

**UNITED STATES PATENT AND TRADEMARK OFFICE**

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**BEFORE THE PATENT TRIAL AND APPEAL BOARD**

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INTEL CORPORATION,  
Petitioner

v.

AX Wireless  
Patent Owner.

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IPR2023-01135  
U.S. Patent 9,973,361

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**PETITION FOR *INTER PARTES* REVIEW  
OF U.S. PATENT 9,973,361**

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## TABLE OF CONTENTS

|      |                                                                                                            |    |
|------|------------------------------------------------------------------------------------------------------------|----|
| I.   | INTRODUCTION .....                                                                                         | 1  |
| II.  | GROUND FOR STANDING.....                                                                                   | 1  |
| III. | IDENTIFICATION OF CHALLENGE .....                                                                          | 1  |
|      | A. Prior Art .....                                                                                         | 1  |
|      | B. Grounds For Challenge .....                                                                             | 4  |
| IV.  | '361 PATENT OVERVIEW .....                                                                                 | 4  |
|      | A. Level Of Ordinary Skill In The Art .....                                                                | 9  |
|      | B. Claim Construction .....                                                                                | 9  |
| V.   | GROUND 1: COMBINATION OF HANSEN AND JULY 2005<br>WWISE RENDERS CLAIMS 1-3, 5, 7-11, AND 13<br>OBVIOUS..... | 9  |
|      | A. Combination Overview .....                                                                              | 9  |
|      | 1. Hansen.....                                                                                             | 9  |
|      | a. TGn Sync Proposal .....                                                                                 | 11 |
|      | b. January 2005 WWiSE Proposal .....                                                                       | 13 |
|      | c. Hansen's Greenfield PPDU .....                                                                          | 14 |
|      | 2. July 2005 WWiSE.....                                                                                    | 15 |
|      | 3. Motivation to Combine.....                                                                              | 18 |
|      | B. Independent Claim 1 .....                                                                               | 25 |
|      | 1. Preamble.....                                                                                           | 26 |
|      | 2. " <i>Packet Type</i> " Limitations.....                                                                 | 28 |
|      | a. " <i>First Packet Type</i> " .....                                                                      | 29 |
|      | b. " <i>Second Packet Type</i> ".....                                                                      | 32 |
|      | 3. Transmission Components.....                                                                            | 36 |
|      | a. " <i>Encoder and [] Modulator</i> " Limitations .....                                                   | 37 |
|      | (i) " <i>Operable to Generate</i> " OFDM Symbols .....                                                     | 38 |

# TABLE OF CONTENTS (continued)

|                                                                                                                           | Page |
|---------------------------------------------------------------------------------------------------------------------------|------|
| (a) “Encoder”                                                                                                             | 39   |
| (b) “Modulator”                                                                                                           | 42   |
| (ii) “First Packet Type” - Ordering .....                                                                                 | 43   |
| (iii) “Second Packet Type” - Symbol Ordering.....                                                                         | 47   |
| b. “Wireless OFDM Communications Transmitter”<br>Limitations .....                                                        | 54   |
| c. “Transmi[ssion] in a Different Order” Limitations<br>[1L]/[1M] .....                                                   | 59   |
| C. Independent Claim 9 .....                                                                                              | 62   |
| D. Dependent Claims .....                                                                                                 | 65   |
| 1. Claims 2, 3, 10, 11 .....                                                                                              | 65   |
| 2. Claims 5, 13 .....                                                                                                     | 68   |
| 3. Claims 7 and 8 .....                                                                                                   | 68   |
| VI. GROUND 2: THE COMBINATION OF HANSEN, JULY 2005<br>WWISE, AND CHOI RENDERS CLAIMS 1-3, 5, 7-11, AND<br>13 OBVIOUS..... | 70   |
| A. Overview and Motivation to Combine .....                                                                               | 70   |
| B. Independent Claim 1 .....                                                                                              | 74   |
| C. Independent Claim 9 .....                                                                                              | 75   |
| D. Dependent Claims .....                                                                                                 | 76   |
| VII. DISCRETIONARY DENIAL IS NOT APPROPRIATE. ....                                                                        | 76   |
| VIII. MANDATORY NOTICES .....                                                                                             | 77   |
| A. Real Party In Interest.....                                                                                            | 77   |
| B. Related Matters .....                                                                                                  | 77   |
| C. Notice Of Counsel And Service Information.....                                                                         | 78   |
| IX. CONCLUSION.....                                                                                                       | 79   |

**EXHIBIT LIST**

| <b>Exhibit</b> | <b>Reference</b>                                                                                                                                                                                                                                                 |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1001           | U.S. Patent 9,973,361                                                                                                                                                                                                                                            |
| 1002           | File History of the '361 patent                                                                                                                                                                                                                                  |
| 1003           | Declaration of Thomas LaPorta, Ph.D. in Support of <i>Inter Partes</i> Review of U.S. Patent 9,973,361                                                                                                                                                           |
| 1004           | Curriculum Vitae of Dr. Thomas LaPorta                                                                                                                                                                                                                           |
| 1005           | U.S. Patent Publication 2006/0182017 to Hansen, et al (“Hansen”)                                                                                                                                                                                                 |
| 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”)                                                                                    |
| 1007           | Declaration of James L. Lansford, Ph.D.                                                                                                                                                                                                                          |
| 1008           | U.S. Patent Publication 2005/0243774 to Choi, et al (“Choi”)                                                                                                                                                                                                     |
| 1009           | U.S. Provisional Application 61/235,909                                                                                                                                                                                                                          |
| 1010           | U.S. Patent 8,737,189 to Hansen, et al (“Hansen Patent”)                                                                                                                                                                                                         |
| 1011           | U.S. Provisional Application 60/653,429 (“Hansen Provisional”)                                                                                                                                                                                                   |
| 1012           | IEEE 802.11-04/0889r3, “TGn Sync Proposal Technical Specification” to Mujtaba, uploaded and publicly available on January 20, 2005                                                                                                                               |
| 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”)                                                                            |
| 1014           | U.S. Patent Publication 2007/0115802 to Yu (“Yu”)                                                                                                                                                                                                                |
| 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”)                                                        |
| 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 |

| Exhibit | Reference                                                                                                                                                                                                        |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | Physical Layer in the 5 GHz Band, date of publication December 30, 1999                                                                                                                                          |
| 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”)                                 |
| 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 ’361 patent               |
| 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 ’361 patent                                                            |
| 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 ’361 patent                           |
| 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 <i>Xplore</i> May 8, 2006 |
| 1022    | Van Nee, et al., “OFDM for Wireless Multimedia Communications”, Artech House Publishers (2000)                                                                                                                   |
| 1023    | Bahai, et al., “Multi-Carrier Digital Communications Theory and Applications of OFDM”, Springer (2004)                                                                                                           |
| 1024    | Tse, et al., “Fundamentals of Wireless Communication”, Cambridge University (2005)                                                                                                                               |
| 1025    | Heiskala, et al., “OFDM Wireless LANs: A Theoretical and Practical Guide”, Sams Publishing (2002)                                                                                                                |
| 1026    | RESERVED                                                                                                                                                                                                         |
| 1027    | Cox, “Stage Set for Compromise on IEEE High-Speed Wireless”, Network World (March 21, 2005)                                                                                                                      |
| 1028    | Reardon, “New Wi-Fi Standard Takes the Slow Road”, CNET (May 20, 2005)                                                                                                                                           |
| 1029    | Mujtaba, et al., IEEE 802.11-05/786r0, “TGn Sync, WWiSE, and                                                                                                                                                     |

