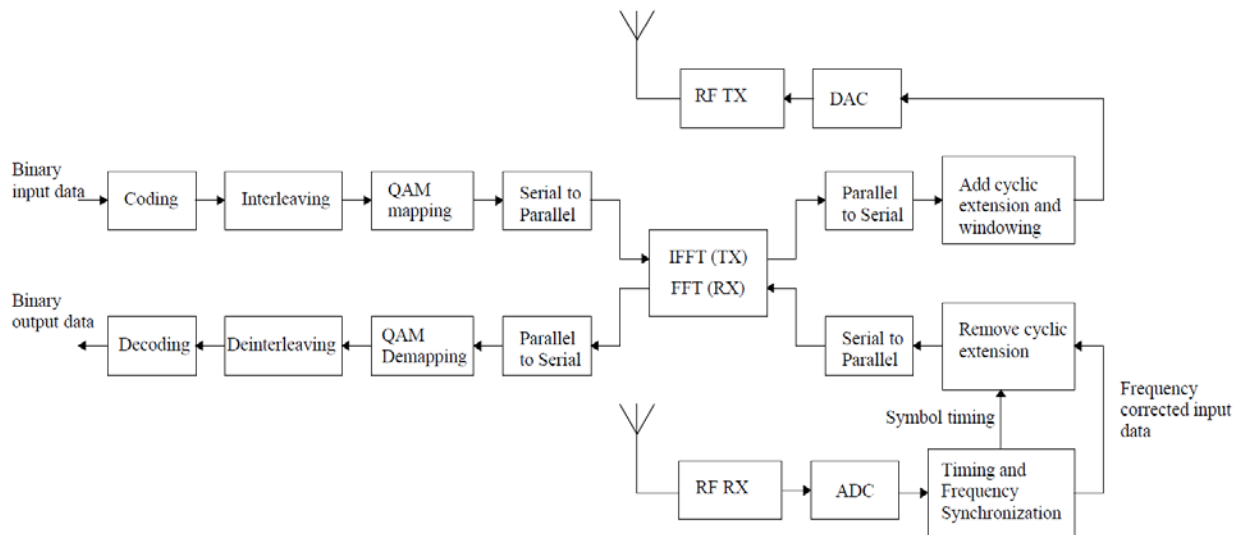


Figure 1: Block diagram of an OFDM transceiver.

OFDM for HSWN contemplated reducing the PAPR by clipping the signal (which significantly increases the out-of-band radiation) or windowing the signal (multiplying large signal peaks with a certain window, e.g., cosine, Kaiser, or Hamming window). See Ex. 1140 at 9.

OFDM for HSWN further reinforces that POSITAs of the relevant time period contemplated varying the number of subcarriers: “it is sometimes argued that OFDM has the disadvantage that the training overhead increases as the number of subcarriers is increased.” Ex. 1140 at 12. HSWN recognized that for accurate frequency offset estimation with a large number of subcarriers, it was necessary to increase the number of subcarriers in the preamble as well. Ex. 1140 at 13; Ex. 1108, ¶147.

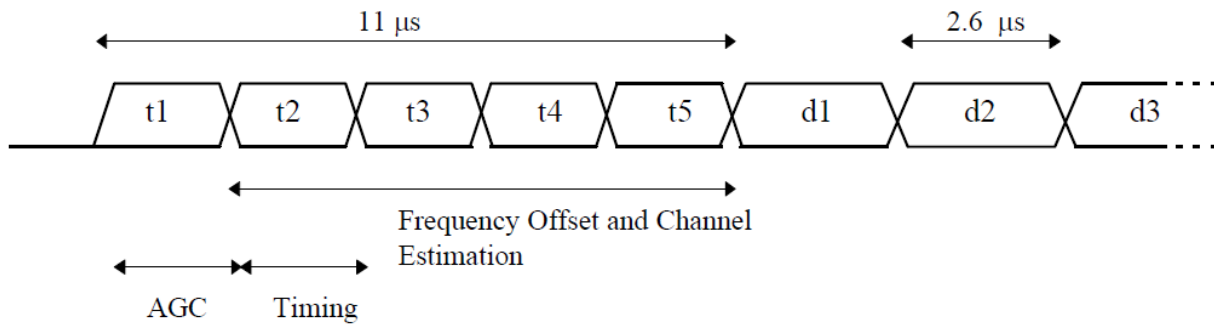


Figure 15: Training structure.

Among methods discussed for addressing peak-to-average power ratio are windowing, which is preferred over clipping to reduce the PAPR. Ex. 1140 at 9-12.

5 Multi-carrier systems, such as OFDM systems, whereby constellation shaping was used to reduce the peak-to-average power ratio of the system were also known to POSITA. For example, Khandani describes a multi-carrier system, such as an OFDM system, whereby constellation shaping is used to reduce the peak-to-average power ratio of the system. Ex. 1119 at [0075], [0086]. Khandani, 10 titled “Method and Apparatus for Scrambling Based Peak-to-Average Power Ratio Reduction Without Side Information,” was filed December 9, 2002, and published May 13, 2004, and claims priority to provisional applications filed on August 23, 2001 (Ex. 1119 at 1; Ex. 1120; Ex. 1121), which is prior to the afforded filing date (July 27, 2004) of the ’842 patent. Khandani discloses an “OFDM Transmitter 15 Structure with Constellation Shaping and Peak Average Power Ratio Reduction Algorithm.” Ex. 1119 at [0086].

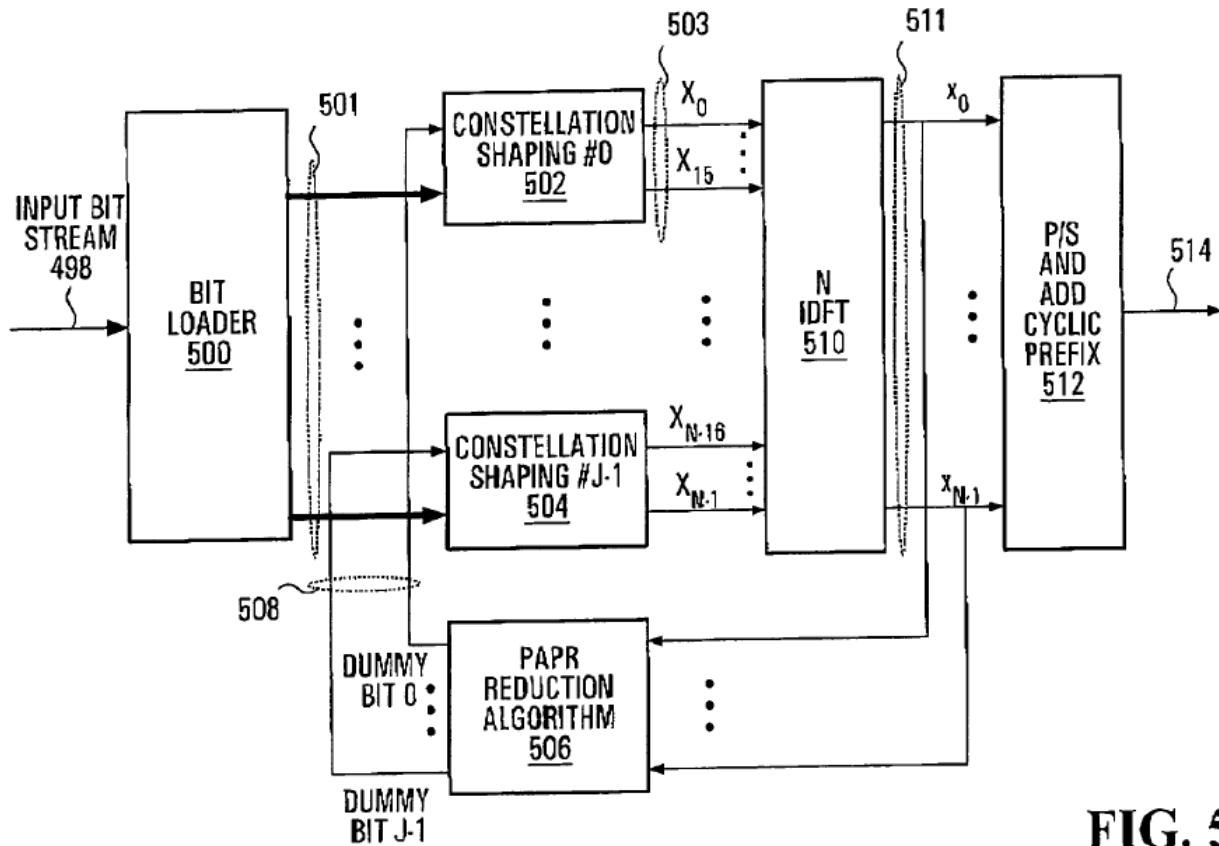


FIG. 5

Ex. 1119 at FIG. 5.

Khandani is directed to an OFDM transmitter with constellation shaping and a PAPR reduction algorithm performed for subcarriers. *Id.*, [0086], [0088].

- 5 Khandani confirms that a person of ordinary skill in the art contemplated and understood selecting constellation points that result in a reduced PAPR. Ex. 1119, [0057], [0082], [0088], FIG. 3. Khandani discusses disadvantages with certain permutations of constellation points, which can result in “high peak power in the multi-tone signal.” Ex. 1119 at [0005]. Khandani notes that other “permutations
- 10 of constellation points,” however, “will result in a low peak power in the multi-tone signal.” Ex. 1119 at [0005].

