

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

~~INTEL CORPORATION~~ DELL INC., and DELL TECHNOLOGIES INC.,

Petitioners

v.

AX Wireless LLC,

Patent Owner.

~~IPR 2023-01145~~ IPR2024-00708

U.S. Patent No. 11,212,146

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 11,212,146**

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1001	U.S. Patent No. 11,212,146 (“the ’146 patent”)
1002	File History of the ’146 patent
1003	Declaration of Dr. Tom La Porta in Support of Petition
1004	Curriculum Vitae of Dr. Tom La Porta
1005	IEEE 802.11-05/0149r5, <i>WWiSE Proposal: High Throughput Extension to the 802.11 Standard</i> to Kose, et al, uploaded and publicly available on July 9, 2005 (“WWiSE”)
1006	U.S. Patent Publication No. 2006/0182017 to Hansen et al. (“Hansen”)
1007	Declaration of James L. Lansford, Ph.D.
1008	U.S. Provisional Application 61/235,909 (“the ’909PROV”)
1009	U.S. Patent 8,737,189 to Hansen, et al (“Hansen Patent”)
1010	U.S. Provisional Application 60/653,429 (“Hansen Provisional”)
1011	IEEE 802.11-04/0889r3, <i>TGn Sync Proposal Technical Specification</i> , to Mujtaba, uploaded and publicly available on January 20, 2005 (“TGn Sync”)
1012	IEEE 802.11-04/0886r6, <i>WWiSE Proposal: High Throughput Extension to the 802.11 Standard</i> , to Hansen, et al, uploaded and publicly available on January 6, 2005 (“January 2005 WWiSE”)
1013	IEEE Std. 802.11a-1999, <i>Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: High-Speed Physical Layer in the 5 GHz Band</i> , approved September 16, 1999 (“802.11a”)
1014	Declaration of David Ringle for 802.11a-1999 - IEEE Standard for Telecommunications and Information Exchange Between Systems – LAN/MAN Specific Requirements - Part 11: Wireless Medium Access Control (MAC) and physical layer (PHY) specifications: High-Speed Physical Layer in the 5 GHz Band, date of publication December 30, 1999
1015	<u>J.</u> Heiskala, et al., <i>OFDM Wireless LANs: A Theoretical and Practical Guide</i> (Sams Publishing 2002) (“Heiskala”)

Exhibit	Reference
1016	<u>D.</u> Tse, et al., <i>Fundamentals of Wireless Communication</i> (Cambridge University 2005) (“Tse”)
1017	U.S. Publication No. 2007/0115802 to Yu et al. (“Yu”)
1018	<u>E.</u> Perahia, “IEEE 802.11n Development: History, Process, and Technology,” IEEE Communications Magazine, July 2008
1019	U.S. Provisional Application 61/229,900 (“the ’900PROV”)
1020	<i>IEEE 100: The Authoritative Dictionary of IEEE Standard Terms</i> (IEEE 7th ed., 2000)
1021	R. Van Nee, et al., <i>OFDM for Wireless Multimedia Communications</i> , Artech House Publishers (2000) (“Van Nee”)
1022	B. Sklar, <i>Digital Communications: Fundamentals and Applications</i> (2d ed. 2001) (“Sklar”)
1023	M. Gast, <i>802.11 Wireless Networks: The Definitive Guide</i> (O’Reilly, 2002) (“Gast”)
1024	Aware, <i>G.hn: PHY-Frame Header Extension</i> , 09CC-046, Concord, CA, as filed in file wrapper of the ’566 patent
1025	CopperGate Communication, <i>G.hn: Using Two Symbols for the Header of a PHY frame on Coax</i> , ITU-T SG15/Q4, 09XC-100, Xian, China July 2009, as filed in file wrapper of the ’566 patent
1026	Intellon Corporation, <i>G.hn: Extended PHY frame header</i> , ITU-T SG15/Q4, 09XC-119, Xian, China, July 2009, as filed in file wrapper of the ’566 patent
1027	B. O’Hara et al., <i>802.11 Handbook: A Designer’s Companion</i> (IEEE 1999) (“O’Hara”)
1028	Editor for G.9960, <i>ITU-T Recommendation G.9960 Next Generation Wire-line Based Home Networking Transceivers-Foundation</i> , ITU-T SG15/Q4, January 2009, as filed in file wrapper of the ’566 patent

Exhibit	Reference
1029	IEEE 802.11-04/422r4, <i>New Participant Orientation</i> , presentation submission (July 2004) (Appendix A to Lansford Declaration, IEEE 802wirelessworld website, “New Participant Orientation” slides, available at https://mentor.ieee.org/802.11/dcn/04/11-04-0422-04-0000-new-participantorientation.ppt (Appendix A to <u>INTELDELL</u> -1007)
1030	IEEE 802.11-04/736r1, <i>Approved Minutes of the IEEE P802.11 Full Working Group</i> , Minutes (July 2004) (Appendix B to Lansford Declaration, <u>INTELDELL</u> -1007) IEEE 802wirelessworld website, July 2004 Meeting Minutes, available at http://grouper.ieee.org/groups/802/11/Minutes/Cons_Minutes_July-2004.pdf (Appendix B to <u>INTELDELL</u> -1007).
1031	U.S. Patent 7,415,074 (Appendix C to <u>INTELDELL</u> -1007)
1032	A. Stephens, <i>802.11 “Decrypted”</i> , ACM SIGCOMM Computer Communication Review, Vol. 35, No. 2 (April 2005) (“Stephens Paper”) (Appendix D to Lansford Declaration, <u>INTELDELL</u> -1007).
1033	<u>J.</u> Lörincz, et al, <i>Physical Layer Analysis of Emerging IEEE 802.11n WLAN Standard</i> , 8th International Conference Advanced Communication Technology (February 20-22, 2006); added to IEEE Xplore May 8, 2006
1034	<u>J.</u> Cox, <i>Stage Set for Compromise on IEEE High-Speed Wireless</i> , Network World (March 21, 2005)
1035	<u>R.</u> Kay, <i>Sidebar: The Battle for 11n</i> , ComputerWorld (March 13, 2006)
1036	“WWiSE” Consortium, <i>Motorola Team on Proposal for IEEE 802.11n</i> , Wireless Design Online (February 24, 2005)
1037	WWiSE Industry Organization press release, “WWiSE” Consortium and Motorola Team to Offer Enhanced Proposal for IEEE 802.11n (February 24, 2005); archived on April 6, 2005 at https://web.archive.org/web/20050406073808/http://www.wwise.org/presreleasefeb23.htm .
1038	<u>A.</u> Bahai, et al., <i>Multi-Carrier Digital Communications theory and Applications of OFDM</i> , (Springer 2004)

Exhibit	Reference
1039	Infringement Contents with Appendices served in <i>AX Wireless LLC v. Dell Inc. et al.</i> , and <i>AX Wireless LLC v. HP Inc.</i> , U.S. District Court Eastern District of Texas, Case Numbers 2:22-cv-00277 and 2:22-cv-00279, November 3, 2022
<u>1040</u>	<u>Jan. 11, 2024 Letter from Sarah Piepmeier to Kevin Wheeler regarding Dell Stipulation</u>
<u>1041</u>	<u>Sixth Amended Docket Control Order, <i>AX Wireless LLC v. Dell Inc. et al.</i>, No. 2:22-cv-00277-RWS-RSP (E.D. Tex. Feb. 26, 2024), ECF No. 171</u>
<u>1042</u>	<u>Third Amended Docket Control Order, <i>AX Wireless LLC v. Lenovo Grp. Ltd.</i>, No. 2:22-cv-00280-RWS-RSP (E.D. Tex. Oct. 31, 2023), ECF No. 130</u>
<u>1043</u>	<u>Docket Control Order, <i>LightGuide, Inc. v. Amazon.com, Inc., et al.</i>, No. 2:22-cv-00433-RWS-RSP (E.D. Tex. May 15, 2023)</u>
<u>1044</u>	<u>Docket Control Order, <i>Textron Innovations Inc., v. SZ DJI Tech. Co., Ltd., et al.</i>, No. 2:22-cv-0351-RWS-RSP (E.D. Tex. May 11, 2023)</u>
<u>1045</u>	<u>“Time to Milestones – Judges: Robert W. Schroeder, III Case Filing Date: On or After Jan. 1st, 2008,” Docket Navigator</u>
<u>1046</u>	<u>Dell’s Opposed Motion for Stay Pending IPR, <i>AX Wireless LLC v. Dell Inc. et al.</i>, No. 2:22-cv-00277-RWS-RSP (E.D. Tex. Mar. 13, 2024), ECF No. 179</u>
<u>1047</u>	<u>Comparison between the current Petition and petition in IPR2023-01145</u>

TABLE OF ABBREVIATIONS

Abbreviation	Meaning
AP	access point
BSS	basic service set
ER	extended range
FFT	fast Fourier transform
GHz	gigahertz
HT	high throughput
IEEE	Institute of Electrical and Electronics Engineers
IFFT	inverse fast Fourier transform
MAC	media access control
MCS	modulation and coding scheme
MHz	megahertz
MIMO	multiple-input multiple-output
NR	normal range
OFDM	orthogonal frequency division multiplexing
PHY	physical layer
PLCP	PHY layer convergence protocol
PPDU	physical layer protocol data unit
PSDU	PLCP Service Data Unit
RX	receive
STA	station
TX	transmit
WLAN	wireless local area network

APPENDIX OF CHALLENGED CLAIMS

Challenged Claim	Limitation
[1Pre]	<i>A wireless communication device, comprising:</i>
[1A]	<i>a wireless receiver configured to receive a wireless packet through a communication channel, formats of the wireless packet including a first packet format and a second packet format, the first packet format comprising a first header field carried by a first orthogonal frequency division multiplexing (OFDM) symbol, the second packet format comprising both the first header field carried by the first OFDM symbol and a second header field carried by a second OFDM symbol which follows the first OFDM symbol, and the second header field being a repetition of the first header field;</i>
[1B]	<i>a demodulator configured to demodulate the received wireless packet,</i>
[1C]	<i>wherein the wireless receiver distinguishes the second packet format from the first packet format by detecting, from the received wireless packet, the second header field which repeats the first header field.</i>
2	<i>The wireless communication device of claim 1, wherein the wireless receiver determines the received wireless packet as the second packet format when the second header field is detected from the wireless packet.</i>
3	<i>The wireless communication device of claim 1, wherein the wireless receiver determines the received wireless packet as the first packet format when the second header field is not detected from the wireless packet.</i>
4	<i>The wireless communication device of claim 1, wherein the first and second header fields contain information for decoding the wireless packet.</i>

Challenged Claim	Limitation
5	<i>The wireless communication device of claim 1, wherein the first and second header fields contain information related to a length of the wireless packet.</i>
[6Pre]	<i>A wireless communication method, comprising:</i>
[6A]	<i>receiving a wireless packet through a communication channel, formats of the wireless packet including a first packet format and a second packet format, the first packet format comprising a first header field carried by a first orthogonal frequency division multiplexing (OFDM) symbol, the second packet format comprising both the first header field carried by the first OFDM symbol and a second header field carried by a second OFDM symbol which follows the first OFDM symbol, and the second header field being a repetition of the first header field, and</i>
[6B]	<i>demodulating the received wireless packet,</i>
[6C]	<i>wherein the second packet format is distinguished from the first packet format by detecting, from the received wireless packet, the second header field which repeats the first header field.</i>
7	<i>The wireless communication method of claim 6, wherein the received wireless packet is determined as the second packet format when the second header field is detected from the wireless packet.</i>
8	<i>The wireless communication method of claim 6, wherein the received wireless packet is determined as the first packet format when the second header field is not detected from the wireless packet.</i>

Challenged Claim	Limitation
9	<i>The wireless communication method of claim 6, wherein the first and second header fields contain information for decoding the wireless packet.</i>
10	<i>The wireless communication method of claim 6, wherein the first and second header fields contain information related to a length of the wireless packet.</i>

I. INTRODUCTION

~~Intel Corporation~~Dell Inc. and Dell Technologies Inc. (collectively, “~~IntelDell~~” or “Petitioner”) petitions for *inter partes* review (“IPR”) of claims 1–10 (“the Challenged Claims”) of U.S. Patent No. 11,212,146 (“the ’146 patent”; ~~INTELDELL~~-1001).

II. GROUNDS FOR STANDING

Petitioner certifies the ’146 patent is available for IPR, and Petitioner is not barred or estopped from requesting IPR on the grounds herein.

III. IDENTIFICATION OF CHALLENGE

A. Prior Art

The ’146 patent claims the benefit of Provisional Application 61/235,909, filed August 21, 2009. Petitioner does not acquiesce that the ’146 patent is entitled to priority benefit the ’909 provisional ~~and has filed a parallel petition that challenges that priority claim (see IPR2023-01146)~~. For purposes of this petition, however, Petitioner assumes that the ’146 patent is entitled to priority based on the ’909 provisional, and each reference presented herein qualifies as prior art because it was publicly available or issued prior to August 21, 2009.

1. **U.S. Publication No. 2007/0115802 to Yu et al.** (“Yu”; ~~INTELDELL~~-1017), published on May 24, 2007, is prior art under pre-AIA §102(b).

2. **U.S. Patent Publication No. 2006/0182017 to Hansen et al.** (“Hansen”; ~~INTELDELL~~-1006), published on August 17, 2006, is prior art under

pre-AIA §102(b).

3. **Kose & M. Fischer, *WWiSE Proposal: High throughput extension to the 802.11 Standard* (IEEE 2005)** (“WWiSE”; ~~INTELDELL~~-1005) is prior art under ~~pre-AIA~~ 35 U.S.C. ~~pre-AIA~~-§102(b) because the document was available and accessible to the public on July 9, 2005. (See ~~INTELDELL~~-1007, ¶24.) WWiSE was a submission made to Task Group n (“TGn”) of the IEEE 802.11 Wireless Local Area Networks (“WLAN”) Working Group. During the 2004-2005 timeframe, IEEE Working Group members could provide submissions. (~~INTELDELL~~-1007, ¶15.) Members made these submissions through the IEEE 802 Wireless World website, <http://802wirelessworld.com>. (~~INTELDELL~~-1007, ¶16; ~~INTELDELL~~-1029 (New Participant Orientation Slides), 35–37; ~~INTELDELL~~-1030 (July 2004 Meeting Minutes), 5.) All submissions were accessible to any member of the public after free registration through the Wireless World website. (~~INTELDELL~~-1007, ¶18; ~~INTELDELL~~-1029 (New Participant Orientation Slides), 25-30 (describing process of becoming a member).) After creating an account, an individual could view the “Working Group Document Listing” and download any submissions that had been uploaded. (~~INTELDELL~~-1029 (New Participant Orientation Slides), 35; ~~INTELDELL~~-1007, ¶18.) Submissions were also publicly available to any member of the public via FTP at [ftp.wirelessworld.com](ftp://ftp.wirelessworld.com). (~~INTELDELL~~-1007, ¶19; ~~INTELDELL~~-1029 (New Participant Orientation Slides), 35 (describing process for

creating a free account).) The FTP server's address and login credentials were also publicly available. (~~INTELDELL~~-1007, ¶19, *citing* ~~INTELDELL~~-1031 and ~~INTELDELL~~-1032)).

In mid-2007, the IEEE's current Mentor website ("Mentor") replaced the Wireless World website. (~~INTELDELL~~-1007, ¶21.) Prior submissions uploaded to the Wireless World server were added to Mentor shortly after its creation. (~~INTELDELL~~-1007, ¶21.) The uploaded documents retained their original submission upload dates. (~~INTELDELL~~-1007, ¶21.) Mentor and all its documents have been freely available to members of the public since soon after its creation in 2007 and before August 21, 2009. (~~INTELDELL~~-1007, ¶21.) Entries in Mentor were and remain searchable by year, task group, title, or other parameters. (~~INTELDELL~~-1007, ¶22.)

WWiSE was uploaded to the IEEE database on July 9, 2005, at which time it would have been available to interested members of the public through the Wireless World website or by FTP. (~~INTELDELL~~-1007, ¶¶18-29, 24.) After mid-2007 and before August 21, 2009, WWiSE would have been available to interested members of the public through Mentor. (~~INTELDELL~~-1007, ¶¶18-18, 21, 24.) Interested members of the public would have been aware of the proposals made to IEEE by WWiSE because they were frequently discussed in 2004 and 2005 in industry publications. (*See, e.g.,* ~~INTELDELL~~-1033–1037.)

For at least these reasons, WWiSE was publicly accessible prior to the earliest priority date of the '566 patent to a person of ordinary skill in the art ("POSITA") exercising reasonable diligence. *See GoPro, Inc. v. Contour IP Holding LLC*, 908 F.3d 690, 693 (Fed. Cir. 2018).

None of the applied references were cited in or discussed during prosecution of the '146 patent, weighing heavily against discretionary denial under 35 U.S.C. §325(d).

B. Grounds For Challenge

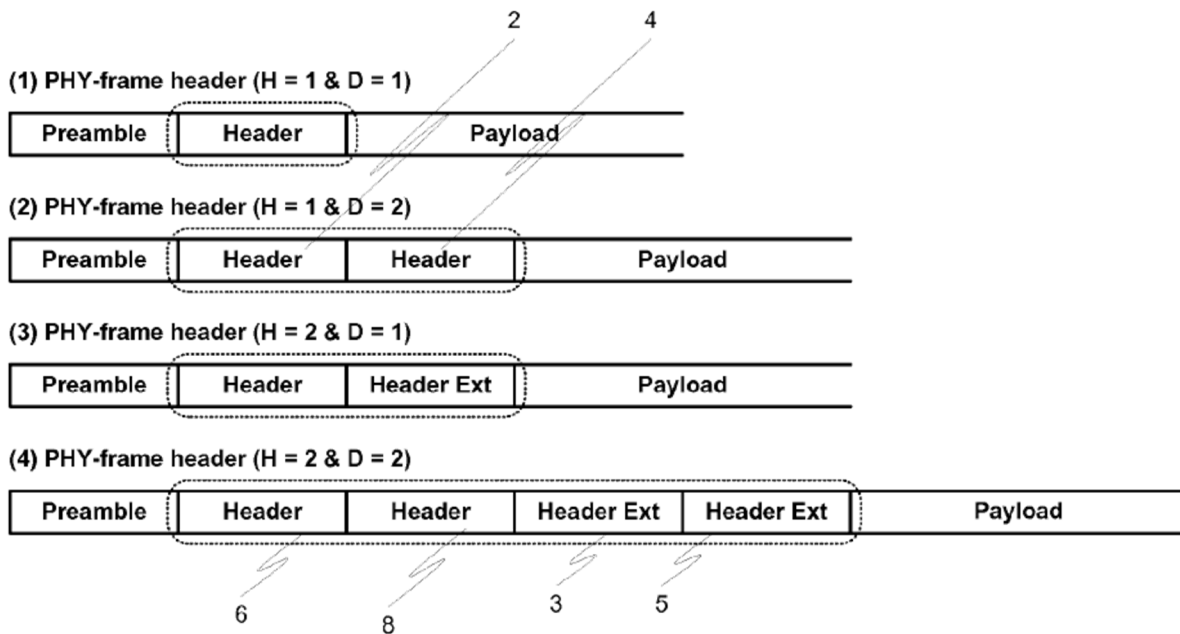
Ground		Claims	Prior Art
1	§103	1–10	Yu
2	§103	1–10	Hansen and WWiSE

IV. '146 PATENT OVERVIEW

The '146 patent relates to “exemplary methods [and] systems . . . directed toward header repetition in a communications environment.” (~~INTELL~~DELL-1001, 1:33–36.) According to the specification, “[t]he header contains important control information for the receiver to decode the payload properly, and also provides information about the packet length for virtual carrier sensing,” so “it is essential to decode the header reliably.” (~~INTELL~~DELL-1001, 1:55–58.) In the prior art, it was known that a “header containing PHY_H bits (header information block) is carried over one or two OFDM symbols (D=1 or 2), and within each symbol, multiple

header information blocks are repeated over the entire frequency band.”
(~~INTELDELL~~-1001, 1:60–64.) It was further known to extend a header to provide more information by “carrying more than PHY_H bits in the header ($H=1$ or 2).”
(~~INTELDELL~~-1001, 1:9–10.)

