IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of:	Joon Bae Kim et al.	
U.S. Patent No.:	10,917,272	Attorney Docket No.: 57633-0002IP1
Issue Date:	February 9, 2021	
Appl. Serial No.:	16/780,589	
Filing Date:	February 3, 2020	
Title:	NON-TRANSITORY COMPUTER-READABLE INFORMATION STORAGE MEDIA FOR VARIABLE HEADER REPETITION IN A WIRELESS OFDM NETWORK	

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PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES PATENT NO. 10,917,272 PURSUANT TO 35 U.S.C. §§ 311–319, 37 C.F.R. § 42

TABLE OF CONTENT

LISTING OF CLAIMS

Claim 1	
[1P]	A non-transitory computer-readable information storage media, having stored thereon instructions, that when executed by one or more processors in a transceiver, cause to be performed a method comprising:
[1A]	generating, by a wireless Orthogonal Frequency Division Multiplexing (OFDM) communications transmitter, a first packet type comprising a first header field,
[1B]	wherein the first header field comprises two parts, a first part comprising a first set of header bits of the first header field and a second part comprising a second set of header bits of the first header field,
[1C]	wherein the first set of header bits of the first header field is different than the second set of header bits of the first header field;
[1D]	generating, by an encoder and a modulator, a first OFDM symbol followed by a second OFDM symbol,
[1E]	wherein the first OFDM symbol is used to transmit the first part of the first header field and the second OFDM symbol is used to transmit the second part of the first header field;
[1F]	transmitting, by the wireless OFDM communications transmitter, the first packet type over a wireless communication channel;
[1G]	generating, by the wireless OFDM communications transmitter, a second packet type comprising a second header field,
[1H]	wherein the second header field comprises four parts, a first part comprising a first set of header bits of the second header field, a second part comprising a second set of header bits of the second header field, a third part comprising a third set of header bits of the second header field and a fourth part comprising a fourth set of header bits of the second header field,

[1I]	wherein the first set of header bits of the second header field is the same as the second set of header bits of the second header field, wherein the third set of header bits of the second header field is the same as the fourth set of header bits of the second header field;
[1J]	generating, by the encoder and the modulator, a first OFDM symbol followed by a second OFDM symbol followed by a third OFDM symbol followed by a fourth OFDM symbol,
[1K]	wherein the first OFDM symbol is used to transmit the first part of the second header field, the second OFDM symbol is used to transmit the second part of the second header field, the third OFDM symbol is used to transmit the third part of the second header field, the fourth OFDM symbol is used to transmit the fourth part of the second header field,
[1L]	wherein the second set of header bits of the second header field transmitted using the second OFDM symbol are transmitted in a different order than the first set of header bits of the second header field transmitted using the first OFDM symbol,
[1M]	wherein the fourth set of header bits of the second header field transmitted using the fourth OFDM symbol are transmitted in a different order than the third set of header bits of the second header field transmitted using the third OFDM symbol; and
[1N]	transmitting, by the wireless OFDM communications transmitter, the second packet type over the wireless communication channel.
Claim 2	
[2]	The media of claim 1, wherein the transmission of the same header bits in the second OFDM symbol provides diversity to increase a likelihood of correctly communicating header information of the second packet type.
Claim 3	
[3]	The media of claim 1, wherein the transmission of the same header bits in the fourth OFDM symbol provides diversity to increase a likelihood of correctly communicating header information of the second packet type.

Claim 5	
[5]	The media of claim 1, wherein the wireless transceiver supports one or more wireless standards.
Claim 7	
[7A]	The media of claim 1, wherein the first packet type is transmitted in a first channel bandwidth and the second packet type is transmitted in a second channel bandwidth,
[7B]	wherein the first channel bandwidth is at least two times wider than the second channel bandwidth.
Claim 8	
[8]	The media of claim 7, wherein the transmission of the same header bits in the second OFDM symbol provides diversity to increase a likelihood of correctly communicating header information of the second packet type.
Claim 9	
[9]	The media of claim 7, wherein the transmission of the same header bits in the fourth OFDM symbol provides diversity to increase a likelihood of correctly communicating header information of the second packet type.
Claim 11	
[11P]	A non-transitory computer-readable information storage media, having stored thereon instructions, that when executed by one or more processors in a transceiver, cause to be performed a method comprising:
[11A]	receiving, by a wireless Orthogonal Frequency Division Multiplexing (OFDM) communications receiver over a wireless communication channel, a first packet type comprising a first header field,
[11B]	wherein the first header field comprises two parts, a first part comprising a first set of header bits of the first header field and a second part comprising a second set of header bits of the first header field,

[11C]	wherein the first set of header bits of the first header field is different than the second set of header bits of the first header field;
[11D]	demodulating, by a demodulator, a first OFDM symbol followed by a second OFDM symbol,
[11E]	wherein the first OFDM symbol is used to receive the first part of the first header field and the second OFDM symbol is used to receive the second part of the first header field;
[11F]	receiving, by the wireless OFDM communications receiver over the wireless communication channel, a second packet type comprising a second header field,
[11G]	wherein the second header field comprises four parts, a first part comprising a first set of header bits of the second header field, a second part comprising a second set of header bits of the second header field, a third part comprising a third set of header bits of the second header field and a fourth part comprising a fourth set of header bits of the second header field,
[11H]	wherein the first set of header bits of the second header field is the same as the second set of header bits of the second header field, wherein the third set of header bits of the second header field is the same as the fourth set of header bits of the second header field; and
[11I]	demodulating, by the demodulator, a first OFDM symbol followed by a second OFDM symbol followed by a third OFDM symbol followed by a fourth OFDM symbol,
[11J]	wherein the first OFDM symbol is used to receive the first part of the second header field, the second OFDM symbol is used to receive the second part of the second header field, the third OFDM symbol is used to receive the third part of the second header field, the fourth OFDM symbol is used to receive the fourth part of the second header field,
[11K]	wherein the second set of header bits of the second header field received using the second OFDM symbol are received in a different order than the first set of header bits of the second header field received using the first OFDM symbol, and

[11L]	wherein the fourth set of header bits of the second header field received using the fourth OFDM symbol are received in a different order than the third set of header bits of the second header field received using the third OFDM symbol.
Claim 12	
[12]	The media of claim 11, wherein the reception of the same header bits in the second OFDM symbol provides diversity to increase a likelihood of correctly receiving header information of the second packet type.
Claim 13	
[13]	The media of claim 11, wherein the reception of the same header bits in the fourth OFDM symbol provides diversity to increase a likelihood of correctly receiving header information of the second packet type.
Claim 15	
[15]	The media of claim 11, wherein the wireless transceiver supports one or more wireless standards.
Claim 17	
[17A]	The media of claim 11, wherein the first packet type is received in a first channel bandwidth and the second packet type is received in a second channel bandwidth,
[17B]	wherein the first channel bandwidth is at least two times wider than the second channel bandwidth.
Claim 18	
[18]	The media of claim 17, wherein the reception of the same header bits in the second OFDM symbol provides diversity to increase a likelihood of correctly receiving header information of the second packet type.

Claim 19	
[19]	19. The media of claim 17, wherein the reception of the same header bits in the fourth OFDM symbol provides diversity to increase a likelihood of correctly receiving header information of the second packet type.

EXHIBIT LIST

Exhibit	Reference
SONY-1001	U.S. Patent 10,917,272 (the ’272 patent)
SONY-1002	File History of the ’272 patent
SONY-1003	Declaration of Thomas LaPorta, Ph.D. dated May 16, 2025, in Support of *Inter Partes* Review Proceeding No. IPR2025-00960 of U.S. Patent 10,079,272
SONY-1004	Curriculum Vitae of Dr. Thomas LaPorta
SONY-1005	U.S. Patent Publication 2006/0182017 to Hansen, et al (“Hansen”)
SONY-1006	IEEE 802.11-05/0149r5, “WWiSE Proposal: High Throughput Extension to the 802.11 Standard” to Kose, et al, uploaded and publicly available on July 9, 2005 (“July 2005 WWiSE”)
SONY-1007	Declaration of James L. Lansford, Ph.D. dated May 17, 2025, in Support of *Inter Partes* Review Proceeding No. IPR2025-00960 of U.S. Patent 10,079,272
SONY-1008	U.S. Patent Publication 2005/0243774 to Choi, et al (“Choi”)
SONY-1009	U.S. Provisional Application 61/235,909 (“the ’272 Provisional”)
SONY-1010	U.S. Patent 8,737,189 to Hansen, et al (“Hansen Patent’)
SONY-1011	U.S. Provisional Application 60/653,429 (“Hansen Provisional”)
SONY-1012	IEEE 802.11-04/0889r3, “TGn Sync Proposal Technical Specification” to Mujtaba, uploaded and publicly available on January 2005
SONY-1013	IEEE 802.11-04/0886r6, “WWiSE Proposal: High Throughput Extension to the 802.11 Standard” to Hansen, et al, uploaded and publicly available on January 6, 2005 (“January 2005 WWiSE”)
SONY-1014	U.S. Patent Publication 2007/0115802 to Yu (“Yu”)
SONY-1015	IEEE Std. 802.11a-1999, “Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: High- Speed Physical Layer in the 5 GHz Band”, approved September 16, 1999 (“802.11a”)

SONY-1016	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
SONY-1017	IEEE Std. 802.11n-2009, "Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: Amendment 5: Enhancements for Higher Throughput" ("802.11n")
SONY-1018	Editor for G.9960, "ITU-T Recommendation G.9960 Next Generation Wire-line Based Home Networking Transceivers-Foundation", ITU-T SG15/Q4, January 2009, as filed in file wrapper of the '272 patent
SONY-1019	Intellon Corporation, "G.hn: Extended PHY frame header," ITU-T SG15/Q4, 09XC-119, Xian, China, July 2009, as filed in file wrapper of the '272 patent
SONY-1020	CopperGate Communication, "G.hn: Using Two Symbols for the Header of a PHY frame on Coax," ITU-T SG15/Q4, 09XC-100, Xian, China July 2009, as filed in file wrapper of the '272 patent
SONY-1021	Lörincz, et al, "Physical Layer Analysis of Emerging IEEE 802.11n WLAN Standard", 8th International Conference Advanced Communication Technology (February 20-22, 2006); added to IEEE *Xplore* May 8, 2006
SONY-1022	Van Nee, et al., "OFDM for Wireless Multimedia Communications", Artech House Publishers (2000)
SONY-1023	Bahai, et al., "Multi-Carrier Digital Communications Theory and Applications of OFDM", Springer (2004)
SONY-1024	Tse, et al., "Fundamentals of Wireless Communication", Cambridge University (2005)
SONY-1025	Heiskala, et al., "OFDM Wireless LANs: A Theoretical and Practical Guide", Sams Publishing (2002)
SONY-1026	RESERVED

SONY-1027	Cox, "Stage Set for Compromise on IEEE High-Speed Wireless", Network World (March 21, 2005)
SONY-1028	Reardon, "New Wi-Fi Standard Takes the Slow Road", CNET (May 20, 2005)
SONY-1029	Mujtaba, et al., IEEE 802.11-05/786r0, "TGn Sync, WWiSE, and Mitmot Closing Report", presentation submission, submitted and publicly available on July 21, 2005.
SONY-1030	Coffey, IEEE 802.11-05/0737r0, "WWiSE IEEE 802.11n Proposal", presentation submission, submitted and publicly available on July 9, 2005
SONY-1031	Gast, "802.11 Wireless Networks: The Definitive Guide", O'Reilly (2002)
SONY-1032	Infringement Contentions with Appendices served in *AX Wireless LLC v. Dell Inc. et al*., and *AX Wireless LLC v. HP Inc.*, U.S. District Court Eastern District of Texas, Case Numbers 2:22-cv-00277 and 2:22-cv- 00279, November 3, 2022
SONY-1033	U.S. Patent 7,415,074 (Appendix C to Lansford Declaration dated May 17, 2025, SONY-1007)
SONY-1034	Stephens, "802.11 'Decrypted'", ACM SIGCOMM Computer Communication Review, Vol. 35, No. 2 (April 2005) (Appendix D to Lansford Declaration dated May 17, 2025, SONY-1007)
SONY-1035	Kay, "Sidebar: The Battle for 11n", ComputerWorld (March 13, 2006)
SONY-1036	"'WWiSE' Consortium, Motorola Team on Proposal for IEEE 802.11n", Wireless Design Online (February 24, 2005)
SONY-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/ pressreleasefeb23.htm.
SONY-1038	IEEE 802.11-04/422r4, "New Participant Orientation", presentation submission (July 2004) (Appendix A to Lansford Declaration dated May 17, 2025, SONY-1007)

SONY-1039	IEEE 802.11-04/736r1, "Approved Minutes of the IEEE P802.11 Full Working Group", Minutes (July 2004) (Appendix B to Lansford Declaration dated May 17, 2025, SONY-1007)
SONY-1040	O'Hara, The IEEE 802.11 Handbook, Standards Information Network, IEEE Press, 1999
SONY-1041	Strom, "An overview of the IEEE 802.11 standard's evolution," EE Times (Oct. 31, 2006)
SONY-1042	RESERVED
SONY-1043	RESERVED
SONY-1044	RESERVED
SONY-1045	Transcript of Christopher Hansen Ph.D. Conducted on November 29, 2023
SONY-1046	Declaration of Matthew Hindman in IPR2023-01139 executed on March 12, 2024

I. Introduction

Sony Interactive Entertainment LLC ("Sony" or "Petitioner") petitions for *inter partes* review ("IPR") of claims 1-3, 5, 7-9, 11-13, 15, and 17-19 of U.S. Patent 10,917,272 ("the '272 patent"; SONY-1001). This petition is modeled on arguments from two prior petitions challenging the '272 patent, captioned as IPR2023-01139 (instituted and settled) and IPR2023-01140 (discretionarily denied second petition).

II. Grounds For Standing

Sony certifies the '272 patent is available for IPR, and Sony is not barred or estopped from requesting IPR.

III. Identification Of Challenge

A. Prior Art

The '272 patent claims priority through a series of applications to August 21, 2009 (SONY-1009). Petitioner does not acquiesce that the '272 patent is entitled to the claimed priority. Each reference was published prior to August 21, 2009.

1. U.S. Patent Publication 2006/0182017 to Hansen, et al

("Hansen"; SONY-1005), published August 17, 2006, is prior art under pre-AIA 35 U.S.C. §102(b).

2. **"WWiSE Proposal: High throughput extension to the 802.11 Standard" to Kose, et al** ("July 2005 WWiSE"; SONY-1006) is prior art under 35 U.S.C. pre-AIA §102(b) because the document was available and accessible to the public on July 9, 2005. (SONY-1007, ¶24.) July 2005 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. (SONY-1007, ¶15.) Members made these submissions through the IEEE 802 Wireless World website, http://802wirelessworld.com. (SONY-1007, ¶16; SONY-1038 (New Participant Orientation Slides), 35-37; SONY-1039 (July 2004 Meeting Minutes), 5.)

All submissions were accessible to any member of the public after free registration through the Wireless World website. (SONY-1007, ¶18; SONY-1038 (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. (SONY-1038 (New Participant Orientation Slides), 35; SONY-1007, ¶18.) Submissions were also publicly available to any member of the public via FTP at ftp.wirelessworld.com. (SONY-1007, ¶19; SONY-

1038 (New Participant Orientation Slides), 35 (describing process for creating a free account).) The FTP server's address and login credentials were also publicly available. (SONY-1007, ¶19, citing SONY-1033 and SONY-1034)).

In mid-2007, the IEEE's current Mentor website ("Mentor") replaced the Wireless World website. (SONY-1007, ¶21.) Prior submissions uploaded to the Wireless World server were added to Mentor shortly after its creation. (SONY-1007, ¶21.) The uploaded documents retained their original submission upload dates. (SONY-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. (SONY-1007, ¶21.) Entries in Mentor were and remain searchable by year, task group, title, or other parameters. (SONY-1007, ¶22.)

July 2005 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. (SONY-1007, ¶¶18-29, 24.) After mid-2007 and before August 21, 2009, July 2005 WWiSE would have been available to interested members of the public through Mentor. (SONY-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. (SONY-1021, SONY-1027, SONY-1035; SONY-1036; SONY-1037.)

For these reasons, July 2005 WWiSE was publicly accessible prior to the earliest possible priority date of the ’272 patent to a person of ordinary skill in the art (“POSITA”) exercising reasonable diligence.

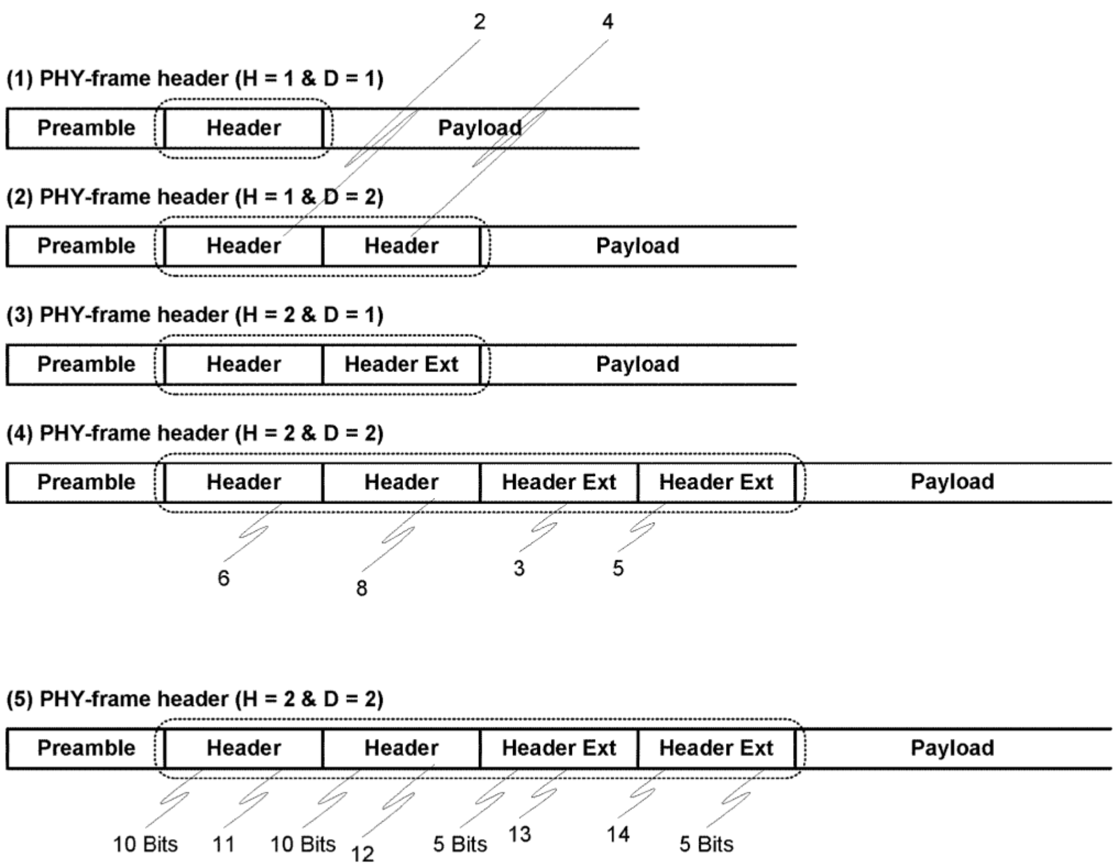
3. U.S. Patent Publication 2005/0243774 to Choi, et al (“Choi”; SONY-1008), published November 3, 2005, is prior art under 35 U.S.C. §102(b).

B. Grounds

Ground		Claims	Prior Art
1	§103	1-3, 5, 7-9, 11-13, 15, 17-19	Hansen and July 2005 WWiSE
2	§103	1-3, 5, 7-9, 11-13, 15, 17-19	Hansen, July 2005 WWiSE, and Choi

IV. ’272 Patent Overview

The ’272 patent is “directed toward header repetition in a communications environment.” (SONY-1001, 1:32-36.) The ’272 patent describes four different header configurations, illustrated in Figure 1. The value of D in Figure 1 corresponds to the number of repetitions of the header and the value of H in Figure 1 corresponds to the number of symbols required for a single header (e.g., whether the header is extended). In the first example where H=1 and D=1, the packet includes a "preamble followed by a header followed by a payload." (SONY-1001, 5:56-59.) This example represents a simple "one-part" header field. In the second example where H=1 and D=2, the packet includes a preamble followed by a header that is repeated, which is followed by the payload. (SONY-1001, 5:59-61.) This "repeated header" example includes a "two-part" header field with each part carrying the same information. (SONY-1001, 5:61-63.)