To address these disadvantages, Khandani illustrates a method of selecting constellation points that result in a reduced PAPR, shown in FIG. 3. Ex. 1119 at [0057], [0082], FIG. 3. Khandani's method shows "evaluating the peak average power ratio for all the possible permutations (step 3-1) and then searching through
5 all possible permutations of choices of constellation points for a set of constellation points which will result in the smallest possible peak average power ratio (step 3-2)." Ex. 1119 at [0082]. Khandani's suggestion is nothing more than what KSR describes as "[w]hen there is a design need or market pressure to solve a problem and there are a **finite number of identified, predictable solutions**, a person of
10 ordinary skill in the art has good reason to pursue the known options within his or her technical grasp. If this leads to the **anticipated success**, it is likely the product not of innovation but of ordinary skill and common sense." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398 at 402-403 (2007) (emphasis added).

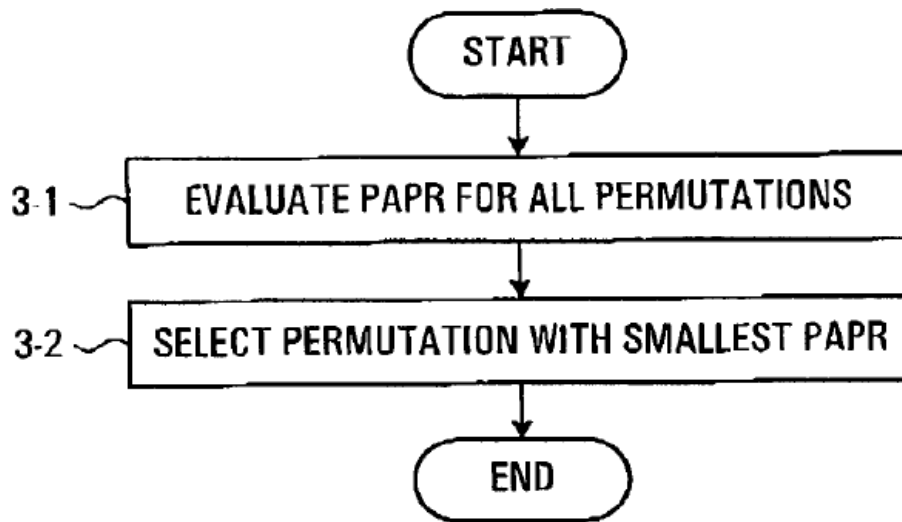


FIG. 3

Ex. 1119 at FIG. 3.

Khandani suggests it was conventional to select an LTS that would achieve a minimal PAPR. Ex. 1108, ¶¶37-42. As shown in Figure 3, Khandani shows

5 “evaluating the peak average power ratio for all the various permutations” and “searching through all possible permutations of choices” to select the selecting the permutation that “will result in the smallest possible peak average power ratio.”

Ex. 1119, [0082], FIG. 3. Thus, Khandani expressly demonstrates selecting the permutation that results in the smallest possible PAPR. As another example of the

10 knowledge known to a person of ordinary skill in the art during the relevant time period, the Khandani '168 provisional filed on August 23, 2001 demonstrates

“selecting a constellation point which will result in a reduced peak average power ratio for the multi-tone signal.” Ex. 1120 at 2:21 to 3:8. The Khandani '168

provisional demonstrates the same conventional concept of “searching through all possible permutations of choices of constellation points for a set of constellation points which will result in an absolute minimum possible peak average power ratio.” Ex. 1120 at 2:21-3:14. The Khandani ’168 provisional also shows

5 “searching through possible permutations of choices of constellation points for a set of constellation points which will result in a peak average power ratio which is less than a predetermined threshold.” Ex. 1120 at 3:15-21.

The Khandani ’168 provisional also shows “randomly selecting a constellation point from each particular respective plurality of constellation points; evaluating a peak average power ratio using the randomly selected constellation points; in the event the peak power ratio is less than the pre-determined threshold, stopping the search; and repeatedly, until the peak average power ratio is less than the pre-determined threshold, changing at least one of the randomly selected constellation points to be a different constellation point in the particular respective plurality of constellation points to which the at least one of the randomly selected constellation points belongs and re-evaluating the peak average power ratio.” Ex. 1120 at 4:10-22. Both of the Khandani references (*see* Ex. 1119 FIG. 2, Ex. 1120 Fig. 2) discuss constellation points that “represent[] a pair of I and Q amplitude components transmitted at the carrier frequency.” Ex. 1119 at [0077]. The Khandani references exhibit iterating through all possible constellation points,

10
15
20

performing a PAPR evaluation, and then choosing a specific data value with the specific I (in-phase) and Q (quadrature) values for each subcarrier. As such, by “searching through possible permutations of choices of constellation points,”

Khandani expressly determine selection of optimal values for the extended long

5 training sequence. Such selection of an LTS that would achieve a minimal PAPR was conventional by the relevant time period.

C. Obviousness in view of IEEE 802.11a and the knowledge of a POSITA

It would have been obvious for a person of ordinary skill in the art at the
10 relevant time of the alleged invention of the '842 patent to combine the teachings of IEEE 802.11a and the knowledge of a person of ordinary skill in the art, to arrive at each and every feature of at least '842 patent claims 1–4, 8, 11, 14, and 19, as discussed below. Ex. 1108, ¶¶37-112, 133-229.

First, such a predictable implementation of POSITA knowledge to the well-
15 known IEEE 802.11a long training sequence would have been a simple process for a POSITA to increase a desirable property (data rate) by improving an existing well-understood system in which the modified long training sequence provided the desired minimal PAPR value (thereby decreasing a potentially less-desirable property) among the small number of possible permutations. Ex. 1108, ¶¶158,
20 167-174. As previously detailed, the optimal sequences found included more than

52 non-zero subcarriers. Thus, a POSITA would have been motivated to evaluate the various permutations to select a sequence and determine that the selected sequence achieved a minimal PAPR value while considering other characteristics (*e.g.*, 3.6 dB). *Id.* **Second**, doing so would have been merely the application of a known technique (*e.g.*, selecting the permutation that results in minimal or minimum PAPR) to a known system (IEEE 802.11a's transmitter system) ready for improvement to yield predictable results. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007). Indeed, the '842 patent admitted that employing the same ELTS as the identified optimal sequence would result in "the minimum peak-to-average power ratio, i.e., a peak-to-average power ratio of 3.6 dB." *Compare* Ex. 1101, FIG. 4, 5:14-25, with Ex. 1123, FIG. 4 (L2). A POSITA would have recognized that applying their knowledge (as a person of ordinary skill in the art) and the suggestions therein to IEEE 802.11a's system would have led to predictable results without significantly altering or hindering the functions performed by the system of IEEE 802.11a and that such modifications would have improved the performance. Ex. 1108, ¶¶199, 200.

As explained above in Section VII.A, IEEE 802.11a is directed to OFDM wireless networks and discloses a transmitter that includes an FEC encoder, an interleaving and mapping block, and an IFFT block. Ex. 1107, FIG. 118. IEEE 802.11a further discloses generating a long OFDM training sequence. Ex. 1107,

21. As explained in Section VII.B, the knowledge of a POSITA is also directed to 802.11a-compliant devices and/or OFDM, and the combination of IEEE 802.11a with POSITA knowledge expressly suggests at least one of four LTSs (with at least 56 active subcarriers), including the same extended LTS as that of the '842 patent (which admittedly results in achieving minimal, and the '842-patent self-identified minimum PAPR). Ex. 1108 ¶¶160-176.

IEEE 802.11a and POSITA knowledge are both directed to wireless communications devices. As further discussed below, it would have been obvious to a POSITA to combine IEEE 802.11a's transmitter for generating LTSs with POSITA knowledge to increase the number of subcarriers and modify the training sequence to reduce PAPR values to allow IEEE 802.11a's transmitter to achieve increased data transmission based on a motivation to improve the existing IEEE 802.11a system. Ex. 1108, ¶182; see Ex. 1124, [0009].

[1.P] A wireless communications device, comprising:

15 To the extent the preamble is limiting, IEEE 802.11a discloses the recited wireless communications device. Ex. 1107, 11, 32, FIG. 118; Ex. 1108, ¶¶23, 182, see 37-112, 133-229. IEEE 802.11a discloses an "OFDM system that provides a wireless LAN with data payload communication capabilities" including a "transmitter." Ex. 1107, 11, 32.

[1.a] a signal generator that generates an extended long training sequence; and

IEEE 802.11a discloses this element. Ex. 1108, ¶¶183, see 37-112, 133-229.

For example, IEEE 802.11a discloses that a “long OFDM training symbol shall be generated according to” a particular equation and further teaches “[g]enerating the

5 long preamble sequence section of the preamble.” Ex. 1107, 21, 62. IEEE

802.11a further discloses an example of a generated LTS, as reproduced above at page 29. Ex. 1107, 21; Ex. 1108, ¶¶123, 126, 135.

To the extent that IEEE 802.11a does not expressly use the term a “signal generator,” a POSITA would have recognized that IEEE 802.11a’s transmitter

10 predictably included a signal generator that generates IEEE 802.11a’s long OFDM training symbol. Ex. 1108, ¶180. Additionally, POSITA knowledge suggests

generating an “extended long training sequence,” as shown in Ex. 1108 ¶¶151-176, and for the reasons articulated below, a POSITA would have been prompted to

implement IEEE 802.11a’s transmitter according to POSITA’s modified LTSs for

15 extended devices (including ELTS that match Figure 4 of the ’842 patent). While the outermost boundaries of the term “extended long training sequence” are subject

to alternative interpretations (Section VI), there is no dispute the element plainly encompasses at least the preferred embodiment of the ’842 patent shown in

Figure 4. Ex. 1101, 5:14-25; Ex. 1108, ¶123.