Both prior-art concepts are illustrated in Figure 1 from the '146 patent below. The value of “D” corresponds to the number of repetitions of the header field and “H” corresponds to the number of symbols required for a single header (*i.e.*, whether the header is extended).



In the first example ($H=1$ and $D=1$), the packet includes a “preamble followed by a header followed by a payload.” (~~INTELDELL~~-1001, 5:57–59.) This represents a simple one-part header field. The second example ($H=1$ and $D=2$), the packet includes a preamble followed by a header that is repeated, followed by the payload.

(~~INTELL~~DELL-1001, 5:59–61.) This “repeated header” example is a two-part header field with each part carrying the same information. (~~INTELL~~DELL-1001, 5:61–63.) In the third example (H=2 and D=1), the packet includes a preamble and header followed by a header extension and the payload. (~~INTELL~~DELL-1001, 5:63–65.) This “extended header” example is also a “two-part” header field, but the two parts carry different information. (See ~~INTELL~~DELL-1001, 2:37–43.) And in the fourth example (H=2 and D=2), the packet includes a preamble, a header that is repeated, and a header extension that is also repeated, followed by the payload. (~~INTELL~~DELL-1001, 5:65–6:1.)

The ’146 patent discusses “allowing different values of D in a single domain where nodes are operating in different portions of frequency bands” and “the level of frequency diversity is different depending on the bandplan.” (~~INTELL~~DELL-1001, 2:18–27.) For example, setting D=2 “increases reliability for the narrowband devices” because “each additional OFDM header symbol provides additional diversity thereby increasing the likelihood of decoding the header information correctly”; however, it “may also unnecessarily increase overhead for the wideband devices.” (~~INTELL~~DELL-1001, 2:28–31, 3:8–11.) The patent therefore focuses on “receiver detection of D with variable repetition,” where “the transmitter selects (or determines)[] the at least one D value ... at its own discretion, or [] based on information communicated between the one or more receivers, or based on

instructions from one or more other receivers and/or a domain master,” and the transmitter will “carry, insert or otherwise communicate the value of D in the header so that all nodes know how many OFDM symbols are carrying header information.” (~~INTELL~~DELL-1001, 2:51–3:1.) To ascertain the number of header symbols, “[t]he receiver(s) starts processing the header by decoding one OFDM header symbol,” and if successful, “the receiver knows how many more OFDM symbols (D-1) are carrying header information for a given frame.” (~~INTELL~~DELL-1001, 3:1–5.) But if unsuccessful “(i.e., the header decoding fails), then the receiver can try to decode two OFDM header symbols, and so on.” (~~INTELL~~DELL-1001, 3:5–8.) In other words, the patent specification teaches explicit signaling of the number of OFDM symbols carrying header information—which indicates the packet format—using a value “D” that the receiver decodes. The claims of the ’146 patent, however, more broadly recite a wireless receiver “configured to receive” first and second packet formats where the receiver “distinguishes the second packet format from the first packet format by detecting, from the received wireless packet, the second header field which repeats the first header field.” (See, e.g., ~~INTELL~~DELL-1001, cl.1.)

The Applicant, however, did not invent extending or repeating the header of an OFDM packet. In fact, PO admits in its provisional application that both were publicly disclosed and openly discussed prior to August 21, 2009, during development of the ITU-T G.hn standards for next-generation home network

technology. (See INTELDELL, 1008, 21–22; INTELDELL-1019; INTELDELL-1020; INTELDELL-1003, ¶¶33.) The challenged claims simply co-opt ideas disclosed in standards submissions from other companies and wrap them into a broadly recited wireless OFDM transceiver architecture.

A. Prosecution History

The '146 patent issued from U.S. Application No. 17/136,801, which was filed with a preliminary amendment cancelling all pending claims and adding a single new claim 60 that recited “An Orthogonal Frequency Division Multiplexing (OFDM) communications transmitter capable of generating a first packet type comprising a first header field.” (INTELDELL-1002 (Prelim. Amend. dated 12-29-2020), at 369–372).) The Examiner rejected that claim for non-statutory double patenting and under 35 U.S.C. §102. (INTELDELL-1002, 149–155).) On September 9, 2021, the applicant cancelled claim 60 and submitted an amendment with new claims 61-70 in substantially the same form as issued claims 1-10. (See INTELDELL-1002, 94–100.) The Examiner allowed the claims, noting in the Reasons for Allowance that the prior art failed to disclose “the second packet format comprising both the first header field carried by the first OFDM symbol and a second header field carried by a second OFDM symbol which follows the first OFDM symbol and the second header field being a repetition of the first header field.” (INTELDELL-1002, 19.)

B. Level Of Ordinary Skill In The Art

A POSITA at the time of the purported invention would have had at least a master's degree in electrical engineering or similar discipline, and/or two to three years of experience working or conducting research in wireless communication protocols, or an equivalent combination of education and experience.

(~~INTEL~~DELL-1003, ¶71.)

C. Claim Construction

Claim terms are typically given their ordinary and customary meanings as understood by a POSITA at the time of the invention. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-16 (Fed. Cir. 2005) (en banc). Petitioner does not believe it is necessary for the Board to expressly construe any term for the purpose of this IPR proceeding. *See Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

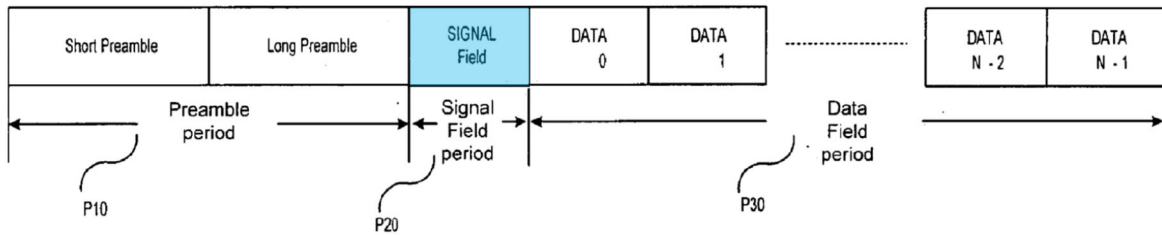
V. GROUND 1: Claims 1–10 Are Obvious Based On Yu.

A. Yu Overview

Yu is the May 24, 2007 publication of U.S. Patent Application 11/635,927, which matured into U.S. Patent No. 7,839,760 (~~INTEL~~DELL-1017; “Yu”). Yu relates “to an orthogonal frequency division multiplexing wireless local area network (LAN) transmitting/receiving system for providing expanded service coverage.” (~~INTEL~~DELL-1017, Abstract.) Yu describes its invention in the context of the IEEE 802.11a and 802.11g wireless LAN standards, which Yu sought to

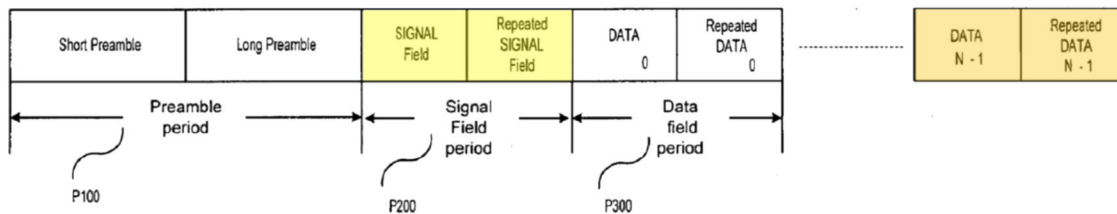
extend by adding new signaling modes with “high receiving sensitivity and wider coverage” while “providing compatibility with a conventional system.” (~~INTEL~~DELL-1017, ¶¶ 21–22.) In other words, Yu expanded the range for 802.11a/g networks while maintaining backward compatibility by adding an expanded range signaling mode in which the “SIGNAL” header field and data fields of a frame are repeated to increase communication range (“service radius”) by “50% to 100%,” at the expense of cutting the transmission speed in half. (~~INTEL~~DELL-1017, ¶¶24–28, 80.)

As Yu explains, legacy 802.11a-type frames do not include repeated header SIGNAL or data fields, which limits effective transmission range to “approximately 100m.” (~~INTEL~~DELL-1017, ¶17.) Figure 2, reproduced below, illustrates such a legacy frame. As shown, “the preamble period P10 includes a short preamble and long preamble,” and the “signal field of the signal field period P20 has transmission mode information (i.e., modulation method and code rate information) and frame length information.” (~~INTEL~~DELL-1017, Fig. 2, ¶¶10–15.)



Yu, Figure 2¹

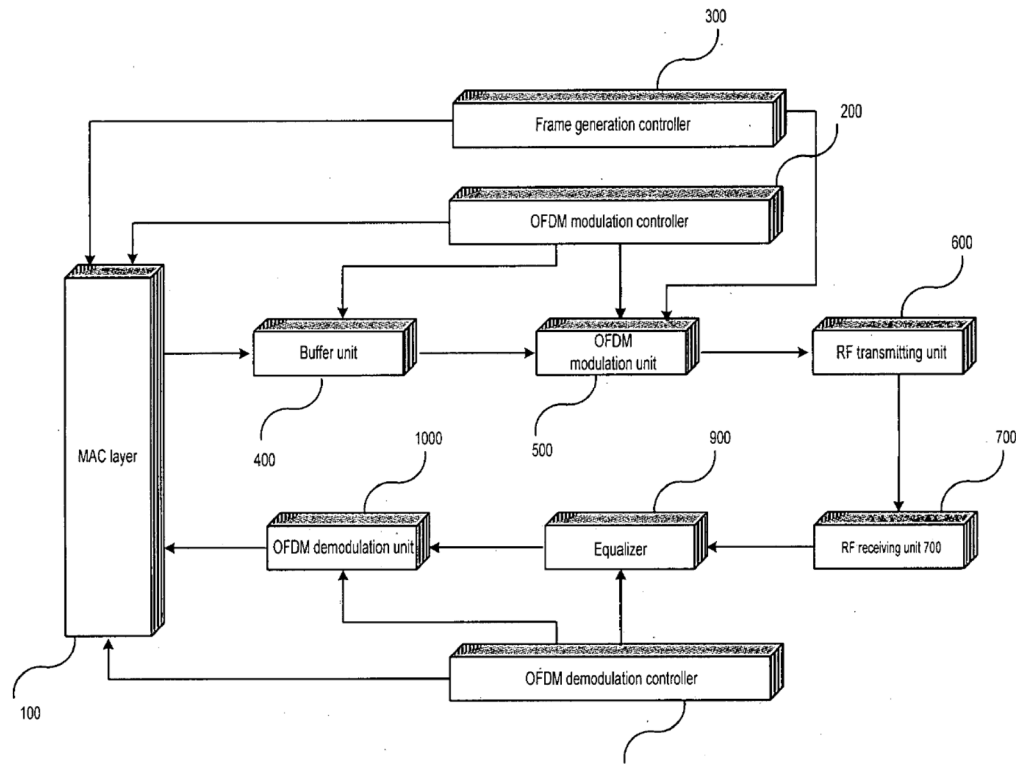
Yu's solution for increasing transmission range was to repeat the SIGNAL and data fields in the new frame format of Figure 7 (below). Yu explains that the new frame format includes "preamble period P100 [that] is the same as that of the conventional wireless LAN frame shown in FIG. 2" except the "signal field period P200 and the data field period P300 [that] are repeated." (~~INTEL~~DELL-1017, ¶83.)



Yu, Figure 7

Yu also describes a "wireless LAN transmitting/receiving system" for frames having the formats of Figures 2 and 7. (~~INTEL~~DELL-1017, ¶44, Fig. 3.)

¹ Annotations and emphases have been added throughout this petition unless otherwise noted.



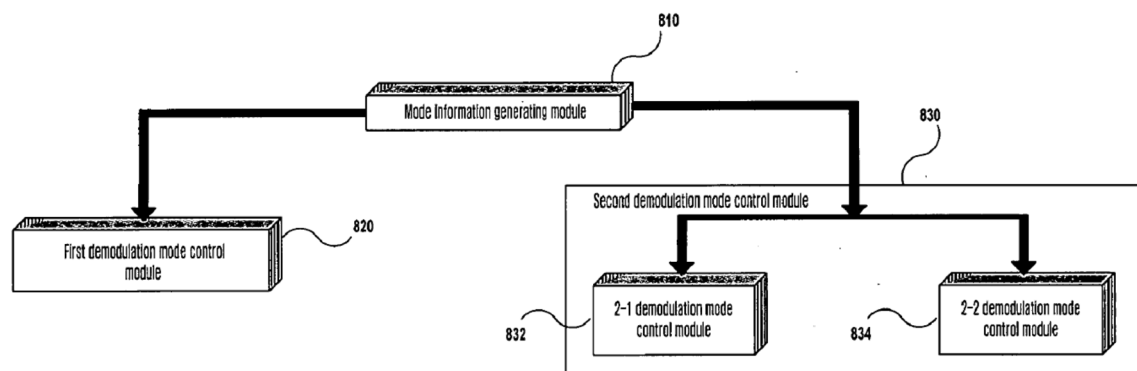
Yu, Figure 3

For receiving frames, Yu describes “RF receiving unit 700,” “OFDM demodulation controller 800,” “equalizer 900,” and “OFDM demodulation unit 1000.” (~~INTELDELL~~-1017, ¶46.) “OFDM demodulation controller 800 determines whether a received frame includes repeatedly modulated OFDM symbols, and controls an operation of a demodulation mode according to a determination result.” (~~INTELDELL~~-1017, ¶53.) “[E]qualizer 900 performs an equalization operation for each demodulation mode according to the determination result on whether the received frame includes the repeatedly modulated OFDM symbols.” (~~INTELDELL~~-1017, ¶54.) And “OFDM demodulation unit 1000 demodulates the signal field of the received frame for each demodulation mode determined according

to whether the received frame includes the repeatedly modulated OFDM symbols.”

(~~INTEL~~DELL-1017, ¶55.)

As shown in Figure 5 below, Yu’s OFDM demodulation controller 800 includes “mode information generating module 810,” which “generates demodulation mode information according to the determined result on whether the received frame includes the repeated signal fields.” (~~INTEL~~DELL-1017, ¶67.) “The first demodulation mode control module 820” controls the demodulation of normal-range packets, which are detected by the mode information generating module 810 because they lack a repeated signal field. (~~INTEL~~DELL-1017, ¶68.) Conversely, the “second demodulation mode control module 830” controls the demodulation of the expanded range packets detected by the mode information generation module based on a repeated signal field. (~~INTEL~~DELL-1017, ¶69.)

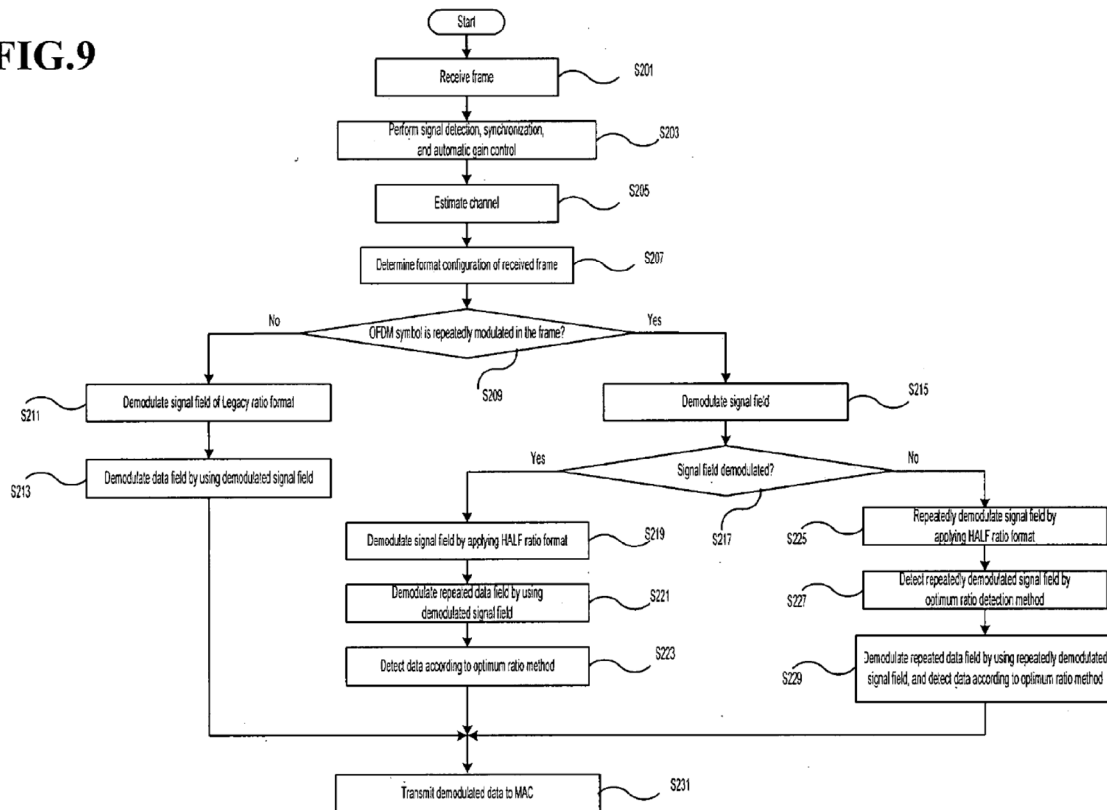


Yu, Figure 5

Yu additionally includes a flow diagram in Figure 9 that describes the receive process for the frame formats in Figures 2 and 7. In steps S207 and S209 “a format

configuration of the received frame is determined” to allow the selection of “a demodulation mode of the frame in which the signal field is not repeated, or a demodulation mode of the frame in which the signal field is repeated.” (~~INTELL~~-1017, ¶102.) Steps S207 and S209 correspond to mode information generating module 810 of Figure 5, which “generates demodulation mode information according to the determined result on whether the received frame includes the repeated signal fields.” (~~INTELL~~-1017, ¶67.)

FIG.9



If it is determined at steps S207 and S208 that the frame does not include a repeated signal field, control follows to the left branch in the flow diagram, and the frame is demodulated as a conventional, normal range frame. (~~INTELL~~-1017, ¶103.)

On the other hand, “when it is determined in step S209 that the signal field is repeatedly generated in the frame (i.e., the OFDM symbol is repeatedly modulated), the signal field is demodulated in step S215.” (~~INTEL~~DELL-1017, ¶104.) If “the signal field is successfully demodulated” in step S215, control flows down the center branch, and the frame is demodulated as an expanded range frame at a rate that corresponds to the demodulated signal field. (~~INTEL~~DELL-1017, ¶¶105–106.) “When a failure to demodulate the signal field occurs (i.e., the demodulation may not be performed by one single signal field), the repeated signal field is demodulated in step S225,” and the frame is then demodulated as an expanded range frame at a rate that corresponds to the contents of the demodulated signal field according to the right branch of the flow diagram. (~~INTEL~~DELL-1017, ¶¶108–109.)