'272 Patent, Figure 1

In the third example where H=2 and D=1, the packet includes a preamble and a header followed by a header extension and the payload. (SONY-1001, 5:63-65.) This "extended header" is also a "two-part" header field but in this example the two parts carry **different** information. (SONY-1001, 6:4-7.) And in the fourth example where H=2 and D=2, the packet includes a preamble, a header which is repeated, and a header extension which is also repeated, followed by the payload. (SONY-1001, 5:65-6:2.) This "repeated, extended header" is a "four-part" header field with the first and second parts carrying the same information and the third and fourth parts carrying the same information. (SONY-1001, 6:1-19.) In the Notice of Allowance, the Examiner pointed to the third and fourth example as the basis for allowance, finding the "prior art of record fails to disclose the first header field (i.e., Figure 1 "(3)") and the second header field (i.e., Figure 1 "(4)"). (SONY-1002 (NOA), 2.)

The extended and/or repeated headers of the '272 patent can be used in communications systems such as ITU G.9960 (G.hn) and IEEE 802.11 that use "frame-based (or packet-based) transmission to communication [sic] between two or more users over a shared channel based on Orthogonal Frequency Division Multiplexing (OFDM[1])." (SONY-1001, 1:40-49; 4:38-55.) The '272 patent acknowledges that, prior to its earliest possible priority

[1] An acronym list is provided in Appendix B.

date, G.9960 "has defined two overlapped baseband bandplans, 50MHz-PB and 100MH-PB" and the "possibility of having narrower bandplans such as 25 MHz-PB and 12.5 MHz-PB are under discussion." (SONY-1001, 2:21-23; 1:58-60 (noting that G.9960 "should be familiar to those skilled in the art").) Thus, the '272 patent admits the existing ITU G.9960 standard supported two channel bandwidths—one at least two times wider than the other.

Applicant did not invent the concept of extending the header of an OFDM packet, nor did the Applicant invent the concept of repeating the OFDM packet header. To the contrary, these two concepts were publicly disclosed and openly discussed prior to August 21, 2009, during development of the ITU-T G.hn (next generation home network technology) standards—a fact PO openly admits in its provisional application. (SONY-1009, 21-22; SONY-1019; SONY-1020; SONY-1003, ¶¶37-38.)

The ITU-T G.hn standards group was not the only standards group openly discussing the concepts of repeating and extending a physical layer header prior to August 2009. Four years before ITU-T G.hn considered these concepts, the IEEE 802.11 TGn working group discussed similar proposals from the TGn Sync and WWiSE industry groups during development of the IEEE 802.11n standard. (SONY-1012, 133:7-134:2 (disclosing a 2 symbol ("extended") header); SONY-1006, 69:16-19, 67:1-69:17 (Figure 007-Figure

016, illustrating duplicate SIG-N header fields); SONY-1003, ¶38.)

A. 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 the field of wireless communication protocols, or an equivalent combination of education and experience. (SONY-1003, ¶62.)

B. Claim Construction

Claim terms are typically given their ordinary and customary meanings as understood by a POSITA at the time of the invention. Petitioner does not believe it is necessary for the Board to expressly construe any term for the purpose of this IPR proceeding.

V. GROUND 1: Combination of Hansen and July 2005 WWiSE Renders Claims 1-3, 5, 7-9, 11-13, 15, and 17-19 Obvious.

A. Combination Overview

1. Hansen

Hansen is the U.S. Patent Publication of Application 11/151,772 which matured into U.S. Patent 8,737,189 ("Hansen Patent"; SONY-1010). Hansen relates to "compromise greenfield preambles for 802.11n." (SONY-1005, ¶7.)

Hansen explained that IEEE 802.11 task group N ("TGn") was "chartered to develop a standard to enable WLAN devices to achieve throughput rates beyond 100 Mbits/s" which will "be documented in IEEE resolution 802.11n." (SONY-1005, ¶9.) According to Hansen, one objective of TGn was to "enable WLAN devices compatible with IEEE 802.11n to also interoperate with IEEE 802.11 devices that are not compatible with IEEE 802.11n" (referred to as "legacy" devices). (SONY-1011, ¶38; SONY-1005, ¶32, SONY-1005, ¶¶1, 6 (incorporating Hansen Provisional by reference).) This "backward compatible" access is referred to as "mixed mode access." (SONY-1005, ¶32.) In mixed mode access, a physical layer frame includes "legacy" information for non-IEEE 802.11n compatible devices and 802.11n information for IEEE 802.11n compatible devices. (SONY-1005, ¶32.)

TGn also recognized IEEE 802.11n-compatible devices that only communicate with other IEEE 802.11n-compatible devices can operate in a greenfield access mode. (SONY-1005, ¶32.) In greenfield mode, the physical layer frame (packet) does not require inclusion of the "legacy" information and can therefore be shortened to omit that information, further improving throughput. (SONY-1005, ¶27; SONY-1011, ¶55 (describing efficiency gain with greenfield); SONY-1005, ¶¶1, 6.)

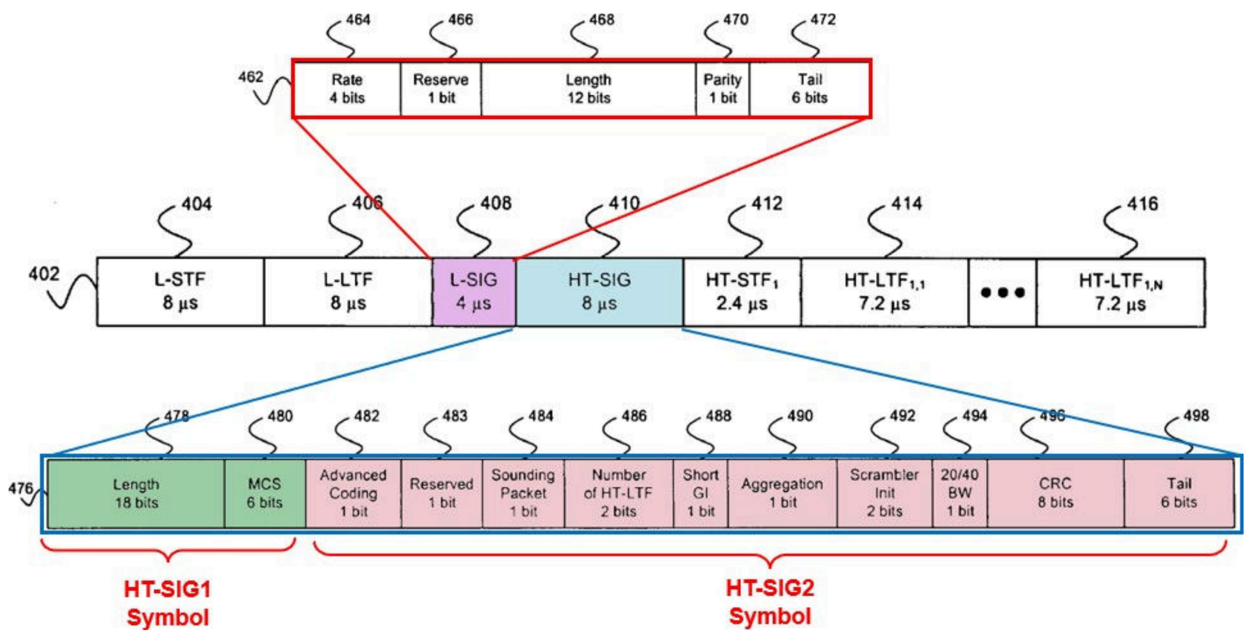
Two competing proposals emerged in TGn as "candidates for incorporation in IEEE 802.11n." (SONY-1005, ¶9.) The first proposal, from the TGn Sync industry group, provided a mechanism to support mixed mode access but did "not provide a mechanism to support greenfield access." (SONY-1005, ¶33.) The second proposal, from the Worldwide Spectrum Efficiency (WWiSE) industry group, provided mechanisms to support both greenfield and mixed mode access. (SONY-1006, 67:1-69:7 (depicting mixed mode and greenfield training structures).) Hansen sought to bridge the gap between these two competing proposals. (SONY-1005, Title, ¶¶7, 11, 27.)

a. TGn Sync Proposal[2]

Hansen first describes the mixed mode physical protocol data unit (PPDU) preamble and header from the TGn Sync proposal. (SONY-1005, ¶¶61-76.) This preamble and header 402, illustrated below for a single spatial stream, comprises a legacy (L) portion to be used by non-802.11n devices and a High Throughput (HT) portion to be used by 802.11n devices. (SONY-1005, ¶61, Figure 4a, *compare* SONY-1012, 131:10-13, 121:1-2

[2] A copy of the January 2005 TGn Sync proposal forming the basis of Hansen's discussion is provided as SONY-1012. (SONY-1007, ¶31 (discussing the public availability of the January 2005 TGn Sync Proposal on January 20, 2005); SONY-1003, ¶69.)

(Figure 55).) The legacy portion includes a 24-bit (one symbol) header field (L-SIG), shaded pink in annotated Figure 4a (below, middle) and illustrated in Figure 4b (below, top). (SONY-1005, ¶¶62, 66, *compare* SONY-1012, 131:10-13, 121:1-2 (Figure 55).)



Hansen, Annotated Figures 4b (top), 4a (middle), 4c (bottom)

The HT portion includes a 48-bit, two symbol header field (HT-SIG), shaded blue in annotated Figure 4a (above, middle) and illustrated in annotated Figure 4c (above, bottom). (SONY-1005, ¶¶62, 67; *compare* SONY-1012, 134:1-2 (Figure 62), 121:1-2 (Figure 55).) The part of HT-SIG (shaded green in annotated Figure 4c above, bottom), corresponding to one symbol in the transmitted PPDU, includes length and modulation and coding scheme (MCS) fields. (SONY-1005, ¶67; SONY-1012, 134:1-2 (mapping first

24 bits of HT-SIG field to first symbol).) The TGn Sync proposal refers to this part of the HT-SIG header field as HT-SIG1. (SONY-1012, 134:1-2.) The second part (shaded red in annotated Figure 4c above, bottom), corresponding to a second symbol in the transmitted PPDU, includes, among other fields, the advanced coding, sounding packet, number of HT-LTF, and 20/40 bandwidth fields. (SONY-1005, ¶67; SONY-1012, 134:1-2 (mapping second 24 bits of HT-SIG field to second symbol).) The TGn Sync proposal refers to this part of the HT-SIG header field as HT-SIG2. (SONY-1012, 134:1-2.) For ease of discussion, Petitioner adopts the HT-SIG1 and HT-SIG2 terminology used in the TGn Sync proposal to refer to the separate parts of the two-part HT-SIG header field.

b. January 2005 WWiSE Proposal[3]

Unlike the TGn Sync proposal, the January 2005 WWiSE proposal

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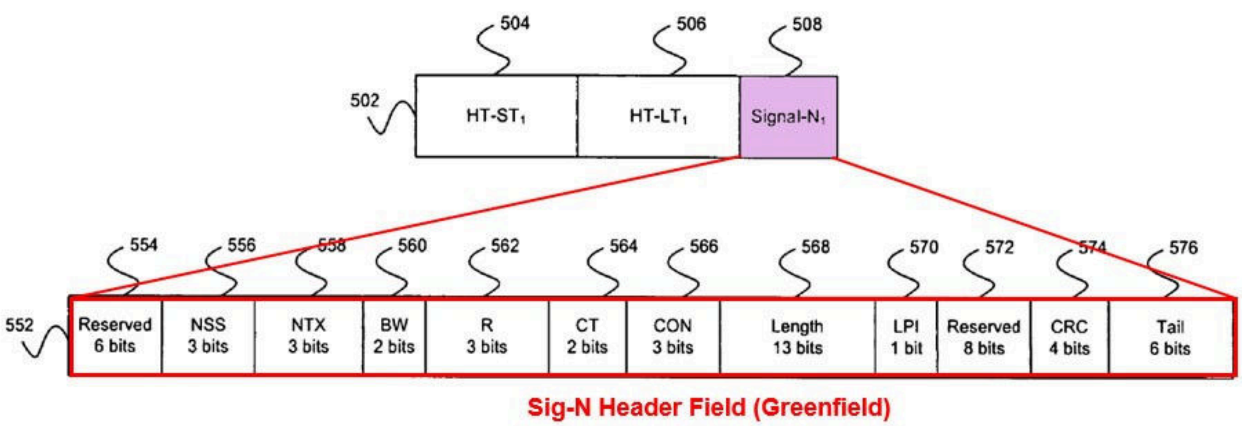
[3] A copy of the WWiSE proposal by Hansen which forms the basis of Hansen's WWiSE discussion, is provided as SONY-1013. (SONY-1007, ¶¶25-26 (discussing the public availability of the January 2005 WWiSE proposal); SONY-1003, ¶74.) Petitioner refers to this version of the WWiSE proposal as the "January 2005 WWiSE" proposal to distinguish it from the July 2005 WWiSE proposal used as a reference in Petitioner's Grounds.

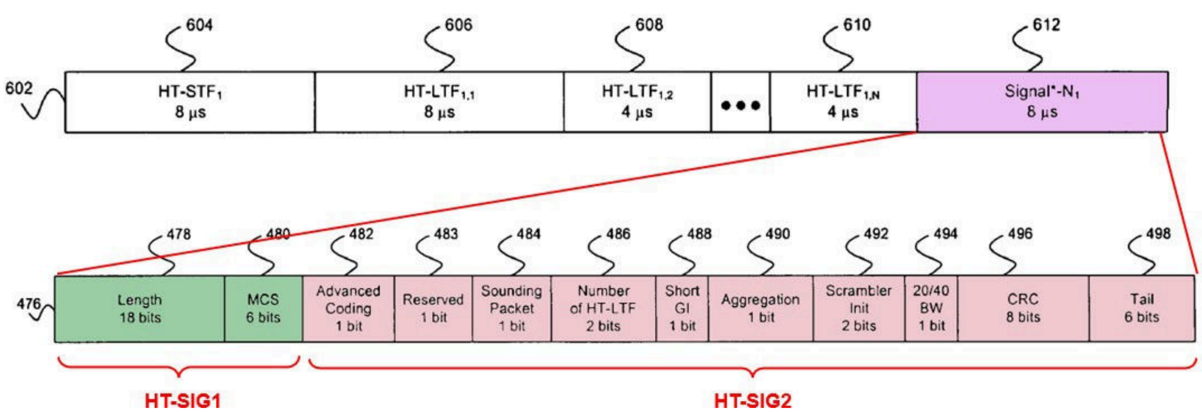
referenced in Hansen includes PPDUs for both mixed mode and greenfield access. (SONY-1013, 50:16-52:7 (Figures 007-016).) The training and header fields 502 for an exemplary January 2005 greenfield PPDU are illustrated in Figure 5a below (top) for a single spatial stream. (SONY-1005, ¶77.) Training and header fields 502 include a Signal-N header field 508 (shaded pink), illustrated in Figure 5b below (bottom). (SONY-1005, ¶¶77, 79, *compare* SONY-1013, 50:16-18 (Figure 007), 53:8-10.)



Hansen, Excerpt for Annotated Figure 5a (top), Figure 5b (bottom)

c. Hansen's Greenfield PPDU

Hansen next presents a "compromise" PPDU that combines WWiSE's concept of a greenfield PPDU with a TGn Sync-style format for HT fields. (*Compare* SONY-1005, Figures 4a, 5a, and 6a.) By using TGn Sync's HT-SIG field, the "compromise" PPDU also includes a "sounding field", not present in the January 2005 WWiSE proposal. (SONY-1005, ¶27.) The training and header fields of Hansen's "compromise" greenfield PPDU are illustrated in the excerpt from Figure 6a below showing a single spatial stream. (SONY-1005, ¶¶87-110.) Hansen's training and header fields include short and long training fields (HT-STF/HT-LTF) and a Signal*-N_1 field 612 (shaded pink). (SONY-1005, ¶87.) The Signal*-N_1 field 612 is "represented as described in Fig. 4c" which, as discussed above, discloses the two-part extended HT-SIG field (shaded green (first part) and shaded red (second part)) from the TGn Sync proposal. (SONY-1005, ¶97.) The embodiment using the header field (HT-SIG) from Figure 4c in Figure 6a's preamble and training fields is referred to herein as "Hansen's 'compromise' greenfield PPDU."



Hansen, Excerpt from Annotated Figure 6a (top); Figure 4c (bottom)

2. July 2005 WWiSE

July 2005 WWiSE is a proposal submitted to the TGn working group by the WWiSE industry group building on the January 2005 proposal discussed in Hansen. (SONY-1006, 1.) Specifically, July 2005 WWiSE adds an extended range (ER) capability for 802.11n compliant devices. (SONY-1006, 1, 31, 46-48, 50, 67-70.)

The format of a July 2005 WWiSE greenfield PPDU, illustrated in Figure 001 below, consists of a preamble, the Signal-N field (also referred to as SIG-N), and data. (SONY-1006, 58:17-19.)

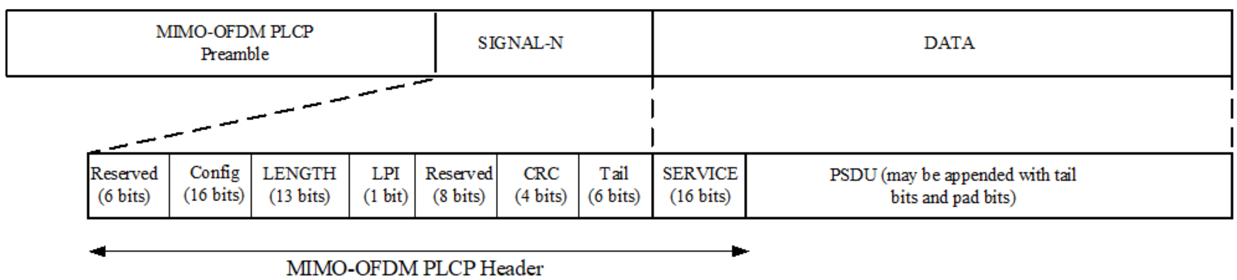


Figure 001 – PPDU frame format: Greenfield access in the 1TX (40 MHz) and 2TX (20 and 40 MHz) modes

July 2005 WWiSE's SIGNAL-N (SIG-N) field "is separately defined for a mandatory standard configuration and an optional 'extended communication range' configuration (ER)." (SONY-1006, 69:10-11.) In the mandatory standard configuration (also referred to as normal range (NR)), "SIG-N is composed of a **single MIMO-OFDM symbol** that provides all length and configuration parameters" associated with the greenfield PPDU. (SONY-1006, 69:13-14.)

In the extended 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."

(SONY-1006, 69:16-18.) July 2005 WWiSE refers to this two-symbol SIG-N field as "the long SIG-N field format." (SONY-1006, 50:9-10.) The second OFDM symbol (designated ER-SIG-N) in the long SIG-N field duplicates (repeats) the information carried in the SIG-N symbol, as illustrated in Figure 011 below. (SONY-1006, 68:1-2 (referencing the "optional **duplicate** SIG-N", designated as ER-SIG-N); Figures 007-016 (including the "optional duplicate SIG-N for extended range communication").)

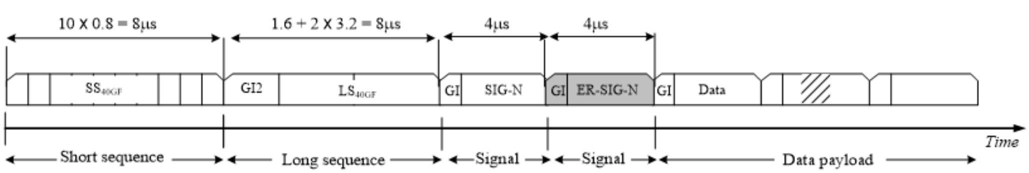


Figure 011 – MIMO-OFDM Training structure for N_{TX}=1, 40 MHz, greenfield operation. The shaded field indicates the optional duplicate SIG-N for extended range communication.