Multiple reasons existed that would have prompted a POSITA to modify the OFDM transmitter of IEEE 802.11a to generate an optimal ELTS, as shown for example in Figure 4 of the '842 patent (resulting in an ELTS with a minimal PAPR). **First**, such a predictable implementation of IEEE would have

5 advantageously resulted in a transmitter that generates ELTSs. Ex. 1108, ¶¶179-181. POSITA knowledge suggests the importance of coexistence and interoperability between devices that use different communication standards. Ex. 1108, ¶¶48-53, 103-109, 187. Thus, a POSITA would have been motivated to modify the transmitter of IEEE 802.11a to permit the generating of ELTSs to
10 beneficially promote coexistence and interoperability. Ex. 1108, ¶183. **Second**, the predictable implementation of IEEE 802.11a would have advantageously resulted in the use of ELTSs. *Id.* POSITA knowledge disclosed that an ELTS allows “energy [to be] transmitted on every single tone except the DC tone,” thus increasing the efficiency in data transfer. Ex. 1124, [0106]; Ex. 1108, ¶183. Thus,
15 a POSITA would have been motivated to modify the transmitter of IEEE 802.11a to allow generating of ELTSs so that more data can be transferred using those subcarriers over which the ELTS is defined. Ex. 1108, ¶50. **Third**, doing so would have been merely the application of a known technique (*e.g.*, generating an ELTS with a minimal PAPR) to a known system (IEEE 802.11a’s transmitter)
20 ready for improvement to yield predictable results. *KSR*, 550 U.S. at 417. Indeed,

the '842 patent admitted that generating the same ELTS as the optimized sequence would result in a sequence with “the minimum peak-to-average power ratio, i.e., a peak-to-average power ratio of 3.6 dB.” Compare Ex. 1101, FIG. 4, 5:14-25, with Ex. 1108 ¶¶164-180. A POSITA would have recognized that applying POSITA’s suggestion of generating any of its sequences to IEEE 802.11a’s transmitter would have led to predictable results without significantly altering or hindering the functions performed by IEEE 802.11a’s transmitter. Ex. 1108, ¶124. Thus, it would have been obvious to a POSITA to modify the OFDM transmitter of IEEE 802.11a in light of POSITA’s teaching of generating ELTSs, which would result in a signal generator that generates ELTSs. Ex. 1108, ¶124.

[1.b] an Inverse Fourier Transformer operatively coupled to the signal generator,

IEEE 802.11a discloses this element. Ex. 1108, ¶¶126-128, 189-192, see 37-112, 133-229. IEEE 802.11a discloses a transmitter that includes an “IFFT,” and that the generated frequency domain LTS is input into an IFFT, which outputs a time domain LTS. Ex. 1107, 16, 32, 62, 67, FIG. 118.

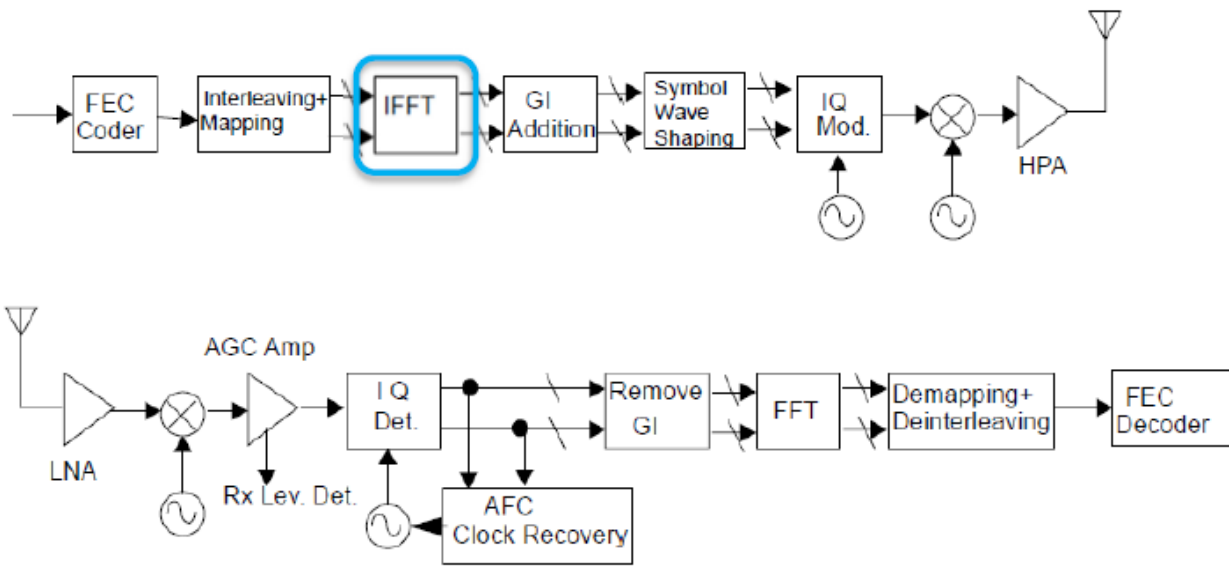


Figure 118—Transmitter and receiver block diagram for the OFDM PHY

Ex. 1107 at FIG. 118 (annotated).

To the extent that IEEE 802.11a does not explicitly teach that its “IFFT” transforms an input signal from the frequency to the time domain, the evidence confirms a POSITA would have understood this to be the function of IEEE 802.11a’s IFFT block. Ex. 1108, ¶128. A POSITA would have further understood that performing an IFFT operation requires a circuit and/or software coupled to the signal generator. *Id.*

[1.c] wherein the Inverse Fourier Transformer processes the extended long training sequence from the signal generator and provides an optimal extended long training sequence with a minimal peak-to-average ratio, and

IEEE 802.11a teaches an Inverse Fourier Transformer that synthesizes a time domain representation of a long training sequence from an input frequency

domain representation of the long training sequence. Ex. 1108 ¶¶193-206, *see* 37-112, 133-229; Ex. 1107 at 67; *supra* ¶¶126-128.

To the extent that IEEE 802.11a does not explicitly teach processing the extended long training sequence from the signal generator and providing an
5 optimal extended long training sequence with a minimal peak-to-average ratio, the knowledge of a POSITA teaches this feature. Ex. 1108 ¶190.

The combination of IEEE 802.11a and POSITA knowledge discloses this element. Ex. 1108, ¶¶189-202. As discussed in Section VII.C (element [1.b]), IEEE 802.11a discloses an Inverse Fourier Transformer that processes the ELTS.

10 Ex. 1107, 16, 32, 62, 67, FIG. 118. To the extent that IEEE 802.11a does not explicitly teach processing the ELTS from the signal generator and providing an optimal ELTS with a minimal PAPR, POSITA knowledge teaches optimal ELTSs, each with a minimal PAPR, including the ELTS shown in Figure 4 of the '842 patent (depicted above). Ex. 1108 ¶¶169-175, 191-194.

15 While the outermost boundaries of the claim term “optimal extended long training sequence” are subject to alternative interpretations (Section VI), there is no dispute this element plainly encompasses at least the preferred embodiment of the '842 patent: “FIG 4 illustrates the long training sequence with a minimum peak-to-average power ratio[.]” Ex. 1101, 5:14-21. IEEE 802.11a, in combination
20 with POSITA knowledge teaches optimal ELTSs, each with a minimal PAPR,

including the ELTS shown in Figure 4 of the '842 patent (depicted above). Ex.
1108 ¶¶169-175.

The knowledge of a POSITA encompasses teaching the preferred
embodiment of the claim term as described in the '842 patent—in particular, the
5 extended long training sequence with a minimum peak-to-average power ratio that
is used in 56 active sub-carriers. Ex. 1101 at FIG. 4, 5:14-19. For example, as
discussed above, a POSITA would have modified the long training sequence
defined in IEEE 802.11a to arrive at the extended long training sequence shown
over 56 sub-carriers as described in the '842 patent. The '842 patent itself
10 observes that “[o]ut of 16 possibilities for the four new sub-carrier positions, the
sequence illustrated in FIG. 4 has the minimum peak-to-average power ratio, i.e. a
peak-to-average power ratio of 3.6 dB.” Ex. 1101 at 5:14-19 (emphasis added).