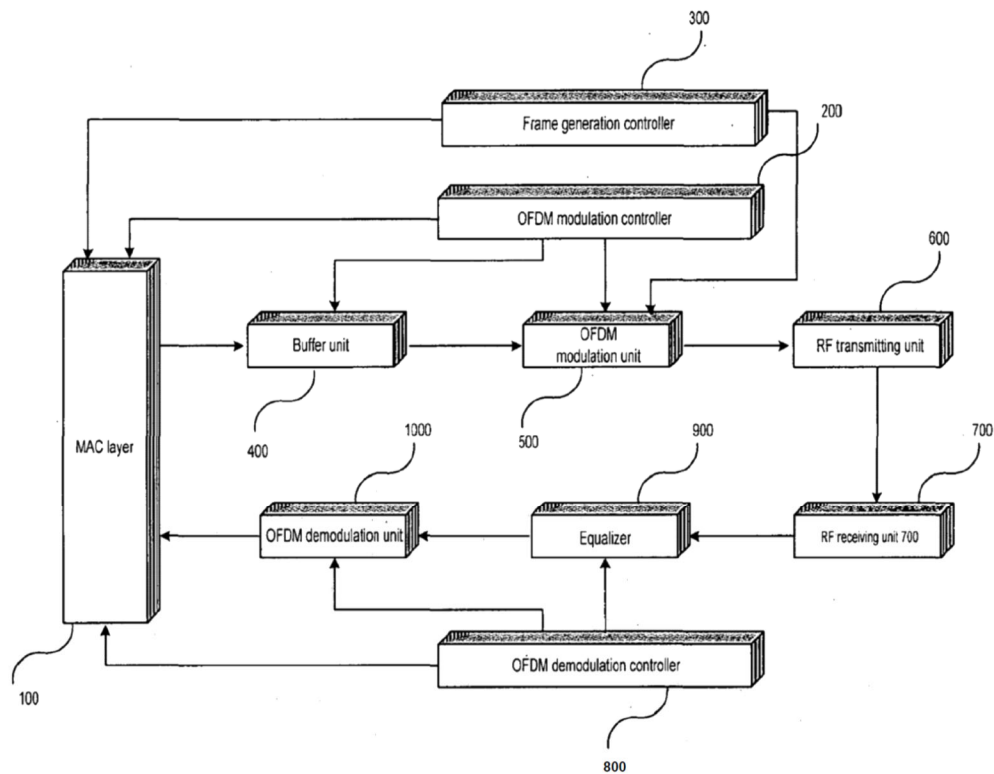
B. Independent Claims 1 and 6

Yu renders these claims obvious, as set forth below.

1. Preamble [1Pre] and [6Pre]

Petitioner does not acquiesce that the preamble is limiting. Nevertheless, Yu discloses the preamble. Yu discloses a “wireless LAN transmitting/receiving system” that is “based on OFDM-based IEEE 802.11a/g standards” and would be implemented in, for example, an AP or STA (a “*wireless communication device*”). (See ~~INTEL~~DELL-1017, Fig. 3, ¶44 (“FIG. 3 shows a block diagram of a wireless LAN transmitting/receiving system”).)

FIG.3



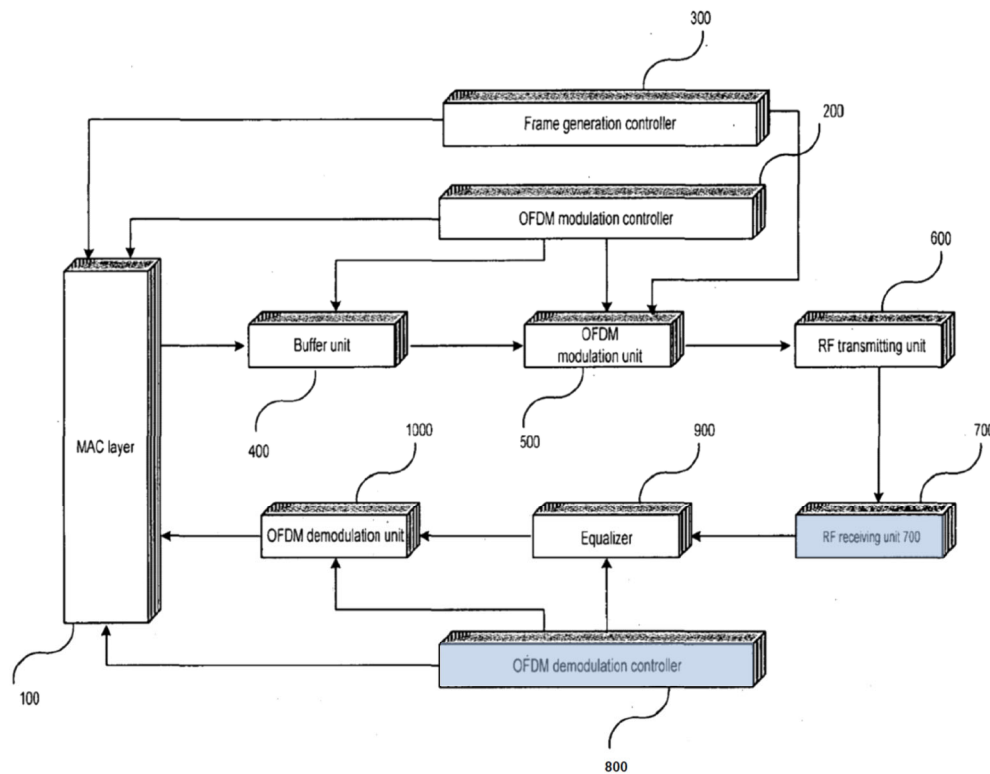
2. Claim Limitations [1A] and [6A]

Yu renders this limitation obvious.

- a. *A wireless receiver to receive first and second wireless packet formats through a communication channel*

Yu's wireless communication device of Figure 3 has "a receiving system" that includes an "OFDM demodulation controller" and a "RF receiving unit" that receives a wireless LAN "frame." (~~INTEL~~~~DELL~~-1017, ¶46.)

FIG.3



Yu's OFDM system is configured "according to the IEEE 802.11a standard" and therefore uses wireless communication channels with subcarriers. (~~INTELDELL~~-1003 ¶85; ~~INTELDELL~~-1013, 24–25 ("17.3.8.3 Operating *channel* frequencies").) Accordingly, Yu teaches a long preamble "for performing fine frequency synchronization and *channel* estimation of each subcarrier" in a wireless OFDM channel. (~~INTELDELL~~-1017, ¶13.)

Yu's receiving system is further adapted to receive frames in two different formats, including a "conventional" format ("*first packet format*") shown in Figure 2 with only one "SIGNAL" field (shaded blue), and a format as shown in Figure 7 ("*second packet format*") with a repeated SIGNAL field (shaded yellow) and a

repeated DATA field.

FIG.2

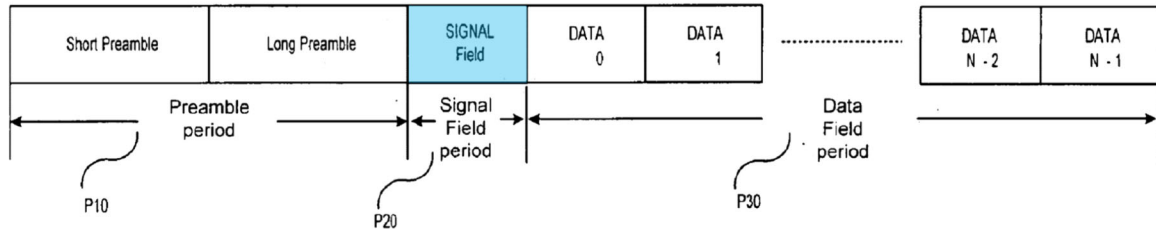
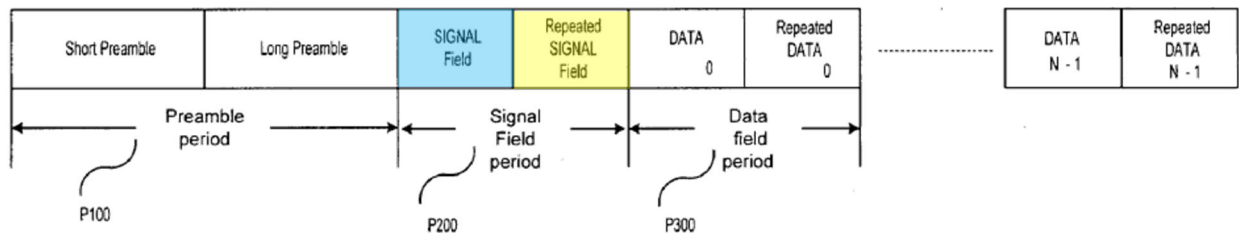


FIG.7



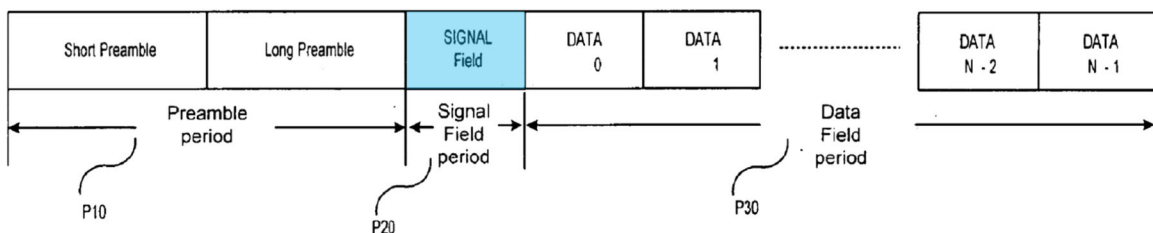
(~~INTELDELL~~-1017, Figs. 2 & 7.) In both formats, the signal field precedes the payload and includes “transmission mode information (i.e., modulation method and coding rate information) and frame length” (~~INTELDELL~~-1017, ¶14.) A POSITA would therefore have considered the SIGNAL and “Repeated SIGNAL” fields to be header fields. (~~INTELDELL~~-1003, ¶86.) Furthermore, although Yu does not use the term “packet,” a POSITA would have understood that Yu’s “frame” corresponds to an 802.11 packet. (~~INTELDELL~~-1003, ¶86.) Yu expressly describes a “wireless LAN system according to the IEEE 802.11a standard” (~~INTELDELL~~-

1017, ¶7), and the IEEE 802.11a standard uses the term “frame” when describing packets. (~~INTELDELL~~-1003, ¶86; *see, e.g.*, ~~INTELDELL~~-1013, 7 (describing the “PLCP *frame* format,” illustrating the “PPDU *frame* format” in Figure 107, and explaining that “[t]he RATE and LENGTH” in the frame header “are required for decoding the DATA part of the *packet*”).)

b. First packet format comprises a first header field carried by a first OFDM symbol

Although Yu does not use the term “header,” the frame format in Figure 2 includes a “SIGNAL” field (blue) that a POSITA would have recognized as a “*header field*” because it precedes the data payload and contains “modulation method and code rate” and “frame length information” for decoding the frame data. (~~INTELDELL~~-1003, ¶87; ~~INTELDELL~~-1017, ¶14, Fig. 2.)

FIG.2



Furthermore, as noted above (*supra* §V.B.2.a), Yu describes a “wireless LAN system according to the IEEE 802.11a standard” (~~INTELDELL~~-1017, ¶7), which describes an analogous SIGNAL field in the “PLCP Header” of the “PPDU frame

format,” confirming that Yu’s SIGNAL is a header field. (~~INTELDELL~~-1013, 7, Fig. 107; ~~INTELDELL~~-1003, ¶87.)

A POSITA reading Yu would also understand that the SIGNAL field is carried by an OFDM symbol within Yu’s “OFDM wireless LAN.” (See ~~INTELDELL~~-1017, ¶25 (describing “OFDM symbol modulation” and “demodulation” in “[a]n exemplary receiving system of an OFDM wireless LAN according to an embodiment of the present invention”), ¶49 (same); ¶104 (explaining that the signal field can be “repeatedly generated in the frame (i.e., the OFDM symbol is repeatedly modulated) ...”); ~~INTELDELL~~-1003, ¶88.) To the extent Yu does not teach that the SIGNAL field is carried by a single OFDM symbol, Petitioner does not believe that is a requirement of the claim, but it nevertheless would have been obvious to a POSITA to implement Yu’s SIGNAL field in a single OFDM symbol as described in the IEEE 802.11a standard, which incorporates the SIGNAL field into “One OFDM Symbol” as shown in green in Figure 107 below. (~~INTELDELL~~-1013, 7, Fig. 107.)

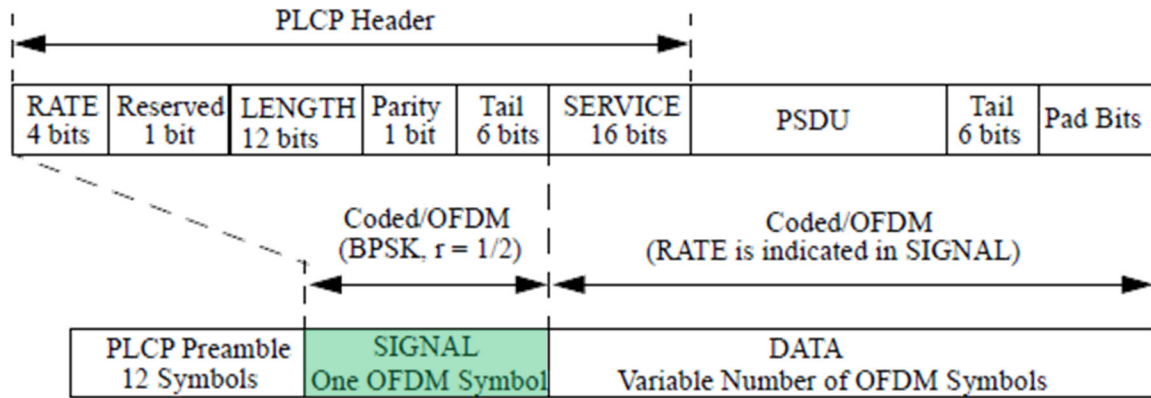


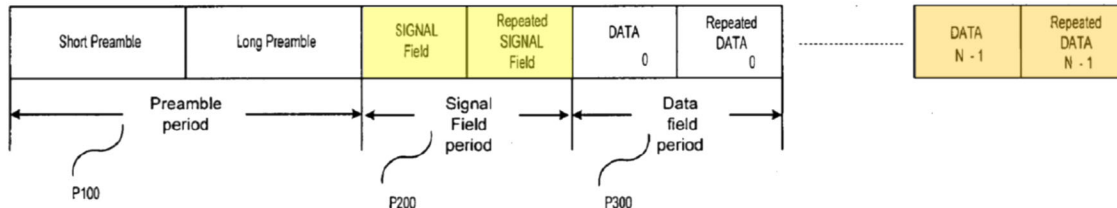
Figure 107—PPDU frame format

A POSITA would have had a reasonable expectation of success in implementing Yu’s SIGNAL field as a single OFDM symbol since Yu’s system is expressly designed to be compatible with the IEEE 802.11a standard (~~INTELDELL~~-1017, ¶7), and Yu’s SIGNAL field includes the same kind of information as the SIGNAL symbol of the 802.11a standard (compare ~~INTELDELL~~-1017, ¶14 with ~~INTELDELL~~-1013, 7, Fig. 107). (~~INTELDELL~~-1003, ¶88.)

- c. *Second packet format comprises the first header field carried by the first OFDM symbol and a second header field carried by a second OFDM symbol that repeats the first*

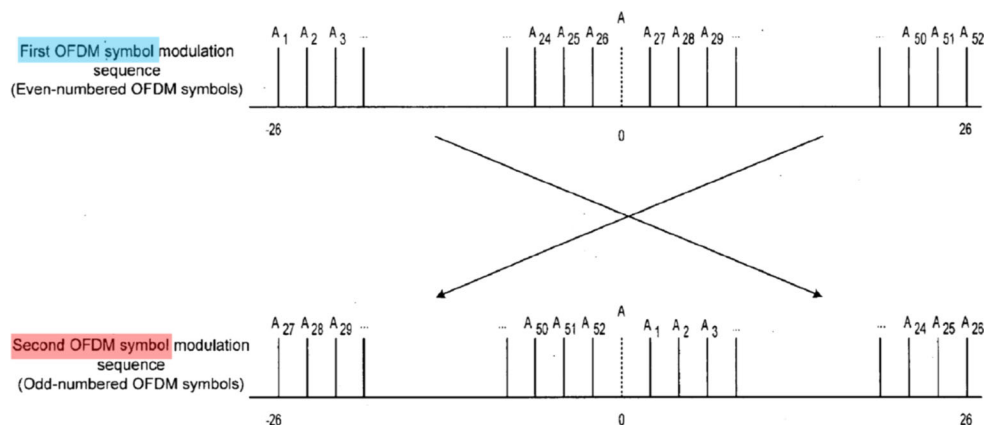
Yu discloses a second expanded service area packet format as shown in Figure 7 below. This packet has the same format as the conventional packet format of Figure 2 except that “[i]n the signal period P200, *the signal field is repeated*,” and the data is likewise repeated. (~~INTELDELL~~-1017, ¶83.) As discussed above, a POSITA reading Yu would have understood that the signal field is in the header and

carried by a first OFDM symbol (*supra* §V.B.2.b), so when it is repeated in the expanded service area packet format, the repeated SIGNAL header field is carried by a second OFDM symbol. (~~INTELDELL~~-1017, Fig. 7.)



This is confirmed in Yu's Figure 6, which shows the subcarrier assignments for the packet format of Figure 7, including that each of the repeated signal fields is carried by an OFDM symbol. (~~INTELDELL~~-1017, Fig. 6, ¶74 ("FIG. 6 shows a diagram representing the repeated *OFDM symbols* of the wireless LAN transmitting system according to the exemplary embodiment of the present invention."); ~~INTELDELL~~-1003 ¶89.)

FIG.6



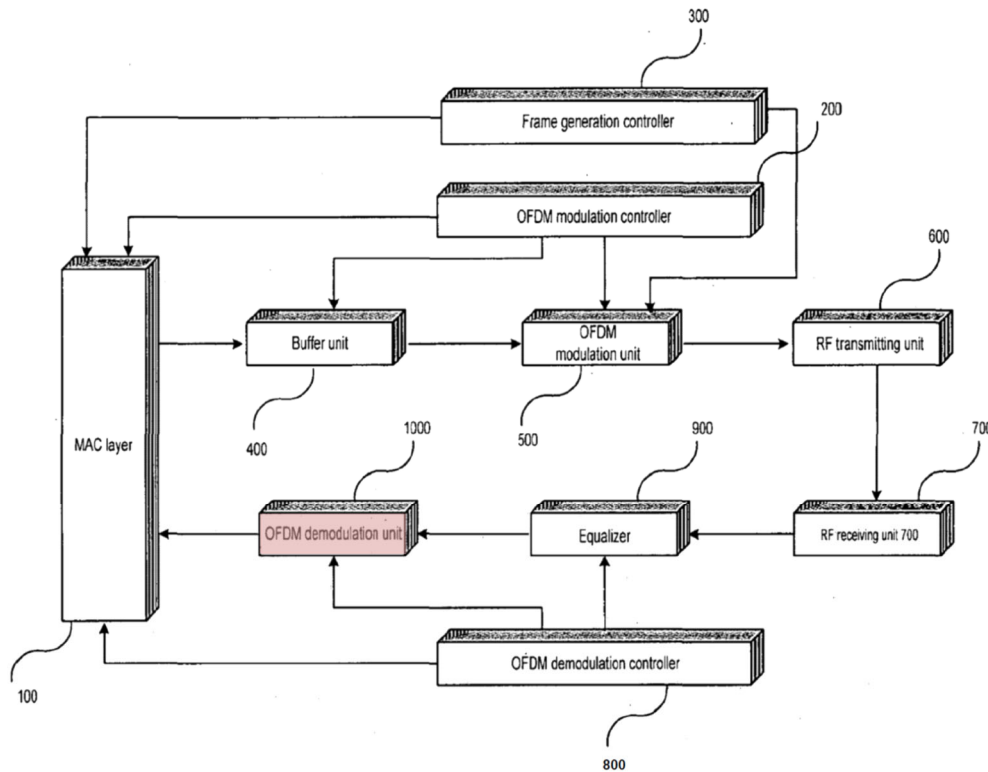
Yu explains that “an input OFDM symbol is transmitted for the even-numbered time to form a *first OFDM symbol* modulation sequence,” after which “the OFDM

symbol transmitted during the even-numbered time is repeated, and a subcarrier location is circulated by $\frac{1}{2}$ of the FFT point to transmit the OFDM symbol, which forms a *second OFDM symbol* modulation sequence.” (~~INTEL~~DELL-1017, ¶77.) Accordingly, Figure 6 shows “data A1 to A52 and a pilot symbol are allocated to subcarriers -26 to -1 and 1 to 26,” and “in the next repeated OFDM symbol, data A27 to A52 are allocated to subcarriers -26 to -1, and data A1 to A26 are allocated to subcarriers 1 to 26.” (~~INTEL~~DELL-1017, ¶78.) Yu thus discloses that in the expanded service area packet format (“*second packet format*”), the “SIGNAL” field (“*first header field*”) is “*carried by the first OFDM symbol*,” and the “Repeated SIGNAL Field” (“*a second header field ... that repeats the first*”) is “*carried by a second OFDM symbol*.” (~~INTEL~~DELL-1003, ¶89.)