July 2005 WWiSE, Figure 011

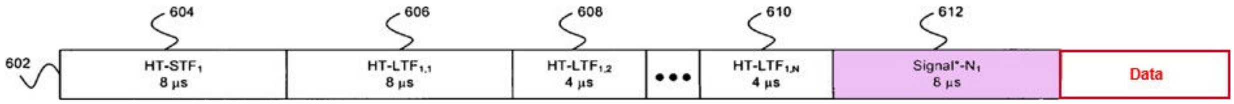
Additionally, July 2005 WWiSE applies a frequency permutation on the subcarrier indices of the OFDM data symbols composing SIG-N to derive the frequency domain OFDM symbol ER-SIG-N. (SONY-1006, 69:18-25.)

July 2005 WWiSE also added a one-bit field to the SIG-N field, the REXT bit, to indicate whether the device was operating in standard configuration or ER configuration. (SONY-1006, 69:30-31, 70:6-7.) July

2005 WWiSE explains that "Extended Range (ER) capable devices are devices which support the optional Extended Range MCS, in addition to the Normal Range (NR) MCS, and the long SIG-N field format." (SONY-1006, 50:9-11.) ER frames (PPDUs) "shall be transmitted with the long SIG-N field format and the REXT bit set to value 1." (SONY-1006, 50:12-13.) For NR frames (PPDUs), the optional repeated header symbol (ER-SIG-N) is not included and the REXT bit is set to value 0. (SONY-1006, 50:12-13; 70:6-7 (value 0 of REXT "indicates the standard configuration").)

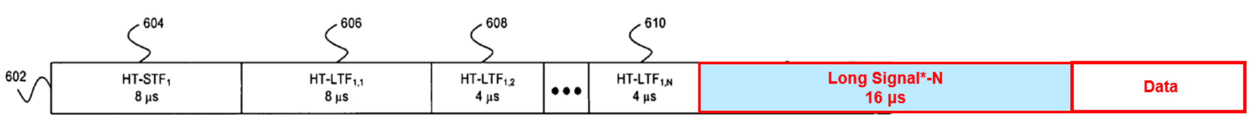
3. Motivation to Combine

A POSITA would have been motivated to combine the teachings of Hansen with the teachings of July 2005 WWiSE. (SONY-1003, ¶87.) Specifically, a POSITA would have been motivated to combine July 2005 WWiSE's ER communication teachings (§V.A.2) with Hansen's "compromise" greenfield PPDU (§V.A.1.c) to support both NR and ER capabilities in a single greenfield-compatible device. (SONY-1003, ¶87.) In the combination, Hansen's "compromise" greenfield PPDU is used for standard, or normal range (NR) communication and is referred to herein as the NR greenfield PPDU.



NR Greenfield PPDU
(Combined Hansen Figure 3a and Excerpt from Figure 6a)

ER communication in the combination repeats the two parts of Hansen's Signal*-N header field, as taught by July 2005 WWiSE. (SONY-1006, 69:16-18, 68:1-2; Figures 007-016.) This header repetition creates a "Long Signal*-N", illustrated in the figure below, which duplicates HT-SIG1 and HT-SIG2 of Hansen's Signal*-N header field and therefore occupies 4 OFDM symbols when transmitted or received. (SONY-1006, 50:9-10; SONY-1003, ¶89.) For ease of discussion, Petitioner refers to the duplicated version of the header symbols HT-SIG1 and HT-SIG2 as ER-HT-SIG1 and ER-HT-SIG2 respectively. The greenfield PPDU used for ER communication in the combination of Hansen and July 2005 WWiSE, illustrated below, is referred to herein as the ER greenfield PPDU.



ER Greenfield PPDU
(Combined Hansen Figure 3a and Excerpt from Figure 6a, as modified by July 2005 WWiSE)

In the combination, the frequency permutation described in July 2005 WWiSE for the repeated header symbol is applied to the repeated version of each header symbol (ER-HT-SIG1 and ER-HT-SIG2). Additionally, the combination further uses a one-bit field (REXT) in the header to indicate whether the device is operating in standard (NR) or ER mode. (SONY-1006, 69:30-31, 70:6-7.) A POSITA would have understood that the reserved field of the HT-SIG2 part of Signal*-N and Long Signal*-N would be used to carry this REXT information. (SONY-1003, ¶90; SONY-1005, ¶67 (reserved field not utilized).)

A POSITA would have been motivated to combine Hansen and July 2005 WWiSE as described above for numerous reasons. (SONY-1003, ¶91.) First, Hansen repeatedly suggests the combination. Hansen describes the earlier January 2005 WWiSE proposal and TGn Sync proposal submitted to TGn. (SONY-1005, ¶33.) Hansen defined a compromise proposal based on aspects of both January 2005 WWiSE and the TGN Sync proposal. (SONY-1005, Title, ¶¶7, 11, 27; SONY-1011, 14.) Based on Hansen's suggestion to bridge the gap between the WWiSE and TGn Sync industry groups, a POSITA would have been motivated to combine July 2005 WWiSE with Hansen to incorporate the newly introduced aspects of the July 2005 WWiSE proposal, including support for the ER capability, into Hansen's greenfield PPDU. (SONY-1003, ¶¶91-92; SONY-1006, 1, 31, 46-48, 50, 67-70.) Indeed, others in the field recognized the critical need to merge these two competing proposals to reach a final version of the 802.11n standard. (SONY-1027, 1; SONY-1028, 1; SONY-1021, 1.)

Second, a POSITA would have been motivated to incorporate July 2005 WWiSE's ER capability into Hansen's greenfield PPDU to extend the range of successful communication between devices. (SONY-1003, ¶93.) In fact, July 2005 WWiSE expressly suggests the benefit of including an ER capability, stating: "A characteristic of ER MCS is that they have a longer range than NR MCS." (SONY-1006, 50:15.) An ER capability is particularly beneficial in WLAN systems in which a potential exists for the receiver to move a significant distance from the transmitter. (SONY-1003, ¶93, *citing* SONY-1030, 21-22.) As the distance between transmitter and receiver increases, the communications channel is subjected to increased fading. (SONY-1003, ¶93.) The ER capability of July 2005 WWiSE achieves communications at a greater distance through the introduction of diversity into its transmitted frames (PPDU). Specifically, as discussed in §V.A.2, July 2005 WWiSE uses both temporal diversity (repeated header field) and frequency diversity (frequency permutation on duplicated version of header field) to provide ER capability. This introduction of two additional forms of diversity makes the header (Signal-N) field more decodable for a given signal power, improving the receiver gain and allowing weaker signals to be received and decoded more effectively. (SONY-1003, ¶93.) A POSITA would have therefore been motivated to combine July 2005 WWiSE's ER capability into Hansen's system to achieve better coverage at a greater distance.

Third, a POSITA would have been motivated to include the capability for an ER capable device to turn on or off ER operation using a header bit (REXT). (§V.A.2.) For example, a POSITA would have understood that a transmitter is motivated to transmit at the highest speed achievable based on the current conditions of a channel. (SONY-1003, ¶94.) Therefore, an ER capable device would start communication in NR mode and move to ER mode if channel conditions become bad and messages are dropping. (SONY-1003, ¶94.) In such circumstances, an ER-capable station can utilize ER to successfully communicate, at the cost of some throughput reduction, a tradeoff that was already familiar to a POSITA long before August 21, 2009. (SONY-1003, ¶94; SONY-1014, ¶80.)

Fourth, a POSITA would have been motivated to combine Hansen and July 2005 WWiSE because the combination is merely the application of a known technique (July 2005 WWiSE's ER capability) to a known device (device with Hansen's "compromise" greenfield PPDU) ready for improvement and use of a known technique (July 2005 WWiSE's ER capability) to improve similar devices (device with Hansen's "compromise" greenfield PPDUs) in the same way (providing ER capability). The addition of ER capability to Hansen would have been seen by a POSITA as an improvement to a device using Hansen's "compromise" greenfield PPDU because ER extends the range of reliable communication between a transmitter and receiver by providing diversity to overcome environmental conditions (e.g., fading and/or noise). (SONY-1003, ¶95.) A POSITA would have applied the known improvement (ER capability of July 2005 WWiSE) in the same way to Hansen because Hansen's "compromise" greenfield PPDU has a similar structure to the greenfield PPDU disclosed in WWiSE. (SONY-1003, ¶95; *compare* SONY-1005, Figure 5a *with* SONY-1006, Figure 007.)

Fifth, the combination further merely combines prior art elements according to known methods. As explained above, the combination repeats the header field and uses a one-bit reserved sub-field to indicate whether ER operation is enabled. (SONY-1003, ¶96.) A POSITA would have known how to make these modifications to Hansen's "compromise" greenfield PPDU because the addition of fields and the use of reserved fields was commonly done to support modifications or customizations to a standard such as IEEE 802.11 long before August 21, 2009. (SONY-1003, ¶96.) For example, both Hansen and July 2005 WWiSE discuss modifications to the existing 802.11a

PPDU, including the addition of fields. (SONY-1003, ¶96.) A POSITA would have also known how to integrate the frequency permutation of July 2005 WWiSE because assignment of data bits to OFDM subcarriers was a basic aspect of OFDM before August 2009. (SONY-1003, ¶96.)

The results of the combination of Hansen and July 2005 WWiSE would have been predictable and a POSITA would have had a reasonable expectation of success in the combination. (SONY-1003, ¶97.) Both Hansen and July 2005 WWiSE describe PPDUs for use in the 802.11n standard being developed by IEEE. (SONY-1005, Figure 6a; SONY-1006, Figure 007.) Existing 802.11 standards, which both Hansen and July 2005 WWiSE build upon, would have been extremely well-known to a POSITA by August 21, 2009. (SONY-1003, ¶97.) And as discussed above, the combination adds fields to a message, uses a reserved field to signal that ER operation is enabled (the REXT bit), and performs a frequency permutation on a symbol. (SONY-1003, ¶97.) Because such modifications were known and in fact commonplace when dealing with evolving communications technologies, the results of such modifications would have been predictable, and a POSITA would have been had a reasonable expectation that the combination would operate successfully. (SONY-1003, ¶97.)

B. Independent Claims 1 and 11

Claims 1 and 11 relate to transmission (claim 1) and reception (claim 11) of particular types of packets. Claims 1 and 11 each recite a "*first packet type*[4]" having a two-part header field and a "*second packet type*" having a four-part header field. Claim 1 recites the generation of symbols included in these two packet types using "*an encoder and a modulator*" and the generation and transmission of these two packet types using "*a wireless OFDM communications transmitter*." Claim 11 recites the reception of these two packet types using "*a wireless OFDM communications receiver*" and demodulation of OFDM symbols associated with the header fields of these packet types using "*a demodulator*." For ease of discussion, Petitioner addresses the preamble and "*first*" and "*second packet types*" limitations first followed by the transmission/reception limitations. The following table maps limitations to the section in which the limitation is discussed.

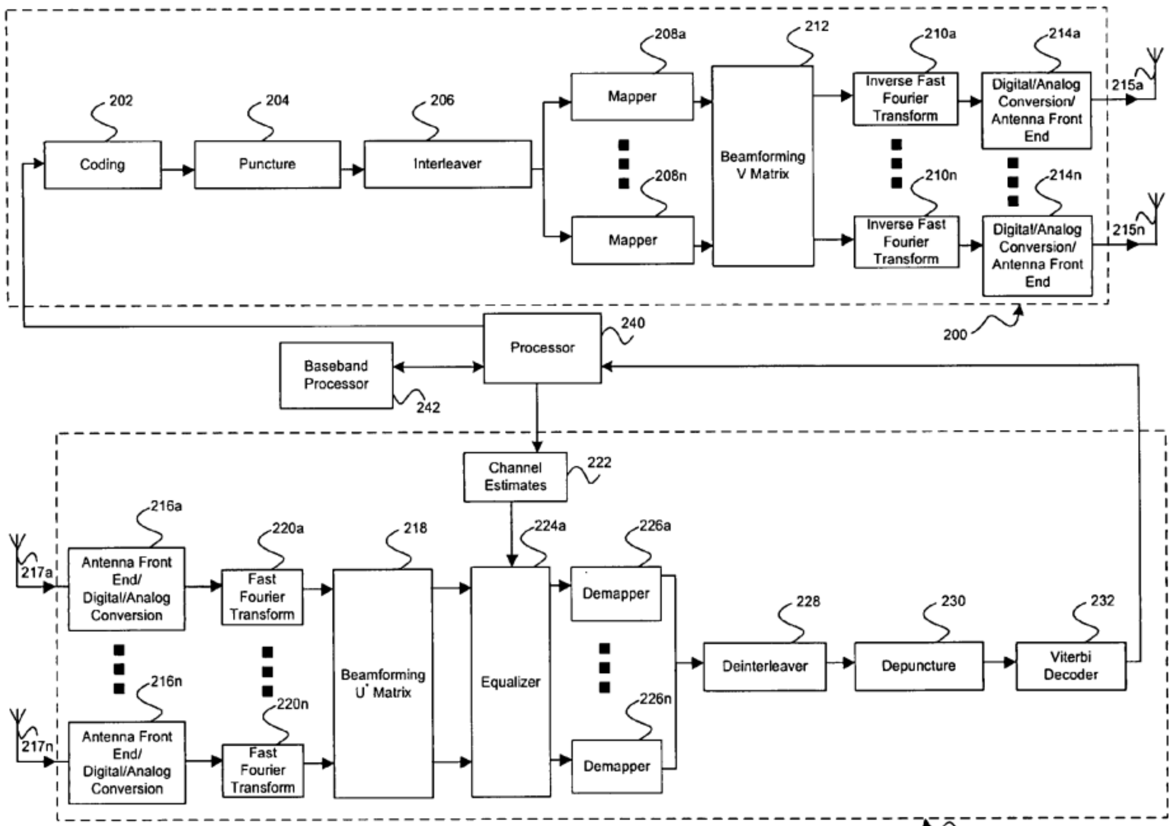
Claims 1 and 11	Section
[1P]	§V.B.1
[1A]	§§V.B.2, V.B.2.a, V.B.3.b
[1B]	§V.B.2.a
[1C]	§V.B.2.a
[1D]	§§V.B.3.a, V.B.3.a.i, V.B.3.e.i
[1E]	§§V.B.3.a, V.B.3.a.ii, V.B.3.e.i

[4] Except in the tables, claim language is indicated herein by italics.

[1F]	§V.B.3.b
[1G]	§§V.B.2, V.B.2.b, V.B.3.b
[1H]	§V.B.2.b
[1I]	§V.B.2.b
[1J]	§§V.B.3.a, V.B.3.a.i, V.B.3.e.ii
[1K]	§§V.B.3.a, V.B.3.a.iii, V.B.3.e.ii
[1L]	§V.B.3.f
[1M]	§V.B.3.f
[1N]	§V.B.3.b
[11P]	§V.B.1
[11A]	§§V.B.2, V.B.2.a, V.B.3.c
[11B]	§V.B.2.a
[11C]	§V.B.2.a
[11D]	§V.B.3.d, V.B.3.e.i
[11E]	§V.B.3.d, V.B.3.e.i
[11F]	§§V.B.2, V.B.2.b, V.B.3.c
[11G]	§V.B.2.b
[11H]	§V.B.2.b
[11I]	§V.B.3.d, V.B.3.e.ii
[11J]	§V.B.3.d, V.B.3.e.ii
[11K]	§V.B.3.f
[11L]	§V.B.3.f

1. Preamble

Petitioner does not acquiesce that the preamble is limiting. Regardless, the combination of Hansen and July 2005 WWiSE discloses [1P]/[11P]. (SONY-1003, ¶¶99-105, 191-197.) Hansen discloses "**a transceiver** comprising a transmitter and a receiver in a MIMO system" that transmits and receives RF signals via an antenna. (SONY-1005, ¶¶15, 49-50, Figure 2b below.)



Hansen, Figure 2b

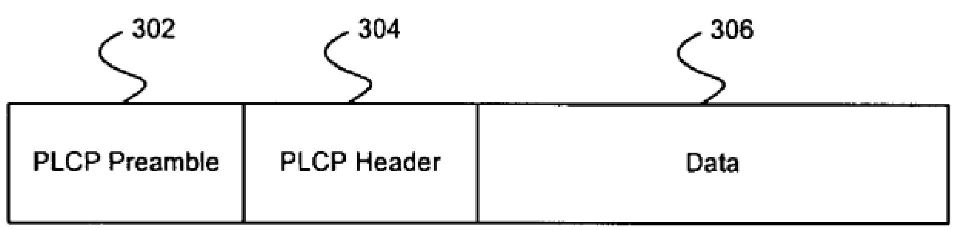
Hansen discloses that its "invention" may "be embedded in a computer program product, which comprises all the features enabling the implementation of the methods described herein, and which when loaded in a computer system is able to carry out these methods." (SONY-1005, ¶121.) A POSITA would have understood that Hansen is describing an embodiment in which the disclosed functionality (e.g., transmission and reception of its "compromise" greenfield PPDU) is implemented in software. (SONY-1003, ¶¶100, 192.) Should PO argue that Hansen's software implementation is a separate embodiment from its "compromise" greenfield PPDU, a POSITA would have been motivated to implement the functions performed by Hansen's "*transceiver*" in software "*executed by one or more processors*." SONY-1003, ¶¶101-105, 193-197.

A POSITA would have been motivated to implement the transceiver functions in software for improved flexibility and easier updates. (SONY-1003, ¶¶101, 193.) WLAN standards are frequently updated. The "first wireless network standards were approved in late 1999 by the IEEE as part of the 802.11b effort." (SONY-1041, 1.) Shortly after the approval of 802.11b, "the 802.11a standard was ratified, which used orthogonal frequency division multiplexing (OFDM) methods to enable higher data rates." (*Id.*) 802.11g was ratified 4 years later in 2003 and applied "the frequency division techniques of 802.11a but used the original 802.11b radio frequencies." (*Id.*) Less than one year later, in January 2004, IEEE announced that it had formed TGn to develop amendments to the 802.11 standard that will be known as 802.11n. (SONY-1021, 1.) A POSITA would have understood that if a transceiver was implemented in hardware, many of these updates would require changes to the hardware, potentially rendering a product incompatible with the newest version of the standard. (SONY-1003, ¶¶101, 193.) Because of the frequency of standards updates, a POSITA would have been motivated to implement transceiver functions in software to avoid the need to replace hardware or entire products. (*Id.*) Moreover, a POSITA would have understood that security patches and bug fixes are generally easier to handle in software, than in hardware. (SONY-1003, ¶¶102, 194.)

Additionally, the implementation of Hansen's transceiver functionality in software is simply the use of a known technique (Hansen's software implementation) to improve similar devices (Hansen's communications device) in the same way and the application of a known technique (Hansen's software implementation) to a known product (Hansen's communication device) ready for improvement to yield predictable results. SONY-1003, ¶¶103-104, 195-196. A POSITA would have recognized that implementing communications functionality in software would have resulted in an improved system for the reasons discussed above. (*Id.*) A POSITA would have had a reasonable expectation of success and the results of the combination would have been predictable because a POSITA would have been familiar with software development and it was well understood how to implement communications functionality such as encoding, decoding, modulation, and demodulation in software. (SONY-1003, ¶¶99-105, 191-197)

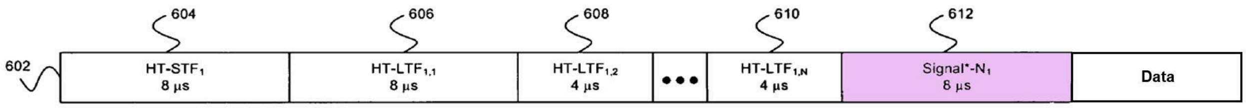
2. "*Packet Type*" Limitations – [1A]/[1G]/[11A]/[11F]

Petitioner addresses the "*first packet type*" and "*second packet type*" portions of those limitations in this section. A physical layer protocol data unit (PPDU), illustrated in Hansen's Figure 3a below, includes preamble 302, header 304, and data field 306. (SONY-1005, ¶59.) July 2005 WWiSE similarly describes a PPDU as having a preamble, header, and data. (SONY-1006, 58:17-60:4 (illustrating PPDU frame formats).) A PPDU is a "*packet*", consistent with the usage of the term packet in the '272 patent. (SONY-1001, 1:45-47; SONY-1003, ¶¶107-109, 199-201.)