| Exhibit | Reference                                                                                                                                                                                                                                                                                                                                                                          |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | Mitmot Closing Report”, presentation submission, submitted and publicly available on July 21, 2005.                                                                                                                                                                                                                                                                                |
| 1030    | Coffey, IEEE 802.11-05/0737r0, “WWiSE IEEE 802.11n Proposal”, presentation submission, submitted and publicly available on July 9, 2005                                                                                                                                                                                                                                            |
| 1031    | Gast, “802.11 Wireless Networks: The Definitive Guide”, O’Reilly (2002)                                                                                                                                                                                                                                                                                                            |
| 1032    | Infringement Contents with Appendices served in <i>AX Wireless LLC v. Dell Inc. et al.</i> , and <i>AX Wireless LLC v. HP Inc.</i> , U.S. District Court Eastern District of Texas, Case Numbers 2:22-cv-00277 and 2:22-cv-00279, November 3, 2022                                                                                                                                 |
| 1033    | U.S. Patent 7,415,074 (Appendix C to INTEL-1007)                                                                                                                                                                                                                                                                                                                                   |
| 1034    | Stephens, “802.11 ‘Decrypted’”, ACM SIGCOMM Computer Communication Review, Vol. 35, No. 2 (April 2005) (Appendix D to Lansford Declaration, INTEL-1007).                                                                                                                                                                                                                           |
| 1035    | Kay, “Sidebar: The Battle for 11n”, ComputerWorld (March 13, 2006)                                                                                                                                                                                                                                                                                                                 |
| 1036    | “‘WWiSE’ Consortium, Motorola Team on Proposal for IEEE 802.11n”, Wireless Design Online (February 24, 2005)                                                                                                                                                                                                                                                                       |
| 1037    | WWiSE Industry Organization Press Release, “‘WWiSE’ Consortium and Motorola Team to Offer Enhanced Proposal for IEEE 802.11n” (February 24, 2005); <i>archived</i> on April 6, 2005 at <a href="https://web.archive.org/web/20050406073808/http://www.wwise.org/pressreleasefeb23.htm">https://web.archive.org/web/20050406073808/http://www.wwise.org/pressreleasefeb23.htm</a> . |
| 1038    | IEEE 802.11-04/422r4, “New Participant Orientation”, presentation submission (July 2004) (Appendix A to Lansford Declaration, INTEL-1007)                                                                                                                                                                                                                                          |
| 1039    | IEEE 802.11-04/736r1, “Approved Minutes of the IEEE P802.11 Full Working Group”, Minutes (July 2004) (Appendix B to Lansford Declaration, INTEL-1007)                                                                                                                                                                                                                              |

## **I. Introduction**

Intel Corporation (“Intel” or “Petitioner”) petitions for *inter partes* review (“IPR”) of U.S. Patent 9,973,361 (“the ’361 patent”; INTEL-1001) claims 1-3, 5, 7-11, and 13.

## **II. Grounds For Standing**

Intel certifies the ’361 patent is available for IPR, and Intel is not barred or estopped from requesting IPR.

## **III. Identification Of Challenge**

### **A. Prior Art**

The ’361 patent claims priority through a series of continuations to U.S. Patent 9,584,262, filed August 20, 2010. The ’361 patent also claims benefit to Provisional Application 61/235,909, filed August 21, 2009 (“’361 Provisional”; INTEL-1009). Petitioner does not agree the ’361 patent is entitled to priority to any of these prior applications. Regardless, each reference was published or issued prior to August 21, 2009.

1. **U.S. Patent Publication 2006/0182017 to Hansen, et al** (“Hansen”; INTEL-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”; INTEL-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. (*See* INTEL-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. (INTEL-1007, ¶15.) Members made these submissions through the IEEE 802 Wireless World website, <http://802wirelessworld.com>. (INTEL-1007, ¶16; INTEL-1038, 35-37; INTEL-1039 (July Meeting Minutes), 5.)

All submissions were accessible to the public after free registration through the Wireless World website. (INTEL-1007, ¶18; INTEL-1038 , 25-30.) After creating an account, an individual could view the “Working Group Document Listing” and download submissions that had been uploaded. (INTEL-1038, 35; INTEL-1007, ¶18.) Submissions were publicly available to the public via FTP at <ftp.wirelessworld.com>. (INTEL-1007, ¶19; INTEL-1038, 35 .) The FTP server’s address and login credentials were publicly available. (INTEL-1007, ¶19, *citing* INTEL-1033 and INTEL-1034)).

In mid-2007, the IEEE’s current Mentor website (“Mentor”) replaced the Wireless World website. (INTEL-1007, ¶21.) Prior submissions uploaded to the Wireless World server were added to Mentor shortly after its creation. (INTEL-1007, ¶21.) The uploaded documents retained their original submission upload

dates. (INTEL-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. (INTEL-1007, ¶21.) Entries in Mentor were and remain searchable by year, task group, title, or other parameters. (INTEL-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. (INTEL-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. (INTEL-1007, ¶¶18-18, 21, 24.) Interested members of the public would have been aware of the proposals made to IEEE by WWiSE because they were frequently discussed in 2004 and 2005 in industry publications. (*See, e.g.*, INTEL-1021, INTEL-1027, INTEL-1035; INTEL-1036; INTEL-1037.)

For at least these reasons, July 2005 WWiSE was publicly accessible prior to the earliest possible priority date of the '361 patent to a person of ordinary skill in the art ("POSITA") exercising reasonable diligence. *See GoPro, Inc. v. Contour IP Holding LLC*, 908 F.3d 690, 693 (Fed. Cir. 2018).

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

None of the applied references were cited or discussed during prosecution of the '361 patent or cited or discussed during prosecution in any of patents to which the '361 patent claims priority, weighing heavily against discretionary denial under 35 U.S.C. §325(d).

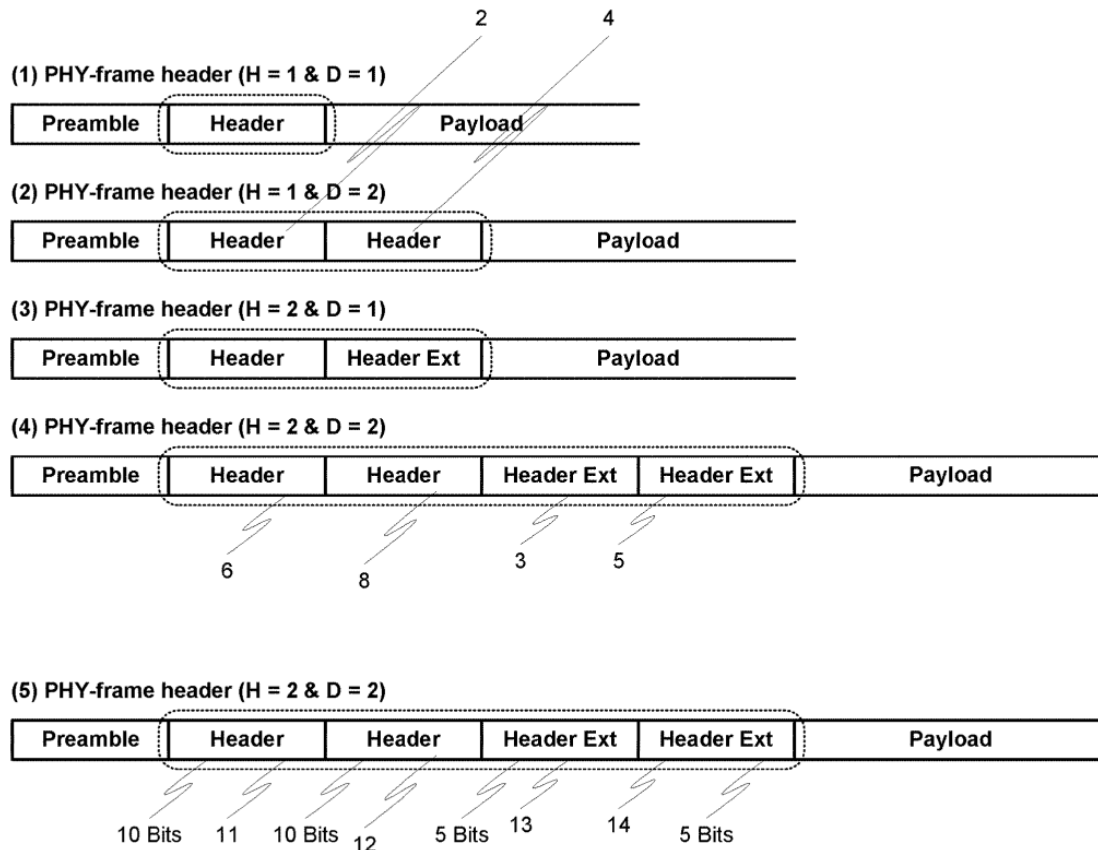
#### **B. Grounds For Challenge**

| <b>Ground</b> |     | <b>Claims</b>    | <b>Prior Art</b>                  |
|---------------|-----|------------------|-----------------------------------|
| 1             | 103 | 1-3, 5, 7-11, 13 | Hansen and July 2005 WWiSE        |
| 2             | 103 | 1-3, 5, 7-11, 13 | Hansen, July 2005 WWiSE, and Choi |

#### **IV. '361 Patent Overview**

The '361 patent is “directed toward header repetition in a communications environment.” (INTEL-1001, 1:25-28.) The '361 patent describes four different header configurations, illustrated in Figure 1. The value of D in Figure 1 corresponds to the number of header repetitions 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.” (INTEL-1001, 5:47-49.) 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. (INTEL-1001, 5:49-51.) This

“repeated header” example includes a “two-part” header field with each part carrying the same information. (INTEL-1001, 5:51-53.)