3. Claim Limitations [1B] and [6B]

Yu discloses an “OFDM demodulation unit 1000” that “demodulates the signal field of the received frame for each demodulation mode” (~~INTEL~~DELL-1017, ¶55, Fig. 3.)

FIG.3

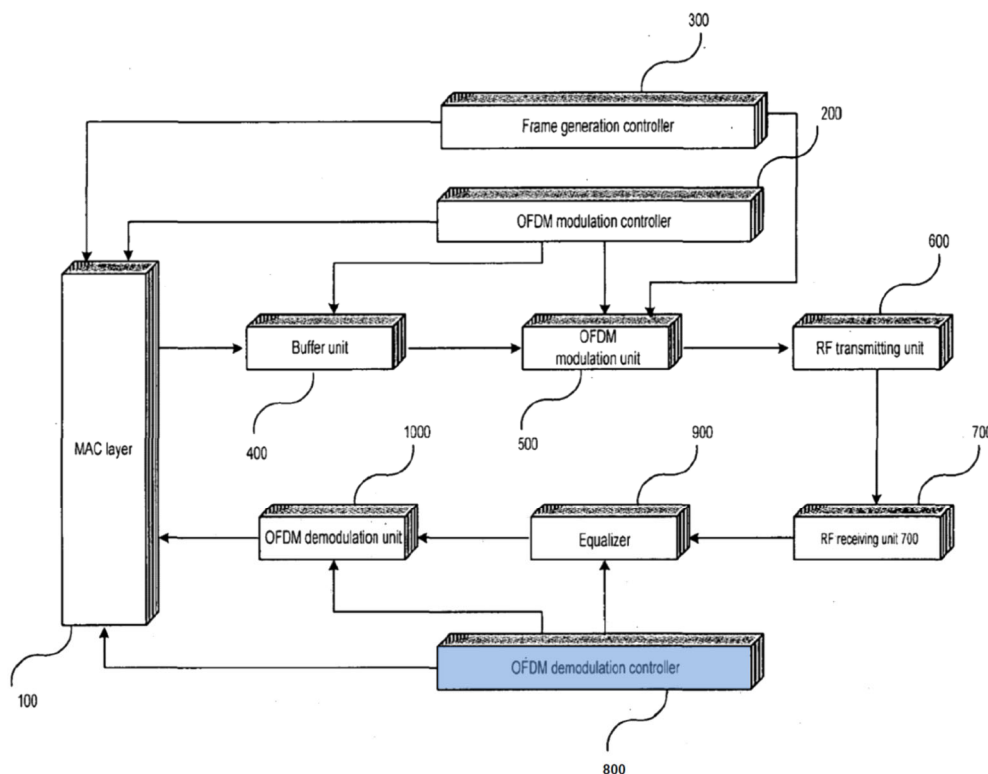


The OFDM demodulation unit operates under the control of the “OFDM demodulation controller 800” to determine “whether a received frame includes repeatedly modulated OFDM symbols, and controls an operation of a demodulation mode according to a determination result.” (~~INTELDELL~~-1017, ¶53, Fig. 3.) “[W]hen receiving the frame having the format configuration shown in FIG. 7 and obtaining the SNR for *demodulating the frame*, the conventional wireless LAN system *demodulates* the signal field.” (~~INTELDELL~~-1017, ¶90; see also ~~INTELDELL~~-1017, ¶25 (“The OFDM demodulation controller determines whether OFDM symbol modulation is repeated in a format configuration of a received frame, and controls a demodulation mode according to a determined result.”).)

4. Claim Limitations [1C] and [6C]

Yu's receiver includes "OFDM demodulation controller 800" that "determines whether a received frame includes repeatedly modulated OFDM symbols, and controls an operation of a demodulation mode according to a determination result." (~~INTEL~~DELL-1017, ¶53, Fig. 3.)

FIG.3

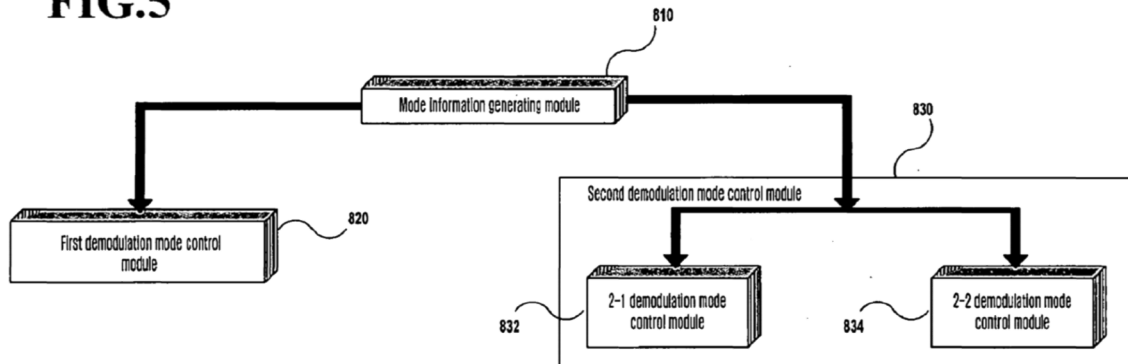


"The OFDM demodulation unit" within the receiver then "demodulates the signal field of the received frame for each demodulation mode determined according to whether the received frame includes the repeatedly modulated OFDM symbols." (~~INTEL~~DELL-1017, ¶¶53, 55.)

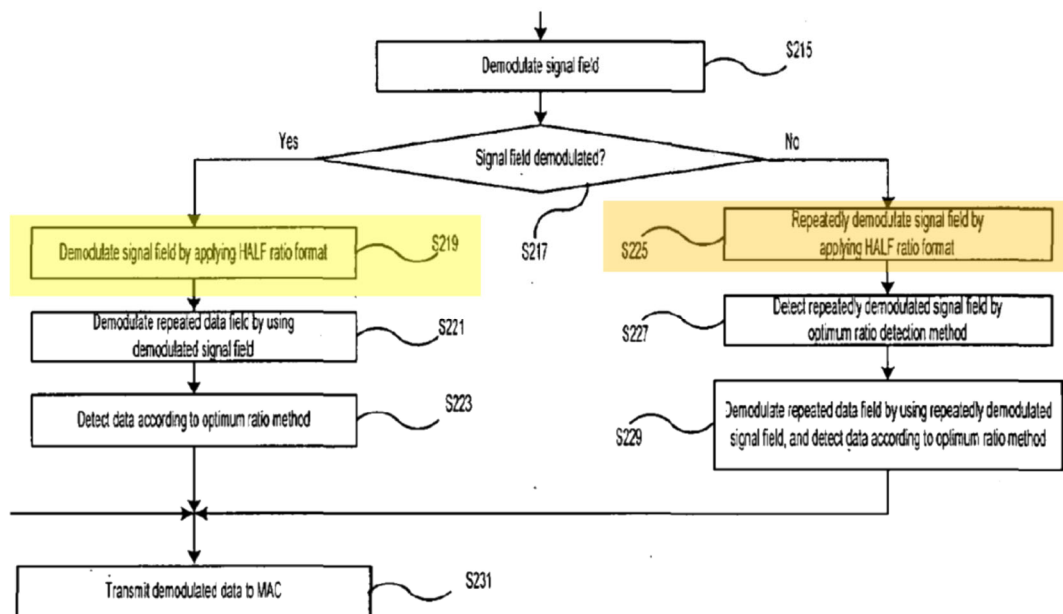
"As shown in FIG. 5, the OFDM demodulation controller 800 includes a mode

information generation module 810” that “generates the demodulation mode information according to the determined result on whether the received frame includes the repeated signal fields.” (~~INTELL~~ELL-1017, ¶¶66–67, Fig. 5.)

FIG. 5



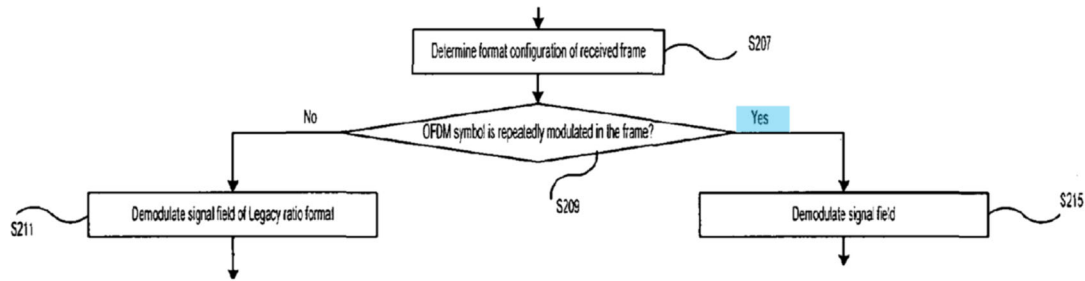
The packet/frame “receiving method” shown in Figure 9 determines the “format configuration of the received frame” at step S207 and selects one of the “demodulation mode[s],” depending on whether “the signal field is repeated” in the received frame. (~~INTELL~~ELL-1017, ¶102.)



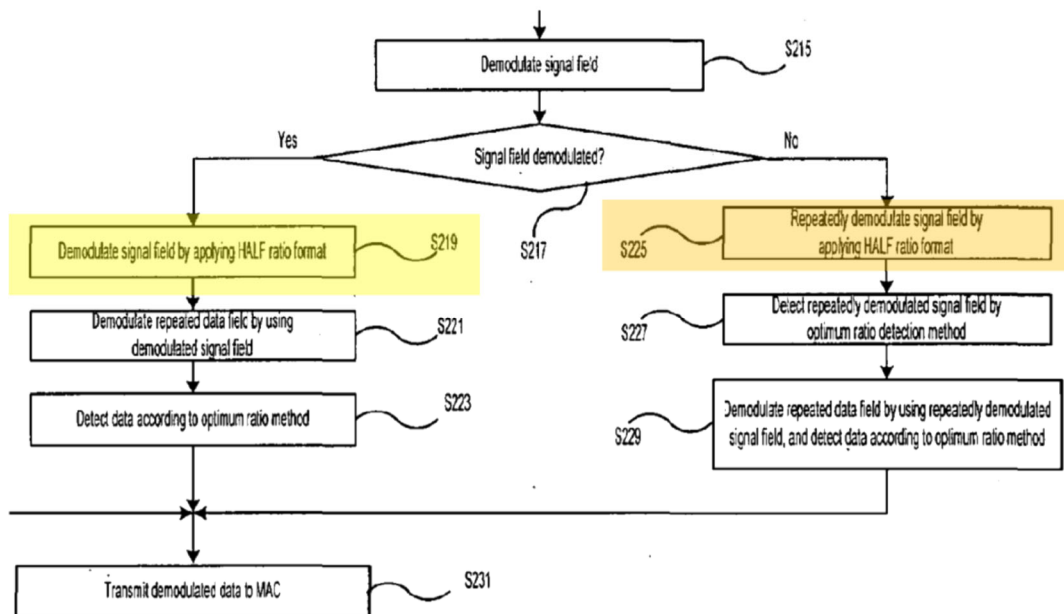
In the left pathway of excerpt from Figure 9 above, the first copy of the SIGNAL header is successfully demodulated. (~~INTELDELL~~-1017, ¶106.) In the right pathway of the excerpt from Figure 9 above, the second copy of the SIGNAL field is used because the first copy was not successfully demodulated. (~~INTELDELL~~-1017, ¶108.) In this manner, the receiver detects an expanded service area packet when the system detects the existence of the repeated SIGNAL header in steps S207 and S209, and then demodulation proceeds based on how the repeated SIGNAL header is handled in steps S215 and S217. Yu thus teaches distinguishing between the packet formats of Figures 2 and 7 based on detecting the second SIGNAL field which repeats the first SIGNAL field. (~~INTELDELL~~-1003, ¶98.)

C. Claims 2 and 7

As discussed above in §V.B.4., *supra*, Yu's receiver determines the format of the received frame by detecting the presence of a repeated signal field, and selects the demodulation mode on that basis. (~~INTELDELL~~-1017, ¶¶53–55.) Yu first determines whether “the signal field is repeatedly generated in the frame (i.e., the OFDM symbol is repeatedly modulated).” (~~INTELDELL~~-1017, ¶¶102–104.) As shown in the excerpt of the process of Figure 9 below, when the decision of step S209 is in the affirmative (shaded blue)—*i.e.*, the repeated signal field is detected—the receiver determines that the format is the second format of Figure 7 and demodulates the signal field accordingly.



In this case, the “second demodulation mode control module 830” is used to control the demodulation operation of the received frame. (~~INTELDELL~~-1017, ¶69.) Module 830 uses the “bit allocation information” of the repeated OFDM symbols (e.g., as shown in Figure 7) to demodulate the received frame by applying a half ratio format according to steps S219 or S225 of the receiving process of Figure 9. (~~INTELDELL~~-1017, ¶69, Fig. 7.)

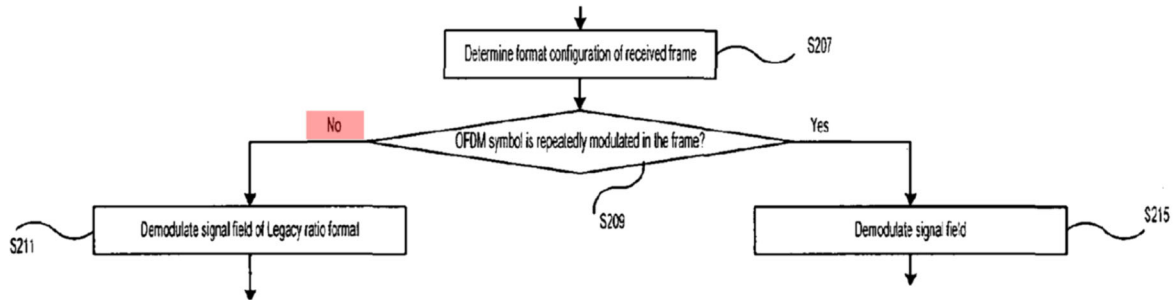


As discussed above, demodulation of the packet then follows either the left or right pathway in the above excerpt from Figure 9. In the left pathway, the first copy of the SIGNAL header is successfully demodulated. (~~INTELDELL~~-1017, ¶106.) In

the right pathway, the second copy of the SIGNAL field is used because the first copy was not successfully demodulated. (~~INTELDELL~~-1017, ¶108.) In this manner, the receiver detects an expanded service area packet when the system detects the existence of the repeated SIGNAL header in steps S207 and S209, and then demodulation proceeds based on how the repeated SIGNAL header is handled in steps S215 and S217. In both instances, however, the second header field is required for the determination. (~~INTELDELL~~-1003 ¶101.)

D. Claims 3 and 8

As discussed above in §VI.B.4., *supra*, Yu's receiver determines the format of the received frame by detecting the presence of a repeated signal field, and selects the demodulation mode accordingly. (~~INTELDELL~~-1017, ¶¶53–55.) Yu determines whether “the signal field is repeatedly generated in the frame (i.e., the OFDM symbol is repeatedly modulated),” and demodulates the signal field accordingly. (~~INTELDELL~~-1017, ¶¶102–104.) As shown in the excerpt of the process of Figure 9 below, when the decision of step S209 is in the negative (shaded red)—*i.e.*, the repeated signal field is **not** detected—the receiver determines the format is the first format of Figure 2 and demodulates the signal field accordingly.



In this case, the “first demodulation mode control module 820” is used to control the demodulation operation of the received frame (~~INTELDELL~~-1017, ¶68) and “the demodulation is performed by using a Legacy ratio format ...” (~~INTELDELL~~-1017, ¶103) according to step S211 of the receiving process shown in Figure 9.

E. Claims 4 and 9

As discussed above in §V.B.2.b., *supra*, the signal fields “*contain information for decoding the wireless packet,*” and a POSITA would have understood them to be “*header fields.*” In particular, the signal fields contain the “modulation method and code rate” and “frame length information” that a receiver would use to decode an incoming frame (“*packet*”). (~~INTELDELL~~-1003 ¶106; ~~IntelDELL~~-1017, ¶14.)

F. Claims 5 and 10

Yu discloses this limitation. As discussed above in §V.B.2.b., *supra*, the signal field contains “frame length information” which is “*information related to a length of the wireless packet.*” (~~INTELDELL~~-1017, ¶14.)

VI. GROUND 2: Claims 1–10 Are Obvious Based On the Combination of Hansen and WWiSE

As set forth below, the proposed combination involves programming Hansen’s 802.11-compliant, wireless OFDM transceivers to support WWiSE’s packet formats—including extended range (ER) packets—within WWiSE’s WLAN.

A. Combination Overview

In 2002, “discussions began in the IEEE 802.11 Working Group (WG) to extend the data rates of the physical layer beyond those of IEEE 802.11a/g in order to address higher throughput wired applications that would benefit from the flexibility of wireless connectivity.” (~~INTELDELL~~-1018, 48.) In September of that year, the IEEE formed a High Throughput (HT) Study Group (SG) to, among other things, work “on usage model development, channel model development, and selection procedures” for a new extension to 802.11a/g. (~~INTELDELL~~-1018, 49.) A year later, an 802.11n Task Group (TGn) was formed to continue this work and “to develop an amendment to the IEEE 802.11 standard (i.e., IEEE 802.11n).” (~~INTELDELL~~-1018, 48–49.) TGn began by defining “functional requirements and comparison criteria” for 802.11n, including usage models that “were to be relevant to the expected uses of the technology,” where “[e]ach usage model contained an access point (AP) and a defined number of stations running a mix of applications based on the use cases.” (~~INTELDELL~~-1018, 49–50.) Other key requirements included “the capability of at least 100 Mb/s MAC throughput” and “interoperability

between 802.11a/g and 802.11n.” (~~INTELDELL~~-1018, 51–52.) After defining the requirements and criteria, TGn issued a call for proposals in May 2004. (~~INTELDELL~~-1018, 50.)