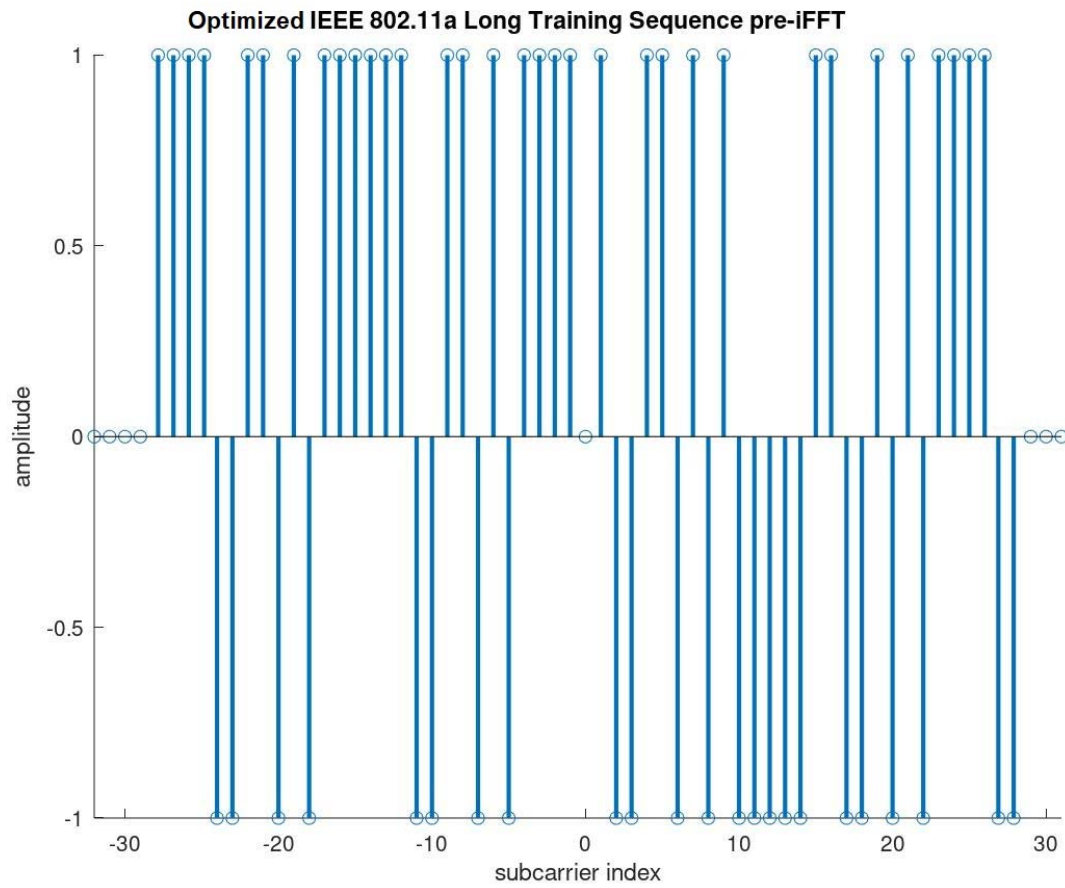
Notably, the extended long training sequence discussed above is identical to
the long training sequence that the '842 patent discloses in FIG. 4 (reproduced
15 below) as having “a minimum peak to-average power ratio that is used in 56 active
sub-carriers,” in particular, a peak-to-average power ratio of 3.6 dB. *Compare*
extended long training sequence (ELTS below) with Ex. 1101 at FIG. 4, at 5:14-
19. For reference, the optimized extended long training sequence obtained through
application of the knowledge of a person of ordinary skill in the art to the IEEE
20 802.11a training sequence is reproduced below (with annotations in red of the

subcarrier indices). Comparing this optimized sequence against the corresponding extended training sequence of the '842 patent's FIG. 4 confirms that the sequences are in fact identical.

$$ELTS_{(-28,28)} = \{1, 1, 1, 1, -1, -1, 1, 1, -1, 1, -1, 1, 1, 1, 1, 1, -1, -1, 1, 1, -1, 1, -1, 1, 1, 1, 0, 1, -1, -1, 1, 1, -1, 1, -1, 1, -1, -1, -1, -1, -1, 1, 1, -1, -1, 1, -1, 1, -1, 1, 1, 1, 1, -1, -1\}$$

5

$$ELTS_{56} = \begin{matrix} \{0^{-32}, & 0^{-31}, & 0^{-30}, & 0^{-29}, & 1^{-28}, & 1^{-27}, & 1^{-26}, & 1^{-25}, & -1^{-24}, & -1^{-23}, & 1^{-22}, & 1^{-21}, & -1^{-20}, & 1^{-19}, & -1^{-18}, & 1^{-17}, \\ 1^{-16}, & 1^{-15}, & 1^{-14}, & 1^{-13}, & 1^{-12}, & -1^{-11}, & -1^{-10}, & 1^{-9}, & 1^{-8}, & -1^{-7}, & 1^{-6}, & -1^{-5}, & 1^{-4}, & 1^{-3}, & 1^{-2}, & 1^{-1}, \\ 0^0, & 1^1, & -1^2, & -1^3, & 1^4, & 1^5, & -1^6, & 1^7, & -1^8, & 1^9, & -1^{10}, & -1^{11}, & -1^{12}, & -1^{13}, & -1^{14}, & 1^{15}, \\ 1^{16}, & -1^{17}, & -1^{18}, & 1^{19}, & -1^{20}, & 1^{21}, & -1^{22}, & 1^{23}, & 1^{24}, & 1^{25}, & 1^{26}, & -1^{27}, & -1^{28}, & 0^{29}, & 0^{30}, & 0^{31}\} \end{matrix}$$



+1	+1	1	1	-1	-1	1	1	-1	1	-1	1	1	1
-28	-27	-26	-25	-24	-23	-22	-21	-20	-19	-18	-17	-16	-15

Sub-carrier index

1	1	1	-1	-1	1	1	-1	1	-1	1	1	1	1	0
-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0

Sub-carrier index

+1	-1	-1	1	1	-1	1	-1	1	-1	-1	-1	-1	-1
1	2	3	4	5	6	7	8	9	10	11	12	13	14

Sub-carrier index

1	1	-1	-1	1	-1	1	-1	1	1	1	1	-1	-1
15	16	17	18	19	20	21	22	23	24	25	26	27	28

Sub-carrier index

LONG TRAINING SEQUENCE FOR 56 ACTIVE FIGURE 4

Ex. 1101 at FIG. 4.

The '842 patent additionally discloses that “[o]ut of the 16 possibilities for the element new subcarrier positions,” accounting for the 4 additional active subcarriers over the conventional 52 active subcarriers, the sequence illustrated in FIG. 4 of the '842 patent—and as shown above—“has the minimum peak-to-average power ratio, i.e., a peak-to-average power ratio of 3.6 dB.” Ex. 1101 at 5:14-19. Thus, the combination of IEEE 802.11a and the knowledge of a POSITA teaches providing an optimal long training sequence with a minimum peak-to-

average ratio by inputting the extended long training sequence into IEEE 802.11a's Inverse Fast Fourier Transformer, as IEEE 802.11a teaches.

IEEE 802.11a and POSITA knowledge are replete with disclosures of OFDM systems that perform the inverse Fourier transform function. Ex. 1107 at 5 67, FIG. 118. IEEE 802.11a and POSITA knowledge both teach an extended long training sequence for which “energy is transmitted on every single tone except the DC tone,” and both further recognize that it is desirable to select an extended long training sequence with a low peak to average power ratio. The modified extended long training sequence is identical to the extended long training sequence taught in 10 the '842 patent as having “the minimum peak-to- average power ratio, i.e., a peak-to-average power ratio of 3.6 dB” and a POSITA further recognizes that it is desirable to select an extended long training sequence with a low peak to average power ratio. Ex. 1101 at 5:22-25.

As discussed by Dr. Min, a POSITA would have known how to create an 15 extended long training sequence with a minimal peak average power ratio starting with the existing IEEE 802.11a long training sequence. Ex. 1108 ¶¶199-202. A POSITA would have recognized that such an extended long training sequence provides such an “optimal” extended long training sequence with a minimal peak average power ratio of 3.6 dB. The combination of IEEE 802.11a and the 20 knowledge of a POSITA thus would have advantageously resulted in IEEE

802.11a's transmitter including an IFFT that processes the extended long training sequence and provides an optimal extended long training sequence with a minimal peak-to-average ratio of 3.6 dB. Indeed, many references available to a POSITA at the time recognize a desire to achieve a low peak-to-average ratio, as a large
5 dynamic range of the signal causes the transmitter to perform unpredictably due to the amplifier saturation. Ex. 1108, ¶199. This is a well-known fact that a person of ordinary skill in the art would have known in selecting optimal extended long training sequence(s).

For example, to the extent that IEEE 802.11a alone does not teach this
10 feature, Khandani evidences the knowledge of a POSITA during the relevant time period that would teach this feature. In particular, Khandani demonstrates "evaluating the peak average power ratio for all the various permutations" and "searching through all possible permutations of choices" to select the selecting the permutation that "will result in the smallest possible peak average power ratio."

15 Ex. 1119 at [0082].

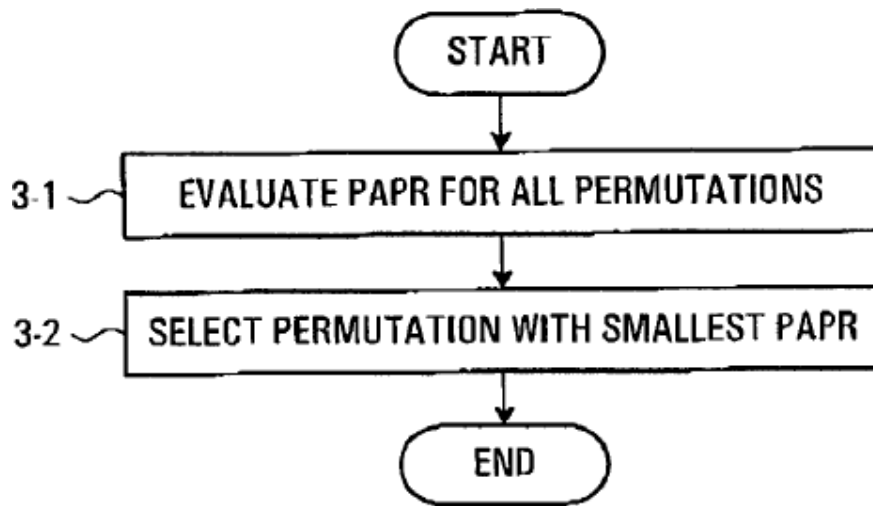


FIG. 3

Ex. 1119 at FIG. 3.