**'361 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. (INTEL-1001, 5:53-55.) This “extended header” example is also a “two-part” header field but in this example the two parts carry **different** information. (See, e.g., INTEL-1001, 5:61-63.) 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. (INTEL-1001, 5:55-58.) This “repeated, extended header” example 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. (INTEL-1001, 5:61-63.) 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)”). (INTEL-1002 (NOA), 3.)

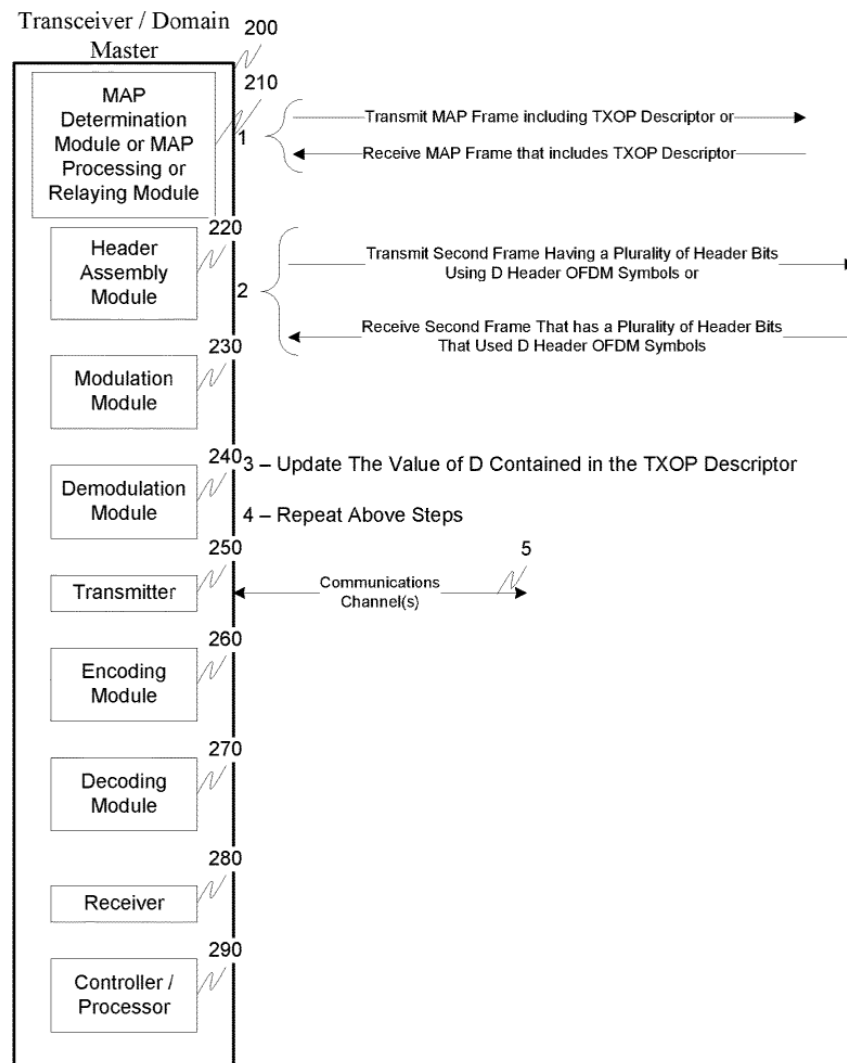
The extended and/or repeated headers of the ’361 patent can be used in communications systems such as ITU G.9960 (G.hn) and IEEE 802.11 that use “frame-based (or packet-based) transmission to communication [sic] between two or more users over a shared channel based on Orthogonal Frequency Division Multiplexing (OFDM<sup>1</sup>).” (INTEL-1001, 1:32-41; *see also*, INTEL-1001, 4:29-46.) The ’361 patent acknowledges that, before its earliest possible priority date, G.9960 “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.” (INTEL-1001, 2:13-16; *See also*, INTEL-1001, 1:51-53 (noting that G.9960 “should be familiar to those skilled in the art”).)

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<sup>1</sup> An acronym list is provided in Appendix B.

Thus, the '361 patent admits the existing ITU G.9960 standard supported two channel bandwidths—one at least two times wider than the other.

The generic transceiver 200 described for these systems includes header assembly module 220, modulation module 230, demodulation module 240, transmitter 250, encoding module 260, decoding module 270, receiver 280, and controller/processor 290. (INTEL-1001, 6:10-18; Figure 2 below.)



'361 patent, Figure 2

Applicant, Applied Transform, LLC, 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 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 admits in its provisional application. (*See* INTEL-1009, 21-22; INTEL-1019; INTEL-1029; INTEL-1003, ¶¶37.)

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 the earliest possible priority date of 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. (INTEL-1012, 133:7-134:2 (disclosing a 2 symbol (“extended”) header); INTEL-1006, 69:16-19, 67:1-69:17 (Figures 007-Figure 016, illustrating duplicate SIG-N header fields).)

The challenged claims of the ’361 patent therefore are more than co-opt ideas disclosed in standards submissions from other companies and wrap these ideas onto a broadly recited, yet extremely well-known, wireless OFDM transceiver architecture.

**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. (INTEL-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. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-16 (Fed. Cir. 2005) (en banc). Petitioner does not believe it is necessary for the Board to expressly construe any term for the purpose of this IPR proceeding. *See Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

**V. GROUND 1: Combination of Hansen and July 2005 WWiSE Renders Claims 1-3, 5, 7-11, and 13 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"; INTEL-1010). Hansen relates to "compromise greenfield preambles for 802.11n." (INTEL-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.” (INTEL-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). (INTEL-1011, ¶38; *see also*, INTEL-1005, ¶32, INTEL-1005, ¶¶1, 6 (incorporating Hansen Provisional by reference).) This “backward compatible” access is referred to as “mixed mode access.” (INTEL-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. (*See* INTEL-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. (INTEL-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. (*See* INTEL-1005, ¶27; *see, e.g.*, INTEL-1011, ¶55 (describing efficiency gain with greenfield); INTEL-1005, ¶¶1, 6.)

Two competing proposals emerged in TGn as “candidates for incorporation in IEEE 802.11n.” (INTEL-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.” (INTEL-1005, ¶33.) The second proposal, from the Worldwide Spectrum Efficiency (WWiSE) industry group, provided mechanisms to support both greenfield and mixed mode access. (See, e.g., INTEL-1006, 67:1-69:7 (depicting mixed mode and greenfield training structures).) Hansen sought to bridge the gap between these two competing proposals. (See, e.g., INTEL-1005, Title, ¶¶7, 11, 27.)

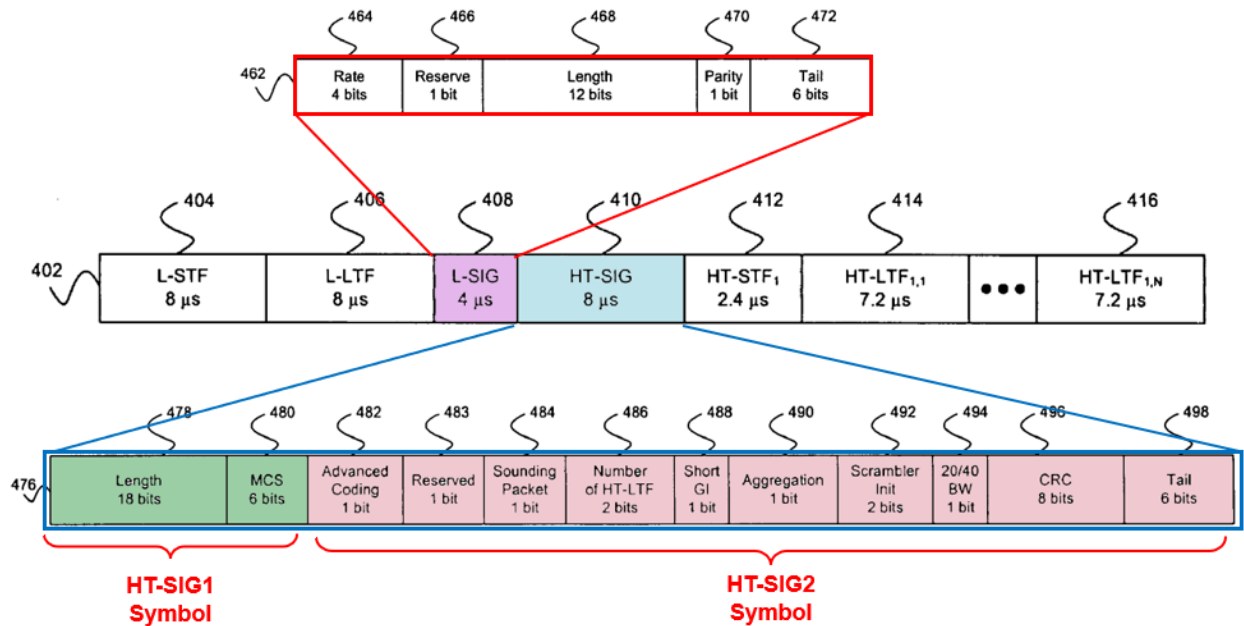
**a. TGn Sync Proposal<sup>2</sup>**

Hansen first describes the mixed mode physical protocol data unit (PPDU) preamble and header from the TGn Sync proposal. (See INTEL-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. (INTEL-1005, ¶61,