In total, TGn received five complete proposals for consideration in 802.11n: three from individual companies, and two from consortia of companies—“TGn Sync (started by Intel, Cisco, Agere, and Sony) and WWiSE (started by Broadcom, Conextant, Texas Instruments, and Airgo Networks.” (~~INTELDELL~~-1018, 50.) “The basic features and technologies in the various proposals were actually the same. All proposals included MIMO, 40 MHz bandwidth channels, frame aggregation, and enhanced block acknowledgement. For the most part, the difference between the proposals was the implementation details of these features.” (~~INTELDELL~~-1018, 50.) For example, TGn Sync’s proposal provided a mechanism for “mixed mode” access by legacy devices (*i.e.*, devices that supported 802.11a/g) but not a mechanism for “greenfield” access in “environments free from legacy devices” such that “backward compatibility is not required.” (~~INTELDELL~~-1011, 14, 36; ~~INTELDELL~~-1018, 53.) The WWiSE proposal, on the other hand, provided mechanisms to support *both* greenfield and mixed mode access. (~~INTELDELL~~-1005, 58-60.) After considerable negotiation, TGn ultimately approved a joint proposal that incorporated elements from both TGn Sync and WWiSE in January 2006. (~~INTELDELL~~-1018, 50.)

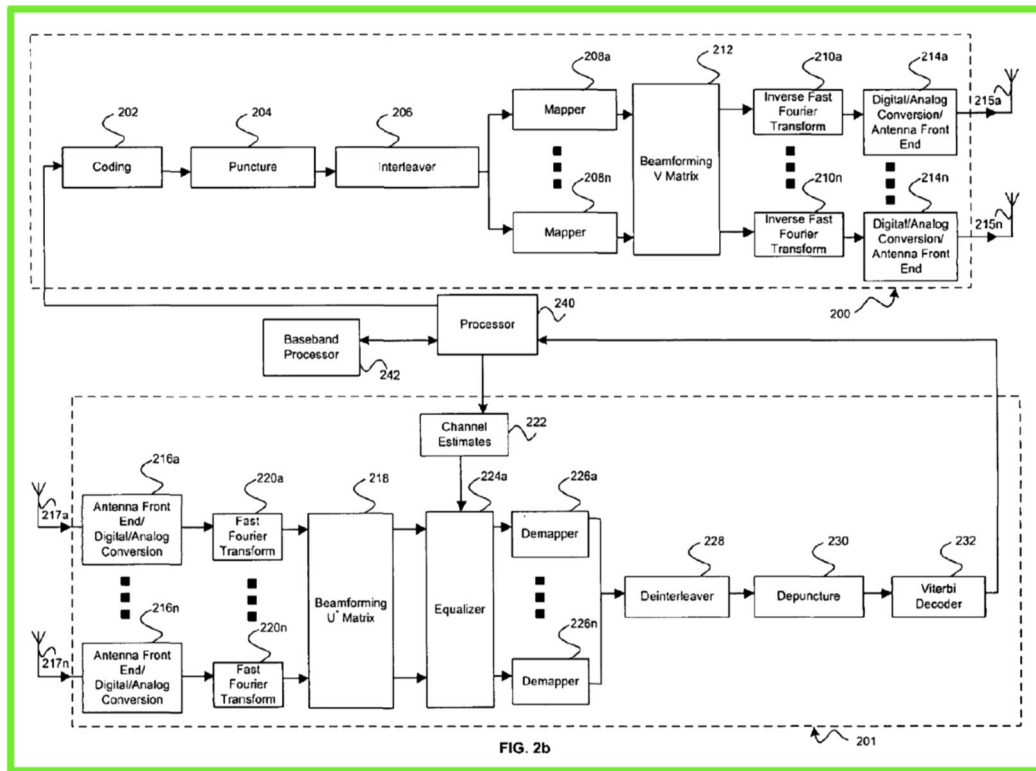
1. Hansen

Hansen is the publication of U.S. Patent Application 11/151,772, which matured into U.S. Patent 8,737,189 (~~INTELDELL~~-1009; “Hansen Patent”). Hansen relates “to a method and system for compromise greenfield preambles for 802.11n.” (~~INTELDELL~~-1006, ¶7.)

In particular, Hansen sought a compromise between the TGn Sync and WWiSE proposals discussed above by combining aspects of the mixed-mode TGn Sync preambles and headers with greenfield preambles and headers proposed by the WWiSE industry group during development of 802.11n. (~~INTELDELL~~-1006, ¶¶7, 11, 27, Fig. 4a, Fig. 5a, Fig. 6a; ~~INTELDELL~~-1010, 14; *see also* ~~INTELDELL~~-1006, ¶¶1, 6 (incorporating the Hansen Prov. by reference); ~~INTELDELL~~-1003, ¶112.) In the corresponding Hansen Patent, Hansen submitted the WWiSE proposal from January 2005 (“January 2005 WWiSE”) and the TGn Sync proposal from January 2005 in an Information Disclosure Statement. (See ~~INTELDELL~~-1009, (56) OTHER PUBLICATIONS.) Petitioner refers to the WWiSE proposal discussed in Hansen as “January 2005 WWiSE” to distinguish it from the March 2005 version of the WWiSE proposal applied in this ground (~~INTELDELL~~-1005).

Hansen also describes transceiver hardware, illustrated in Figure 2b, that “may be utilized in accordance with an embodiment of the invention.” (~~INTELDELL~~-1009, 2:12-13; ~~INTELDELL~~-1006, ¶¶15, 29, 41, 57.)

Wireless OFDM Transceiver



2. WWiSE

WWiSE was a proposal submitted to the TGn working group in July 2005 that built upon an earlier January 2005 WWiSE proposal. (~~INTELDELL~~-1005, 1.) WWiSE proposed HT extensions to the existing 802.11 standard to double the bandwidth from previous versions of 802.11 by providing a 40 MHz frequency band for HT device communications or two 20 MHz frequency bands—which WWiSE referred to as “channels”—for devices that did not support the 40 MHz band (*e.g.*, legacy 802.11 devices). (*See, e.g.*, ~~INTELDELL~~-1005, 13-14, 48-49, 84.)

WWiSE also added PHY specifications for ER operation for improved reliability in conditions where an 802.11-compliant device operates at the edge of

the wireless range of an AP or STA. (See, e.g. ~~INTELDELL~~-1005, 50, 67-69.) ER-capable devices support both an Extended Range Modulation and Coding Scheme (MCS) and a Normal Range MCS as well as the long SIG-N field format in the PPDU. (~~INTELDELL~~-1005, 50:9-10.) In the extended communication range configuration (ER), “SIG-N is composed of two consecutive MIMO-OFDM symbols: The SIG-N MIMO-OFDM symbol is followed by a second MIMO-OFDM symbol, denoted as ER-SIG-N.” (~~INTELDELL~~-1005, 69:16-18.) To support ER capability, the SIGNAL-N field includes a REXT field indicating whether standard or extended range communication is being used for transmission. (~~INTELDELL~~-1005, 69-70.)

The following figure illustrates a mixed mode ER PPDU for two spatial streams ($N_{TX}=2$) at 20 MHz. The shaded gray field “indicates the optional duplicate SIG-N for extended range communication.” (~~INTELDELL~~-1005, 68:1-4.)

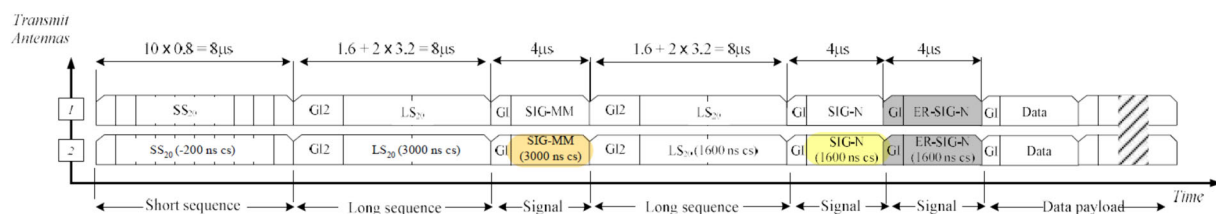


Figure 008 – MIMO-OFDM Training structure for $N_{TX} = 2$, 20 MHz, mixed-mode operation. The shaded field indicates the optional duplicate SIG-N for extended range communication.

And the figure below illustrates a mixed mode normal range (NR)—*i.e.*, non-ER—PPDU for one (40 MHz) or two (20 and 40 MHz) spatial streams.

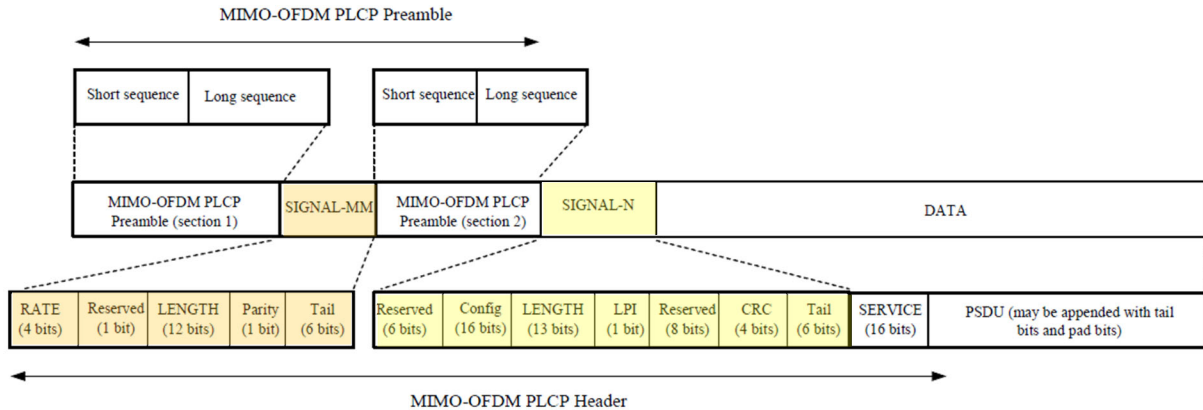
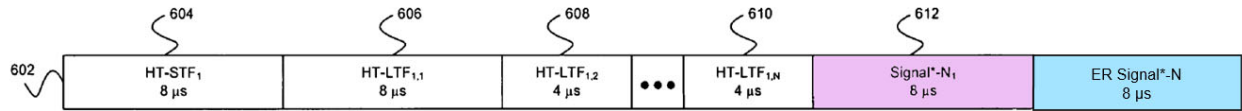


Figure 003 – PPDU frame format: Mixed-mode access in the 1TX (40 MHz) and 2TX (20 and 40 MHz) modes

B. Motivation to Combine

A POSITA would have been motivated to combine Hansen and WWiSE to include support for WWiSE’s ER communication in Hansen’s transceiver. (~~INTELDELL~~-1003, ¶117.) For example, a POSITA would have understood the advantages in duplicating header fields for improved diversity and would have been motivated to program Hansen’s processors to generate duplicate (*i.e.*, repeated) header fields such as Signal*-N of Hansen’s Fig. 6a during ER communications, as taught by WWiSE. (~~INTELDELL~~-1003, ¶117.) The duplicated header is referred to herein as “ER-Signal*-N”, consistent with the terminology used by WWiSE.



Hansen’s “Compromise” PPDU with WWiSE’s duplicate SIG-N field for ER communication

A POSITA would have been motivated to include support for the fields (or

subfields) necessary to support ER in Hansen's transceiver and would have had a reasonable expectation of success since programming such fields would have been well within the level of skill of ordinary artisans based on WWiSE's disclosure that is commensurate with other 802.11 wireless standards documents. (~~INTELDELL~~-1003, ¶118.) For example, a POSITA would have been motivated to use one of the reserved bits in Hansen's Signal*-N header field or to extend Hansen's Signal*-N header field to incorporate WWiSE's REXT bit indicating whether a device is operating in NR or ER configuration. (~~INTELDELL~~-1003, ¶118.) A POSITA would have understood that the added bit(s) could be used for the REXT field. (~~INTELDELL~~-1003, ¶118; ~~INTELDELL~~-1006, ¶¶67, 97.) When the REXT field indicates the device is operating in NR mode, the repeated header ER-Signal*-N is not included in the PPDU, and when the REXT field indicates the device is operating in ER mode, the repeated header is included in the PPDU. (~~INTELDELL~~-1003, ¶118; ~~INTELDELL~~-1005, 69–70, Table 011.) A POSITA would have had several reasons to make this proposed combination.

First, Hansen provides an express teaching that would have led a POSITA to the combination with WWiSE. Hansen describes the earlier January 2005 WWiSE and TGn Sync proposals submitted to the TGn working group. (~~INTELDELL~~-1006, ¶33.) Both the January 2005 and March 2005 WWiSE proposals include support for greenfield access. (See, e.g., ~~INTELDELL~~-1006, ¶¶21-23, 77, 79, 82.) Hansen notes

however that TGn Sync did “not provide a mechanism to support greenfield access.” (~~INTELDELL~~-1006, ¶33.) Hansen therefore sought to define a compromise proposal based on the WWiSE and TGN Sync January 2005 proposals. (~~INTELDELL~~-1006, Title (“Method and system for compromise greenfield preambles for 802.11n”), ¶7 (“certain embodiments of the invention relate to a method and system for compromise greenfield preambles for 802.11n”); ~~INTELDELL~~-1010 (Hansen Prov.), 14 (“Embodiments of this invention may comprise a plurality of proposals that seek to define a compromise proposal to TGn which is based on aspects of current proposals from WWiSE and TGn sync”); ~~INTELDELL~~-1006 ¶6 (incorporating Hansen Prov. by reference).) Based on the suggestion to bridge the gap between the WWiSE and TGn Sync industry groups, a POSITA would have been motivated to combine the teachings of WWiSE with Hansen to support the newly introduced aspects of the March WWiSE proposal, including support for WWiSE’s ER features. (~~INTELDELL~~-1003, ¶119.)

Second, this combination involves use of a known technique to improve similar devices in the same way. (*See KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007).) In particular, WWiSE’s ER capability is based on repeating the SIGNAL-N header field (a known technique), which would improve Hansen’s transceiver by providing additional diversity. (~~INTELDELL~~-1003, ¶120.) Diversity is a known technique to improve system performance over fading channels.

(~~INTELDELL~~-1015, 130; ~~INTELDELL~~-1003, ¶91.) Fading is generally the variation of received signal power due to changes in transmission medium or paths that occurs from numerous sources including reflections from the ground and surrounding buildings, as well as scattered signals from trees, people and towers present in the larger area. (~~INTELDELL~~-1022, 944-1011; ~~INTELDELL~~-1003, ¶120.) Large-scale fading occurs when an obstacle comes in-between the transmitter and receiver. (~~INTELDELL~~-1022, 947.) Small-scale fading is concerned with rapid fluctuations of received signal strength over a very short distance and short time period. (~~INTELDELL~~-1022, 947.)

The three main forms of diversity that are “traditionally exploited in communication systems for fading channels: temporal, spectral, and spatial diversity.” (~~INTELDELL~~-1015, 130.) By repeating the header (Signal-N) in the time domain, WWiSE’s ER capability introduces temporal diversity. (See ~~INTELDELL~~-1005, ¶¶67–69.) Each repeated symbol provides additional diversity, which increases the likelihood of decoding the information correctly at the receiver. (~~INTELDELL~~-1003, ¶121.) This introduction of diversity improves the decodability of the header (Signal-N) in noisy environments or at a greater distance for a given signal power—extending the range of communication and improving the receiver gain. (~~INTELDELL~~-1003, ¶121.) A POSITA therefore would have been motivated to include WWiSE’s ER capability to improve robustness of communication in noisy

or otherwise degraded channel conditions. (~~INTELDELL~~-1003, ¶121.)

Third, this combination is merely the application of a known technique (WWiSE's ER capability) to a known device (Hansen's transceiver) that was ready for improvement to yield predictable results. *See KSR*, 415–421. The addition of support for WWiSE's ER capability to Hansen's transceiver would extend the range of reliable communication between devices by providing diversity when environmental conditions (fading and/or noise) adversely affect communication. (~~INTELDELL~~-1003, ¶122.) A POSITA would have applied the known improvement (ER capability of WWiSE) in the same way to Hansen, which already uses a PPDU based on the one disclosed in WWiSE. (~~INTELDELL~~-1003, ¶122.)

Fourth, this is merely a combination of prior art elements according to known methods to yield predictable results (*i.e.*, extended range for devices in a WLAN). *See KSR*, 550 U.S. at 416. (~~INTELDELL~~-1003, ¶123.) For example, as explained above, the combination adds a repeated data field (known method) to the PPDU frame (prior art element) and adds a one-bit sub-field (or reassign existing reserved bit if available) to the header field. A POSITA would have known how to make these modifications because the addition of fields/sub-fields to network packets was commonly done to implement enhanced features or otherwise support modifications to standards such as 802.11. (~~INTELDELL~~-1003, ¶123.) Indeed, reserved bits are provided for this specific purpose. (*See, e.g.*, ~~INTELDELL~~-1008, 30 (“... define two

one-bit fields which are assigned to bits in the PHY frame header that are currently reserved.”.) For example, both Hansen and WWiSE discuss modifications to existing 802.11 PPDU's by the addition of fields and sub-fields. (INTELDELL-1003, ¶123.)

The results of this combination would have been predictable, and a POSITA would have had a reasonable expectation of success. (INTELDELL-1003, ¶124.) Both Hansen and WWiSE describe PPDU's for use in the 802.11n standard under development. Existing 802.11 standards, which both Hansen and WWiSE build upon, would have been well-known to a POSITA by the earliest priority date of the '146 patent. (INTELDELL-1003, ¶124.) And as discussed above, the combination adds fields/sub-fields to an existing packet structure. (INTELDELL-1003, ¶124.) Because such modifications were commonplace when dealing with evolving communications technologies, the results would have been predictable, and a POSITA would have had a reasonable expectation that the combination would operate successfully. (INTELDELL-1003, ¶124.)

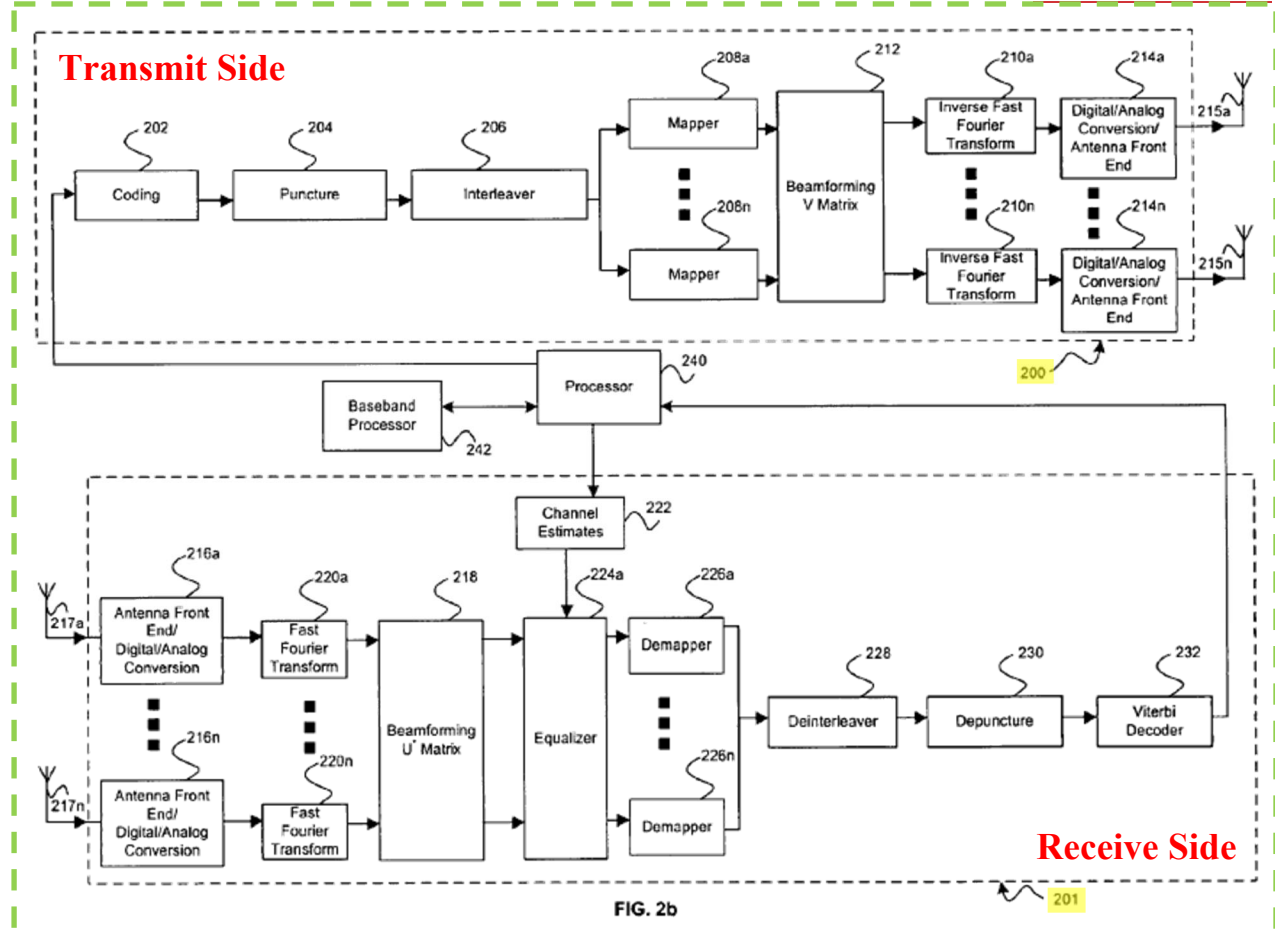
C. Independent Claims 1 and 6²

Hansen in combination with WWiSE renders these claims obvious, as set forth below.