The modification of IEEE 802.11a using POSITA knowledge as shown in Khandani would provide a wireless transmitter that includes an IFFT that processes
5 the extended long training sequence and provides an optimal extended long training sequence that provides a minimal peak-to-average ratio.

For example, POSITA knowledge includes transmitters in OFDM systems that perform an inverse Fourier transform function. An example is discussed in Khandani, which additionally teaches “evaluating the peak average power ratio for
10 all the various permutations” and “searching through all possible permutations of choices” to select the selecting the permutation that “will result in the smallest possible peak average power ratio.” Ex. 1119 at [0082].

As discussed by Dr. Min, in light of the POSITA knowledge exemplified in Khandani, Khandani provides an explicit suggestion that an extended long training sequence that provides a minimal peak average power ratio should be selected, and a POSITA would have recognized that POSITA's modified extended long training
5 sequence provides such an "optimal" extended long training sequence with a minimal peak average power ratio of 3.6 dB. Ex. 1108 ¶ 199. Khandani's algorithm of selecting the permutation that results in the smallest peak-to-average power ratio evidences the knowledge of a POSITA. Such a modified extended long training sequence would have predictably confirmed that the transmitter's
10 processing of the extended long training sequence via its IFFT provides an optimal extended long training sequence with a minimal peak-to-average ratio of 3.6 dB. Indeed, a POSITA would have been motivated to evaluate the various permutations, as expressed in Khandani, to select the sequence with the minimal peak-to-average ratio.

15 Moreover, selecting the permutation that results in the minimal peak-to-average power ratio as in Khandani to the modified transmitter system would have yielded predictable results without altering IEEE 802.11a's transmitter system or hindering its function. Combining the generation of the extended long training sequence with IEEE 802.11a's OFDM transmitter would have yielded predictable
20 results without altering IEEE 802.11a's OFDM transmitter or hindering its

function. Thus, for at least all of these reasons, a POSITA would have been motivated to incorporate a method for selecting a minimal PAPR (as discussed in Khandani for example) into 802.11a's transmitter device (as suggested by Khandani).

5 Moreover, even if IEEE 802.11a did not explicitly disclose the peak-to-average power ratio of the existing 52 sub-carrier sequence, a POSITA would have been motivated and had the knowledge as evidenced by Khandani to select an extended long training sequence that would have resulted in a minimal PAPR.

 Futhermore, as Dr. Min has indicated, the PAPR ratio of the resulting time
10 domain sequence that results from a specified frequency domain sequence over 52-subcarriers is an inherent property of the time domain sequence, due to the mathematics of how the IFFT and FFT functions operate. EX. 1108 at 204. Such extrinsic knowledge/evidence "makes clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so
15 recognized by persons of ordinary skill." *Continental*, 948 F.2d at 1268. See Ex. 1101, 5:2-25 (admitting that these characteristics resulted from the same sequence shown in the modified sequences discussed above). That the specific minimal PAPR dB value is not explicitly disclosed in IEEE 802.11a for either the existing 52 sub-carrier sequence or the modified extended 56 sub-carrier sequence is of no
20 consequence, given that the PAPR ratio is a fixed, deterministic and easily-

determinable value. Ex. 1108 at 204. Furthermore, it is axiomatic that to perform a search for minimal PAPR values, persons having ordinary skill in the art would have known how to calculate and evaluate the resulting PAPR for each candidate extended long training sequence (as demonstrated by the Khandani references). Ex
5 1108 at 139, 153.

Multiple reasons existed that would have prompted a POSITA to improve the transmitter of IEEE 802.11a to generate an optimized ELTS (resulting in an ELTS with a minimal PAPR). **First**, such a predictable implementation of IEEE 802.11a would have advantageously resulted in a transmitter that provides a
10 sequence with a minimal PAPR. Ex. 1108, ¶135. POSITA recognizes a desire to select an ELTS with a low PAPR. *See* Ex. 1124, [0106]. Thus, a POSITA would have been motivated to implement an ELTS, such as the optimal ones found. Ex. 1108, ¶135. **Second**, doing so would have been merely the application of a known technique (*e.g.*, generating an ELTS with a minimal PAPR) to a known system
15 (IEEE 802.11a's transmitter) ready for improvement to yield predictable results. *KSR*, 550 U.S. at 417. Indeed, the '842 patent admitted that generating the same ELTS as POSITA's optimized sequence would have resulted in a sequence with "the minimum peak-to-average power ratio, i.e., a peak-to-average power ratio of 3.6 dB." *Compare* Ex. 1101, FIG. 4, 5:14-25, with Ex. 1108 ¶174-177. A
20 POSITA would have recognized that applying POSITA's suggestion of generating

its optimal sequences to IEEE 802.11a's transmitter would have led to predictable results without significantly altering or hindering the functions performed by IEEE 802.11a's transmitter. Ex. 1108, ¶202.

5 ***[1.d] wherein at least the optimal extended long training sequence is carried by a greater number of subcarriers than a standard wireless networking configuration for an Orthogonal Frequency Division Multiplexing scheme.***

 The combination of IEEE 802.11a and POSITA knowledge discloses that the optimal extended long training sequence is carried by a greater number of
10 subcarriers than a standard wireless networking configuration for an Orthogonal Frequency Division Multiplexing scheme. Ex. 1108, ¶¶37-112, 207-210, 133-229. Although the outermost bounds of this claim term are ambiguous, the claim term “standard wireless networking configuration for an Orthogonal Frequency Division Multiplexing scheme” clearly encompasses at least the preferred embodiment of
15 the '842 patent. Ex. 1108 ¶204. However, IEEE and the knowledge of a POSITA clearly teaches the preferred embodiment of the claim term as described in the '842 patent—in particular, the 802.11a or 802.11g wireless networking configurations that only use 52 active subcarriers. Ex. 1101 at 2:8-16. For example, IEEE
20 802.11a states that the IEEE 802.11a standard uses “52 subcarriers that are modulated.” Ex. 1107 at 11. That is, a typical long training sequence in an 802.11a system, which uses OFDM techniques, is carried by 52 subcarriers. A

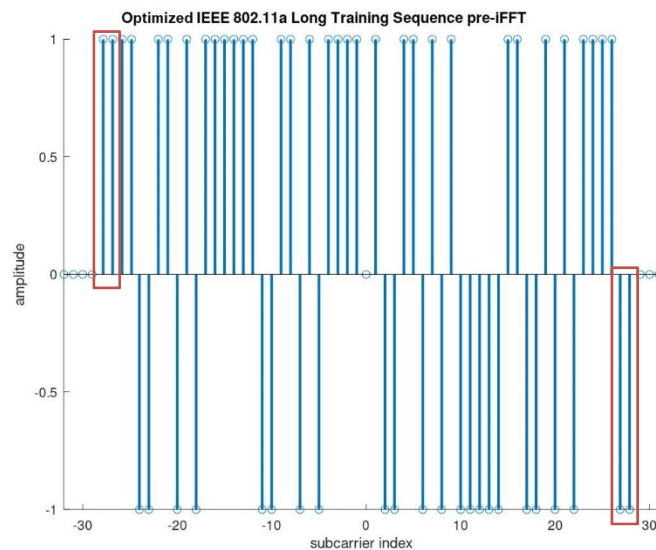
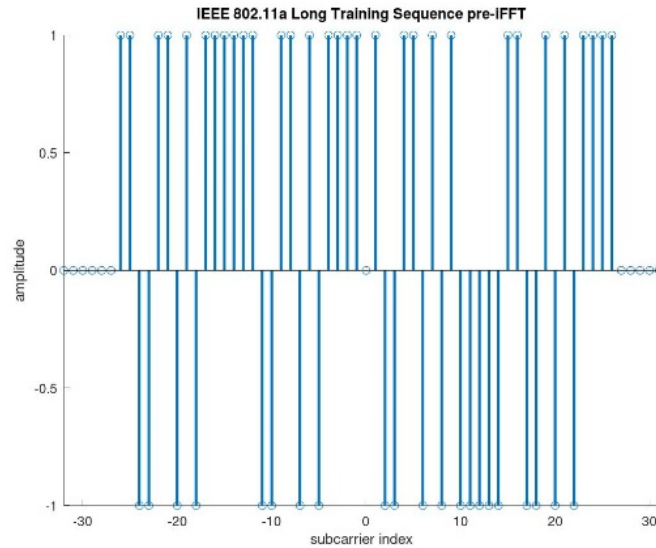
person of ordinary skill in the art at the time of the alleged invention's modification of the IEEE 802.11a long training sequence would have resulted in an optimal extended long training sequence that is carried by at least 56 subcarriers, as evidenced below where the active subcarriers are highlighted. Notably, a person of ordinary skill in the art at the time of the alleged invention would have recognized that when an inverse Fourier transform is performed on an extended long training sequence with at least 56 active subcarriers, such as the extended long training sequence discussed above, that such a sequence would be longer than the long training sequence defined in IEEE 802.11a that used 52 active subcarriers. As such, some of the previously unused subcarriers can now be used to carry data in the payload portion of the packet, necessitating their inclusion in the long training sequence for channel estimation purposes. Ex. 1108 at 207.