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<sup>2</sup> A copy of the January 2005 TGn Sync proposal forming the basis of Hansen’s discussion is provided as INTEL-1012. (See INTEL-1007, ¶31 (discussing the public availability of the January 2005 TGn Sync Proposal on January 20, 2005); INTEL-1003, ¶69.)

Figure 4a, *compare* INTEL-1012, 131:10-13, 121:1-2 (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). (INTEL-1005, ¶¶62, 66, *compare* INTEL-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). (See INTEL-1005, ¶¶62, 67 (HT-SIG header field “for mixed mode access in accordance with a TGn Sync proposal”); *compare* INTEL-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. (*See* INTEL-1005, ¶67; INTEL-1012, 134:1-2 .) The TGn Sync proposal refers to this part of the HT-SIG header field as HT-SIG1. (INTEL-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. (*See* INTEL-1005, ¶67; INTEL-1012, 134:1-2.) The TGn Sync proposal refers to this part of the HT-SIG header field as HT-SIG2. (INTEL-1012, 134:1-2.) Petitioner herein 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.

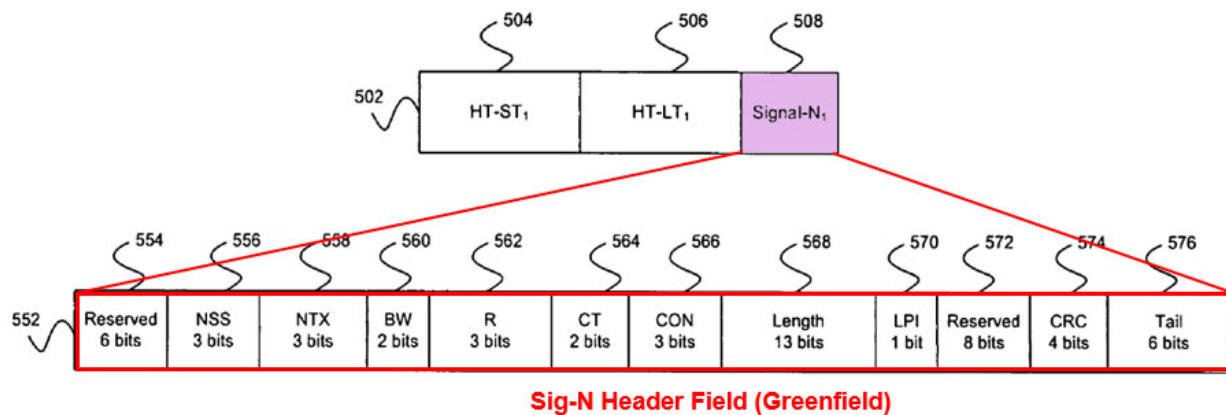
**b. January 2005 WWiSE Proposal<sup>3</sup>**

Unlike the TGn Sync proposal, the January 2005 WWiSE proposal referenced in Hansen includes PPDU's for both mixed mode and greenfield access. (*See, e.g.*, INTEL-1013, 50:16-52:7 (Figures 007-016).) The training and header

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<sup>3</sup> A copy of the WWiSE proposal by Hansen which forms the basis of Hansen's WWiSE discussion, is provided as INTEL-1013. (*See* INTEL-1007, ¶¶25-26; INTEL-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.

fields 502 for an exemplary January 2005 greenfield PPDU are illustrated in Figure 5a below (top) for a single spatial stream. (INTEL-1005, ¶¶77.) Training and header fields 502 include a Signal-N header field 508 (shaded pink), illustrated in Figure 5b below (bottom). (INTEL-1005, ¶¶77, 79, *compare* INTEL-1013, 50:16-18 (Figure 007), 53:8-10.)

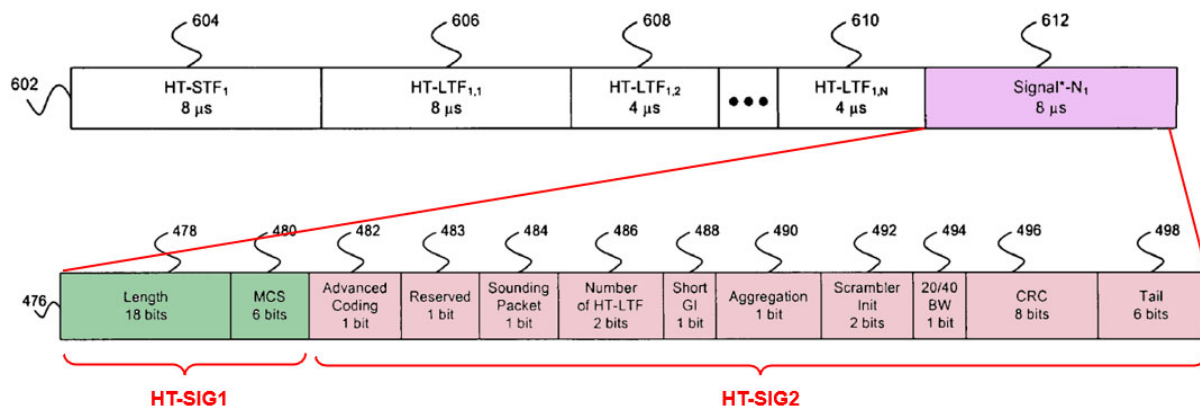


### Hansen, Excerpt for Annotated Figure 5a (top), Figure 5b (bottom)

#### 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* INTEL-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. (*See* INTEL-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. (*See* INTEL-1005, ¶¶87-

110.) Hansen's training and header fields include short and long training fields (HT-STF/HT-LTF) and a Signal\*-N<sub>1</sub> field 612 (shaded pink). (INTEL-1005, ¶87.) The Signal\*-N<sub>1</sub> 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. (INTEL-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 to the TGn working group by the WWiSE industry group building on the January 2005 proposal discussed in Hansen. (INTEL-1006, 1.) Specifically, July 2005 WWiSE adds an extended range (ER) capability for 802.11n compliant devices. (INTEL-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 (SIG-N), and data. (INTEL-1006, 58:17-19.)

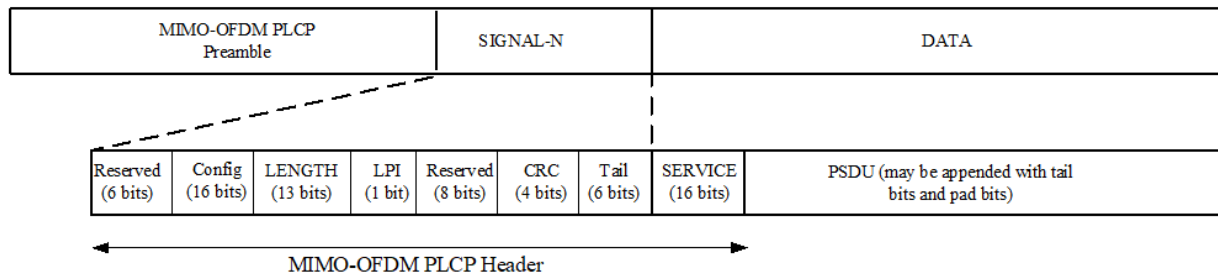


**Figure 001 – PPDU frame format: Greenfield access in the 1TX (40 MHz) and 2TX (20 and 40 MHz) modes**

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).” (INTEL-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. (INTEL-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.” (INTEL-1006, 69:16-18.) July 2005 WWiSE refers to this two-symbol SIG-N field as “the long SIG-N field format.” (INTEL-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.