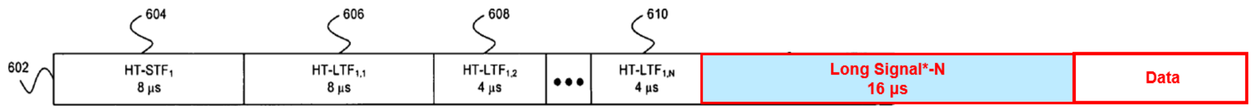


Hansen, Figure 3a

As discussed in §V.A.3, the combination of Hansen and July 2005 WWiSE includes two different types of PPDUs: an NR greenfield PPDU ("*a first packet type*") and an ER greenfield PPDU ("*a second packet type*"), illustrated below. (SONY-1003, ¶¶110, 202.) Petitioner addresses the "*first* *header field*" and "*second header field*" limitations in §§V.B.2.a-b.



NR Greenfield PPDU ("*First Packet Type*")
(Combined Hansen Figure 3a and Excerpt from Figure 6a)



ER Greenfield PPDU ("*Second Packet Type*")
(Combined Hansen Figure 3a and Excerpt for Figure 6a as modified by July 2005 WWiSE)

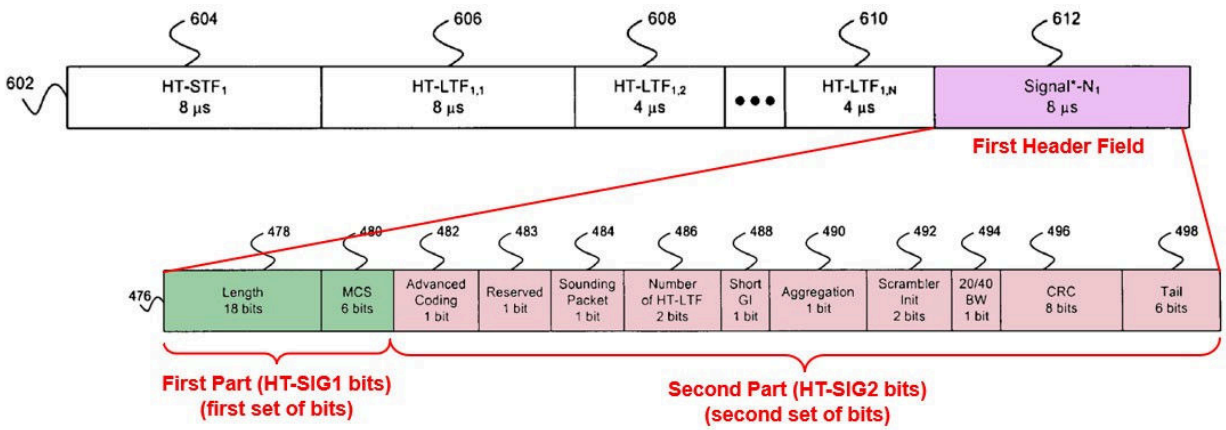
a. "*First Packet Type*"

The combination of Hansen and July 2005 WWiSE discloses [1A]/[11A] and [1B]/[11B]. (SONY-1003, ¶¶111-119, 209-217.)

The training (preamble) and header fields for a single spatial stream 602 of the NR greenfield PPDU[5] are illustrated in the excerpt from Hansen's Figure 6a below (top). As shown, the PPDU includes a Signal*-N field (the HT-SIG field of TGn Sync), which Hansen refers to as a "header field." (SONY-1005, ¶¶67, 20, 97.) Signal*-N carries control information (e.g., MCS field, advanced coding, and 20Mz or 40Mhz bandwidth fields). (SONY-1005, ¶¶67-68.) Signal*-N is therefore "*a first header field*" of the

[5] Hansen's Figure 6a omits the PPDU data (payload).

NR greenfield PPDU ("*first packet type*"). (SONY-1003, ¶¶113-114, 211-212; SONY-1001, 1:54-58; SONY-1005, ¶59.)



Excerpt of Hansen, Figure 6a (top); Figure 4c (bottom)

The Signal*-N header field of the NR greenfield PPDU uses the HT-SIG field from the TGn Sync proposal, shown in Figure 4c above (at bottom). (SONY-1005, ¶¶87, 97 (Signal*-N represented "as described in FIG. 4c"), ¶67; §V.A.3.) The Signal*-N field (prior to coding and modulation) comprises 48 total bits corresponding to 2 transmitted OFDM symbols. (SONY-1005, ¶¶97, 62, 67-68.) The TGn Sync proposal specifies that the first 24 bits of HT-SIG (Signal*-N) correspond to a first transmitted OFDM symbol (HT-SIG1 symbol) and the second 24 bits of the HT-SIG field correspond to the second transmitted OFDM symbol (HT-SIG2 symbol). (SONY-1012, 133:7-134:2; SONY-1005, ¶67 (HT-SIG is "in accordance" with TGn Sync proposal); §V.A.1.) Thus, Signal*-N ("*first header field*") of the NR greenfield PPDU includes "*two parts*"—HT-SIG1 and HT-SIG2. (SONY-1003, ¶¶115-116, 213-214.)

Prior to coding and modulation and after decoding by the receive chain, the HT-SIG1 part of the Signal*-N field (shaded green above) includes an 18-bit length field 478 and a 6-bit MCS field 480 (referred to collectively as the HT-SIG1 bits). (SONY-1005, ¶¶67-68.) HT-SIG1 is therefore "*a first part*" of the Signal*-N header field "*comprising a first set of header bits of the first header field*." (SONY-1003, ¶¶117, 215.)

Prior to coding and modulation at the transmitter and after decoding by the receive chain, the HT-SIG2 part of the Signal*-N field (shaded red above) includes a 1-bit advanced coding field 482, a 1-bit reserved field 483, a 1-bit sounding packet field 484, a 2-bit number of HT-LTF field 486, a 1-bit short GI field, a 1-bit aggregation field 490, a 2-bit scrambler initialization field 492, a 1-bit 20 MHz or 40 MHz bandwidth (BW) field 494, an 8-bit cyclical redundancy check field 496, and a 6-bit tail field 498 (referred to collectively as the HT-SIG2 bits). (SONY-1005, ¶¶67-68.) HT-SIG2 is therefore "*a second part*" of Signal*-N "*comprising a second set of header bits of the first header field*." (SONY-1003, ¶¶118, 216.)

Thus, the combination of Hansen and July 2005 WWiSE discloses limitations [1B]/[11B]. (SONY-1003, ¶¶111-119, 209-217.)

Because the "*first set of header bits of the first header field*" includes different fields than the "*second set of header bits of the first header field*" as discussed above, the combination of Hansen and July 2005 WWiSE also discloses "*the first set of header bits of the first header field* [HT-SIG1 bits] *is different than the second set of header bits* [HT-SIG2 bits] *of the first header field*" [1C]/[11C]. (SONY-1003, ¶¶120, 218.)

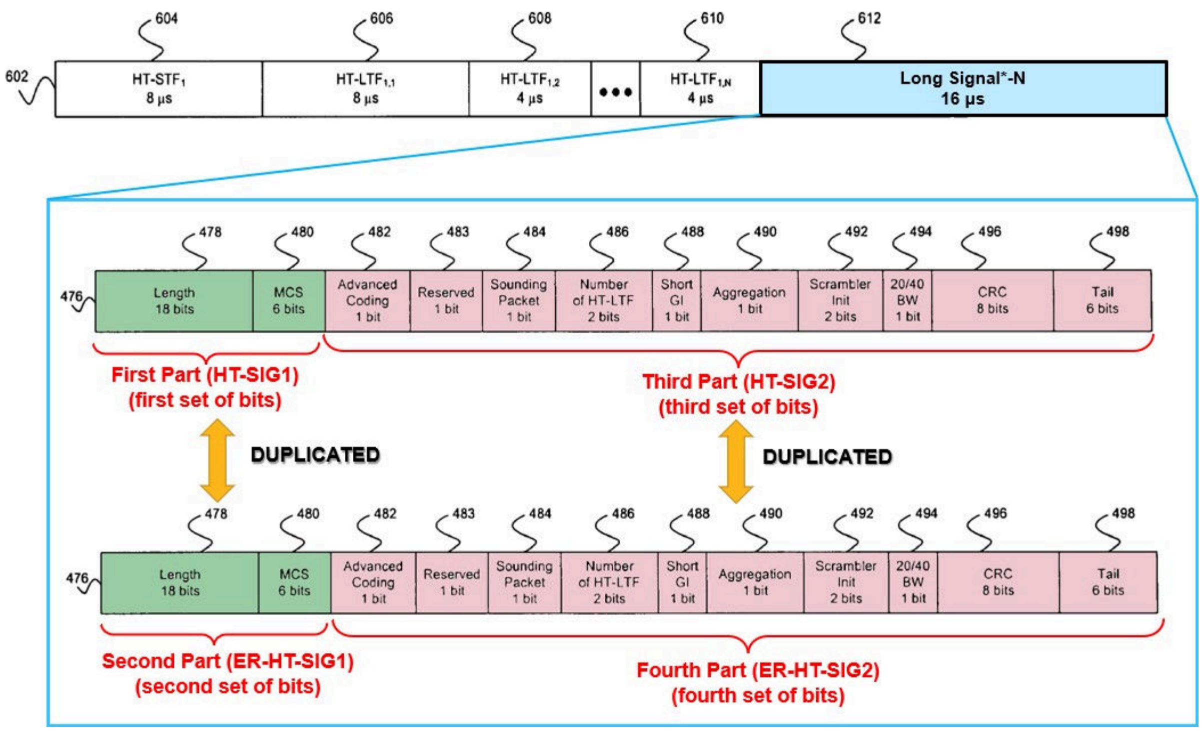
Petitioner addresses the generation of the OFDM symbols corresponding to the HT-SIG1 bits and the HT-SIG2 bits of Signal*-N ("*the first header field*") in §§V.B.3.a.

b. "*Second Packet Type*"

The combination of Hansen and July 2005 WWiSE further discloses [1G]/[11F] and [1H]/[11G]. (SONY-1003, ¶¶122-130, 222-230.)

The ER greenfield PPDU in the combination of Hansen and July 2005 WWiSE includes the "Long Signal*-N" field which repeats each part of Hansen's Signal*-N (HT-SIG1 and HT-SIG2). (§V.A.3; SONY-1006, 69:16-18, 67:1-69:7 (Figures 007-016, referring to "duplicate SIG-N"), 50:9-10 (referring to header with repeated symbols as the "long SIG-N").) For the same reasons discussed in §V.B.2.a for Signal*-N, "Long Signal*-N" is a "*second header field*" of the ER greenfield PPDU ("*second packet type*"). (SONY-1003, ¶¶123, 223.)

The repetitions of the two parts of Signal*-N results in a four-part header having two HT-SIG1 parts (HT-SIG1/ER-HT-SIG1) and two HT-SIG2 parts (HT-SIG2/ER-HT-SIG2), as illustrated in the figure below. (§V.B.2.a.) Thus, the "Long Signal*-N" ("*second header field*") of the ER greenfield PPDU includes "*four parts*." (SONY-1003, ¶¶124, 224.)



Prior to coding and modulation at the transmitter and after decoding by the receive chain, the first HT-SIG1 part of Long Signal*-N (shaded green above) includes length and MCS fields. HT-SIG1 is therefore a "*first part*" of Long Signal*-N "*comprising a first set of header bits of the second header field*." (SONY-1005, ¶¶67-68; SONY-1003, ¶¶125, 225.) Prior to coding and modulation at the transmitter and after decoding by the receive chain, the repeated HT-SIG1 part of Long Signal*-N (ER-HT-SIG1; shaded green above) includes the same fields as HT-SIG1. ER-HT-SIG1 is therefore a "*second part*" of Long Signal*-N "*comprising a second set of header bits of the second header field*." (SONY-1005, ¶¶67-68; SONY-1006, 69:16-18, 67:1-69:3 (Figures 007, 009, 011, 013, and 015, showing duplicated headers for ER greenfield operation); SONY-1003, ¶¶126, 226.)

Prior to coding and modulation by the transmitter and after decoding by the receive chain, the first HT-SIG2 part of Long Signal*-N (shaded red above) includes advanced coding, reserved, sounding packet, number of HT-LTF, short GI, aggregation, scrambler initialization, 20 MHz or 40 MHz BW, cyclical redundancy check, and tail fields. HT-SIG2 is therefore a "*third part*" of Long Signal*-N "*comprising a third set of header bits of the second header field*." (SONY-1005, ¶¶67-68; SONY-1003, ¶¶127, 227.)

Prior to coding and modulation by the transmitter and after decoding by the receive chain, the repeated HT-SIG2 part of the Long Signal*-N field (ER-HT-SIG2; shaded red above) includes the same fields as HT-SIG2. ER-HT-SIG2 is therefore a "*fourth part*" of Long Signal*-N "*comprising a fourth set of header bits of the second header field*." (SONY-1005, ¶¶67-68; SONY-1006, 69:16-18, 67:1-69:3; SONY-1003, ¶¶128, 228.)

Thus, the combination of Hansen and July 2005 WWiSE discloses limitation [1G]/[11F]/[1H]/[11G]. (SONY-1003, ¶¶122-129, 222-229.)

Because the "*first set of header bits of the second header field*" encodes the same fields as the "*second set of header bits of the second header field*" and "*the third set of header bits of the second header field*" encodes the same fields as the "*fourth set of header bits of the second header field*", the combination of Hansen and July 2005 WWiSE discloses "*the first set of header bits of the second header field is the same as the second set of header bits of the second header field*" and "*the third set of header bits of the second header field is the same as the fourth set of header bits of the second header field*" [1I]/[11H]. (SONY-1003, ¶130.)

Petitioner addresses the generation of the OFDM symbols corresponding to the HT-SIG1, ER-HT-SIG1, HT-SIG2, ER-HT-SIG2 bits of Long Signal*-N in §V.B.3.a.i.

3. Generation, Transmission, Reception, and Demodulation Limitations

Claim 1 recites "*generating, by a wireless OFDM communications transmitter*" a first and second packet type and "*transmitting, by the wireless OFDM communications transmitter*" the first and second packet type. Claim 1 further recites "*generating, by an encoder and a modulator*"

OFDM symbols in specific orders. At a high level, the transmission chain of a transceiver receives an input stream associated with the PPDU to be transmitted, converts the input stream into OFDM symbols through the process of coding and modulation, generates the PPDU, and finally transmits the PPDU over the wireless physical medium. (SONY-1005, ¶¶44-49; SONY-1006, 60:6-61:42; SONY-1015, Appendix G, 54-82.) After transmission, the PPDU is received by a wireless Orthogonal Frequency Division Multiplexing (OFDM) communications receiver over a wireless communication channel. Claim 11 recites reception and demodulation features. Therefore, for ease of discussion, consistent with the logical flow of data through the transmission chain of the transceiver to the receive chain, Petitioner addresses the "*encoder and [] modulator*" generation limitations, then the "*wireless OFDM communications transmitter*" generation and transmission limitations, the "*wireless Orthogonal Frequency Division Multiplexing (OFDM) communications receiver*" reception limitations, and finally the "demodulator" limitations.

a. "*Generating, by an Encoder and [] Modulator*" Limitations

Claim 1 recites "*encoder*" and "*modulator*" generation limitations in [1D], [1E], [1J], and [1K]. Outside of the claims, the '272 patent does not mention the generation of OFDM symbols, let alone generation of OFDM symbols in a particular order.[6] Regardless, the combination of Hansen and July 2005 WWiSE renders the "*encoder and [] modulator*" generation limitations obvious.

(i) "*Generating*" OFDM Symbols

The combination of Hansen and July 2005 WWiSE discloses "*an encoder and a modulator*" that "*generate[s]*" OFDM symbols. (SONY-1003, ¶¶134-135.) In Hansen's transceiver, illustrated in annotated Figure 2b below, an input bitstream associated with the PPDU to be transmitted is received at coding block 202 (shaded blue) from processor 240 and baseband processor 242. (SONY-1005, ¶56 (processor "generate[s] a plurality of bits that are communicated to the coding block 202"), ¶44.) The PPDU input bit stream at this point in the transmission chain includes the header and data (payload)[7] bits associated with the PPDU to be transmitted. (SONY-1003, ¶¶134-135; SONY-1005, ¶59; SONY-1006, 60:14-24.)

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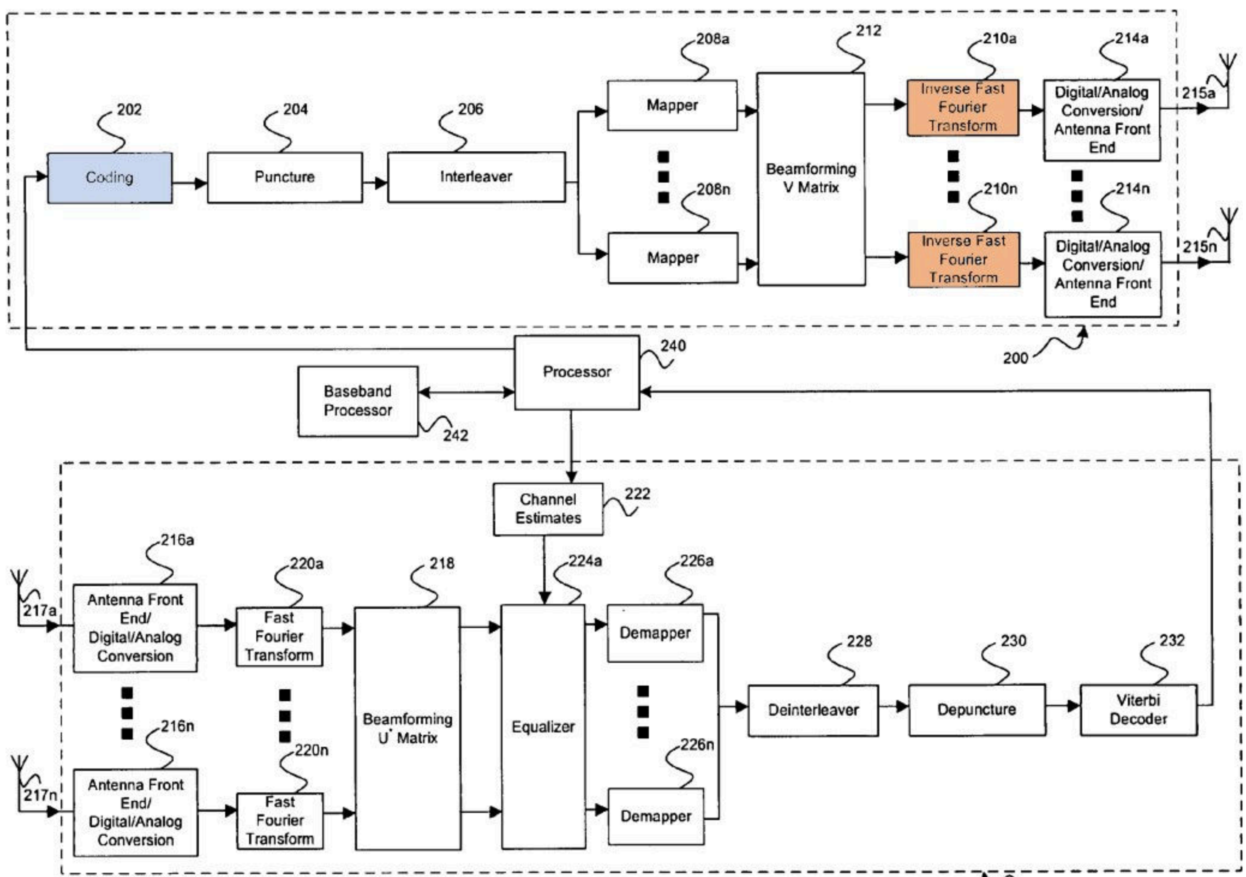
[6] Petitioner reserves the right to challenge these claims under 35 U.S.C. §112.

[7] The preamble is not added until after modulation which completes the PPDU ("*packet*"). (SONY-1006, 61:37-39.)



Hansen, Annotated Figure 2b

(a) "Encoder"

Coding block 202 transforms blocks of the input stream "by applying a forward error correction (FEC) technique such as, for example, binary convolutional coding (BCC)." (SONY-1005, ¶44.) Coding block 202 (shaded blue above) is therefore "*an encoder*." (SONY-1003, ¶¶136-137.)