$$ELTS_{(-28,28)} = \{1, 1, 1, 1, -1, -1, 1, 1, -1, 1, -1, 1, 1, 1, 1, 1, -1, -1, 1, 1, -1, 1, -1, 1, 1, 1, 0, 1, -1, -1, 1, 1, -1, 1, -1, 1, -1, -1, -1, -1, -1, 1, 1, -1, -1, 1, -1, 1, 1, 1, 1, -1, -1\}$$

$$ELTS_{56} = \begin{matrix} & \{0^{-32}, & 0^{-31}, & 0^{-30}, & 0^{-29}, & 1^{-28}, & 1^{-27}, & 1^{-26}, & 1^{-25}, & -1^{-24}, & -1^{-23}, & 1^{-22}, & 1^{-21}, & -1^{-20}, & 1^{-19}, & -1^{-18}, & 1^{-17}, \\ & 1^{-16}, & 1^{-15}, & 1^{-14}, & 1^{-13}, & 1^{-12}, & -1^{-11}, & -1^{-10}, & 1^{-9}, & 1^{-8}, & -1^{-7}, & 1^{-6}, & -1^{-5}, & 1^{-4}, & 1^{-3}, & 1^{-2}, & 1^{-1}, \\ 0^0, & 1^1, & -1^2, & -1^3, & 1^4, & 1^5, & -1^6, & 1^7, & -1^8, & 1^9, & -1^{10}, & -1^{11}, & -1^{12}, & -1^{13}, & -1^{14}, & 1^{15}, \\ 1^{16}, & -1^{17}, & -1^{18}, & 1^{19}, & -1^{20}, & 1^{21}, & -1^{22}, & 1^{23}, & 1^{24}, & 1^{25}, & 1^{26}, & -1^{27}, & -1^{28}, & 0^{29}, & 0^{30}, & 0^{31}\} \end{matrix}$$

A comparison of the graphical representations also confirms that the optimal extended long training sequences discussed above are longer than the IEEE

802.11a long training sequence (red box annotation added around additional subcarriers).



5 Thus, the combination of IEEE 802.11a and POSITA knowledge discloses an optimal extended long training sequence that is carried by 56 active subcarriers, which is greater than the 52 active subcarriers of the 802.11a standard scheme.

Therefore, the combination of IEEE 802.11a and POSITA knowledge discloses that the optimal extended long training sequence is carried by a greater number of subcarriers than a standard wireless networking configuration for an Orthogonal Frequency Division Multiplexing scheme.

5 While the outermost boundaries of the claim term “a standard wireless networking configuration for an Orthogonal Frequency Division Multiplexing scheme” are subject to alternative interpretations (Section VI), there is no dispute this element plainly encompasses at least the preferred embodiment of the ’842 patent—where “only 52 of the 64 active subcarriers are used” in “802.11a and
10 802.11g compliant devices,” but the ’842 patent’s “optimal expanded long training sequence may be used in ... 63 [subcarriers]. Ex. 1101, 2:14-16, 4:59-61; Ex. 1108, ¶138. POSITA knowledge clearly teaches such an optimal ELTS with up to 63 subcarriers, and at least 56 subcarriers, which is more than the 52 subcarriers in an 802.11a/g system for an OFDM scheme. As discussed in Section VII.C
15 (element [1.c]), a POSITA would have been motivated to implement the transmitter of IEEE 802.11a to generate POSITA’s optimized ELTS. Ex. 1108, ¶135.

[2] The wireless communications device according to claim 1, wherein at least the optimal extended long training sequence is carried by at least 56 active sub-carriers.

As discussed in Section VII.C (element [1.d]), the combination of IEEE

5 802.11a and POSITA knowledge discloses that the optimal ELTS is carried by at least 56 active subcarriers. Ex. 1101, 2:14-16, 4:5-14; Ex. 1108, ¶¶164-180, 211-212, 37-112, 181-229.

[3] The wireless communications device according to claim 2, wherein the at least 56 active sub-carriers correspond to at least indexed sub-carriers –28 to +28.

10 The combination of IEEE 802.11a and POSITA knowledge discloses that the at least 56 active sub-carriers correspond to at least indexed sub-carriers –28 to +28. Ex. 1108, ¶212, see 37-112, 133-229. As discussed in Section VII.C (claim 2), POSITA teaches ELTS(s) with at least 56 subcarriers that is input into an IFFT, 15 which generates an output. Ex. 1108, ¶207. A POSITA would have recognized that using the optimal ELTSs as an input would result in an output having at least 56 non-zero subcarriers corresponding to indexed subcarriers -32 to -1 and 1 to +31,⁹—or at least indexed subcarriers –28 to +28. Ex. 1108, ¶208.

⁹ A POSITA would further recognize that the optimal LTS would include a DC subcarrier at subcarrier index 0. Ex. 1108, ¶¶124, 157, 161, 182, 183, 194, 208.

[4] The wireless communications device according to claim 2, wherein the optimal extended long training sequence has a minimum peak-to-average power ratio of 3.6 dB.

As discussed in Section VII.C (element [1.c]), the combination of IEEE

5 802.11a and POSITA knowledge discloses this element. Ex. 1107, 67; Ex. 1101, 5:14-25, FIG. 4; Ex. 1108, ¶¶, 209, 213, 37-112, 181-229.

[8] The wireless communications device according to claim 1, wherein a binary phase shift key encoding is used for each sub-carrier above the +26 indexed sub-carrier and below the -26 indexed sub-carrier.

10 The combination of IEEE 802.11a and POSITA knowledge discloses this element. Ex. 1108, ¶¶214, 215, see 37-112, 133-229. IEEE 802.11a discloses that the 802.11a standard allows BPSK encoding. Ex. 1107, 11. Additionally, POSITA knowledge teaches an extended long sequence with at least 56 non-zero subcarriers.

15

$$ELTS_{56} = \begin{matrix} \{0^{-32}, & 0^{-31}, & 0^{-30}, & 0^{-29}, & 1^{-28}, & 1^{-27}, & 1^{-26}, & 1^{-25}, & -1^{-24}, & -1^{-23}, & 1^{-22}, & 1^{-21}, & -1^{-20}, & 1^{-19}, & -1^{-18}, & 1^{-17}, \\ 1^{-16}, & 1^{-15}, & 1^{-14}, & 1^{-13}, & 1^{-12}, & -1^{-11}, & -1^{-10}, & 1^{-9}, & 1^{-8}, & -1^{-7}, & 1^{-6}, & -1^{-5}, & 1^{-4}, & 1^{-3}, & 1^{-2}, & 1^{-1}, \\ 0^0, & 1^1, & -1^2, & -1^3, & 1^4, & 1^5, & -1^6, & 1^7, & -1^8, & 1^9, & -1^{10}, & -1^{11}, & -1^{12}, & -1^{13}, & -1^{14}, & 1^{15}, \\ 1^{16}, & -1^{17}, & -1^{18}, & 1^{19}, & -1^{20}, & 1^{21}, & -1^{22}, & 1^{23}, & 1^{24}, & 1^{25}, & 1^{26}, & -1^{27}, & -1^{28}, & 0^{29}, & 0^{30}, & 0^{31}\} \end{matrix}$$

The yellow highlighting above shows each subcarrier above the +26 indexed subcarrier and below the -26 indexed subcarrier. Notably, each value is either -1 or +1, indicating that BPSK encoding was used for each subcarrier. Ex. 1108,

20

¶210. Thus, the combination of IEEE 802.11a and POSITA knowledge discloses BPSK encoding is used for each subcarrier above the +26 indexed subcarrier and below the -26 indexed subcarrier.

5 ***[11] The wireless communications device according to claim 1, wherein the wireless communications device comprises a wireless mobile communications device.***

The combination of IEEE 802.11a and POSITA knowledge discloses this element. Ex. 1108, ¶¶216-221, 37-112, see 133-229. IEEE 802.11a teaches the use of OFDM devices for wireless transmitting and receiving data. See Ex. 1107,
10 12. POSITA knowledge also discloses a “wireless network” for “communications among transmitters and receivers.”

In light of the disclosures of IEEE 802.11a and POSITA knowledge, a POSITA would have recognized that the disclosed OFDM devices could be mobile devices, as wireless devices are, by definition, devices without wires, which are
15 therefore portable or mobile. Ex. 1108, ¶¶215-216. Indeed, the devices of IEEE 802.11a and POSITA knowledge are both devices that communicate wirelessly using OFDM systems, and a POSITA would have further recognized that devices that communicate in a wireless network can be mobile. *Id.* Thus, the obvious combination of IEEE 802.11a and POSITA knowledge teaches a wireless mobile
20 communication device. Ex. 1108, ¶¶217-218.

[14] The wireless communications device according to claim 1, wherein the optimal extended long training sequence is longer than a long training sequence used by a legacy wireless local area network device in accordance with a legacy wireless networking protocol standard.

5 The combination of IEEE 802.11a and POSITA knowledge discloses this element. Ex. 1108, ¶¶222-226, see 37-112, 133-229. IEEE discloses that the 802.11a legacy wireless networking protocol standard uses “52 subcarriers.” See Ex. 1107, 11; Ex. 1108, ¶224. The optimized ELTS has 56 active subcarriers. *Id.* A POSITA would have recognized that when an IFFT is performed on an ELTS
10 with 56 active subcarriers, an optimal ELTS synthesized from ***56 active subcarriers*** is produced. Ex. 1108, ¶¶221-222.

 While the outermost boundaries of the term “a legacy wireless local area network device in accordance with a legacy wireless networking protocol standard” are subject to alternative interpretations (Section VI), there is no dispute
15 this element plainly encompasses at least the preferred embodiment of the ’842 patent—that is, 802.11a or 802.11g compliant devices. Ex. 1101, 4:6-8; Ex. 1108, ¶¶220. As explained above, POSITA knowledge teaches wherein a 56-subcarrier ELTS, which is longer than a 52-subcarrier LTS used by 802.11a or 802.11g compliant devices. Ex. 1108, ¶221-223.