(INTEL-1006, 68:1-2 (“optional **duplicate** SIG-N”, designated as ER-SIG-N); *see also*, Figures 007-016 (“optional duplicate SIG-N for extended range communication”).)

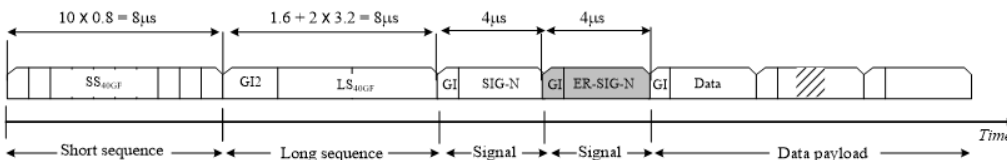


**Figure 011 – MIMO-OFDM Training structure for  $N_{TX}=1$ , 40 MHz, greenfield operation. The shaded field indicates the optional duplicate SIG-N for extended range communication.**

### July 2005 WWiSE, Figure 011

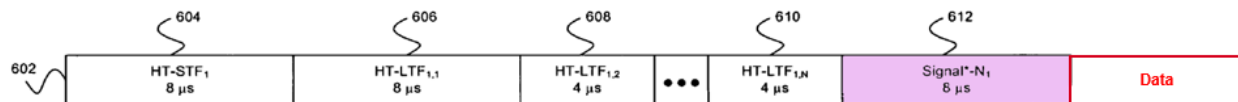
Additionally, July 2005 WWiSE applies a frequency permutation on the subcarrier indices of the OFDM data symbols composing SIG-N to derive the frequency domain OFDM symbol ER-SIG-N. (INTEL-1006, 69:18-25.)

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. (INTEL-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.” (INTEL-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.” (INTEL-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. (See INTEL-1006, 50:12-13; 70:6-7 (value 0 of REXT “indicates the standard configuration”).)

### 3. Motivation to Combine

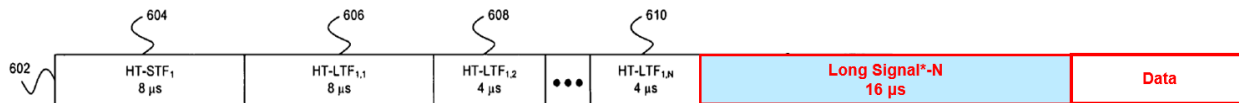
A POSITA would have been motivated to combine the teachings of Hansen with the teachings of July 2005 WWiSE. (INTEL-1003, ¶87.) Specifically, a POSITA would have been motivated to combine July 2005 WWiSE’s ER communication teachings (§V.A.2) with Hansen’s “compromise” greenfield PPDU (§V.A.1.c) to support both NR and ER capabilities in a single greenfield-compatible device. (INTEL-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 of Hansen and July 2005 WWiSE repeats the two parts of Hansen’s Signal\*-N header field, as taught by July 2005 WWiSE. (See, e.g., INTEL-1006, 69:16-18, 68:1-2; see also, Figures 007-016 (“optional duplicate SIG-N for extended range communication”).) 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. (See INTEL-1006, 50:9-10 (use of “long SIG-N” field for ER communication); INTEL-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 the device is operating in standard (NR) or ER mode. (See INTEL-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. (INTEL-1003, ¶90; *see also*, INTEL-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. (INTEL-1003, ¶91.) First, Hansen repeatedly suggests the combination. Hansen describes the earlier January 2005 WWiSE proposal and TGn Sync proposal submitted to TGn. (INTEL-1005, ¶33.) Hansen defined a compromise proposal based on aspects of both January 2005 WWiSE and the TGN Sync proposal. (INTEL-1005, Title (“Method and system for compromise greenfield preambles for 802.11n”), ¶¶7, 11, 27; *see also*, INTEL-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 the Hansen’s greenfield PPDU. (INTEL-1003, ¶91; *see also*, INTEL-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. (*See, e.g.*, INTEL-1027, 1; INTEL-1028, 1; INTEL-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. (INTEL-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.”

(INTEL-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. (INTEL-1003, ¶93, *citing* INTEL-1030, 21-22.) As the distance between transmitter and receiver increases, the communications channel is subjected to increased fading. (INTEL-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. (INTEL-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). (*See* §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. (INTEL-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. (INTEL-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. (INTEL-1003, ¶94; *see, e.g.*, INTEL-1014, ¶80 (“repetition of the OFDM symbol and a diversity effect due to the subcarrier allocation may be achieved, the transmission speed may be reduced by half, **but a service radius may be increased to 50% to 100%**”).)

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 PPDU) in the same way (providing ER capability). *See KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 415-421 (2007). 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). (INTEL-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. (INTEL-1003, ¶95; *compare* INTEL-1005, Figure 5a *with* INTEL-1006, Figure 007.)

Fifth, the combination further merely combines prior art elements according to known methods. *See KSR*, 550 U.S. at 416. As explained above, the combination repeats the header field and uses a one-bit reserved sub-field to indicate whether ER operation is enabled. (INTEL-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. (INTEL-1003, ¶96.) For example, both Hansen and July 2005 WWiSE discuss modifications to the existing 802.11a PPDU, including the addition of fields. (INTEL-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. (INTEL-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. (INTEL-1003, ¶97.) Both Hansen and July 2005 WWiSE describe PPDU's for use in the 802.11n standard being developed by IEEE. (*See, e.g.* INTEL-1005, Figure 6a; INTEL-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. (INTEL-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. (INTEL-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 had a reasonable expectation that the combination would operate successfully. (INTEL-1003, ¶97.)

## B. Independent Claim 1

Claim 1<sup>4</sup> recites a “*first packet type*”<sup>5</sup> having a two-part header field and a “*second packet type*” having a four-part header field. Claim 1 further 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*.” For ease of discussion, Petitioner addresses the preamble and “*first*” and “*second packet types*” limitations first followed by the “*encoder and [] modulator*” and “*wireless OFDM communications transmitter*” limitations. The following table maps limitations to the section in which the limitation is discussed.

| Claim 1 | Section       |
|---------|---------------|
| [1P]    | §V.B.1        |
| [1A]    | §V.B.3.b      |
| [1B]    | §V.B.2.a      |
| [1C]    | §V.B.2.a      |
| [1D]    | §V.B.3.a.i-ii |
| [1E]    | §V.B.3.a.ii   |
| [1F]    | §V.B.3.b      |
| [1G]    | §V.B.3.b      |

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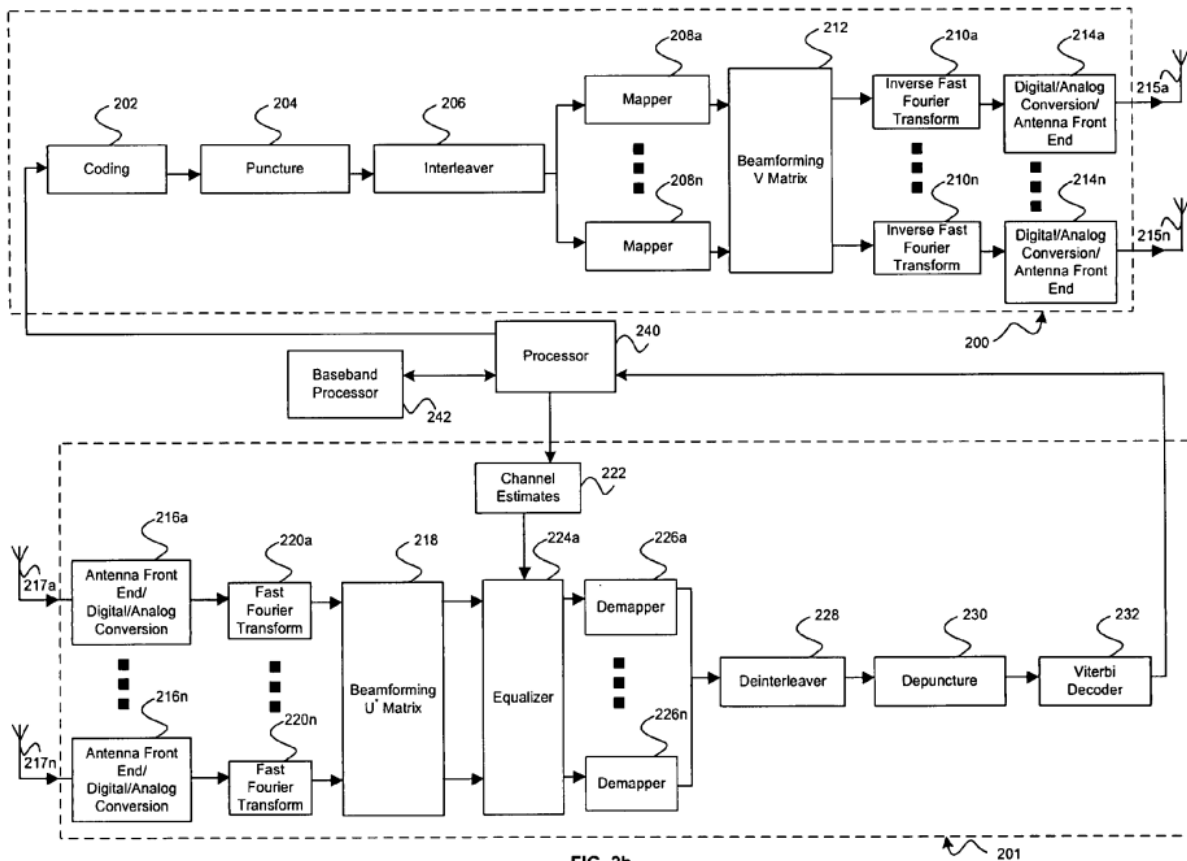
<sup>4</sup> A listing of claims is provided in Appendix A.