Interleaver block 206 rearranges the bits of a coded data block to "reduce the probability of uncorrectable corruption of data." (SONY-1005, ¶45.) The output of interleaver block 206 is divided into a plurality of streams, corresponding to the number of spatial streams (antennas) being used for transmission. (SONY-1005, ¶45.) In the simplest case of a single antenna system, the output of interleaver block 206 for both the coded header and coded data is provided to a single mapper. (SONY-1015, 7-8 (describing coding process for a single antenna).) But even in a multiple antenna system having multiple spatial streams, the interleaver output associated with a coded header is not divided. (SONY-1006, 70:18-21.) Instead, the header is either transmitted by a single antenna (SONY-1012, 121:1-2 (illustrating transmission using a single antenna), 121:24-27) or the same coded/interleaved header is provided to each mapper in parallel (SONY-1006, 70:18-21; SONY-1012, 121:24-122:2; SONY-1003, ¶¶141-142.)

Mapper block 208 receives a plurality of bits from an interleaver and "map[s] those bits into a [constellation] 'symbol' by applying a modulation technique based on a 'constellation' utilized to transform the plurality of bits into a signal level representing the symbol." (SONY-1005, ¶46.) Petitioner refers to the symbol generated by the mapper as a "constellation symbol." For a multiple antenna system, because the header is provided in parallel to each mapper, each mapper receives the same bits from the interleaver and outputs the same constellation symbols. (SONY-1006, 70:18-21; SONY-1012, 121:1-122:2; SONY-1003, ¶143.)

Puncturing, Interleaving, and Mapping are often also considered to be part of coding. (SONY-1003, ¶143, *citing, e.g.,* SONY-1006, 60:8-61:42 (describing the PPDU encoding process).) Accordingly, coding block 202, puncture block 204, interleaving block 206, and mapping block 208 collectively are also an "*encoder*." (SONY-1003, ¶144.)

Should PO contend the term "*encoder*" should be interpreted as a component that encodes values into bit fields on the header, the combination of Hansen and July 2005 WWiSE discloses an "*encoder*" under this interpretation. (SONY-1001, 7:63-8:7; SONY-1003, ¶145.) Hansen discloses that processor 282 and baseband processor 272 "generate data to be transmitted via an RF channel by the transmitter 286." (SONY-1005, ¶40.) July 2005 WWiSE similarly teaches that the header field is produced "from the LENGTH, DATARATE, TRANSMISSION_MODE, NUM_STREAMS, CODE_TYPE, and SERVICE fields of the TXVECTOR **by filling the appropriate bit fields**." (SONY-1006, 60:14-16.)

(b) "*Modulator*"

The output of mapper block 208 is provided to IFFT 210[8] which

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[8] Although Hansen describes beamforming after the mapper, because the header is repeated and provided to each antenna, beamforming is not performed on the

"subdivide[s] the bandwidth of the RF channel into a plurality of n sub-band frequencies to implement orthogonal frequency division multiplexing (OFDM), buffering a plurality of received signals." (SONY-1005, ¶48.) Each buffered signal is "**modulated** by a carrier signal whose frequency is based on of [sic] one of the sub-bands." (SONY-1005, ¶48.) IFFT block 210 then independently sums its "respective buffered and modulated signals across the frequency sub-bands to perform an n-point IFFT, thereby generating a composite OFDM signal." (*Id.*) The composite OFDM signal corresponds to an OFDM symbol. (SONY-1003, ¶147; SONY-1006, 61:32-35; SONY-1022, 33-42.) For a multiple antenna system, because the header is provided in parallel to each mapper and then to a corresponding IFFT, each IFFT receives the same data and outputs the same header OFDM symbols. (SONY-1006, 70:18-21; SONY-1012, 121:1-122:2; SONY-1003, ¶¶147-149.)

IFFT 210 (shaded orange above) is therefore a "*modulator*" that generates OFDM symbols. (SONY-1003, ¶¶147-151.) Should PO contend that an OFDM symbol includes the IFFT output plus a guard interval (GI), July 2005 WWiSE discloses prepending a GI to the IFFT output to generate an

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header. (SONY-1003, ¶146.) Instead, the same data would be provided to the each IFFT when the header is being processed. (*Id.*)

OFDM symbol. (SONY-1006, 61:32-35, 83:21-25 (TX Block Diagram showing "add cyclic extension (guard)"); SONY-1003, ¶150, *citing* SONY-1023, 260-262.) Accordingly, the combination of Hansen and July 2005 WWiSE discloses a "*modulator*" that generates an OFDM symbol under this interpretation. (SONY-1003, ¶150.)

Thus, the combination of Hansen and July 2005 WWiSE discloses "*an encoder and a modulator*" [1D] that "*generate*" an OFDM symbol corresponding to a set of bits in the PPDU input stream. (SONY-1003, ¶160.)

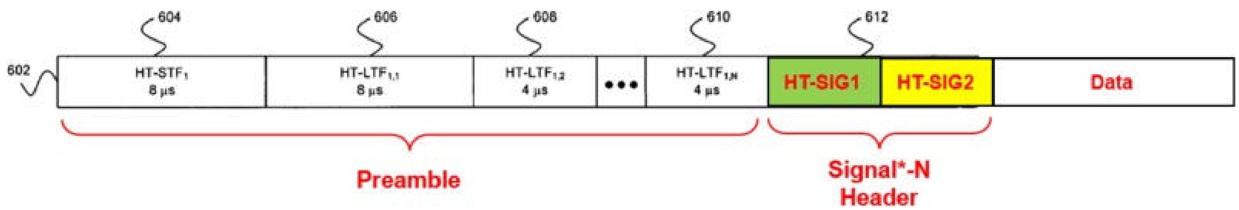
b. "*Wireless OFDM Communications Transmitter*" Generation and Transmission Limitations

Claim 1 recites "*wireless OFDM communications transmitter*" limitations in [1A], [1F], [1G], and [1N]. Outside of the claims, the '272 patent does not mention the generation of the recited packet types.[9] Regardless, the combination of Hansen and July 2005 WWiSE discloses these "*wireless OFDM communications transmitter*" limitations.

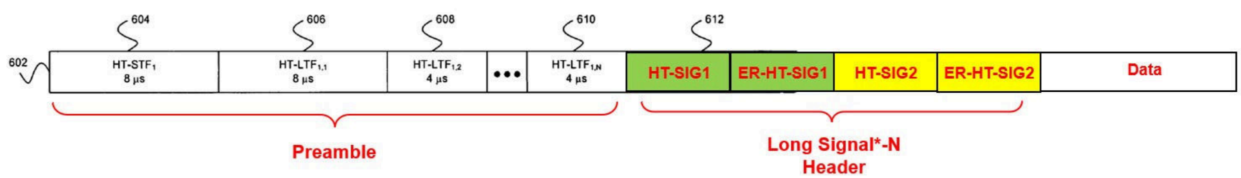
The NR greenfield PPDU ("*first packet type*") and ER greenfield PPDU ("*second packet type*") in the combination of Hansen and July 2005 WWiSE are illustrated below. As discussed in §V.B.2.a, "*the first packet*

[9] Petitioner reserves the right to challenge these claims under 35 U.S.C. §112.

type compris[es] a first header field" [1A] and as discussed in §V.B.2.b, "*second packet type compris[es] a second header field*" [1B].



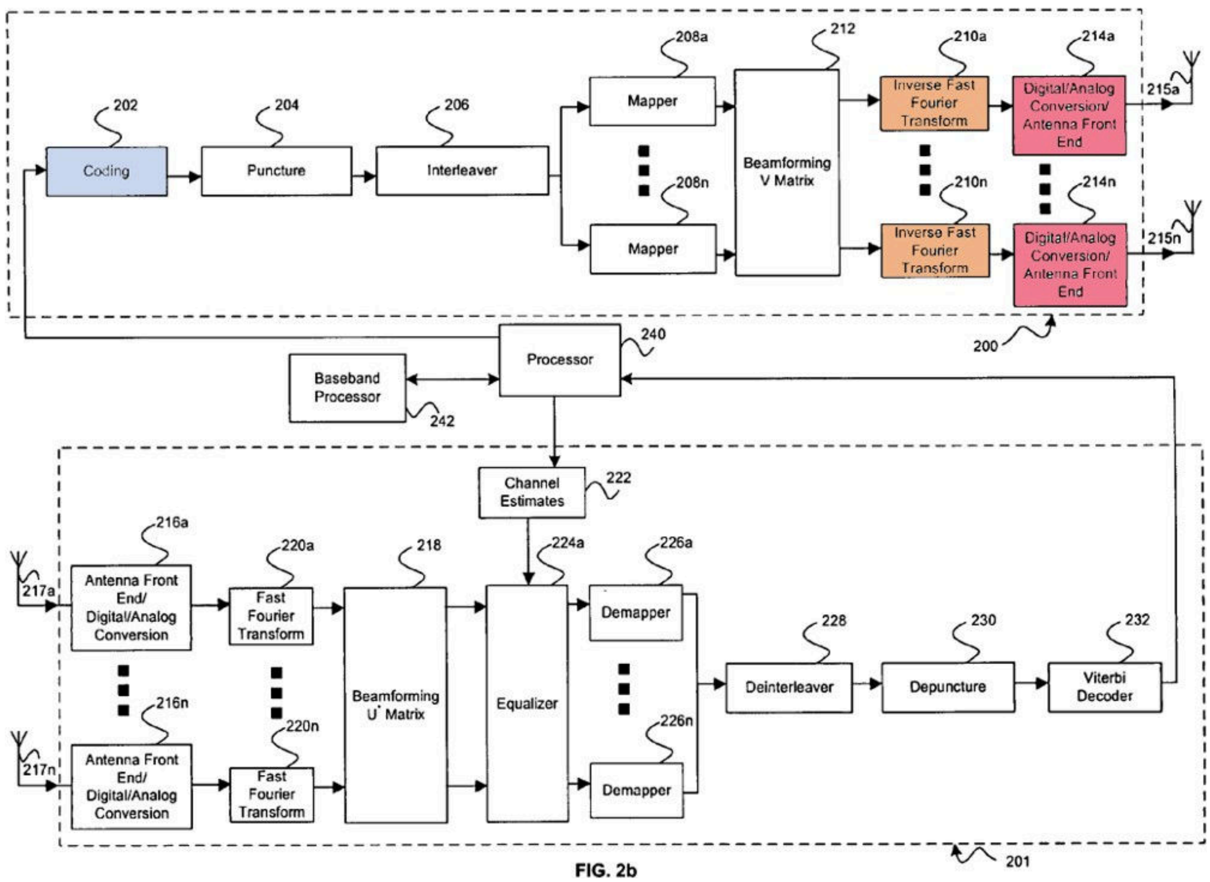
NR Greenfield PPDU ("*First Packet Type*")
(Combined Hansen Figure 3a, Excerpt from Figure 6a,
with HT-SIG symbols added)



ER Greenfield PPDU ("*Second Packet Type*")
(Combined Hansen Figure 3a and Excerpt from Figure 6a,
as modified by July 2005 WWiSE with HT-SIG symbols added)

After generation of the OFDM symbols discussed in §V.B.3.a, the PPDU includes the OFDM symbols associated with the header and data fields. July 2005 WWiSE explains that these OFDM symbols are appended one after another and the preamble added to form a complete PPDU ("*packet*"). (SONY-1006, 61:37-39.) A POSITA would have been motivated to apply this step from July 2005 WWiSE in the combination because this is a well-understood and standard operation in the transmit chain to generate the complete PPDU for transmission. (SONY-1003, ¶179, *citing* SONY-

1015, 8 (step m); SONY-1023, 263-264.) The complete PPDU is provided to the "plurality of digital (D) to analog (A) conversion and antenna front end blocks 214a, …, 214n" (shaded red). (SONY-1005, ¶49.) Specifically, the digital signal representation is "converted to an analog RF signal that may be amplified and **transmitted via an antenna**." (*Id.*)



Hansen, Annotated Figure 2b

The components in the transceiver after Hansen's IFFT blocks (e.g., the one or more DAC/Antenna Front Ends) that generate and transmit the complete PPDU are the recited "*wireless OFDM communications transmitter*." (SONY-

1003, ¶180.) As highlighted by Hansen's annotated Figure 2b (above), the "*wireless OFDM communications transmitter*" (DAC/AFE; shaded red) is a separate component from the "*encoder*" (coding block 202; shaded blue) and "*modulator*" (IFFT blocks 210; shaded orange). (*Id*.)

Hansen's D to A conversion and antenna front end block(s) utilize an antenna "to transmit one RF signal via **an RF channel**." (SONY-1005, ¶49; SONY-1005, ¶31 (describing wireless communication "via an RF channel" by the system), ¶15 (referring to the system of Figure 2b as a "transceiver").) Accordingly, the combination of Hansen and July 2005 WWiSE discloses [1A], [1F], [1G], and [1N]. (SONY-1003, ¶¶181-183.)

The combination of Hansen and July 2005 WWiSE discloses that the same device generates and transmits both the "*first packet type*" [NR greenfield PPDU] and the "*second packet type*" [ER greenfield PPDU]. (SONY-1003, ¶182.) July 2005 WWiSE specifies that ER "capable devices are devices which support the optional Extended Range MCS, **in addition** to the Normal Range (NR) MCS, and the long SIG-N field format." (SONY-1006, 50:9-10.) The REXT bit in the Signal*-N field in the combination of Hansen and July 2005 WWiSE indicates whether an ER capable device is operating in ER or NR mode. (SONY-1006, 69:29-31, 70:6-7, 50:9-1.) Thus, the combination of Hansen and July 2005 WWiSE discloses a "*transceiver*"

(ER capable device) that generates and transmits both the "*first packet type*" (NR greenfield PPDU) and the "*second packet type*" (ER greenfield PPDU). (SONY-1003, ¶183.)

c. "Wireless OFDM Receiver"

The receiver portion 201 of Hansen's transceiver, illustrated in annotated Figure 2b below[10], includes antenna front end and analog to digital conversion blocks 216a-n (shaded red), referred to herein as "AFE/ADC blocks". (SONY-1005, ¶50, SONY-1005, ¶15.) Each AFE/ADC block 216 receives analog RF signals via an antenna, converts the RF signal to baseband and generates a digital equivalent of the received analog baseband signal. (SONY-1005, ¶50.) The number of AFE/ADC blocks 216 equals "the number of receiving antenna 117a, …, 117n at the receiver." (SONY-1005, ¶50.) A single antenna system would include only a single AFE/ADC block 216. (SONY-1003, ¶204; SONY-1015, 24 (illustrating a receiver for a single antenna system).)

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[10] Figure 2b appears to include a typographical error. It labels block 216 "antenna front end/digital/analog conversion." Based on the specification (¶50) and general knowledge in the art, a POSITA would have understood this block includes analog/digital conversion not digital/analog conversion.

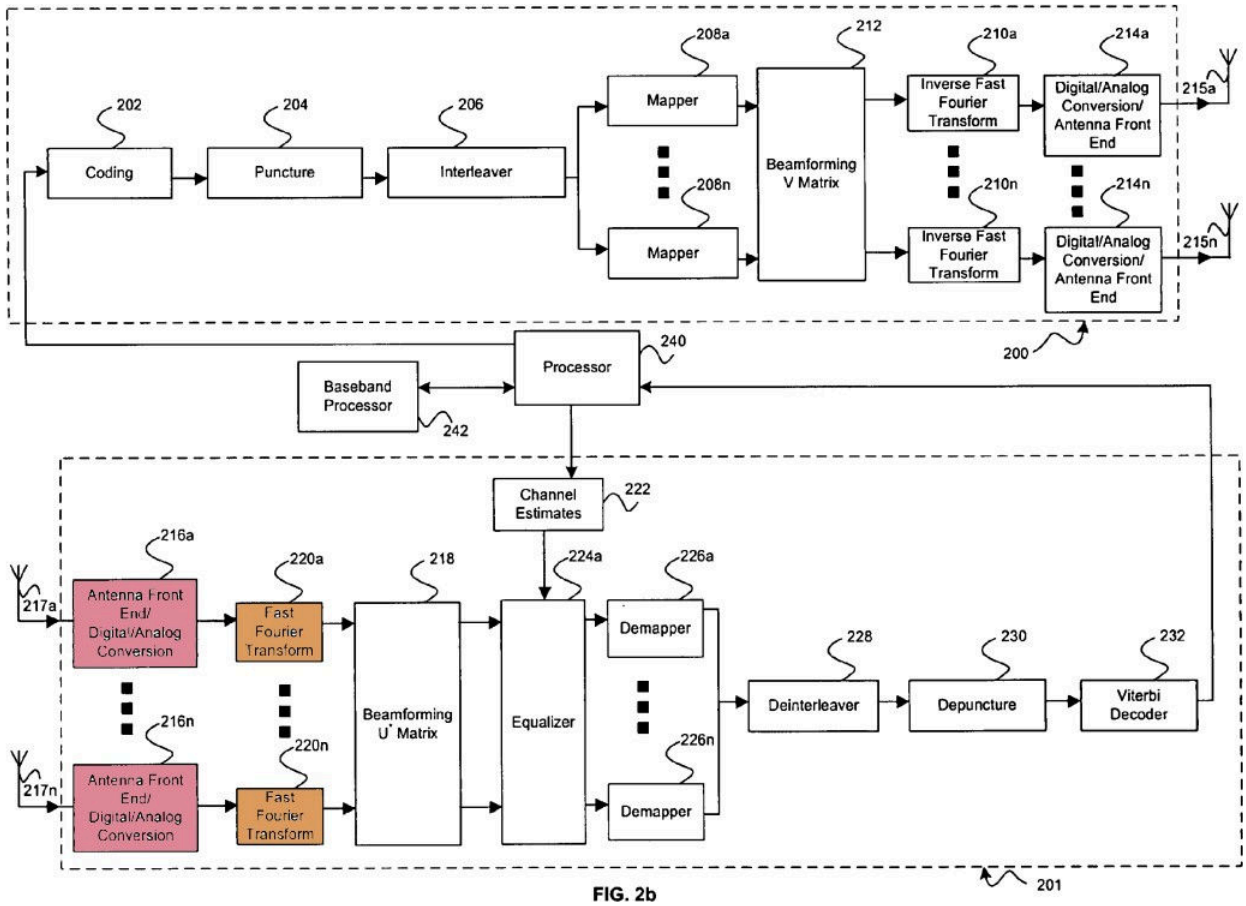


FIG. 2b

Hansen, Annotated Figure 2b

The one or more AFE/ADC blocks 216 used to receive the RF signals associated with an incoming "*packet*" are collectively the "*receiver*" for that incoming "*packet*." (SONY-1003, ¶¶204-206, *citing, e.g.,* SONY-1005, ¶39.) Thus, the combination of Hansen and July 2005 WWiSE discloses "*receiving, by the wireless [OFDM] communications receiver*" PPDUs, including the NR greenfield PPDU ("*first packet type*") and the ER greenfield PPDU ("*second packet type*"). (§V.B.1 ("*OFDM transceiver*").

Hansen's AFE/ADC blocks 216 utilize an antenna to receive RF signals over an RF channel. (SONY-1005, ¶¶50, 59, 56; SONY-1005, ¶31, ¶15.) The combination of Hansen and July 2005 WWiSE therefore discloses [11A] and [11F]. (SONY-1003, ¶¶204-207.) Petitioner establishes in §V.B.3.a that the combination of Hansen and July 2005 WWiSE discloses the "*first packet type comprises a first header field*" and in §V.B.3.b that the combination of Hansen and July 2005 WWiSE discloses the "*second packet type comprises a second header field*."

The combination of Hansen and July 2005 WWiSE discloses that the same device receives both the "*first packet type*" [NR greenfield PPDU] and the "*second packet type*" [ER greenfield PPDU]. (SONY-1003, ¶207.) July 2005 WWiSE specifies that ER "capable devices are devices which support the optional Extended Range MCS, **in addition** to the Normal Range (NR) MCS, and the long SIG-N field format." (SONY-1006, 50:9-10.) The REXT bit in the Signal*-N field in the combination of Hansen and July 2005 WWiSE indicates whether an ER capable device is operating in ER or NR mode. (SONY-1006, 69:29-31, 70:6-7, 50:9-1.) For example, in July 2005 WWiSE "ER frames shall be transmitted with the long SIG-N field format and the REXT bit set to value 1." (SONY-1006, 50:12-13.) NR frames are sent with the SIG-N field format and the REXT bit set to value 0. (SONY-1003, ¶207.)