Thus, the combination of IEEE 802.11a and POSITA knowledge discloses an ELTS with 56 active subcarriers, which is longer than an LTS used in legacy WLAN device (e.g., 52 subcarriers).

5 ***[19] The wireless communications device according to claim 1, wherein the extended long training sequence or the optimal extended long training sequence is encoded using binary phase shift key encoding on each of the subcarriers.***

As discussed in Section VII.C (claim 8), the combination of IEEE 802.11a and POSITA knowledge discloses this element. Ex. 1107, 11; Ex. 1108, ¶227-229,
10 see 37-112, 133-226. The optimized POSITA long training sequence shows that BPSK encoding is used on every active subcarrier of the ELTS. Ex. 1108, ¶225. Additionally, IEEE 802.11a states that the 802.11a standard allows for BPSK encoding. Ex. 1107, 11.

While the outermost boundaries of the term “extended long training
15 sequence” are subject to alternative interpretations (Section VI), there is no dispute this element plainly encompasses at least the preferred embodiment of the ’842 patent shown in Figure 5. Ex. 1101, 5:20-25; Ex. 1108, ¶225. As the ’842 patent explains, “[t]he long training sequence of 802.11a and 802.11g is defined such that
20 each of sub-carriers -26 to +26 has one BPSK constellation[sic] point, either +1 or 1.” Ex. 1101, 2:29-35. As shown in the optimized long training sequence, BPSK encoding is applied to each active subcarrier in the LTS (all non-zero

subcarriers), which is identical to the preferred embodiment of the '842 patent. Ex. 1108, ¶225. Thus, POSITA knowledge discloses that the ELTS or the optimal ELTS is encoded using BPSK encoding on each of the subcarriers.

**VIII. STATEMENT RESPONSIVE TO JULY 2019 TRIAL PRACTICE
GUIDE UPDATE REGARDING PARALLEL *INTER PARTES*
REVIEW PETITIONS**

Petitioners submit (1) that they wish the Board to consider first the merits of this Petition (IPR2019-01437) filed today, August 5, 2019, and then the ZTE/Coolpad IPR Petition (IPR2019-01345) filed on July 18, 2019, if the Board uses its discretion to institute any of the petitions, and (2) that the primary difference between the earlier-filed petitions and this Petition is that this Petition provides an obviousness ground under § 103 that is entirely based on prior art under § 102(b).

In co-pending district court litigation, BNR recently asserted an invention date before July 21, 2004, which is the earliest priority date claimed in the '842 patent. Under the pre-AIA “first to invent” system, BNR’s newly-asserted early invention date could be used to swear behind each § 102(e) prior art reference contained in (all) grounds of the ZTE/Coolpad IPR Petition, which is identical to

the Huawei IPR Petition IPR2019-01174, in its grounds, prior art, analyses, and evidence. See below comparison of the petitions' prior art grounds.

Ground	'842 Patent Claims	Huawei IPR Petition (IPR2019-01174); ZTE/Coolpad follow-on IPR Petition (IPR2019-01345)	This Petition (IPR2019-01437)
1	1–4, 8, 11, 14, 19	§102: U.S. Pat. No. 7,453,793 (“Jones”)	§103: IEEE Std 802.11a-1999 (“IEEE 802.11a”) <i>IEEE 802.11a is prior art under §102(b), and cannot be sworn behind by earlier pre-filing evidence</i>
2	1–4, 8, 11, 14, 19	§103: Jones in view of U.S. Pub. No. 2004/0093545 (“Khandani”). <i>Both are prior art under §102(e) and may potentially be sworn behind.</i>	N/A
3	1–4, 8, 11, 14, 19	§103: IEEE Std 802.11a-1999 (“IEEE”) in view of U.S. Pub. No. 2005/0286474 (“Zelst”). <i>Zelst is prior art under §102(e) and may potentially be sworn behind.</i>	N/A
4	1–4, 8, 11, 14, 19	§103: IEEE in view of Zelst and Khandani. <i>Zelst and Khandani are prior art under §102(e) and may potentially be sworn behind.</i>	N/A

This Petition presents a new ground based on § 102(b) prior art IEEE 802.11a and supporting evidence that are different from the other two petitions,

which is significant in light of BNR's newly alleged invention date because the applicability of prior art references and/or combinations could significantly impact whether an IPR is instituted and ultimately, the outcome of a Final Written Decision. In the interest of efficiently resolving and addressing the patentability issues of the '842 patent (in light of infringement actions against multiple practicing technology company defendants), and in the interest of the integrity of the patent system under § 316(b) (in light of the preponderance of evidence presented in the three petitions), the Board should exercise its discretion to institute more than one petition on the '842 patent under 35 U.S.C. § 314(a). As explained

below, Petitioners submit that the circumstances surrounding the '842 patent are sufficiently rare to require more than one petition: BNR has engaged in expansive infringement actions against multiple defendants, which are increasingly complex and time-consuming due to BNR's new assertions of an earlier invention date.

This is precisely the situation identified in the Board's July 2019 AIA Patent Trial

Practice Guide Update at 26:

the Board recognizes that there may be circumstances in which more than one petition may be necessary, including for example . . . when there is a dispute about priority date requiring arguments under multiple

prior art references. In such cases two petitions by a petitioner may be needed, although this should be rare.

The Board's institution of more than one IPR petition in this situation can be dispositive on all disputes in connection with the '842 patent. Furthermore, to facilitate the efficient administration of the Office in conducting more than one IPR proceeding on the '842 patent and to timely complete the IPR proceedings within one year under §§ 316(a) and 316(b) in light of specific circumstances on the different petitions on the '842 patent, Petitioners request the Board merge the different IPR proceedings into the same trial schedule based on Board's processing of the earliest Huawei IPR Petition under Case No. IPR2019-01345. This request also enables BNR to defend the validity of the '842 patent in a single proceeding.

A. The *Becton Dickinson* factors under § 325(d) favor institution

This Petition should be instituted under the *Becton Dickinson* factors.

Considering **Factors One and Two**, the prior art IEEE 802.11a standard was neither submitted by the applicant in an Information Disclosure Statement nor independently considered by the Examiner during prosecution of the '842 patent (or its parent application). See Ex. 1101 at 1, Ex. 1102, Ex. 1105 at 1, Ex. 1106. Hence, the proposed ground based on the IEEE 802.11a standard is not cumulative to prior art or rejections in the original examination. With respect to the earlier Huawei and ZTE/Coolpad petitions (Case Nos. IPR2019-01345, IPR2019-01174), the proposed ground based on the IEEE 802.11a standard cannot be overcome

because the earliest effective filing date for the '842 patent was fatally late after the 1-year bar under § 102(b), and is not cumulative because all grounds in the prior petitions contain § 102(e) prior art and are materially different under pre-AIA novelty law.

5 With respect to **Factor Three**, although IEEE 802.11a was discussed in the applications' Background section, the Examiner never evaluated IEEE 802.11a during examination of the '842 patent or its parent. In comparison with the earlier Huawei and ZTE/Coolpad petitions, this Petition presents new evidence and analyses to demonstrate that a POSITA would have considered each challenged
10 claim as obvious in light of the teachings of IEEE 802.11a and the well-known (by the end of 2001) wireless communications techniques that should have barred the grant of the '842 patent under § 102(b).

 Consideration of **Factor Four** favors institution. Notably, the '842 patent's parent's prosecution history was very brief. The Examiner allowed the
15 independent claims in the first Office action, and rejected only the dependent claims under 35 U.S.C. § 101. Ex. 1106 at 56. In applicant's response that led to allowance, the applicant merely amended the claims to recite "Inverse Fourier Transformer" (instead of "Inverse Fourier Transform"), to specify the method to be performed "in a wireless communication device" and to add dependent claims on
20 examples of network devices, all of which were well known features. *Id.* at 44

and 34.

The same Examiner examined and allowed the '842 patent without having considered the substantial evidence of prior art such as IEEE 802.11a as in the parent case. The '842 patent was filed with the abstract, specification, figures, and
5 claims of the parent application (Ex. 1102 at 62–79), and a preliminary amendment that canceled all but original claim 1 (*id.* at 60, 71–72). In response to a first Office action that rejected claim 1 based on “same invention”-type double patenting over the parent patent (*id.* at 48), applicant canceled claim 1 and added claims 16–35 (*id.* at 37–43). The Examiner rejected claims 16–35 under
10 obviousness-type double patenting in a second Office action (*id.* at 32–36), but accepted applicant’s terminal disclaimer over the parent patent. The Examiner never made any substantive analyses of the prior art nor raised any prior art rejections and nothing was made in the record regarding the teachings in IEEE 802.11a. Therefore, there is no overlap between any aspect of the original
15 examination and IEEE 802.11a.

As for **Factor Five**, although it is understandable that the original examination was conducted with limited Office resources and time, the failure to consider the teachings of IEEE 802.11a and the well-known wireless communications techniques of the time was a significant error that led to the grant
20 of the '842 patent. This Petition provides a remedial proceeding under the AIA to

efficiently address that error in the interest of the integrity of the patent system under § 316(b).

Finally, turning to **Factor Six**, the additional evidence and facts presented in this Petition provide a significant showing of the status of the prior art by the end of 2001 that is material to the important statutory requirement of timely patent filing and policy considerations under the 1-year bar in § 102(b), and thus warrant reconsideration of the small amount of non-overlapping prior art or examination arguments. The 1-year bar in § 102(b) is an important and unique U.S. patent law provision in the pre-AIA system and is also present in the AIA novelty law.