1. Preamble [1Pre] and [6Pre]

Petitioner does not acquiesce that the preamble is limiting. Nevertheless, the combination of Hansen and WWiSE discloses the preamble. (~~INTELDELL~~-1003, ¶126.) Hansen—which expressly refers to WWiSE (*e.g.*, ~~INTELDELL~~-1006, ¶¶34, 36, 77, 79)—discloses “a transceiver comprising a transmitter and a receiver in a MIMO system.” (~~INTELDELL~~-1006, ¶15, Figure 2b (below); *see also* ~~INTELDELL~~-1006, ¶57 (structure of Figure 2b is a “wireless communications transceiver”).)

² Given the repeated subject-matter among the claims, this petition addresses overlapping claims together. To the extent there are substantive differences between claims or the corresponding analysis, that is noted herein.



Hansen's transceiver corresponds to "[a] wireless communication device," as recited in the preamble.

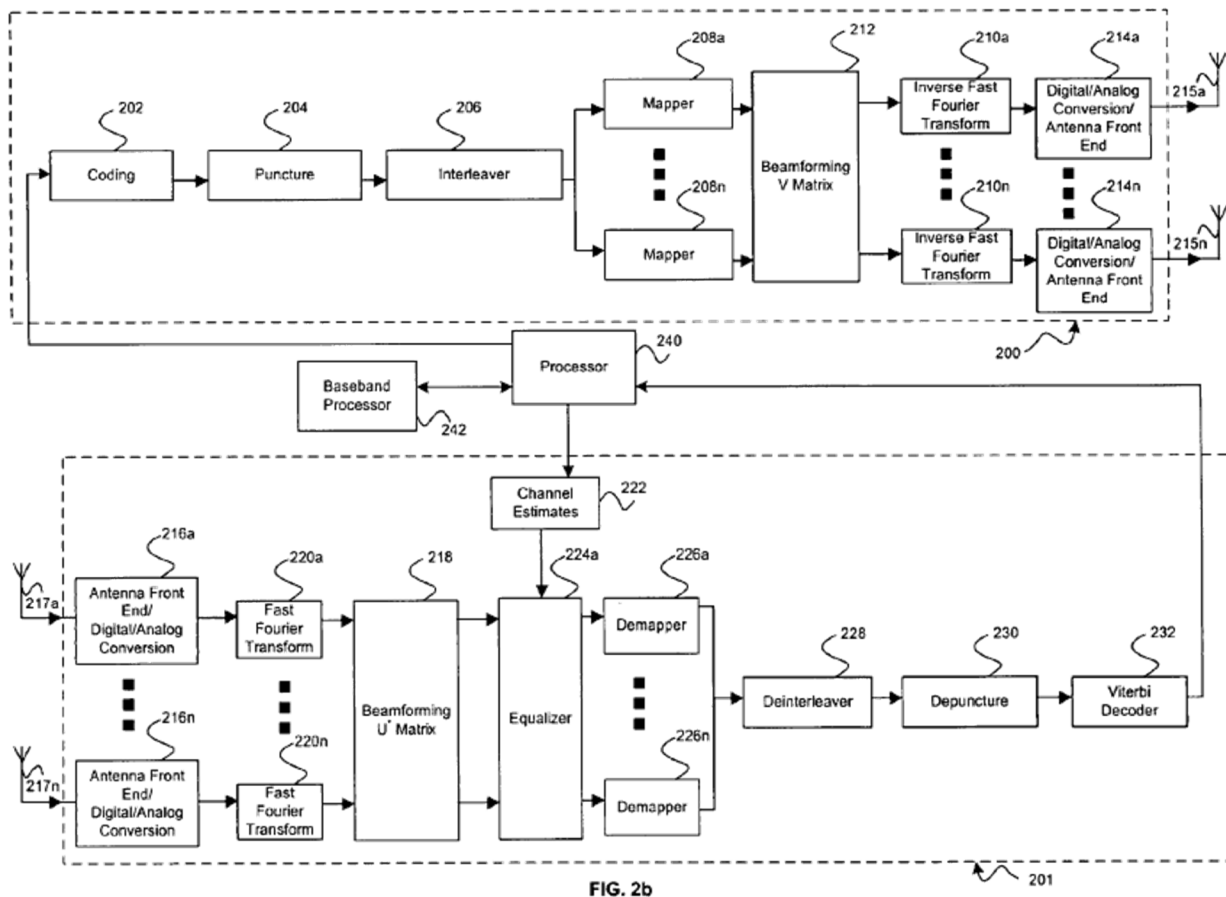
2. Claim Limitations [1A] and [6A]

The combination of Hansen and WWiSE discloses this limitation.

a. *Wireless receiver configured to receive a wireless packet through a communication channel*

Hansen's transceiver includes a receiver for receiving wireless packets through a communication channel. Figure 2b of Hansen (reproduced below) "is an exemplary block diagram of a transceiver comprising a transmitter and a receiver in a MIMO system." (~~INTELDELL~~-1006, ¶16.) "The receiver 201 may comprise a

plurality of antenna front end and analog to digital (A/D) conversion blocks 216a, ..., 216n, a beam forming U matrix block 218, a plurality of fast Fourier transform (FFT) blocks 220a, ..., 220n, a channel estimates block 222, an equalizer block 224, a plurality of demapper blocks 226a, ..., 226n, a deinterleaver block 228, a depuncture block 230, and a Viterbi decoder block 232.” (~~INTELL~~-1006, ¶41; see also ~~INTELL~~-1006, ¶¶50–56 (describing how the components of receiver 201 operate and interact to “*receive* analog RF signals” and ultimately output “decoded data from the Viterbi decoder”).)



A POSITA would have understood that the parallel input pathways in Hansen’s

receiver 201—including the “plurality of antenna front end and analog to digital (A/D) conversion blocks 216a, ..., 216n”—operate cooperatively in a MIMO system to receive an incoming wireless transmission, so a POSITA would consider them to be part of a wireless receiver rather than multiple independent wireless receivers. (~~INTELDELL~~-1003, ¶128.)

Hansen’s transceiver receives PPDUs, which are 802.11-compliant packets. (~~INTELDELL~~-1006, ¶59; ~~INTELDELL~~-1003, ¶102 (citing ~~INTELDELL~~-1013, 7, 13, 33 (referring to “packet” structure and contents)).) Hansen’s PPDU is analogous to—and, as discussed above, based in part on—the 802.11 PPDUs in WWiSE (which WWiSE includes in “frames”). (~~INTELDELL~~-1005, 59, 67.) Examples of mixed-mode PPDUs from WWiSE appear in Figures 003 and 008 of ~~INTELDELL~~-1005 below. The first (Figure 003) is for a NM transmission, and the second (Figure 008) is for an ER transmission.

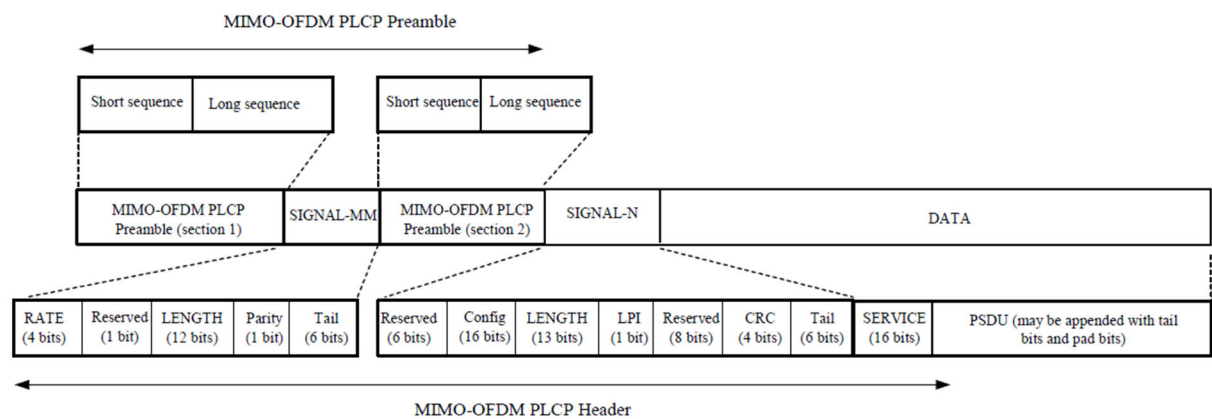


Figure 003 – PPDU frame format: Mixed-mode access in the 1TX (40 MHz) and 2TX (20 and 40 MHz) modes

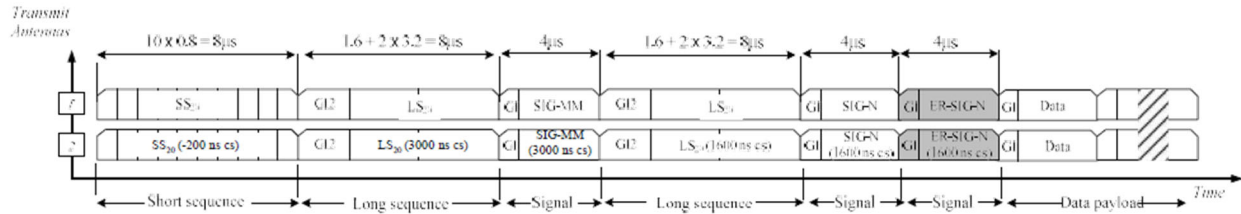


Figure 008 – MIMO-OFDM Training structure for $N_{TX} = 2$, 20 MHz, mixed-mode operation. The shaded field indicates the optional duplicate SIG-N for extended range communication.

Hansen's transceiver is compatible with WWiSE's mixed-mode PPDU's, which can be communicated in a "multiple input multiple output orthogonal frequency division multiplexing (MIMO-OFDM) system" like the one in Hansen's Figure 2b. (See ~~INTELDELL~~-1005, 13–14, 30–55; ~~INTELDELL~~-1006, ¶41.) Hansen's transceiver also supports communications over the 20MHz and 40MHz frequency bands. (~~INTELDELL~~-1006, ¶¶67–68 ("20 MHz or 40 MHz bandwidth field 494 may indicate whether the PPDU was transmitted utilizing a 20 MHz RF channel, or a 40 MHz RF channel"), 79 ("BW field 560 may represent a bandwidth, for example, 20 MHz, or 40 MHz"). WWiSE refers to these same 20MHz and 40MHz frequency bands as "channels." (E.g., ~~INTELDELL~~-1005, 48–49 ("High Throughput PHYs [that] can transmit a frame utilizing a 40 MHz *channel* pair in order to achieve lower frame durations than if a single 20 MHz *channel* was used."), 84 (40 MHz channel "consists of two 20 MHz *channels*, on each of which there could be 20 MHz transmissions").) And WWiSE describes "mandatory" transmitting and receiving capabilities over these channels that a POSITA would understand to be performed by a transceiver like Hansen's. (~~INTELDELL~~-1003,

¶130; see INTELDELL-1005, 27 (describing “the bitmap size in bytes between the transmitter and *receiver* STAs with HT Capability”), 55 (explaining that “support for transmitting and *receiving* data using the MIMO-OFDM PHY defined in this Clause is *mandatory*”), 58 (explaining how “PSDUs are converted to and from PPDU s at the transmitter and *receiver*”), 83 (“The transmitter (*receiver*) shall initiate the modulation constellation, code rate, code type, and other configuration parameters according to the CONFIG indicated in the SIG-N field.”).) A POSITA would therefore have had a reasonable expectation of success in implementing WWiSE’s PPDU s using Hansen’s transceiver. (INTELDELL-1003, ¶130.) And to the extent that Hansen’s transceiver would require modification to be capable of receiving the ER packets of WWiSE (e.g., in Figure 008 above), that modification (e.g., to receive the additional ER-SIG-N header symbol) would have been well within the ability of a POSITA, who would have been motivated to make the modification for the reasons discussed above. (*Supra* § VI.B.)

b. *First packet format with a first header field carried by a first OFDM symbol*

Hansen’s 802.11-compliant transceiver “implement[s] orthogonal frequency division multiplexing (OFDM).” (See INTELDELL-1006, ¶¶48, 51.) And WWiSE similarly describes “the PHY entity for a multiple input multiple output orthogonal frequency division (MIMO-OFDM) system” (INTELDELL-1005, 55.) As discussed above (*supra* §V.C.2.a), Hansen’s OFDM transceiver would receive

WWiSE’s mixed-mode PPDU in both the ER and NR configurations. And WWiSE explains that devices operating in NR configuration communicate using a PPDU (*i.e.*, a packet) that includes “MIMO-OFDM PLCP preamble, MIMO-OFDM PLCP header, PSDU, and may consist of appended tail bits and pad bits.” (~~INTELL~~DELL-1005, 58.) “The MIMO-OFDM PLCP header is composed of the SIGNAL-N field and the SERVICE field,” where “[t]he SIGNAL-N field ... consists of 54 bits that specify all configuration and length-related parameters associated with PPDU transmission,” including “bandwidth, modulation, code rate, code type, number of TX antennas, and number of spatial streams.” (~~INTELL~~DELL-1005, 58, 83.) WWiSE further explains that “[i]n the mandatory standard configuration, SIG-N is composed of a single MIMO-OFDM *symbol*” (~~INTELL~~DELL-1005, 69.) Figure 003 of WWiSE presents an example of a NR packet for a device in mixed mode.

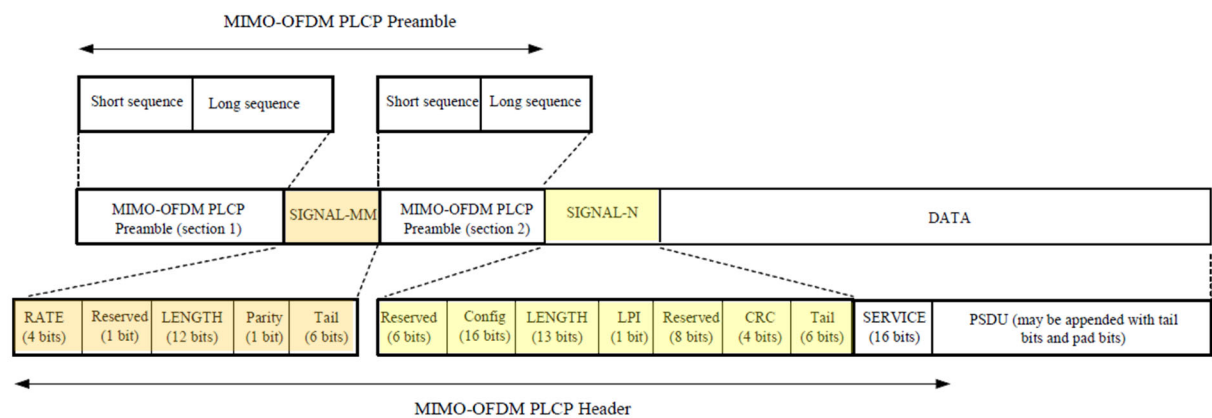


Figure 003 – PPDU frame format: Mixed-mode access in the 1TX (40 MHz) and 2TX (20 and 40 MHz) modes

c. *Second packet format with the first header field and a second header field that repeats the first header field*

When operating in ER mode, devices communicate using “the long SIG-N field format”—which, according to WWiSE, means “[t]he SIG-N MIMO-OFDM symbol, followed by a second MIMO-OFDM symbol, denoted as ER-SIG-N.” (~~INTELDELL~~-1005, 50, 69.) An example is shown in Figure 008 for a device in “mixed mode operation.” (~~INTELDELL~~-1005, 67.)

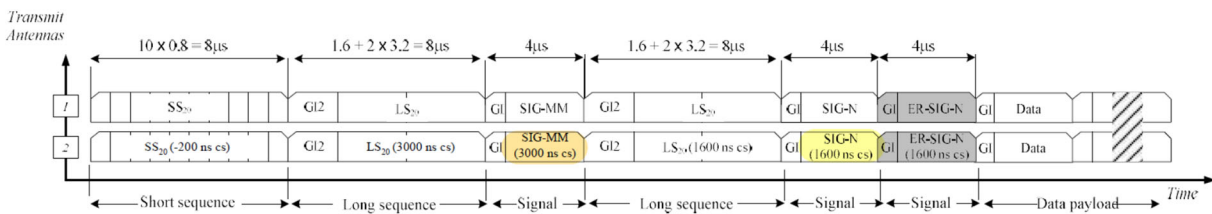


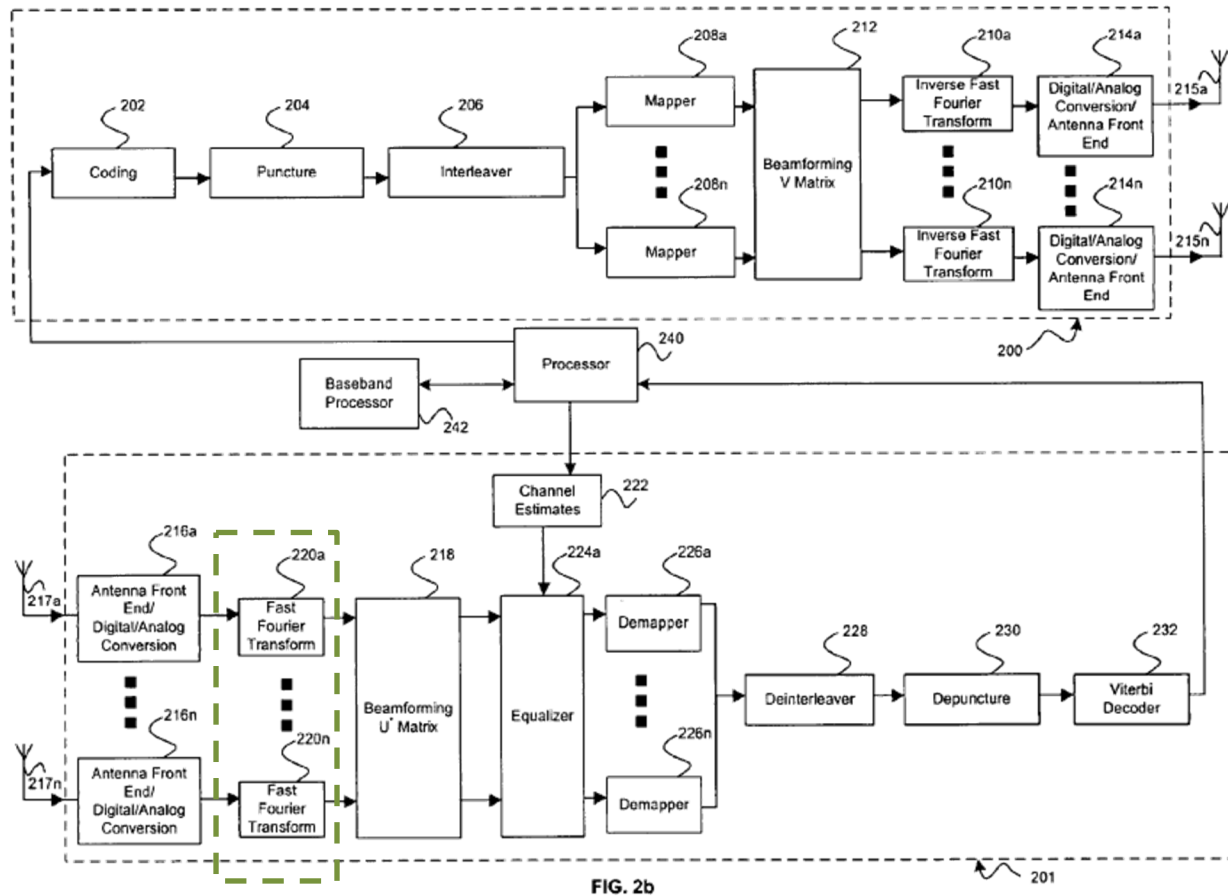
Figure 008 – MIMO-OFDM Training structure for $N_{Tx} = 2$, 20 MHz, mixed-mode operation. The shaded field indicates the optional duplicate SIG-N for extended range communication.