An ER capable device therefore receives both ER and NR PPDUs. Thus, the combination of Hansen and July 2005 WWiSE discloses a "*transceiver*" (ER capable device) that receives both the "*first packet type*" (NR greenfield PPDU) and the "*second packet type*" (ER greenfield PPDU). (*Id*.)

d. "*Demodulator*" Limitations

Claim 11 recites demodulator limitations in [11D], [11E], [11I], and [11J]. The combination of Hansen and July 2005 WWiSE discloses "*demodulating, by the demodulator*" the OFDM symbols associated with the "*first header field*" and the OFDM symbols associated with the "*second header field*." (SONY-1003, ¶¶242-252.)

In Hansen's transceiver, illustrated in annotated Figure 2b below, FFT block(s) 220 (shaded orange) receive signals from the AFE/ADC block 216. July 2005 WWiSE teaches that header field is transmitted simultaneously from all TX antennas in all modes. (SONY-1006, 70:18-21.) The TGn Sync proposal similarly teaches that the header field is either transmitted by a single antenna or by all antennas in parallel. (SONY-1012, 121:24-122:2; SONY-1005, ¶67 HT-SIG header field of Figure 4c is "in accordance with a TGn Sync proposal"); ¶97 (Signal*-N is "represented as described in FIG. 4c.")) Accordingly, each antenna and AFE/ADC block receives the same signal associated with the header and passes the same header signal to the

FFT blocks 220. (SONY-1003, ¶243.)

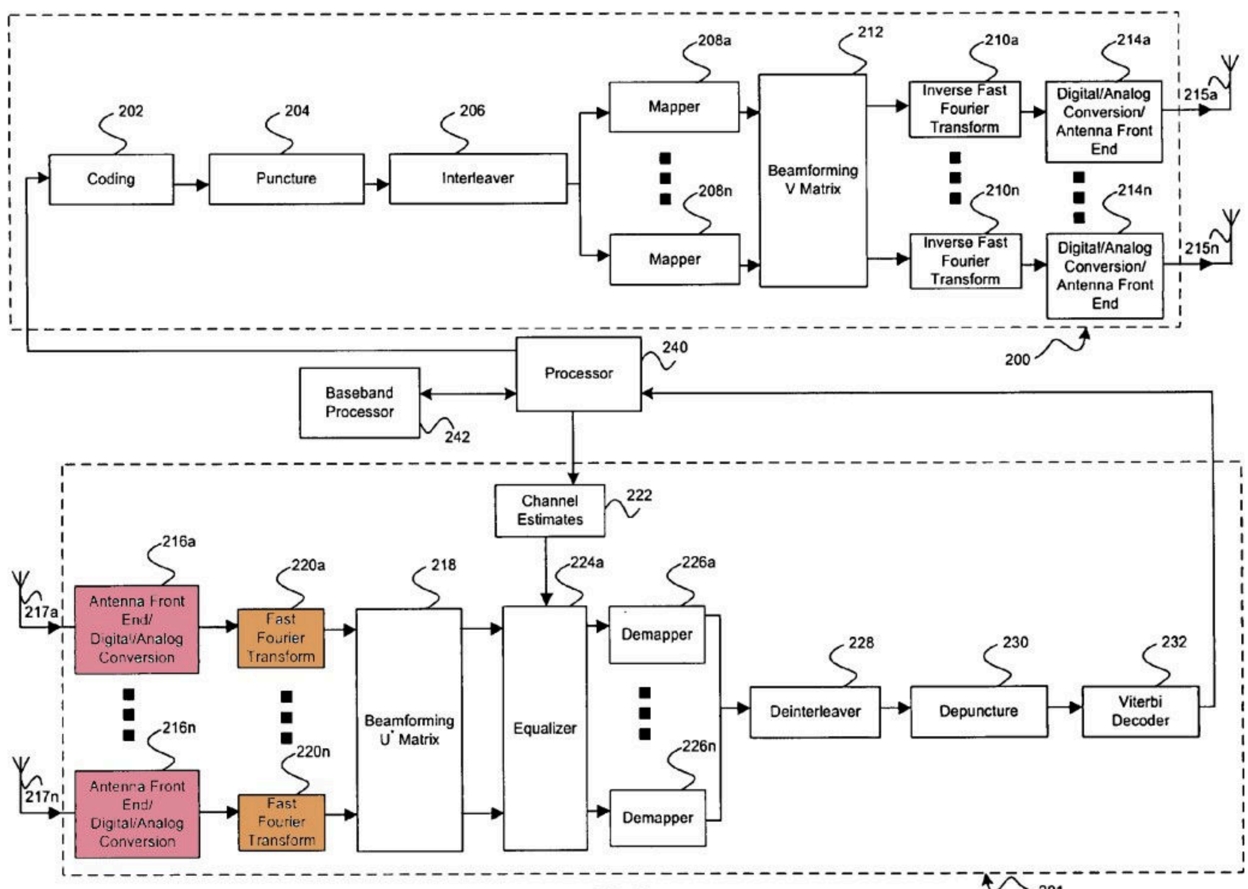


FIG. 2b

Hansen, Annotated Figure 2b

An FFT block 220 "appl[ies] an n-point FFT technique" to "**demodulat[e]** the signal by a plurality of carrier signals based on the n sub-band frequencies utilized in the transmitter 200." (SONY-1005, ¶51.) The demodulated signals are "mathematically integrated over one sub band frequency period" by an FFT block to extract the OFDM symbol. (SONY-1005, ¶51.) Because each FFT block 220 receives the same header signal, each FFT block produces the same OFDM symbols associated with the header. (SONY-1003, ¶244.)

FFT block 220 is therefore a "*demodulator*" that demodulates OFDM symbols. (SONY-1003, ¶¶243-245.) As highlighted by Figure 2b above, the "*demodulator*" (shaded orange) is a separate component from the "*wireless OFDM receiver*." (SONY-1003, ¶245.)

e. First and Second Packet Type – Symbol Ordering

The combination of Hansen and July 2005 WWiSE renders obvious generating/demodulating *a first OFDM symbol followed by a second OFDM symbol* for *the first header field* and generating/demodulating *a first OFDM symbol followed by a second OFDM symbol followed by a third OFDM symbol followed by a fourth OFDM symbol* for *the second header field.*

(i) "*First Packet Type*" – Symbol Ordering

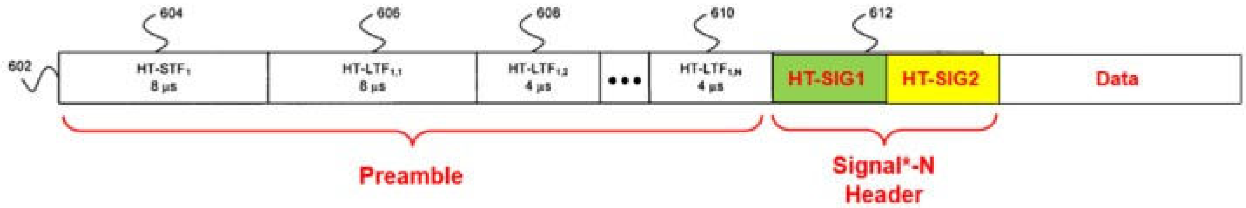
An OFDM transmitter transmits a PPDU over the wireless medium as a sequence of OFDM symbols. (SONY-1006, 58:6-8; SONY-1015, 7 (§17.3.1).) Through the process of coding and modulation described above, the "*first set of header bits of the first header field* [HT-SIG1 bits] and the "*second set of header bits of the first header field* [HT-SIG2 bits]" of the NR greenfield PPDU are converted into OFDM symbols for transmission over the wireless medium. (SONY-1005, ¶¶44-49; SONY-

1006, 60:6-61:42.) An OFDM receiver receives the PPDU over the wireless medium as the same sequence of OFDM symbols. (SONY-1003, ¶¶151, 219, *citing* SONY-1006, 67:1-3, 68:1-4.) The ordering of OFDM symbols in the NR greenfield PPDU ("first packet type") reflects the order the OFDM symbols of the PPDU are transmitted by the transmitter and the order the same OFDM symbols are received by the receiver. (SONY-1003, ¶¶152, 220.)

Hansen teaches its Signal*-N field, when transmitted, "comprise[s] 2 OFDM symbols." (SONY-1005, ¶97.) Consistent with Hansen, the TGn Sync proposal sets forth that "HTSIG consists of two OFDM symbols: HTSIG1 and HTSIG2." (SONY-1012, 133:9; 121:1-2 (Figure 55, mapping HT-SIG header bits to 8μs header field in transmitted PPDU), 133:27 (explaining symbol duration is 4μs).)

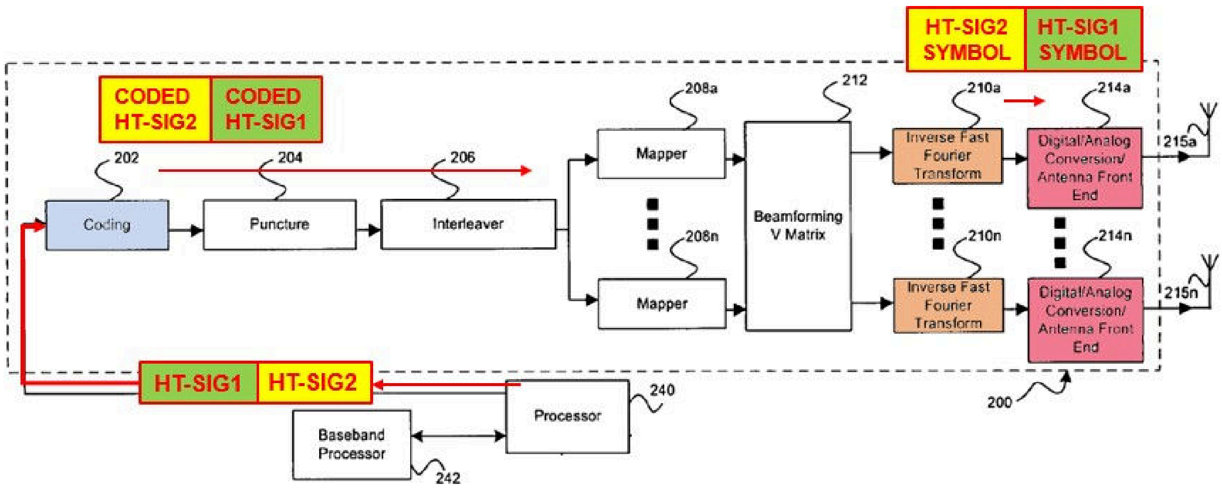
Because the HT-SIG1 bits are associated with the HT-SIG1 symbol and the HT-SIG2 bits are associated with the HT-SIG2 symbol, in the combination of Hansen and July 2005 WWiSE a "*first OFDM symbol* [HT-SIG1 symbol] *is used to transmit the first part of the first header field* [HT-SIG1 bits]" and a "*second OFDM symbol* [HT-SIG2 symbol] *is used to transmit the second part of the first header field*." (§V.B.2.a; SONY-1003, ¶¶151-154, 219-220; *citing* SONY-1012, 133:9-10, 134:1-2 (Figure 62).)

The TGn Sync proposal specifies that "**HTSIG1 shall be transmitted first in time**." (SONY-1012, 133:9-10; SONY-1005, ¶67 (HT-SIG header field of Figure 4c "in accordance with a TGn Sync proposal"), ¶97 (Signal*-N is "as described in FIG. 4c").) Thus, in the NR greenfield PPDU, the HT-SIG1 symbol is generated and transmitted before the HT-SIG2 symbol (SONY-1003, ¶155) and therefore received before the HT-SIG2 symbol. (SONY-1003, ¶221.) This ordering of symbols is illustrated in the NR greenfield PPDU ("*first packet type*") below which shows the order of symbol transmission over the wireless medium, with the HT-STF1 preamble symbol transmitted first. (SONY-1003, ¶155.) Similarly, the order of the symbols for Signal*-N in the PPDU indicates the order those symbols are generated. (SONY-1003, ¶155.) The NR greenfield PPDU illustrated below shows the order the PPDU OFDM symbols are transmitted and received over the wireless medium, with the HT-STF (short training field) OFDM symbol being transmitted first. (SONY-1003, ¶221.) The OFDM symbols of the NR greenfield PPDU are received in the same order that they are transmitted, with HT-STF (short training field) being received first. (*Id.*)



NR Greenfield PPDU
(Hansen's Figure 3a and Excerpt from Figure 6a with Signal*-N symbols)

The combination of Hansen and July 2005 WWiSE discloses "*generating, by an encoder and a modulator*, a *first OFDM symbol* ***followed by*** *a second OFDM symbol*" [1D] for the Signal*-N header field of the NR greenfield PPDU illustrated above. (SONY-1003, ¶¶156-160.) In Hansen's transmission chain, coding block 202 ("*encoder*") receives the HT-SIG1 bits followed by the HT-SIG2 bits in the input stream from the processor. (SONY-1005, ¶56; SONY-1006, 60:14-61:10) Coding block 202 applies a FEC technique such as BCC to encode these header bits. (SONY-1005, ¶44.) The output of coding block 202 is split into two coded bit strings. (SONY-1006, 61:18-20.) The first coded bit string (referred to as "coded HT-SIG1") corresponds to the "*first part of the first header field*" and includes information related to each of the bits in HT-SIG1 and the second coded bit string (referred to as "coded HT-SIG2") corresponds to the "*second part of the first header field*" and includes information related to each of the bits in HT-SIG2, as illustrated in the figure below annotating Hansen's Figure 2b to show encoding and modulation of the HT-SIG1 and HT-SIG2 bits into OFDM symbols. (SONY-1003, ¶157.)



After interleaving, the first coded bit string (coded HT-SIG1) is provided to mapper 208 which maps bits in coded HT-SIG1 into constellation symbols[11]. (SONY-1005, ¶46.) An IFFT 210 ("*modulator*") then modulates the constellation symbols to "*generate a first OFDM symbol*" (HT-SIG1 symbol). (SONY-1003, ¶158.) The second coded bit string (coded HT-SIG2) is similarly processed after the first coded bit string. Coded (and

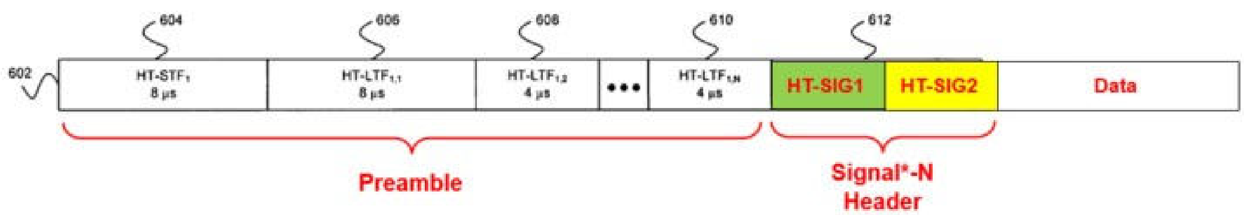
[11] In a multiple antenna system, the header is either transmitted on a single antenna or the same coded and interleaved header bits are sent to each mapper which send their outputs to IFFTs, resulting in the same OFDM symbols for the header being transmitted by each antenna. (SONY-1006, 70:18-21; SONY-1012, 121:1-122:2.)

interleaved) HT-SIG2 is provided to mapper 208 which maps the bits to constellation symbols. The IFFT then modulates the constellation symbols associated with coded HT-SIG2 to generate "*a second OFDM symbol*" (HT-SIG2 symbol). (SONY-1003, ¶159.)

Because the coded bit strings (coded HT-SIG1 and coded HT-SIG2) associated with the first and second parts of Signal*-N are processed sequentially through the transmission chain, the first OFDM symbol (HT-SIG1 symbol) is generated before the second OFDM symbol (HT-SIG2 symbol). (SONY-1012, 133:9-10.) Thus, the combination of Hansen and July 2005 WWiSE discloses "*generating, by an encoder and a modulator*, a *first OFDM symbol followed by a second OFDM symbol*" [1D] for the "*first header field*" of the NR greenfield packet. (SONY-1003, ¶¶156-160.)

The combination of Hansen and July 2005 WWiSE also discloses [11D] and [11E]. (SONY-1003, ¶¶246-248.)

The symbols of the NR greenfield PPDU, illustrated below, are received and demodulated in the order of transmission. (SONY-1003, ¶247.) As discussed above, each FFT receives the same signal corresponding to the transmitted Signal*-N header field. (SONY-1006, 70:18-21; SONY-1012, 121:24-122:2; SONY-1005, ¶67 HT-SIG header field of Figure 4c is "in accordance with a TGn Sync proposal"); ¶97 (Signal*-N is "represented as described in FIG. 4c.”)) Because HT-SIG1 is transmitted first, it is received and demodulated first, followed by HT-SIG2. The combination of Hansen and July 2005 WWiSE therefore discloses [11D]. (SONY-1003, ¶247.)



NR Greenfield PPDU
(Hansen’s Figures 3a, 6a, and 4c)

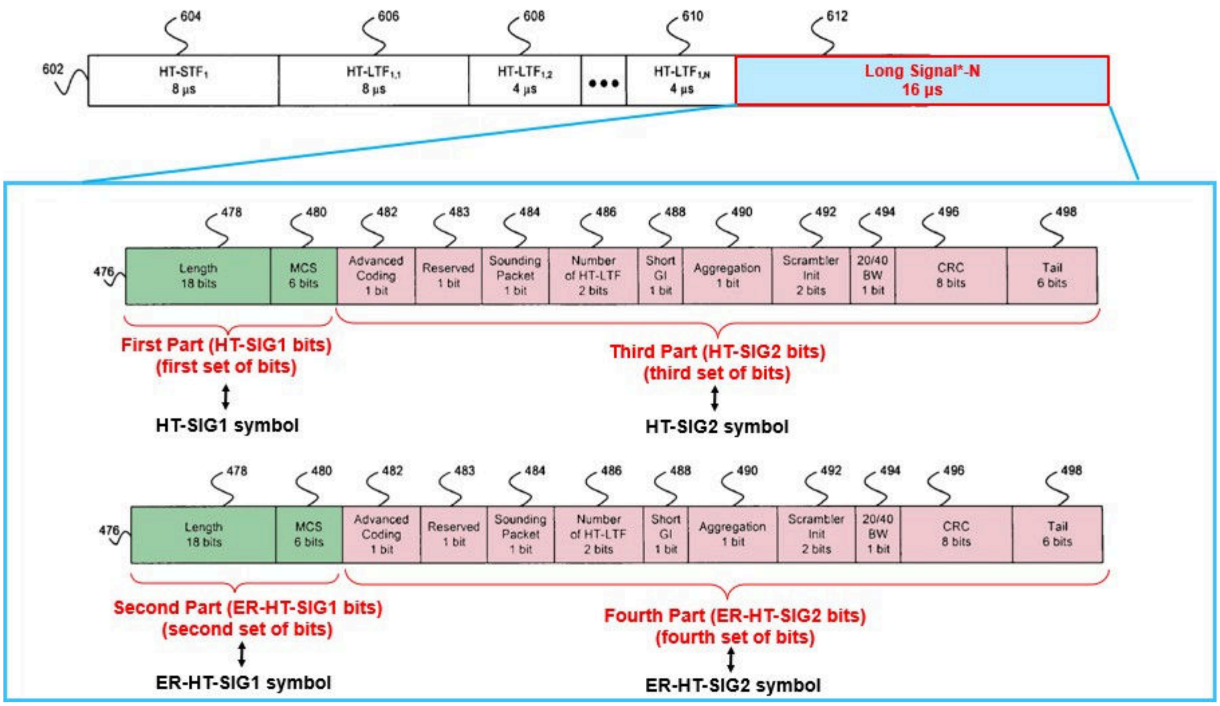
As discussed above, Signal*-N consists of two symbols: HT-SIG1 and HT-SIG2. Because the HT-SIG1 bits are associated with the HT-SIG1 symbol and the HT-SIG2 bits are associated with the HT-SIG2 symbol, in the combination of Hansen and July 2005 WWiSE a “*first OFDM symbol* [HT-SIG1 symbol] *is used to receive the first part of the first header field* [HT-SIG1 bits]” and a “*second OFDM symbol* [HT-SIG2 symbol] *is used to receive the second part of the first header field*” [11E]. (SONY-1003, ¶248; SONY-1012, 133:9, 134:1-2; SONY-1005, ¶67; ¶97)

(ii) “*Second Packet Type*” – Symbol Ordering

Like the NR greenfield PPDU, the transmission chain of Hansen’s transceiver converts the “*first set of header bits of the second header field* [HT-SIG1 bits], the “*second set of header bits of the second header field* [ER-

HT-SIG1 bits], the "*third set of header bits of the second header field*" [HT-SIG2 bits], and the "*fourth set of header bits of the second header field*" [ER-HT-SIG2 bits] of the ER greenfield PPDU into OFDM symbols for transmission over the wireless medium and ultimately reception and demodulation.