<sup>5</sup> Except in the tables, claim language is indicated herein by italics.

| Claim 1 | Section         |
|---------|-----------------|
| [1H]    | §V.B.2.b        |
| [1I]    | §V.B.2.b        |
| [1J]    | §V.B.3.a.i, iii |
| [1K]    | §V.B.3.a.iii    |
| [1L]    | §V.B.3.c        |
| [1M]    | §V.B.3.c        |
| [1N]    | §V.B.3.b        |
|         |                 |

## 1. Preamble

Petitioner does not acquiesce that the preamble is limiting. Regardless, the combination of Hansen and July 2005 WWiSE discloses a “*wireless OFDM (Orthogonal Frequency Division Multiplexing) transceiver*” [1P]. (INTEL-1003, ¶¶99.) Hansen discloses “**a transceiver** comprising a transmitter and a receiver in a MIMO system” that transmits and receives RF signals via an antenna. (INTEL-1005, ¶¶15, 49-50, Figure 2b below.)



Hansen, Figure 2b

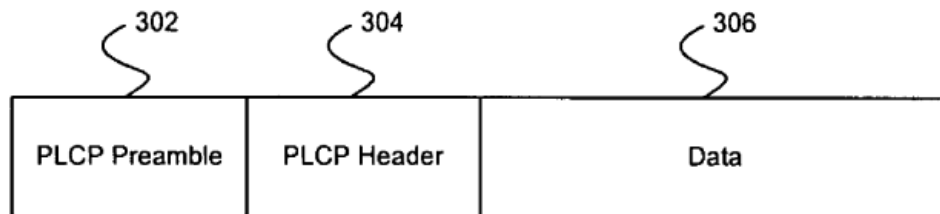
Transmitter portion 200 includes a “plurality of IFFT blocks 210a, ..., 210n” which “implement **orthogonal frequency division multiplexing (OFDM)**.” (See, e.g., INTEL-1005, ¶48 (IFFT blocks “generat[e] a composite OFDM signal”).) Receiver portion 201 includes a “plurality of FFT blocks 220a, ..., 220n” which demodulate received signals and mathematically integrate the demodulated signals “to extract n symbols contained **in each of the plurality of OFDM signals** received by the receiver 201.” (INTEL-1005, ¶51.) Because the transceiver generates OFDM signals and processes received OFDM signals, Hansen’s

transceiver is a “*wireless OFDM (Orthogonal Frequency Division Multiplexing) transceiver*” [1P]. (INTEL-1003, ¶¶99-101.)

## 2. “*Packet Type*” Limitations

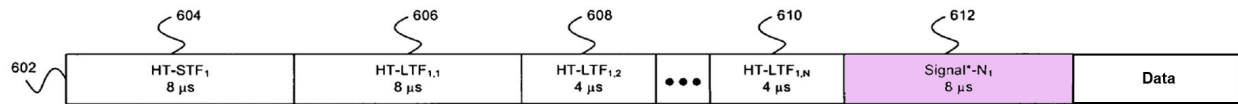
A physical layer protocol data unit (PPDU), illustrated in Hansen’s Figure 3a below, includes preamble 302, header 304, and data 306. (INTEL-1005, ¶59.)

July 2005 WWiSE similarly describes a PPDU as having a preamble, header, and data. (See INTEL-1006, 58:17-60:4 .) A PPDU is a “*packet*”, consistent with the usage of the term packet in the ’361 patent. (INTEL-1003, ¶103; INTEL-1001, 1:37-39 (“A packet is usually formed by a preamble, header, and payload”); INTEL-1003, ¶¶103-105.)

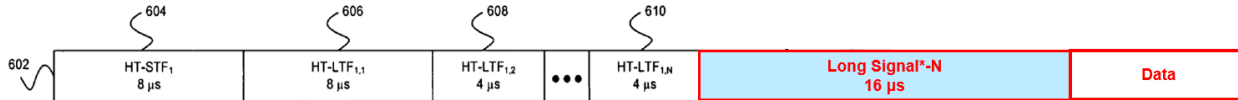


**Hansen, Figure 3a**

As discussed in §V.A.3, the combination of Hansen and July 2005 WWiSE includes two different types of PPDU: an NR greenfield PPDU (“*a first packet type*”) and an ER greenfield PPDU (“*a second packet type*”), illustrated below. (INTEL-1003, ¶¶103-105.) Petitioner addresses the “*first header field*” and “*second header field*” limitations in §§V.B.3.a-b.



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

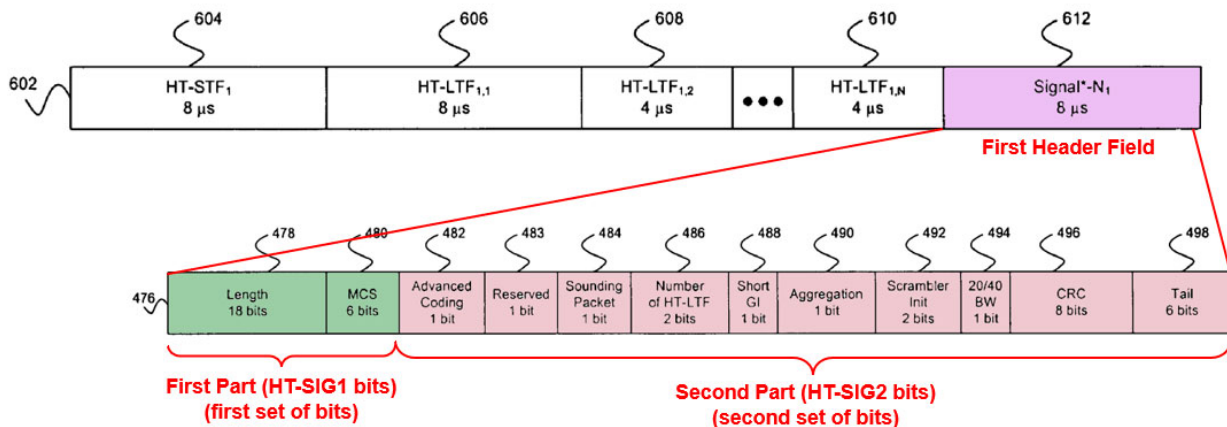


**ER Greenfield PPDU (“*Second Packet Type*”)**  
(Combined Hansen Figure 3a and Excerpt for Figure 6a  
as modified by July 2005 WWiSE)

**a. “*First Packet Type*”**

The combination of Hansen and July 2005 WWiSE discloses the “*first packet type comprising a first header field*” [1A] and “*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*” [1B]. (INTEL-1003, ¶107.) Petitioner addressed the “*first packet type*” portion of those limitations in §V.B.2.a above and addresses the “*first header field*” portions of this limitation in this section.