The figure caption explains that ER-SIG-N (shaded gray) is an “optional duplicate [of] SIG-N for extended range communication.”

Thus, while NR mode thus uses a “*first packet format*” with a SIG-N symbol in the header (“*a first header field carried by a first OFDM symbol*”), ER mode uses a “*second packet format*” with a SIG-N header symbol (“*the first header field carried by the first OFDM symbol*”) followed by a ER-SIG-N header symbol (“*a second header field carried by a second OFDM symbol which follows the first OFDM symbol*”) that repeats SIG-N (“*the second header field being a repetition of the first header field*”). (~~INTELDELL~~-1003, ¶133.)

3. Claim Limitations [1B] and [6B]

Hansen's transceiver includes a demodulator that demodulates a received wireless PPDU. The demodulator is illustrated, for example, in Figure 2b of Hansen (below).



Hansen explains that “[e]ach [Fast Fourier Transform] FFT block 220a, ..., 220n may receive a signal from an antenna front end and A to D conversion block 216a, ..., 216n, independently applying a n-point FFT technique, **demodulating** the signal by a plurality of carrier signals” for the purpose of “extract[ing] n signals contained in each of the plurality of OFDM signals received by the receiver 201.”

(~~INTELDELL~~-1006, ¶51.) A POSITA would have understood Hansen’s collection of FFTs (in the green dashed box above) to be “*a demodulator*” for an incoming wireless packet in Hansen’s MIMO-capable system. (~~INTELDELL~~-1003, ¶134.)

Moreover, a demodulator would have been needed to demodulate WWiSE’s packets before they could be decoded and processed. (~~INTELDELL~~-1003, ¶135.) For example, a received OFDM symbol carrying the SIGNAL field in WWiSE (like the one in Figure 008) must be demodulated before recovering the bits that set receiver configuration parameters. (~~INTELDELL~~-1005, 92.) A POSITA would therefore have had a reasonable expectation of success in using Hansen’s demodulator to demodulate WWiSE’s packets because they are compatible with the same versions of 802.11, because Hansen expressly refers to packet structures in WWiSE, and because WWiSE uses header symbols (*e.g.*, SIG-N or Signal-N) analogous to those in Hansen’s PPDU. (~~INTELDELL~~-1005, 69; ~~INTELDELL~~-1006, ¶¶77, 79, Fig. 5a & 5b; ~~INTELDELL~~-1003, ¶116; *see also supra* §VI.C.2.b.)

Notably, however, Hansen describes the demodulator (*i.e.*, FFT block 220a, ..., 220n) as being part of “receiver 201”—which includes the entire chain of components in the receive path—instead of describing the demodulator and receiver as separate components. (~~INTELDELL~~-1006, ¶¶50–51, Fig. 2b.) This contrasts with the ’146 patent disclosure that describes and claims the receiver and demodulator as separate components. The claimed “*receiver*” of the ’146 patent

would thus correspond to Hansen’s Antenna Front End/Digital/Analog Conversion blocks (216*a*, ..., 216*n*), and the claimed “*demodulator*” of the ’146 patent would correspond to Hansen’s FFT blocks (220*a*, ..., 220*n*). (~~INTELDELL~~-1003, ¶136.)

Petitioner therefore disagrees that including the demodulator within the receiver is consistent with the plain and ordinary meaning of the claim language, but Hansen’s description is nevertheless consistent with PO’s apparent interpretation and application of the claims in the co-pending district court case. In particular, PO’s Preliminary Infringement Contentions point to the same PHY-layer disclosures from the 802.11ax standard to satisfy both the “receiver” ([1A]) and “demodulator” ([1B]) limitations of claim 1 (*compare* ~~INTELDELL~~-1039, App. E, 7–9 (relying upon, among other things, excerpts from §§17.3, 19.3, 21.3, 27.3 as evidence of the claimed “*receiver*”) *with* ~~INTELDELL~~-1039, App. E, 31–32 (relying on excerpts from §§17.3, 19.3, 21.3, and 27.3 as evidence of the claimed “*demodulator*”))), indicating that, under PO’s infringement theory, the accused demodulator can be part of the accused receiver. Therefore, under PO’s broad apparent interpretation of the claim, the claimed “*demodulator*” is disclosed in Hansen. (~~INTELDELL~~-1003, ¶136.)

4. Claim Limitations [1C] and [6C]

As discussed above, WWiSE discloses NR wireless packets as well as ER packets for improved reliability when, for example, a STA operates far away from

an AP. (See *supra* §VI.C.2.c; ~~INTELDELL~~-1003, ¶138.) Both packet formats include a SIG-N header symbol—as illustrated, for example, in Figures 003 (NR mixed-mode packet) and 008 (ER mixed-mode packet) below—that “specif[ies] all configuration and length-related parameters associated with PPDU transmission.” (~~INTELDELL~~-1005, 50, 58, 69, 83.)

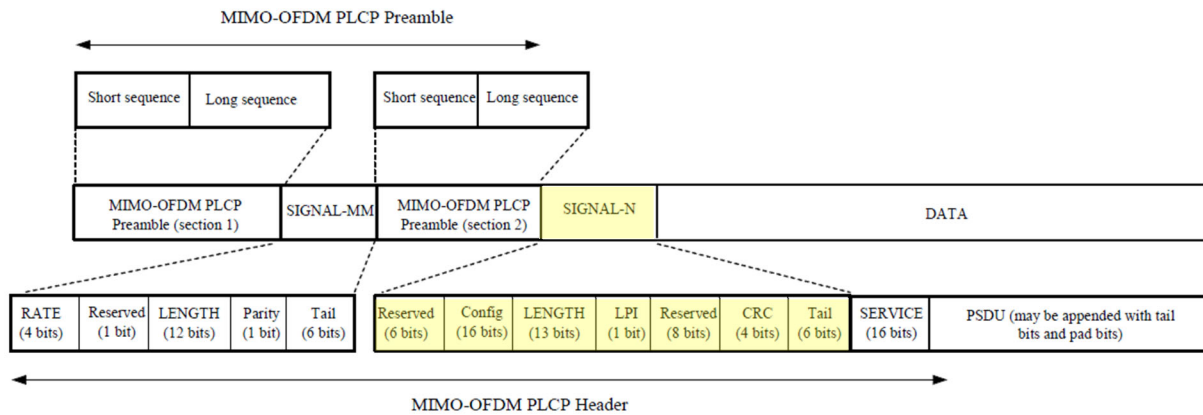


Figure 003 – PPDU frame format: Mixed-mode access in the 1TX (40 MHz) and 2TX (20 and 40 MHz) modes

In addition, the ER packet includes an ER-SIG-N header symbol that repeats the SIG-N header symbol. (See *supra* §VI.C.2.c.)

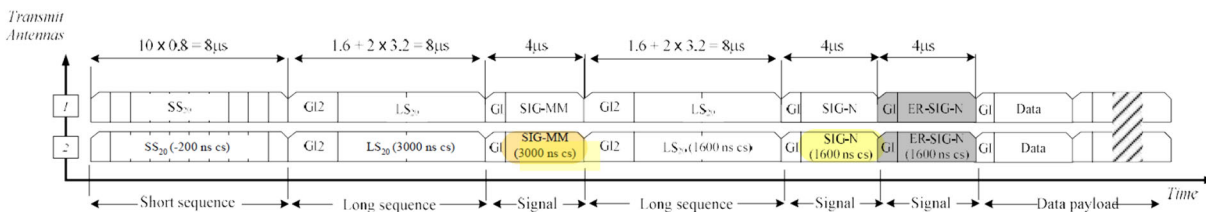


Figure 008 – MIMO-OFDM Training structure for $N_{Tx} = 2$, 20 MHz, mixed-mode operation. The shaded field indicates the optional duplicate SIG-N for extended range communication.

WWiSE further discloses the specific “bit assignment” for the SIG-N field, including a REXT bit that indicates whether “[s]tandard or extended communication

range configuration”—*i.e.*, NR or ER—is used. (~~INTELDELL~~-1005, 50, 69.) An ER packet “shall be transmitted with ... the REXT bit set to value 1” in the SIG-N field, whereas in a NR packet, the REXT bit is set to zero, as shown in Table 011 below. (~~INTELDELL~~-1005, 50, 69, Table 011.)

Table 011—SIG-N field bit assignment

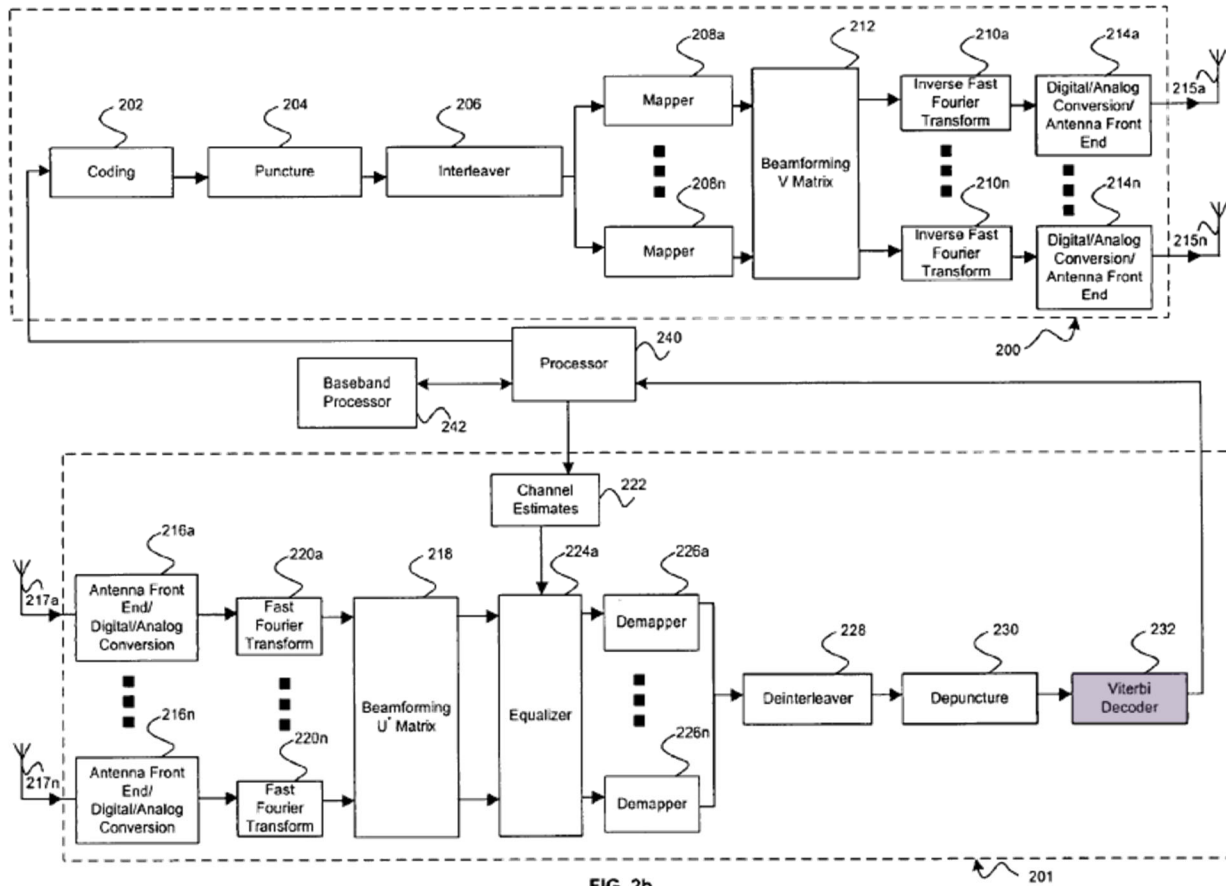
Bits	Field	Subfield	Parameter	Values
B0 : b5	RSVD		Reserved bits	111111. Bits shall be ignored at the receiver
B6 : b21	CONFIG		Configuration	
B6 : b8		NSS	Number of spatial streams	000: 1, 001: 2, 010: 3, 011: 4
B9 : b11		NTX	Number of transmit antennas	000: 1, 001: 2, 010: 3, 011: 4
B12 : b13		BW	Bandwidth	00: 20 MHz, 01: 40 MHz
B14: b16		R	Code rate	000: 1/2, 001: 2/3, 010: 3/4, 011: 5/6
B17 : b18		CT	ECC type	00 : convolutional, 01 : LDPC
B19 : b21		CON	Constellation type	000: BPSK, 001: QPSK, 010: 16-QAM, 011: 64-QAM
B22 : b34	LEN		Length	Number of bytes in the payload. The value of 0 is allowed.
b35	LPI		Last PSDU indicator	1 indicates that this is the last PSDU to be aggregated into the current PPDU. LPI shall have the value of 1 when the value of the LEN field is 0.
b36	REXT		Standard or extended communication range configuration	0 indicates the standard configuration, 1 indicates the extended communication range configuration
b37 : b43	RSVD		Reserved	0000000, bits shall be ignored at the receiver
b44 : b47	CRC		Cyclic Redundancy Check	CRC calculated on bits 0-43 using generator polynomial x^4+x+1
b48 : b53	TAIL			000000

This is analogous to the '146 patent disclosure of communicating “the value of D in the header so that all nodes know how many OFDM symbols are carrying header information.” (~~INTELDELL~~-1001, 2:51–3:1.) And to ascertain the number of header symbols, a receiver in the '146 patent “starts processing the header by decoding one OFDM header symbol,” and if successful, “then the receiver knows how many more OFDM symbols (D-1) are carrying header information for a given

frame.” (~~INTEL~~DELL-1001, 3:1–5.) Similarly, an AP or STA in WWiSE’s system distinguishes between an NR packet (“*first packet format*”) and an ER packet (“*second packet format*”) based on the SIG-N field—including the REXT bit—which indicates the presence or absence of the ER-SIG-N field (“*detecting, from the received wireless packet, the second header field which repeats the first header field*”). (~~INTEL~~DELL-1003, ¶139.)

Claim 1 additionally requires that the “*wireless receiver*” performs the “*detecting*” and “*distinguishing*” operations on the “*received wireless packet*.”³ In the combined system of Hansen and WWiSE, the decoding of SIG-N and/or ER-SIG-N header symbols to obtain the value of the REXT bit occurs in the Viterbi Decoder 232 (shaded purple) in Fig. 2b below.

³ Challenged method claim 6 does not recite “*a receiver*” or “*a demodulator*.”



But as discussed in §VI.C.3 above, Hansen describes “receiver 201” as including the entire chain of components in the receive path, including the FFT block 220a, ..., 220n (the “demodulator”) and Viterbi Decoder 232. (~~INTEL/DELL~~-1006, ¶¶50, 55–56, Fig. 2b.) This contrasts with the ’146 patent disclosure that, for example, describes and claims (e.g., in claim 1) the receiver and demodulator as separate components. (*See supra* §VI.C.3.) Petitioner therefore does not agree that including the demodulator and decoder within the receiver satisfies claim 1 of the patent, but Hansen’s description is nevertheless consistent with PO’s apparent interpretation and application of the claim in the co-pending district court case, where PO’s

Preliminary Infringement Contentions point to the same PHY-layer disclosures from the 802.11ax standard to satisfy both the “receiver” ([1A]/[1C]) and “demodulator” ([1B]) limitations of claim 1 (compare ~~INTEL~~DELL-1039, App. E, 7–9 (relying upon, among other things, excerpts from §§17.3, 19.3, 21.3, 27.3 as evidence of the claimed “receiver”) and 33–36 (not identifying any additional structure for “distinguishing”) with ~~INTEL~~DELL-1039, App. E, 31–32 (relying on excerpts from §§17.3, 19.3, 21.3, and 27.3 as evidence of the claimed “demodulator”))). This indicates that, under PO’s infringement theory, the accused receiver can encompass other components in the receive pathway, including the demodulator and decoder. Therefore, under PO’s broad apparent interpretation of the claim, the combination of Hansen and WWiSE discloses this limitation of claim 1. (~~INTEL~~DELL-1003, ¶140.)

D. Claims 2 and 7

The combination of Hansen and WWiSE teaches a WLAN device (*e.g.*, an AP or STA) with a receiver that receives both NR (“*the first packet format*”) and ER (“*the second packet format*”) packets like the ones in Figures 003 and 008, respectively, below. (*See supra* §VI.C.2.c.)

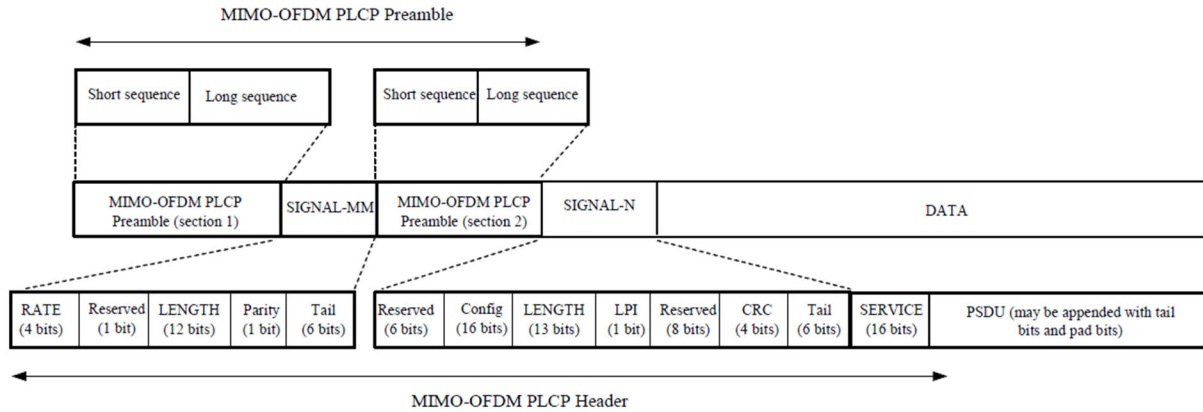


Figure 003 – PPDU frame format: Mixed-mode access in the 1TX (40 MHz) and 2TX (20 and 40 MHz) modes

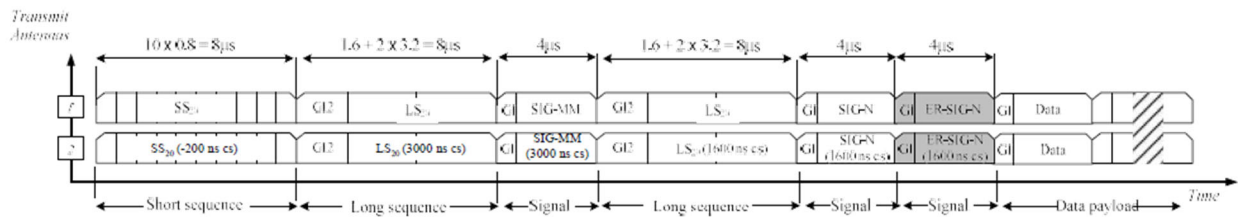


Figure 008 – MIMO-OFDM Training structure for $N_{TX} = 2$, 20 MHz, mixed-mode operation. The shaded field indicates the optional duplicate SIG-N for extended range communication.