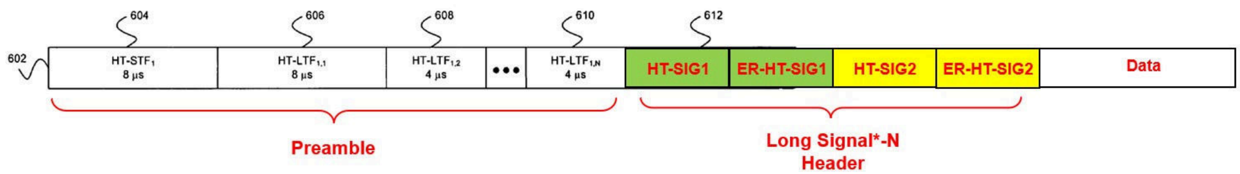
As discussed above, the Signal*-N field "comprise[s] 2 OFDM symbols", HT-SIG1 symbol and HT-SIG2 symbol. (SONY-1005, ¶97; SONY-1012, 133:9.) Repeating the two-part Signal*-N, as taught by July 2005 WWiSE, results in 4 OFDM symbols in the Long Signal*-N header field—two HT-SIG1 symbols and two HT-SIG2 symbols. (SONY-1003, ¶¶162, 250; SONY-1006, 69:16-18.) Each of these symbols corresponds to a set of bits as illustrated below: HT-SIG1 symbol corresponds to HT-SIG1 bits, ER-HT-SIG1 symbol corresponds to ER-HT-SIG1 bits, HT-SIG2 symbol corresponds to HT-SIG2 bits, ER-HT-SIG2 symbol corresponds to ER-HT-SIG2 bits.



Thus, in the combination of Hansen and July 2005 WWiSE, a "*first OFDM symbol* [HT-SIG1 symbol] *is used to transmit/receive the first part of the second header field* [HT-SIG1 bits]", a "*second OFDM symbol* [ER-HT-SIG2 symbol] *is used to transmit/receive the second part of the second header field* [ER-HT-SIG1 bits]", a "*third OFDM symbol* [HT-SIG2 symbol] *is used to transmit/receive the third part of the second header field* [HT-SIG2 bits]", and a "*fourth OFDM symbol* [ER-HT-SIG2 symbol] *is used to transmit/receive the fourth part of the second header field* [ER-HT-SIG2 bits]." (SONY-1003, ¶¶161-163, 251-252.)

Neither Hansen nor July 2005 WWiSE explicitly discloses the order of transmission or generation for the four OFDM symbols corresponding to the

Long Signal*-N header bits. However, it would have been obvious to a POSITA that the Long Signal*-N header OFDM symbols are generated and transmitted in the following order: HT-SIG1, ER-HT-SIG1, HT-SIG2, ER-HT-SIG2, as illustrated in the figure below. (SONY-1003, ¶¶164-173.)



ER Greenfield PPDU

First, the transmission ordering of HT-SIG1, ER-HT-SIG1, HT-SIG2, and ER-HT-SIG2 would have been obvious to try. (SONY-1003, ¶¶165-168.) Because TGn Sync requires that "HTSIG1 shall be transmitted first in time" (SONY-1012, 133:9-10), a POSITA would have understood that only two alternatives exist in the combination of Hansen and July 2005 WWiSE for the order of OFDM symbols associated with the four parts of the Long Signal*-N header field: (1) HT-SIG1, ER-HT-SIG1, HT-SIG2, and ER-HT-SIG2 or (2) HT-SIG1, HT-SIG2, ER-HT-SIG1, and ER-HT-SIG2.

A POSITA would have had a reasonable expectation of success in pursuing both OFDM symbol ordering alternatives. First, both options merely involve copying (repeating) bit strings during the process of generating OFDM symbols for transmission. (SONY-1003, ¶¶166-167.) Such techniques for repetition coding of a message part associated with an OFDM symbol to create two repeated OFDM symbols would have been known to a POSITA. (SONY-1003, ¶166.) In fact, the G.9960 standard, which is admitted by the ’272 patent to be prior art, discloses repetition coding for header bits. (SONY-1018, 51:1331-1358; SONY-1001, 1:57-58 (admitting G.9960 “should be familiar to those skilled in the art”).) Additionally, a POSITA would have understood that the order of Long Signal*-N header parts (and resulting symbols) in a PPDU would be specified in documentation (such as an industry standard) so that a receiver is able to interpret received data. (SONY-1003, ¶167, *citing* SONY-1006, 67:1-69:17 (illustrating PPDUs); SONY-1012, 121:1-2 (Figure 55, illustrating PPDU format); SONY-1015, 33 (Figure 122; illustrating PPDU transmit procedure).) Therefore, a POSITA would have had a reasonable expectation of success in implementing both ordering alternatives in a wireless system. (SONY-1003, ¶¶166-167.)

For these reasons, trying these two alternatives for ordering two repeated OFDM symbols in the Long Signal*-N header field would have led a POSITA to anticipated success with either alternative. (SONY-1003, ¶168.) Accordingly, an ER greenfield PPDU having the symbol order of HT-SIG1, ER-HT-SIG1, HT-SIG2, ER-HT-SIG2 for the Long Signal*-N field is the product **not of innovation** but of ordinary skill and **common sense**. Moreover, a POSITA is an individual with experience with wireless communication protocols. (§IV.B.) The simple concept of repeating parts of a header field one after another would not have required the POSITA to explore new technologies or approaches. (SONY-1003, ¶168.)

Second, July 2005 WWiSE suggests the above ordering. As discussed above, TGn Syn requires that "HTSIG1 shall be transmitted first in time." (SONY-1012, 133:9-10.) July 2005 WWiSE teaches repeating a header symbol, placing the repeated (duplicated) symbol immediately after the original symbol. (SONY-1006, 69:16-18, 67:1-69:17 (Figures 007, 009, 011, 013, and 15 showing greenfield operation).) Based on this suggestion, a POSITA would have been motivated to duplicate the parts of Long Signal*-N on a part-by-part (symbol-by-symbol) basis, resulting in the ordering HT-SIG1, ER-HT-SIG1, HT-SIG2, and ER-HT-SIG2. (SONY-1003, ¶169.)

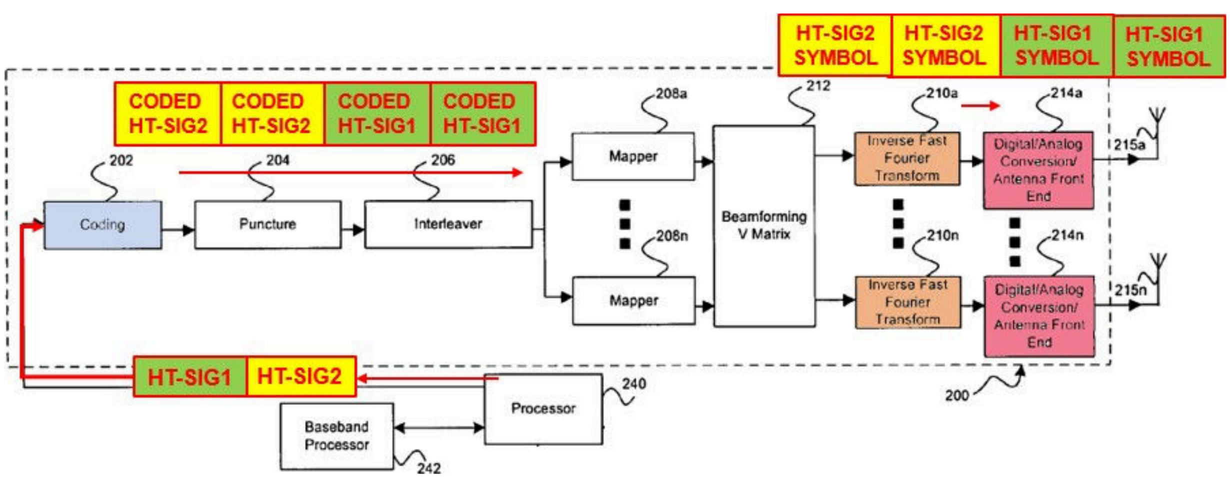
Third, a POSITA would have been motivated to pursue the above ordering to improve efficiency in both the reception chain and transmission chain. (SONY-1003, ¶¶170-172.) When using repeated symbols, the receive chain demodulates both symbols, combines the symbols, and decodes the combined symbol. (*Id.*) For the transmission order HT-SIG1, ER-HT-SIG1, HT-SIG2, ER-HT-SIG2, the first symbol (HT-SIG1) is received, demodulated, and stored in a buffer at the receiver. The second HT-SIG1 symbol (ER-HT-SIG1) is then received, demodulated and combined with HT-

SIG1 from the buffer and the combined demodulated symbol is decoded. (*Id.*) The same process is repeated for HT-SIG2/ER-HT-SIG2. However, if the transmission order was HT-SIG1, HT-SIG2, ER-HT-SIG1, ER-HT-SIG2, the receive chain would need to buffer demodulated HT-SIG1 **and** demodulated HT-SIG2 before the ER-HT-SIG1 symbol is received, requiring an extra buffer to store both demodulated HT-SIG1 and HT-SIG2, before the demodulated symbols could be combined. (SONY-1003, ¶170-171.)

A POSITA would have understood that generating the repeated header fields for ER packets could be efficiently implemented by merely reading the HT-SIG1 and HT-SIG2 fields out of a buffer twice, instead of re-generating them from scratch. A POSITA would have further understood that generating HT-SIG1, repeating HT-SIG1 as ER-HT-SIG1, then generating HT-SIG2, and repeating HT-SIG2 as ER-HT-SIG2 would only require a buffer large enough to hold one symbol's worth of data, whereas generating HT-SIG1 and HT-SIG2 together, and then duplicating both as ER-HT-SIG1 and ER-HT-SIG2 would require a buffer large enough to hold two symbols' worth of data, thereby reducing efficiency. (SONY-1003, ¶172.)

Therefore, it would have been obvious to a POSITA that the Long Signal*-N header OFDM symbols are transmitted in the following order: HT-SIG1, ER-HT-SIG1, HT-SIG2, ER-HT-SIG2. (SONY-1003, ¶¶164-173.)

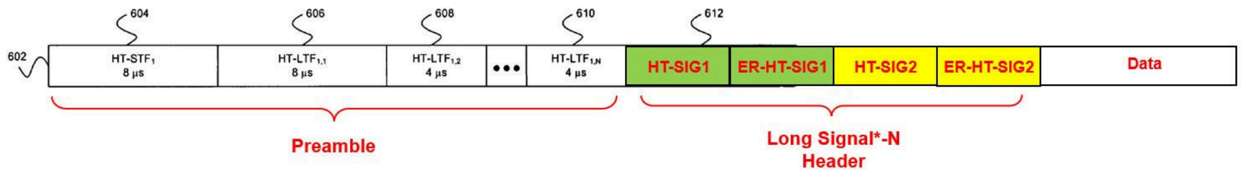
As discussed above, coding block 202 generates two coded bit strings for Signal*-N corresponding to the HT-SIG1 bits ("*first part*" of the "*second header field*") and the HT-SIG2 bits ("*third part*" of the "*second header field*"). (§V.B.3.a.ii.) The first resulting coded bit string (coded HT-SIG1) is repeated pre-modulation to generate coded ER-HT-SIG1 and the following coded bit string (coded HT-SIG2) is repeated pre-modulation to generated coded ER-HT-SIG2. (SONY-1003, ¶174.) The coded bit strings move sequentially through the transmission chain as discussed in §V.B.3.a.ii, resulting in the generation of symbols in the following order, illustrated below: HT-SIG1 symbol, ER-HT-SIG1 symbol, HT-SIG2 symbol, ER-HT-SIG2 symbol, as illustrated in annotated Figure 2b below.



Hansen, Annotated Figure 2b

The combination of Hansen and July 2005 WWiSE therefore renders the limitation "*generating, by the encoder and the modulator, a first OFDM* *symbol followed by a second OFDM symbol followed by a third OFDM symbol followed by a fourth OFDM symbol*" [1J] obvious. (SONY-1003, ¶¶174-175.)

As discussed above, the combination of Hansen and July 2005 WWiSE renders obvious the transmission and reception order for the Long Signal*-N header (HT-SIG1, ER-HT-SIG1, HT-SIG2, ER-HT-SIG2) in the ERgreenfield PPDU, illustrated in the following figure. And as discussed above, each FFT receives the same signal corresponding to the transmitted Long Signal*-N header field. (SONY-1006, 70:18-21; SONY-1012, 121:24-122:2; SONY-1005, ¶67 (HT-SIG header field of Figure 4c is "in accordance with a TGn Sync proposal"); ¶97 (Signal*-N is "represented as described in FIG. 4c.").) Because symbols of a PPDU are received and demodulated in the order of transmission, the combination of Hansen and July 2005 WWiSE renders obvious the limitation "*demodulating, by the demodulator, a first OFDM symbol* [HT-SIG1 symbol] *followed by a second OFDM symbol* [ER-HT-SIG1 symbol] *followed by a third OFDM symbol* [HT-SIG2 symbol] *followed by a fourth OFDM symbol* [ER-HT-SIG2 symbol]" [11I]. (SONY-1003, ¶252.)



ER Greenfield PPDU

f. "*Transmi[ssion]" and "Received in a Different Order*" Limitations [1L]/[1M]/[11K]/[11L]

The combination of Hansen and July 2005 WWiSE discloses "*the second set of header bits of the second header field transmitted/received using the second OFDM symbol are transmitted/received in a different order than the first set of header bits of the second header field transmitted/received using the first OFDM symbol*" [1L]/[11K] and "*the fourth set of header bits of the second header field transmitted/received using the fourth OFDM symbol are transmitted/received in a different order than the third set of header bits of the second header field transmitted/received using the third OFDM symbol*" [1M]/[11L]. (SONY-1003, ¶¶184-189, 253-258.)

Outside of the claims, the '272 patent does not mention or describe the **transmission/reception** of header bits of one symbol in a different order than the same header bits repeated in a different symbol. At most, the '272 patent teaches that "the header bits are **modulated onto** the D OFDM symbols in either the same order or in a **different order**" which would cause the respective bits of the original and repeated header fields to be transmitted on different OFDM subcarriers. (SONY-1001, 9:48-52; SONY-1003, ¶¶185, 254.)

July 2005 WWiSE describes the same type of OFDM subcarrier frequency premutation as described in the ’272 patent. (SONY-1003, ¶¶186, 255.) Specifically, July 2005 WWiSE explains that the “frequency domain MIMO-OFDM symbol ER-SIG-N is derived from MIMO-OFDM symbol SIG-N by applying the following permutation on the subcarrier indices (as described in subclause 20.3.2.4) of the OFDM data symbols composing SIG-N:

- For 20Mhz data transmissions: With SIG-N=(0, s(1), s(2) …, s(28), 0, …, 0, s(-28), s(-27), …, s(-1)), ER-SIG-N is specified as ER-SIG-N=(0, s(-28), s(-27), …, s(-1), 0, …, 0, s(1), s(2) …, s(28));

- For 40Mhz data transmissions: With SIG-N=(0, 0, 0, s(3), s(4) …, s(58), 0, …, 0, s(-58), s(-57), …, s(-3), 0, 0), ER-SIG-N is specified as ER-SIG-N=(0, 0, 0, s(-58), s(-57), …,s(-3), 0, …, 0, s(3), s(2) …, s(58), 0, 0).”

(SONY-1006, 69.) A POSITA would have understood that July 2005 WWiSE’s frequency permutation would be accomplished by changing the order of the bits fed into the IFFT for repeated ER-SIG-N, changing the modulation order. (SONY-1003, ¶¶186, 255-256.) As set forth in July 2005 WWiSE, for 20 MHz, the bits mapped to subcarrier s(1) for SIG-N are mapped to subcarrier s(-28) for ER-SIG-N, the bits mapped to subcarrier s(2) for SIG-N are mapped to subcarrier s(-27), and so on. A similar permutation is applied to the 40MHz transmission. (SONY-1003, ¶¶187, 257.) Notably, PO argued in its infringement contentions that applying a frequency permutation based on changing the order of bit using interleaving, meets this limitation: "The purpose of the interleaver … is to process OFDM symbols such that adjacent bits are not associated with a single subcarrier or adjacent subcarriers. Instead, adjacent bits are permuted onto non-adjacent subcarriers and onto more or less significant bits, i.e., reordered." (SONY-1032, Appx. B, 45.) The infringement contentions are consistent with type of frequency permutation described in July 2005 WWiSE—changing the order of bits fed into the IFFT to change the modulation order. (SONY-1003, ¶188.)

The combination of Hansen and July 2005 WWiSE therefore discloses limitations [1L]/[1M]/[11K]/[11L] according to the sole embodiment described in the specification relating to "different ordering" and in the same manner as alleged by the PO in the co-pending district court litigation. (SONY-1003, ¶¶184-189, 253-258.)

C. Dependent Claims

1. Claims 2, 3, 8, 11, 12, 13, 18, 19

Claims 2 and 8 recite the intended result that "*transmission of the same header bits in the second OFDM symbol provides diversity to increase a likelihood of correctly communicating header information of the second packet type*" and claims 3 and 9 recite the intended result that "*transmission of the same header bits in the fourth OFDM symbol provides diversity to increase a likelihood of correctly communicating header information of the second packet type.*" Claims 12, 13, 18, and 19 recite similar limitations, but in the context of reception. The wherein clauses of these claims should not be afforded any patentable weight because each merely recites the intended result of the recited function. For this reason, claims 2, 3, 8, 11, 12, 13, 18, and 19 are obvious for the same reasons as independent claims 1 and 11.

The combination of Hansen and July 2005 WWiSE also discloses the subject matter of these claims. (SONY-1003, ¶¶259-263.) Diversity is a common technique that improves performance over fading channels by ensuring information symbols pass through multiple signal paths, each of which fades independently. (SONY-1024, 59; SONY-1025,130-131; SONY-1003, ¶260.) This technique "mak[es] sure that reliable communication is possible as long as one of the paths is strong." (SONY-1024, 59; SONY-1025, 130-131.) Diversity can be achieved over time (through channel coding or interleaving), over frequency (if the channel is frequency-selective), or over space (by using multiple transmit and/or receive antennas that are spaced sufficiently apart). (*Id.*) A simple mechanism for achieving time diversity uses repetition coding—repeating the same bits in multiple symbols. (SONY-1024, 59; SONY-1003, ¶260.)

As explained above, the ER greenfield PPDU of the combination of Hansen and July 2005 WWiSE repeats the HT-SIG1 and HT-SIG2 parts of the Signal*-N field, providing temporal diversity, thereby increasing the likelihood of correctly communicating the repeated header information. (SONY-1003, ¶261.) The ER greenfield PPDU further applies a frequency permutation to the repeated parts of Signal-N field (ER-HT-SIG1 and ER-HT-SIG2) providing frequency diversity and increasing the likelihood of correctly communicating the repeated header information. (SONY-1003, ¶261, *citing* SONY-1030, 21.)

Because the combination of Hansen and July 2005 WWiSE provides HT-SIG1 header bits corresponding to the first OFDM symbol (HT-SIG1 symbol) and repeated HT-SIG1 header bits (ER-HT-SIG1 bits) correspond to the second OFDM symbol (ER-HT-SIG1 symbol) and a frequency permutation is applied to the ER-HT-SIG1 (second) OFDM symbol, the combination of Hansen and July 2005 WWiSE discloses [2]/[8]/[12]/[18]. (SONY-1003, ¶¶260-262.)

Because the combination of Hansen and July 2005 WWiSE provides HT-SIG2 header bits corresponding to the third OFDM symbol (HT-SIG1 symbol) and repeated HT-SIG2 header bits (ER-HT-SIG2 bits) correspond to the fourth OFDM symbol (ER-HT-SIG2 symbol) and a frequency permutation is applied to the ER-HT-SIG2 (fourth) OFDM symbol, the combination of Hansen and July 2005 WWiSE discloses [3]/[9]/[13]/[19]. (SONY-1003, ¶¶260-261, 263.)