Broadcom inventors' pre-filing activities under the pre-AIA novelty law do not eliminate Broadcom's compliance with the early filing requirement of the 1-year bar rule under § 102(b). The evidence of knowledge of a POSITA by the end of 2001 regarding the well-known wireless communications techniques in light of teachings of IEEE 802.11a allows evaluation of the compliance with the 1-year bar rule under § 102(b) that was not possible in the original examination and the earlier Huawei and ZTE/Coolpad petitions under Case Nos. IPR2019-01174 and IPR2019-01345.

In light of the six *Becton Dickinson* factors and the unique circumstances, the Board should exercise its discretion to institute this Petition in order to efficiently and fully address the issues under the 1-year bar rule in § 102(b).

B. The *General Plastic* factors suggest the Director/Board should not exercise discretion to deny this Petition under 35 U.S.C. § 316(b)

This is not the *General Plastic* scenario of “potential [] abuse of the review process by repeated attacks on patents.” *General Plastic v. Canon*, IPR2016-01357, Paper 19 at 16–17 (PTAB Sept. 6, 2017). Petitioners bring this second Petition to ward off a belated priority claim by BNR asserted in the underlying district court litigation. Instead of impacting “the efficiency of the *inter partes* review process,” instituting this Petition will positively improve “the fundamental fairness of the process for all parties” because it will allow the Board to properly evaluate prior art material to patentability of the ’842 patent under the § 102(b) 1-year bar rule that is independent of the now-alleged earlier invention date before the earliest filing made for the ’842 patent.

Regarding **Factors One** and **Two**, Petitioners previously filed a follow-on petition on July 18, 2019 challenging the same claims to protect Petitioners’ rights to joinder should Huawei settle before an institution decision could be reached.

When filing the first petition, Petitioners knew of the IEEE 802.11a prior art cited in the second Petition. Petitioners acted expeditiously in preparing this Petition to address the 1-year bar issue under § 102(b) after BNR alleged an earlier pre-filing invention date and served amended infringement contentions on April 19, 2019 in the district court litigation.

As to **Factor Three**, at the time of filing this second Petition, Petitioners

have not received patent owner's preliminary response to the first petition (due this fall), or the Board's decision whether to institute review in the first petition (anticipated in December 2019), mooted any potential allegation that this Petition would game an advantage from previewing any BNR or Board-identified perceived deficiencies. Notably, the evidence in this Petition is presented to specifically address the question of whether the original applicant Broadcom violated the 1-year bar rule under § 102(b) by filing too late in the Patent Office, despite any Broadcom pre-filing activities that may have predated the earliest filing date for the '842 patent. The first petition does not contain any evidence to address this § 102(b) issue and thus it is not possible for the patent owner's preliminary response to the Board in the first petition to provide any advantage to the proposed ground in this Petition.

Relative to **Factors Four and Five**, an important consideration for this Petition is BNR's assertion of a significantly earlier pre-filing invention date (January 1, 2002) relative to the earliest priority claim of the '842 patent (July 27, 2004). A significantly earlier priority date affects the applicability of various non-§ 102(b) references asserted in the first petition, and district court invalidity contentions. Thus, the elapsed time is due to not having notice until June 21, 2019 that BNR was persisting in their potential (and significantly earlier) priority claim. Unable to evaluate the earlier priority date (due to BNR's failure to disclose), and

facing the one-year 35 U.S.C. § 315(b) date, Petitioners had no practical choice but to file a first follow-on petition, and then with a little more preparation time, this second Petition.

Petitioners recognize the finite resources of the Board under **Factor Six**, but
5 do not believe that this Petition will cause undue burden, in part because
Petitioners' first petition has the same content as that already filed by another
defendant. The Board has discretion to join Petitioners' first (and/or second)
petition with the earlier-filed proceedings, which would help alleviate any resource
constraints. Notably, the institution of this Petition would allow the Board to
10 evaluate and decide whether the '842 patent is in compliance with the important §
102(b) 1-year bar statutory requirement that would not be available in the first
petition.

In consideration of the priority date issue, Petitioners advocate for a
balancing of any burden against the clear public interest in addressing the
15 patentability (and priority claim) of such a repeatedly-asserted patent. The PTAB
is an especially appropriate and specialized forum for adjudicating such disputes.

Lastly, as to **Factor Seven**, the requirement under § 316(a)(11) to issue a
final determination not later than 1 year after institution of review is unlikely to be,
or will not be impacted. Petitioners are willing to work with the Board and BNR
20 should this Petition be instituted, on a modified schedule to help align the schedule

of this trial with earlier trials in such a way that does not prejudice BNR or impose any additional burdens on the Board while taking into account the procedures associated with a § 102(b) priority dispute. In addition, the handling of the trial for this Petition would benefit from the knowledge of the technical and legal issues in the claims and teachings in IEEE 802.11a by the Board and the parties in the Huawei and ZTE/Coolpad IPR petitions, thus improving the efficiency in resolving the invalidity of the '842 patent in light of the evidence presented in this Petition.

IX. CONCLUSION

Based on the evidence set forth in Ground 1 above, Petitioners request *inter partes* review of all the Challenged Claims.

Dated: August 5, 2019

Respectfully Submitted,

/ Amol A. Parikh /

Amol A. Parikh
USPTO Reg. No. 60,671
McDERMOTT WILL & EMERY
444 West Lake Street
Chicago, IL 60606-0029
Phone: 312-984-6477
Fax: 312-984-7700
amparikh@mwe.com
jrbaker@mwe.com

Thomas N. Millikan
Reg. No. 72,316
PERKINS COIE LLP
11452 El Camino Real, Suite 300
San Diego, CA 92130-2080
Tel.: 858.720.5723
Fax: 858.720.5799
millikan-ptab@perkinscoie.com

Charles McMahon
USPTO Reg. No. 44,926
McDERMOTT WILL & EMERY
444 West Lake Street
Chicago, Illinois 60606
Phone: 312-984-7641
Fax: 312-984-7700
cmcMahon@mwe.com

Bing Ai
Reg. No. 43,312
PERKINS COIE LLP
11452 El Camino Real, Suite 300
San Diego, CA 92130-2080
Tel.: 858.720.5707
Fax: 858.720.5799
ai-ptab@perkinscoie.com

Thomas M. DaMario
USPTO Reg. No. 77,142
McDERMOTT WILL & EMERY
444 West Lake Street
Chicago, Illinois 60606
Phone: 312-984-7527
Fax: 312-984-7700
tdamario@mwe.com

Yun (Louise) Lu, Reg. No. 72,766
PERKINS COIE LLP
11452 El Camino Real, Suite 300
San Diego, CA 92130-2080
Tel.: 858.720.5732
Fax: 858.720.5799
lu-ptab@perkinscoie.com

Jiaxiao Zhang
USPTO Reg. No. 63,235
McDERMOTT WILL & EMERY
18565 Jamboree Road, Suite 250
Irvine, California 92612
Phone: 949-757-6398
Fax: 949-851-9348
jiazhang@mwe.com

Joseph P. Reid, Reg. No. 72,317
PERKINS COIE LLP
11452 El Camino Real, Suite 300
San Diego, CA 92130-2080
Tel.: 858.720.5764
Fax: 858.720.5799
reid-ptab@perkinscoie.com

John P. Schnurer, Reg. No. 52,196
PERKINS COIE LLP
11452 El Camino Real, Suite 300
San Diego, CA 92130-2080
Tel.: 858.720.5705
Fax: 858.720.5799
schnurer-ptab@perkinscoie.com

James Young Hurt, (*pro hac vice* to be submitted)
PERKINS COIE LLP
11452 El Camino Real, Suite 300
San Diego, CA 92130-2080
Tel.: 858.720.5780
Fax: 858.720.5799
JHurt@perkinscoie.com

CERTIFICATION UNDER 37 C.F.R. §42.24(d)

Under the provisions of 37 C.F.R. §42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for *Inter Partes* Review totals 13,999 words, which is less than the 14,000 allowed under 37 C.F.R. §42.24(a)(i).

Dated: August 5, 2019

Respectfully submitted,

/Amol A. Parikh/

Amol A. Parikh

USPTO Reg. No. 60,671

MCDERMOTT WILL & EMERY

444 West Lake Street, Suite 4000

Chicago, IL 60606-0029

Phone: 312-984-6477

Fax: 312-984-7700

amparikh@mwe.com

jrbaker@mwe.com

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6(e)(4)(i) *et seq.* and 42.105(b), the undersigned certifies that on August 5, 2019, a complete and entire copy of this Petition for *Inter Partes* Review and all supporting exhibits were provided by Federal Express, cost prepaid, to the Patent Owner by serving the correspondence address of record as follows:

MCANDREWS HELD & MALLOY, LTD.
500 West Madison Street
Suite 3400
Chicago, IL 60661

and by electronic mail on the attorneys of record for BNR in the concurrent litigation matter:

Paul J. Skiermont
Sadaf R. Abdullah
Steven W. Hartsell
Christopher Hodge
Steven J. Udick
bnr_sdteam@skiermontderby.com
Mieke K. Malmberg
mmalmberg@skiermontderby.com

Dated: August 5, 2019

/ Amol A. Parikh /

Amol A. Parikh

MCDERMOTT WILL & EMERY

444 West Lake Street, Suite 4000

Chicago, IL 60606-0029

Phone: 312-984-6477

amparikh@mwe.com

jrbaker@mwe.com