(~~INTELDELL~~-1005, 50, 67.) As shown, an ER packet (“the second packet format”) includes SIG-N and ER-SIG-N header symbols, where ER-SIG-N (“the second header field”) repeats the bits of SIG-N. (See *supra* §VI.C.2.c.) Included among those bits is REXT, which, as discussed above, is set to a value of “1” to indicate an ER configuration or a value of “0” to indicate a NR configuration. (See *supra* §VI.C.4; ~~INTELDELL~~-1005, 50, 69, Table 011.)

Table 011—SIG-N field bit assignment

Bits	Field	Subfield	Parameter	Values
B0 : b5	RSVD		Reserved bits	111111, Bits shall be ignored at the receiver
B6 : b21	CONFIG		Configuration	
B6 : b8		NSS	Number of spatial streams	000: 1, 001: 2, 010: 3, 011: 4
B9 : b11		NTX	Number of transmit antennas	000: 1, 001: 2, 010: 3, 011: 4
B12 : b13		BW	Bandwidth	00: 20 MHz, 01: 40 MHz
B14 : b16		R	Code rate	000: 1/2, 001: 2/3, 010: 3/4, 011: 5/6
B17 : b18		CT	ECC type	00 : convolutional, 01 : LDPC
B19 : b21		CON	Constellation type	000: BPSK, 001: QPSK, 010: 16-QAM, 011: 64-QAM
B22 : b34	LEN		Length	Number of bytes in the payload. The value of 0 is allowed.
b35	LPI		Last PSDU indicator	1 indicates that this is the last PSDU to be aggregated into the current PPDU. LPI shall have the value of 1 when the value of the LEN field is 0.
b36	REXT		Standard or extended communication range configuration	0 indicates the standard configuration, 1 indicates the extended communication range configuration
b37 : b43	RSVD		Reserved	0000000, bits shall be ignored at the receiver
b44 : b47	CRC		Cyclic Redundancy Check	CRC calculated on bits 0-43 using generator polynomial x^4+x+1
b48 : b53	TAIL			000000

Detecting a value of “1” for the REXT bit indicates to the receiver that an incoming packet is in the ER format. (~~INTELDELL~~-1003, ¶141.) Furthermore, if the receiver is unable to decode the SIG-N field in an ER packet—and therefore does not detect the value of REXT from the “first header field”—it would have been obvious to a POSITA that the receiver would decode the ER-SIG-N field of that same packet to detect the value of REXT from the “second header field.” (~~INTELDELL~~-1003, ¶141.) As discussed in section §VI.B. above, repeating a header symbol (e.g., duplicating the contents of SIG-N in ER-SIG-N) increases diversity by increasing the likelihood that a given symbol is reliably received and decoded; so if, for example, a deep fade wipes out the first symbol, the header information will

nevertheless be recovered from the repeated copy in the second symbol. (~~INTELDELL~~-1003, ¶141 (citing ~~INTELDELL~~-1024, 60-61, Fig. 3.5).) A POSITA reading WWiSE would have understood this to be reason for duplicating the SIG-N symbol in an ER packet. (~~INTELDELL~~-1003, ¶141.) This corresponds to “*determin[ing] the received wireless packet as the second packet format when the second header field is detected from the wireless packet*” and is consistent with the ’146 patent disclosure, where the value of D—like REXT—is contained “in the header so that all nodes know how many OFDM symbols are carrying header information” (~~INTELDELL~~-1001, 2:51–3:1), and a receiver “starts processing the header by decoding one OFDM header symbol” such that, if successful, “the receiver knows how many more OFDM symbols (D-1) are carrying header information for a given frame,” or if unsuccessful “(i.e., the header decoding fails), then the receiver can try to decode two OFDM header symbols, and so on.” (~~INTELDELL~~-1001, 3:1–8; ~~INTELDELL~~-1003, ¶141.)

E. Claims 3 and 8

As discussed above, the combination of Hansen and WWiSE teaches a WLAN device (e.g., an AP or STA) with a receiver that receives both NR (“*the first packet format*”) and ER (“*the second packet format*”) packets, where both packet types include a SIG-N header symbol, and an ER packet additionally includes an ER-SIG-N header symbol (“*the second header field*”). (See *supra* §VI.C.2.) As

further explained above, the REXT bit in the SIG-N header field indicates the format—NR or ER—of the transmitted packet, where a value of “0” informs the receiver that an incoming packet is in the NR format and therefore will *not* include an ER-SIG-N header symbol. (See *supra* §VI.C.4.) So after decoding a SIG-N symbol with a REXT bit value of “0,” the receiver will not detect an ER-SIG-N symbol (“*the second header field*”) and will determine that the incoming packet is in the NR format (“*the first packet format*”). (~~INTELL~~DELL-1003, ¶142.) This corresponds to the claimed “*determin[ing] the received wireless packet as the first packet format when the second header field is not detected from the wireless packet*” and is consistent with the ’146 patent disclosure as discussed above. (See *supra* §VI.C.4; ~~INTELL~~DELL-1003, ¶142.)

F. Claims 4 and 9

As discussed above, the ER packet format of WWiSE includes a header with SIG-N and ER-SIG-N header fields (“*the first header field*” and “*second header field*,” respectively), as illustrated in Figure 008 below. (See *supra* §VI.C.2.c.)

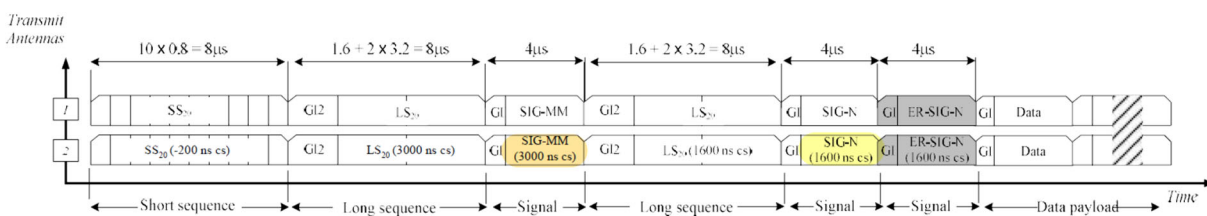


Figure 008 – MIMO-OFDM Training structure for $N_{TX} = 2$, 20 MHz, mixed-mode operation. The shaded field indicates the optional duplicate SIG-N for extended range communication.

The ER-SIG-N field repeats the contents of the SIG-N field, and WWiSE explains that “[t]he SIGNAL-N field”—and therefore also the ER-SIG-N field—“consists of 54 bits that specify all configuration and length-related parameters associated with PPDU transmission,” including “bandwidth, modulation, code rate, code type, number of TX antennas, and number of spatial streams.” (~~INTELDELL~~-1005, 58, 69, 83.) A POSITA would understand this information (e.g., code rate and code type) is required “for decoding the wireless packet” at the receiver. (~~INTELDELL~~-1003, ¶143.)

G. Claims 5 and 10

As discussed above, the ER packet format of WWiSE includes a header with SIG-N and ER-SIG-N header fields (“*the first header field*” and “*second header field*,” respectively), as illustrated in Figure 008 below. (See *supra* §VI.C.2.c.)

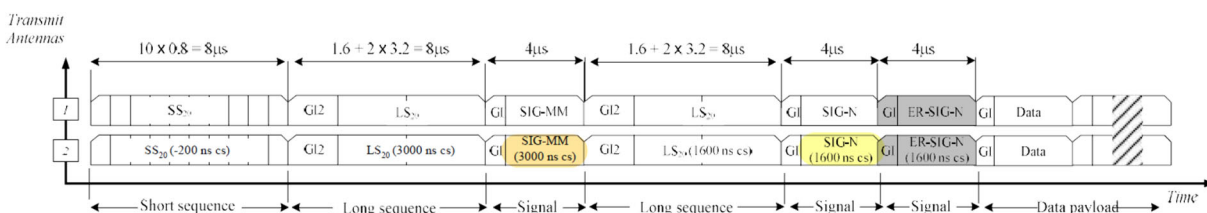


Figure 008 – MIMO-OFDM Training structure for $N_{TX} = 2$, 20 MHz, mixed-mode operation. The shaded field indicates the optional duplicate SIG-N for extended range communication.

The ER-SIG-N field repeats the contents of the SIG-N field, and WWiSE explains that “[t]he SIGNAL-N field”—and therefore also the ER-SIG-N field—“consists of 54 bits that specify all configuration and *length-related parameters* associated with PPDU transmission,” including “bandwidth, modulation, code rate, code type,

number of TX antennas, and number of spatial streams.” (~~INTEL~~DELL-1005, 58, 69, 83.) Additionally, Figure 003 of WWiSE illustrates the “**LENGTH**” field in the SIG-N header symbol (shaded yellow below), which Table 011 (also below) describes as providing the “[n]umber of bytes in the payload.”

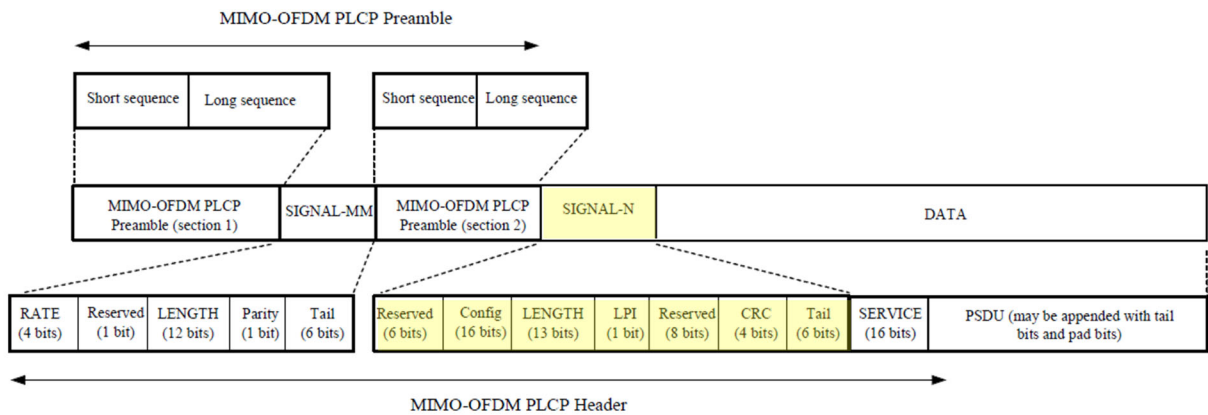


Figure 003 – PPDU frame format: Mixed-mode access in the 1TX (40 MHz) and 2TX (20 and 40 MHz) modes

(~~INTEL~~DELL-1005, 59).

Table 011—SIG-N field bit assignment

Bits	Field	Subfield	Parameter	Values
B0 : b5	RSVD		Reserved bits	111111, Bits shall be ignored at the receiver
B6 : b21	CONFIG		Configuration	
B6 : b8		NSS	Number of spatial streams	000: 1, 001: 2, 010: 3, 011: 4
B9 : b11		NTX	Number of transmit antennas	000: 1, 001: 2, 010: 3, 011: 4
B12 : b13		BW	Bandwidth	00: 20 MHz, 01: 40 MHz
B14: b16		R	Code rate	000: 1/2, 001: 2/3, 010: 3/4, 011: 5/6
B17 : b18		CT	ECC type	00 : convolutional, 01 : LDPC
B19 : b21		CON	Constellation type	000: BPSK, 001: QPSK, 010: 16-QAM, 011: 64-QAM
B22 : b34	LEN		Length	Number of bytes in the payload. The value of 0 is allowed.
b35	LPI		Last PSDU indicator	1 indicates that this is the last PSDU to be aggregated into the current PPDU. LPI shall have the value of 1 when the value of the LEN field is 0.
b36	REXT		Standard or extended communication range configuration	0 indicates the standard configuration, 1 indicates the extended communication range configuration
b37 : b43	RSVD		Reserved	0000000, bits shall be ignored at the receiver
b44 : b47	CRC		Cyclic Redundancy Check	CRC calculated on bits 0-43 using generator polynomial x^4+x+1
b48 : b53	TAIL			000000

(~~INTELDELL~~-1005, 70). SIG-N thus provides “*information related to a length of the wireless packet.*” (~~INTELDELL~~-1003, ¶144.)

VII. DISCRETIONARY DENIAL IS NOT APPROPRIATE

The Board should decline to exercise its discretion to deny institution in this case for the following reasons. First, Dell has offered a stipulation in the litigation, consistent with *Sotera Wireless*. (See DELL-1040.) The *Sotera* stipulation from Dell removes any overlap between this IPR proceeding and the litigation between the parties. “Consistent with *Sotera Wireless, Inc.*, the PTAB will not discretionarily deny institution in view of parallel district court litigation where a petitioner presents a stipulation not to pursue in a parallel proceeding the same grounds or any grounds

that could have reasonably been raised before the PTAB.” (*Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation* (June 21, 2022) (“*Fintiv* Memo”), 3.) Given the *Sotera* stipulation and the *Fintiv* Memo’s guidance, the Board should decline to exercise its discretion to deny institution.

In addition, the *Fintiv* factors weigh heavily against discretionary denial. Dell has filed an opposed motion to stay the litigation between the parties pending the outcome of Intel’s IPR for the ’146 patent which has recently instituted. (*See* Dell-1046.) Thus *Fintiv* factor 1 weighs in favor of granting institution. Further, the median time to trial for Judge Schroeder is just over thirty months. (*See* Dell-1045.) The final written decision in this proceeding will issue within a month of that. Although the trial in the Dell litigation is currently scheduled for July 15, 2024, this date remains speculative because the district court has at least two other patent trials scheduled for the same date. (*See* DELL-1041, DELL-1042, DELL-1043, DELL-1044.) So *Fintiv* factor 2 is neutral. Due to multiple adjustments to the schedules, much substantive work remains, including expert discovery and dispositive motions, rendering *Fintiv* factor 3 neutral at a minimum.

Moreover, discretionary denial is inappropriate here because the Petition presents a “compelling, meritorious challenge.” (*Fintiv* Memo, 4.) The ’146 patent is “directed toward header repetition in a communications environment.” (DELL-

1001, 1:33–36.) The purported novelty of the challenged claims lies in “receiver detection of D with variable repetition,” where D corresponds to the number of repetitions of the header. (DELL-1001, 2:51–64.) However, PO acknowledged in its provisional application that the use of repeated headers and repeated extended headers was publicly proposed during development of the ITU-T G.hn standard, prior its earliest possible priority date. (See DELL-1008, 30; DELL-1024 (Aware Proposal, 09CC-046); DELL-1025 (CopperGate Proposal, 09XC-100); DELL-1026 (Intellon Proposal, 09XC-119).) Petitioner established in §§III.A, VI.A. that these two concepts were also publicly proposed and discussed in the IEEE 802.11 TGn working group, years before the earliest possible priority date of the ’146 patent. The compelling merits of this IPR thus weigh heavily against discretionary denial.

VIII. MANDATORY NOTICES

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

The real parties in interest include Petitioner, as well as Intel Corporation, and Lenovo Group Ltd.

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

To the best of Petitioner’s knowledge, the ’146 patent is involved in the following district court litigations:

- *AX Wireless LLC, v. Dell Inc., and Dell Technologies Inc.*, 2-22-cv-00277 (E.D. Tex.).

- *AX Wireless LLC, v. Lenovo Group Ltd.*, 2-22-cv-00280 (E.D. Tex.).
- *AX Wireless LLC, v. HP Inc.*, 2-22-cv-00279 (E.D. Tex.).
- *AX Wireless LLC, v. Acer Inc.* 2-23-cv-00041 (E.D. Tex.).

C. Notice Of Counsel And Service Information

Pursuant to 37 C.F.R. §§42.8(b)(3), 42.8(b)(4) and 42.10(a), Petitioner appoints ~~**Lori A. Gordon** (Reg. No. 50,633) at the address of Perkins Coie LLP, 700 Thirteenth Street, N.W., Suite 800, Washington, DC 2005-3960, telephone number (202) 654-6200, as lead counsel;~~ **Jon R. Carter** (Reg. No. 75,145) at the address of Perkins Coie LLP, 1155 Avenue of the Americas, 20th Floor, New York, NY 10036-2711, telephone number (212) 262-6900 as lead counsel; and **Matthew W. Hindman** (Reg. No. 57,396) at the address of Perkins Coie LLP, 3150 Porter Drive, Palo Alto, CA 94304-1212, telephone number (650) 838-4300, as backup counsel.

Petitioner consents to electronic service by email at the email addresses: ~~gordon-ptab@perkinscoie.com~~, carter-ptab@perkinscoie.com, and hindman-ptab@perkinscoie.com.

IX. CONCLUSION

Inter Partes Review of the challenged claims is respectfully requested.

Date: ~~July 7, 2023~~March 20, 2024

Respectfully submitted,

/ Jon R. Carter /

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CERTIFICATE OF WORD COUNT UNDER 37 CFR §42.24(d)

Pursuant to 37 C.F.R. §42.24(a), ~~Intel~~Dell hereby certifies that portions of the above-captioned Petition for *Inter Partes* Review of U.S. Patent No. 11,212,146, in accordance with and reliance on the word count provided by the word-processing system used to prepare this Petition, that the number of words in this paper is ~~10,203~~10,261. Pursuant to 37 C.F.R. §42.24(a), this word count is in compliance and excludes the table of contents, table of authorities, mandatory notices under §42.8, certificate of service, certificate of word count, appendix of exhibits, and any claim listing. This word count was prepared using Microsoft Word.

Respectfully submitted,

/ *Jonathan R. Carter* /

Jon R. Carter
Attorney for Petitioner

Date: ~~July 7, 2023~~ March 20, 2024

CERTIFICATE OF SERVICE

The undersigned hereby certifies that true copies of the Petition for *Inter Partes* Review of U.S. Patent No. 11,212,146 and supporting materials (Exhibits and Power of Attorney) were served via overnight delivery on the Patent Owner at the correspondence address of record as listed in USPTO records:

Capitol IP Law Group, PLLC
1629 K Street NW Suite 300
Washington, DC

and via email to the attorneys of record for Plaintiff in the concurrent *AX Wireless LLC, v. Dell Inc., and Dell Technologies Inc.*, 2-22-cv-00277 (EDTX), *AX Wireless LLC, v. HP Inc.*, 2-22-cv-00279 (EDTX), and *AX Wireless LLC, v. Lenovo Group Ltd.*, 2-22-cv-00280 (EDTX) litigations:

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/ Jonathan R. Carter /

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Date: March 20, 2024