The training (preamble) and header fields for a single spatial stream 602 of the NR greenfield PPDU<sup>6</sup> 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." (See, e.g., INTEL-1005, ¶¶67, 20, 97.) Signal\*-N carries control information (e.g., MCS field, advanced coding, and 20Mz or 40Mhz bandwidth fields). (INTEL-1005, ¶¶67-68.) Signal\*-N is therefore "*a first header field*" of the NR greenfield PPDU ("*first packet type*"). (INTEL-1003, ¶¶108-110; INTEL-1001, 1:47-50; INTEL-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). (INTEL-

<sup>6</sup> Hansen's Figure 6a omits the PPDU data (payload).

1005, ¶¶87, 97 (Signal\*-N represented “as described in FIG. 4c”), ¶67 (“FIG. 4c shows an exemplary HT-SIG header field ... in accordance with a TGn Sync proposal”); *see also*, §V.A.3.) The Signal\*-N field (prior to coding and modulation) comprises 48 total bits corresponding to 2 transmitted OFDM symbols. (Hansen, ¶¶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). (See INTEL-1012, 133:7-134:2; INTEL-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. (INTEL-1003, ¶¶111-112.)

Prior to coding and modulation, 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). (Hansen, ¶¶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.*” (INTEL-1003, ¶113.)

Prior to coding and modulation, 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). (Hansen, ¶¶67-68.) HT-SIG2 is therefore “*a second part*” of Signal\*-N “*comprising a second set of header bits of the first header field.*” (INTEL-1003, ¶114.)

Thus, the combination of Hansen and July 2005 WWiSE discloses limitation [1B]. (INTEL-1003, ¶115.)

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]. (INTEL-1003, ¶116.)

Petitioner addresses the generation of the OFDM symbols corresponding to the HT-SIG1 bits and the HT-SIG2 bits of Signal\*-N in §V.B.3.

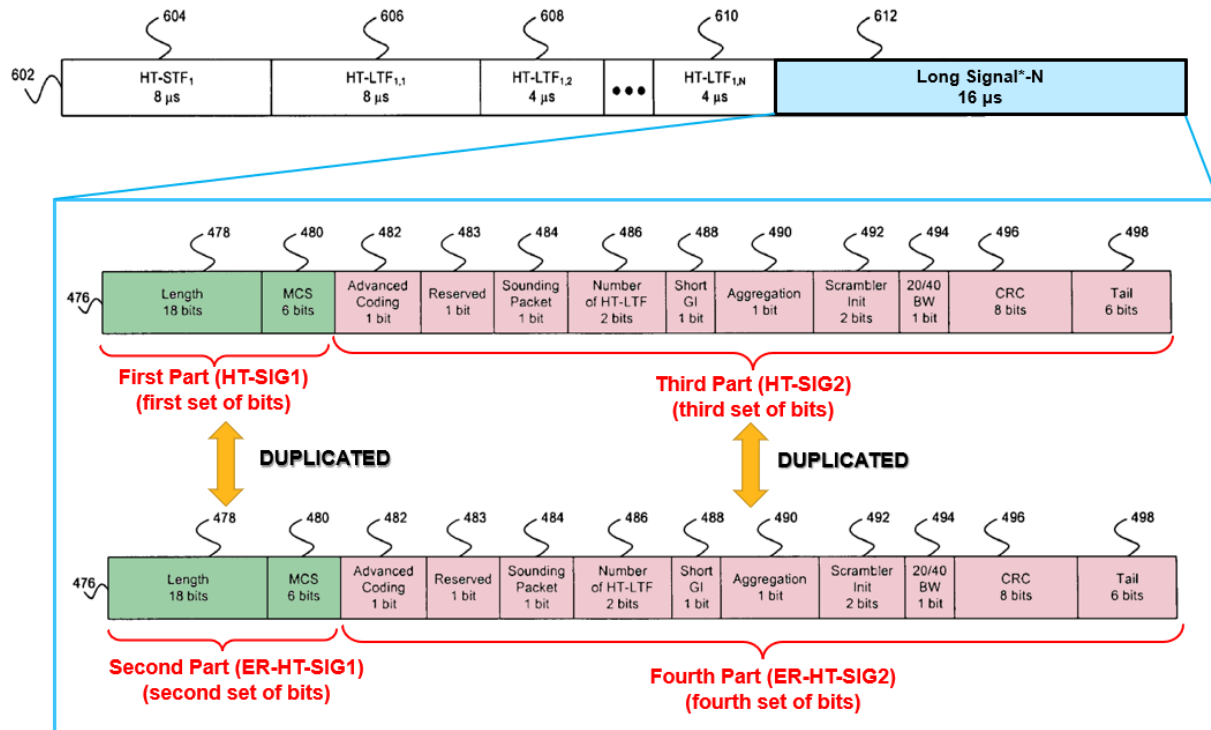
**b. “Second Packet Type”**

The combination of Hansen and July 2005 WWiSE further discloses a “*second packet type comprising a second header field*” [1G] and “*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*” [1H]. (INTEL-1003, ¶118.) Petitioner addressed the “*second packet type*” portion of those limitations in §V.B.2.a above and addresses the “*second header field*” portions of this limitation in this section.

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). (See §V.A.3; INTEL-1006, 69:16-18 (“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”), 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*”). (INTEL-1003, ¶119.)

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. (See also, § V.B.2.a.) Thus, the “Long Signal\*-N” (“*second header field*”) of the ER greenfield PPDU includes “*four parts.*” (INTEL-1003, ¶120.)



Prior to coding and modulation, the first HT-SIG1 part of Long Signal\*-N (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.*” (See INTEL-1005, ¶¶67-68; INTEL-1003, ¶121.) Prior to coding and modulation, 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.*” (See INTEL-1005, ¶¶67-68; INTEL-1006, 69:16-18, 67:1-69:3 (Figures 007, 009, 011, 013, and 015, showing duplicated headers for ER greenfield operation); INTEL-1003, ¶121-122.)

Prior to coding and modulation, the first HT-SIG2 part of Long Signal\*-N (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.*” (See INTEL-1005, ¶¶67-68; INTEL-1003, ¶123.)

Prior to coding and modulation, 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 of header bits of the second header field.*” (See INTEL-1005, ¶¶67-68; INTEL-1006, 69:16-18, 67:1-69:3; INTEL-1003, ¶124.)

Thus, the combination of Hansen and July 2005 WWiSE discloses limitation [1H]. (INTEL-1003, ¶125.)

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]. (INTEL-1003, ¶126.)

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.(iii).

### **3. Transmission Components**

Claim 1 recites a *“wireless OFDM communications transmitter”* operable to perform the functions of *“generat[ing] a [first/second] packet type”* and *“transmit[ting] the [first/second] packet type”* and *“an encoder and a modulator”* operable *“to generate”* OFDM symbols. (INTEL-1003, ¶128.) 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. (See, e.g., INTEL-1005, ¶¶44-49; INTEL-1006, 60:6-61:42; see also, INTEL-1015, Appendix G, 54-82.) Therefore, for ease of discussion, consistent with the logical flow of data through the transmission chain of the transceiver, Petitioner addresses the *“encoder and [modulator]”* limitations and then the *“wireless OFDM communications transmitter”* limitations.

**a. “Encoder and Modulator” Limitations**

Claim 1 recites the following “encoder” and “modulator” limitations:

**[1D]** *an encoder and a modulator operable to generate 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,*

**[1J]** *the encoder and the modulator further operable to generate 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,*

Outside of the claims, the '361 patent does not mention the generation of OFDM symbols, let alone generation of OFDM symbols in a particular order.<sup>7</sup> Regardless,

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<sup>7</sup> Petitioner reserves the right to challenge these claims under 35 U.S.C. §112 in another forum.

the combination of Hansen and July 2005 WWiSE renders the “*encoder and [] modulator*” limitations obvious.

**(i) “Operable to Generate” OFDM Symbols**

The combination of Hansen and July 2005 WWiSE discloses “*an encoder and a modulator operable to generate*” OFDM symbols. (INTEL-1003, ¶130) 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. (INTEL-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)<sup>8</sup> bits associated with the PPDU to be transmitted. (INTEL-1003, ¶131; *See also*, INTEL-1005, ¶59; *see also*, INTEL-1006, 60:14-24 (“Produce the PLCP header field” and “Extend the data bit string ... so that the resulting length will be a multiple of the number of data bits per OFDM symbol”).)

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<sup>8</sup> The preamble is not added until after modulation which completes the PPDU (“*packet*”). ( INTEL-1006, 61:37-39.)