2. Claims 5 and 15

Hansen describes a "system and method for compromise greenfield preambles for **802.11n**." (SONY-1005, ¶11; SONY-1005, ¶¶27, 29-32.) July 2005 WWiSE likewise describes a proposed enhancement to existing IEEE 802.11 Wi-Fi standards, for incorporation into the 802.11n standard. (SONY-1005, ¶¶9, 33; SONY-1006, 1.) Hansen's wireless transceiver further supports mixed mode access for interoperating with legacy devices that only support prior 802.11 standards such as 802.11a. (SONY-1005, ¶¶9, 32, 41, 61-62, 66, 111-112.) Thus, the combination of Hansen and July 2005 WWiSE discloses [5]/[15]. (SONY-1003, ¶265.)

3. Claims 7 and 17

The combination of Hansen and July 2005 WWiSE discloses [7A]/[17A] and [7B]/[17B]. (SONY-1003, ¶¶267-271.)

The systems of both Hansen and July 2005 WWiSE support channels having a bandwidth of 20 MHz and 40 MHz. (SONY-1005, ¶¶34-35; SONY-1006, 70:6-7 (Bandwidth parameter indicating either 20 MHz or 40 MHz).) Therefore, the 20 MHz or 40 MHz **bandwidth** (BW) field 494 included in Signal*-N of the NR greenfield PPDU and in Long Signal*-N of the ER greenfield PPDU "indicate[s] whether the PPDU was transmitted using a **20 MHz RF channel**, or a **40 MHz RF channel**." (SONY-1005, ¶68; SONY-1005, ¶¶67, 87, 97; §§V.B.2.a-b.)

An ER capable device that is also a 40Mz capable device transmits both ER greenfield PPDUs and NR greenfield PPDUs. (SONY-1006, 50:9-10; §V.B.2.a.) The ER device determines whether to transmit on the 20 MHz channel or the 40 MHz channel depending on the needed transmission range and the nature of the receiving device. (SONY-1003, ¶269.) A POSITA would have been motivated to transmit the NR greenfield PPDU ("*first packet type*") on the 40 MHz bandwidth to use the largest bandwidth for the highest throughput. (SONY-1003, ¶270.) A POSITA would have also understood, however, that extending range often involves using lower throughput methods, including narrower channels. A POSITA would therefore have been motivated to transmit the ER greenfield PPDU ("*second packet type*") on the 20 MHz bandwidth because doing so would have allocated the available transmit power to a narrower frequency band, thereby increasing transmit power spectral density, thereby maximizing range. (SONY-1003, ¶270.)

Thus, the NR greenfield PPDU ("*first packet type*") in the combination of Hansen and July 2005 WWiSE "*is transmitted/received in a first channel bandwidth*" [7A]/[17A] (40 MHz) and the ER greenfield PPDU ("*second packet type*") in the combination of Hansen and July 2005 WWiSE "*is transmitted/received in a second channel bandwidth*" [7A]/[17A] (20 MHz). (SONY-1003, ¶271.) The combination of Hansen and July 2005 WWiSE further provides "*the first channel bandwidth is at least two times wider than the second channel bandwidth*" [7B]/[17B]. (*Id.*)

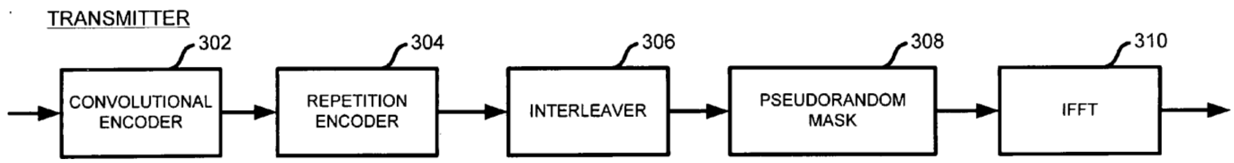
VI. GROUND 2: The combination of Hansen, July 2005 WWiSE, and Choi renders claims 1-3, 5, 7-9, 11-13, 15, and 17-19 obvious.

Petitioner established the combination of Hansen and July 2005 WWiSE renders claims 1-3, 5, 7-9, 11-13, 15, and 17-19 obvious. (§V.B.) Should PO contend the combination of Hansen and July 2005 WWiSE does not suggest limitations [1J] (the order of symbol generation for the second packet type) and [11I] (order of demodulation), these limitations are disclosed by Choi.

A. Overview and Motivation to Combine

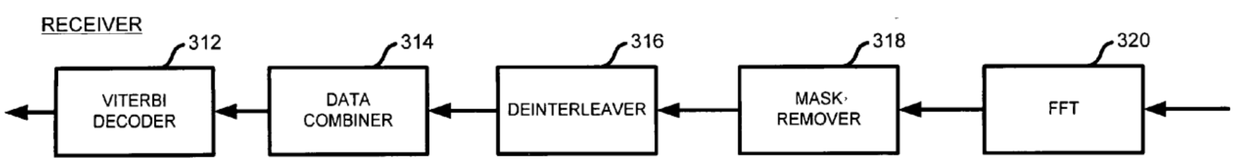
Choi is directed to "a repetition coding scheme for a wireless system." (SONY-1008, ¶1.) Choi explains that in a typical system "bits representing a set of data that is to be communicated are convolutionally encoded or otherwise transformed into values." (SONY-1008, ¶13.) The coded values are modulated and an OFDM symbol transmitted. (*Id*.) To provide extended range, "each value that is sent is repeated several times by the transmitter." (*Id*.) The values are also preferably "repeated in the frequency domain." (*Id*.)

In Choi's transmitter, illustrated in Figure 3A below, the repetition encoder is placed after the convolutional encoder and "before the input of an interleaver designed to handle repetition coded bits." (SONY-1008, ¶26.) The "[i]ncoming data is convolutionally encoded by the convolutional encoder 302." (*Id*.) The coded output "is repetition coded by repetition encoder 304", resulting in two copies of the coded bit sequence. (*Id*.) In Choi, repetition is performed on a part-by-part (symbol-by-symbol) basis, meaning that for post-coding/pre-modulation repetition, a coded block corresponding to a symbol is repeated. (SONY-1008, ¶18.) The repeated data is subsequently interleaved and modulated. (SONY-1008, Figure 3A.)



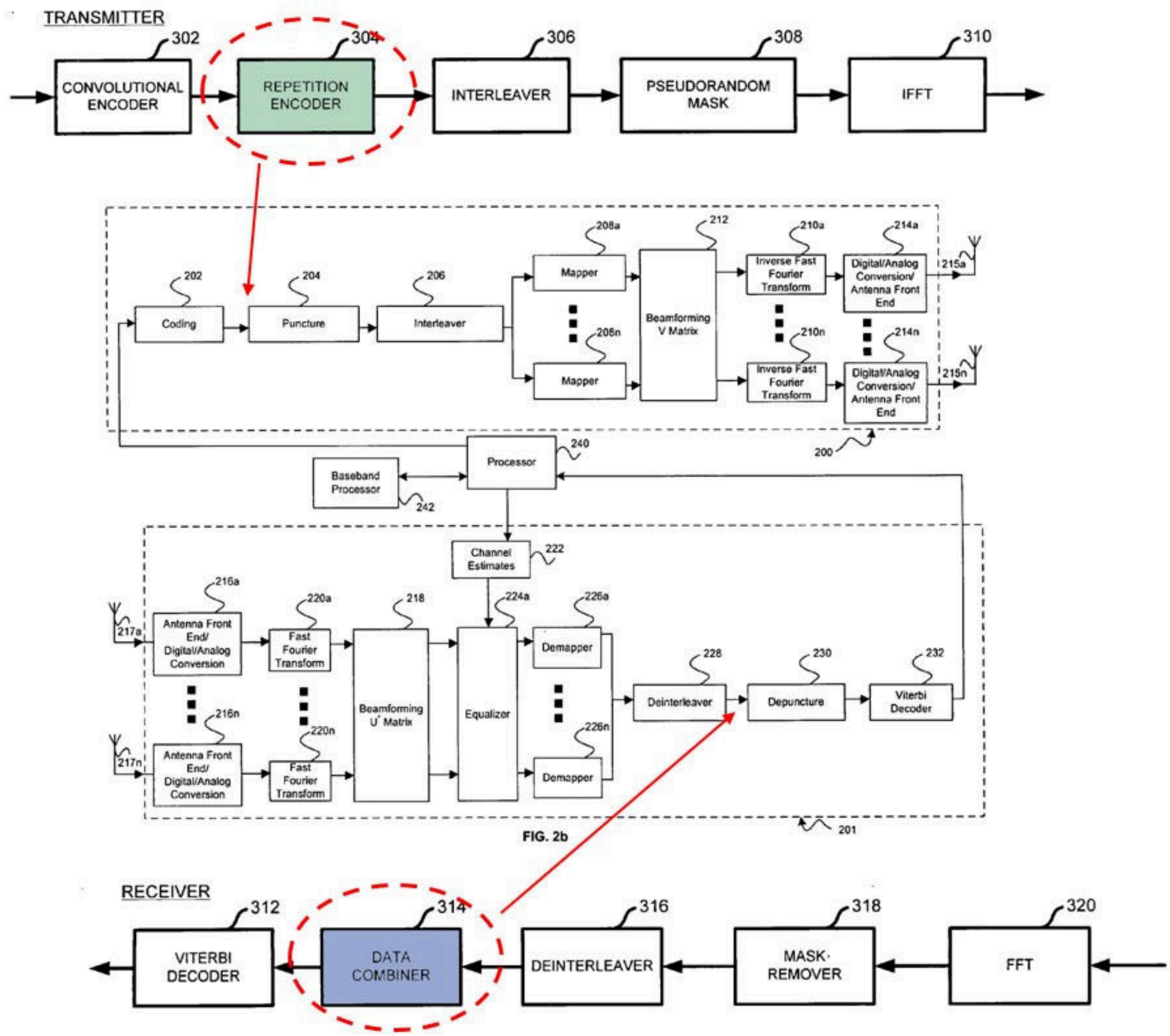
Choi, Figure 3A

The receiver system corresponding to the transmitter of Figure 3A is illustrated in Figure 3B below. In the receiver, the "received signal is processed by FFT processor 320." (SONY-1008, ¶27.) A deinterleaver 316 deinterleaves the data." (*Id.*) The data combiner 314 "combines the repetition encoded data into a stream of nonrepetitive data and "Viterbi decoder 312 determines the most likely sequence of data that was input to the transmission system originally." (*Id.*)



Choi, Figure 3B

A POSITA would have been motivated to combine Choi's repetition coding teachings with the combined system of Hansen and July 2005 WWiSE. (SONY-1003, ¶¶280-283.) A POSITA would have been motivated to integrate a repetition encoder into the transmission portion of Hansen's transceiver and a data combiner 314 into the reception portion of Hansen's transceiver, as taught by Choi and illustrated below. (SONY-1003, ¶280.) Although Choi teaches repetition of "data" generally, a POSITA would have understood that Choi's technique would be applicable to other fields carrying data such as the header. (SONY-1003, ¶280, *citing* SONY-1014, ¶83 (describing repetition of the header), SONY-1018, 51:1331-1358 (disclosing a repetition encoder for header field); SONY-1001, 1:57-59 (admitting the G.9960 specification is prior art and "should be familiar to those skilled in the art").)



Choi, Annotated Figure 3A (top); Hansen, Annotated Figure 2B (middle), Choi, Annotated Figure 3B (bottom)

A POSITA would have been motivated to combine Hansen, July 2005 WWiSE, and Choi because July 2005 WWiSE sets forth specifications for including repeating a header field in its PPDUs but does not provide details regarding how to implement such repetition in the transmission or reception portions of a transceiver. (SONY-1003, ¶281.) Further, the header repetition of July 2005 WWiSE occurs before the IFFTs (pre-modulation) in the transmission chain because a frequency permutation is applied to the repeated version of the header. (SONY-1006, 69) Additionally, as discussed above, a POSITA would have been motivated to perform repetition post-coding in the combination of Hansen and July 2005 WWiSE for efficiency reasons. A POSITA would have therefore been motivated to search for references disclosing repetition coding post-coding/pre-modulation and would have been led to Choi because Choi is in the same field of endeavor as the ’272 patent, Hansen, and July 2005 WWiSE—wireless transmission using OFDM. (SONY-1003, ¶281.)

Choi also expressly motivates the combination. (SONY-1003, ¶282.) First, Choi discloses that its disclosures are applicable to IEEE 802.11 standards, including 802.11a, b, g, and a/g. (SONY-1008, ¶¶2, 17.) Second, Choi explicitly suggests the use of its repetition coding in systems having extended range capabilities, such as the system in the combination of Hansen and July 2005 WWiSE. (SONY-1008, ¶¶2, 15; SONY-1003, ¶282.) Third, Choi teaches that its repetition coding is beneficial for communication “in noisy environments”, which is a common concern for WLAN systems.

(SONY-1008, ¶2; SONY-1003, ¶282.) Each of these suggestions would have motivated a POSITA to combine Choi's repetition coding with Hansen and July 2005 WWiSE.

Additionally, the combination is simply the combination of prior art elements (Hansen's "compromise" greenfield PPDU, WWiSE's ER capabilities, and Choi's repetition encoding) according to known methods to yield predictable results. (SONY-1003, ¶283.) The combination integrates Choi's repetition encoder in the transmission chain after coding and prior to interleaving. (SONY-1003, ¶283.) A POSITA would have understood how to integrate the repetition encoder in the transmission chain because transceiver design includes and incorporates the integration of other components such as puncturing between the coder and interleaver. (SONY-1003, ¶283.) The results of the combination would have been predictable and there would be a reasonable expectation of success in the combination because post-coding repetition encoders were proposed in other standards including G.9960. (*Id.*; SONY-1018, 51:1331-1358 (disclosing a repetition encoder for header field).)

B. Independent Claims 1 and 11

The combination of Hansen, July 2005 WWiSE, and Choi discloses [1J] and [11I]. (SONY-1003, ¶¶284-289.)

In the combination, coding block 202 receives the Signal*-N header bits, representing the "*first set of header bits*" (HT-SIG1) in the "*first part of the second header field*" and the "*third set of header bits*" (HT-SIG2) in the "*third part of the second header field.*" The output of coding block 202 is the coded HT-SIG1 followed by the coded HT-SIG2. As discussed above, coded HT-SIG1 corresponds to the HT-SIG1 header bits and the transmitted HT-SIG1 symbol and coded HT-SIG2 corresponds to the HT-SIG2 header bits and the transmitted HT-SIG2 symbol.

The coded HT-SIG1, output first, is provided to the repetition encoder where it is duplicated to generate a second instance of coded HT-SIG1. (SONY-1008, ¶¶26, 18 (repetition applied to a coded block corresponding to an OFDM symbol).) The coded HT-SIG2 is next provided to the repetition encoder where it is duplicated to generate a second instance of coded HT-SIG2. (SONY-1008, ¶26.) The coded and repeated blocks sequentially traverse the transmission chain, resulting in the following order of symbol generation: HT-SIG1 symbol, ER-HT-SIG1 symbol, HT-SIG2 symbol, and ER-HT-SIG2 symbol. (SONY-1008, ¶26.)

Thus, the "*encoder and [] modulator*" in the combination of Hansen, July 2005 WWiSE, and Choi generates "*a first OFDM symbol followed by a second OFDM symbol followed by a third OFDM symbol followed by a fourth OFDM symbol*" [1J] and the "*demodulator*" demodulates the same

[11I]. (SONY-1003, ¶¶285-289.)

The combination of Hansen, July 2005 WWiSE, and Choi disclose the remaining limitations of independent claims 1 and 11 for the reasons discussed in §V.B.

Thus, the combination of Hansen, July 2005 WWiSE, and Choi renders independent claims 1 and 11 obvious.

C. Dependent Claims

For the reasons discussed in §V.C, the combination of Hansen, July 2005 WWiSE, and Choi renders claims 2, 3, 5, 7-9, 12, 13, 15, and 17-19 obvious.

VII. PAYMENT OF FEES

Petitioner authorizes charge of any fees to Deposit Account No. 06-1050.

VIII. CONCLUSION

Petitioner requests institution and cancellation of the challenged claims.

IX. Mandatory Notices

A. Real Party In Interest

The real parties in interest are Sony Interactive Entertainment Inc., Sony Interactive Entertainment LLC, Sony Group Corporation, Sony Corporation, Sony Corporation of America, and Sony Electronics Inc.

B. Related Matters

To the best of Petitioner's knowledge, the '272 patent is involved in or related to the following matters:

*AX Wireless, LLC v. Vantiva SA et al.,*1-25-cv-00934 (NDGA), filed February 21, 2025; *AX Wireless, LLC* v. *Sony Interactive Entertainment, Inc. et al.,* 4-25-cv-00175 (EDTX), filed February 20, 2025; *Certain Video Game Consoles, Routers and Gateways, and Components Thereof*; Inv. No. 337-TA-1445 (Violation), 337-TA-1445 (ITC), filed February 19, 2025; *Dell Inc. et al.* v. *AX Wireless LLC,* IPR2024-00682 (PTAB), filed March 14, 2024; *Intel Corporation* v. *AX Wireless LLC,* IPR2023-01140 (PTAB), filed July 01, 2023; *Intel Corporation* v. *AX Wireless LLC*, IPR2023-01139 (PTAB), filed June 30, 2023; *AX Wireless LLC* v. *Acer Inc*., 2-23-cv-00041 (EDTX), filed February 02, 2023; *AX Wireless LLC* v. *Dell Inc*. et al., 2-22-cv-00277 (EDTX), filed July 22, 2022; *AX Wireless LLC* v. *HP Inc*., 2-22-cv-00279 (EDTX), filed July 22, 2022; *AX Wireless*

LLC v. *Lenovo Group Limited*, 2-22-cv-00280 (EDTX), filed July 22, 2022.

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), Sony appoints the following lead and backup counsel.

Lead Counsel	Backup counsel
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D. Service Information

Please address all correspondence and service to the address listed above. Petitioner consents to electronic service by email at IPR57633-0002IP1@fr.com.

Respectfully submitted,

Dated May 30, 2025

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APPENDIX - ACRONYM LIST

Acronym	Expansion
BCC	Binary Convolutional Coding
BW	Bandwidth
CBPS	Coded Bits Per Symbol
CRC	Cyclic Redundancy Check
DAC	Digital/Analog Conversion
DBPS	Data Bits Per Symbol
DSSS	Direct-Sequence Spread-Spectrum
EHI	Extended Header Indication
ER	Extended Range
FEC	Forward Error Correction
FHSS	Frequency-Hopping Spread Spectrum
GI	Guard Interval
HT-LTF	High-Throughput Long Training Field
HT-SIG	High-Throughput Signal Field
HT-STF	High-Throughput Short Training Field
IEEE	Institute of Electrical and Electronics Engineers
IFFT	Inverse Fast Fourier Transform
IP	Internet Protocol
IREHI	Immediate Response Frame Extended Header Indication
ITU	International Telecommunication Union
ITU-T	ITU Telecommunication Standardization Sector
LAN	Local Area Network
LLC	Logical Link Control
MAC	Media Access Control
MCS	Modulation and Coding Scheme
MIMO	Multiple Input Multiple Output
MPDU	MAC Protocol Data Unit
NR	Normal Range
OFDM	Orthogonal Frequency Division Multiplexing
OSI	Open Systems Interconnection Model
PCS	Physical Coding Sub-layer
PHY	Physical Layer
PLCP	Physical Layer Convergence Protocol
PMA	Physical Medium Attachment
PMD	Physical Medium Dependent

PPDU	Physical Layer Protocol Data Unit
PSDU	PLCP Service Data Unit
RF	Radio Frequency
RX	Receiver
TCP	Transmission Control Protocol
TGn	IEEE 802.11n Task Group
TX	Transmitter
UDP	User Datagram Protocol
WLAN	Wireless Local Area Network
WWiSE	World-Wide Spectrum Efficiency

CERTIFICATION UNDER 37 CFR § 42.24

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for *Inter partes* Review totals 13,858 words, which is less than the 14,000 allowed under 37 CFR § 42.24.

Dated May 30, 2025

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§ 42.6(e)(4)(i) *et seq.* and 42.105(b), the undersigned certifies that on May 30, 2025, a complete and entire copy of this Petition for *Inter partes* Review, Power of Attorney, and all supporting exhibits were provided via Federal Express, to the Patent Owner by serving the correspondence address of record as follows:

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