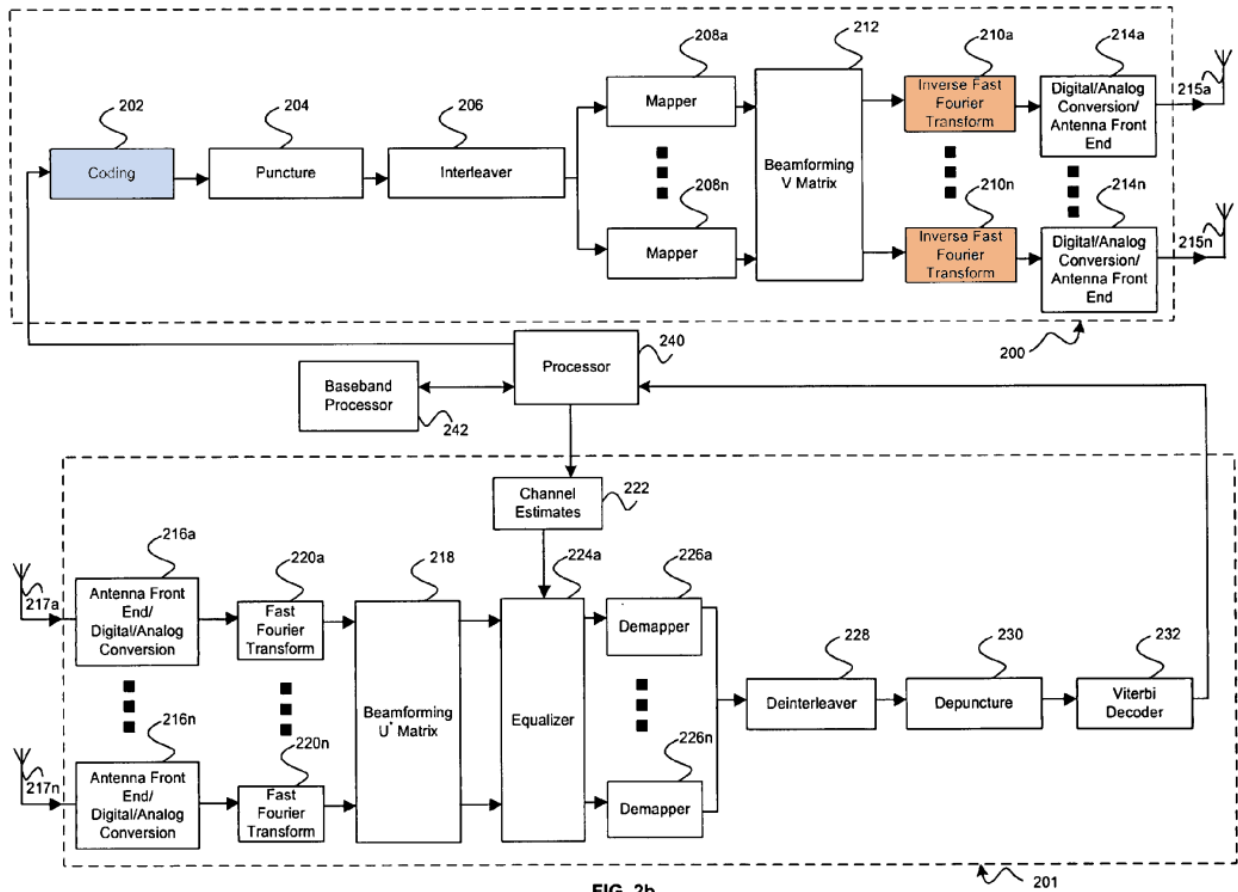


FIG. 2b

## 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).” (INTEL-1005, ¶44.) Coding block 202 (shaded blue above) is therefore “an encoder.” (INTEL-1003, ¶132-133.)

Interleaver block 206 rearranges the bits of a coded data block to “reduce the probability of uncorrectable corruption of data.” (INTEL-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. (INTEL-1005, ¶45.) In the simplest single antenna system, the output of interleaver block 206 for both the coded header and coded data is provided to a single mapper. (*See* INTEL-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. (INTEL-1006, 70:18-21.) Instead, the header is either transmitted by a single antenna (*see, e.g.*, INTEL-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 (INTEL-1006, 70:18-21; INTEL-1012, 121:24-122:2).

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.” (INTEL-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. (*See*, INTEL-1006, 70:18-21; INTEL-1012, 121:1-122:2; INTEL-1003, ¶¶134-139.)

Puncturing, Interleaving, and Mapping are often also considered to be part of coding. (INTEL-1003, ¶140, *citing, e.g.,* INTEL-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*.” (INTEL-1003, ¶140.)

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. (*See* INTEL-1001, 7:57-59.) Hansen discloses that processor 282 and baseband processor 272 “generate data to be transmitted via an RF channel by the transmitter 286.” (INTEL-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.**” (INTEL-1006, 60:14-16. INTEL-1003 ¶141.)

**(b) “Modulator”**

The output of mapper block 208 is provided to IFFT 210<sup>9</sup> which “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.” (INTEL-1005, ¶48; INTEL-1003, ¶143.) Each buffered signal is “**modulated** by a carrier signal whose frequency is based on of [sic] one of the sub-bands.” (INTEL-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. (INTEL-1003, ¶143; *see also*, INTEL-1006, 61:32-35; INTEL-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. (*See* INTEL-1006, 70:18-21; INTEL-1012, 121:1-122:2; INTEL-1003, ¶¶144-145.)

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<sup>9</sup> Although Hansen describes beamforming after the mapper, beamforming is not performed on the header. (INTEL-1003, ¶142.) Instead, the same data would be provided to the each IFFT when the header is being processed. (*Id.*)

IFFT 210 (shaded orange above) is therefore a “*modulator*” that generates OFDM symbols. (INTEL-1003, ¶146.) 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 OFDM symbol. (See INTEL-1006, 61:32-35, 83:21-25 (TX Block Diagram showing “add cyclic extension (guard)”); INTEL-1003, ¶146, *citing* INTEL-1023, 260-262.) Accordingly, the combination of Hansen and July 2005 WWiSE discloses a “*modulator*” that generates an OFDM symbol under this interpretation. (INTEL-1003, ¶146.)

Thus, the combination of Hansen and July 2005 WWiSE discloses “*an encoder and a modulator*” [1D] that are “*operable to generate*” an OFDM symbol corresponding to a set of bits in the PPDU input stream. (INTEL-1003, ¶147.)

**(ii) “*First Packet Type*” - Ordering**

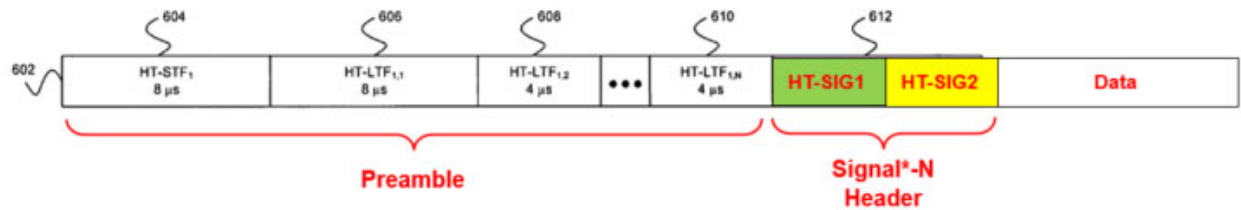
An OFDM transmitter transmits a PPDU over the wireless medium as a sequence of OFDM symbols. (INTEL-1006, 58:6-8; *see also*, INTEL-1015, 7 (§17.3.1).) Through the process of coding and modulation described above, the “*first set of header bits of the first header field* [HT-SIG1 bits] and the “*second 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. (See, e.g., INTEL-1005, ¶¶44-49; INTEL-1006, 60:6-61:42.) Hansen teaches its Signal\*-N field, when transmitted, “comprise[s] 2 OFDM symbols.” (INTEL-

1005, ¶97.) Consistent with Hansen, the TGn Sync proposal sets forth that “HTSIG consists of two OFDM symbols: HTSIG1 and HTSIG2.” (INTEL-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); INTEL-1003 ¶149-150.)

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.*” (See §V.B.2.a; INTEL-1003, ¶151; *citing* INTEL-1012, 133:9-10, 134:1-2 (Figure 62).)

The TGn Sync proposal specifies that “**HTSIG1 shall be transmitted first in time.**” (INTEL-1012, 133:9-10; INTEL-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. (INTEL-1003, ¶152.) 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. (INTEL-1003, ¶152.)

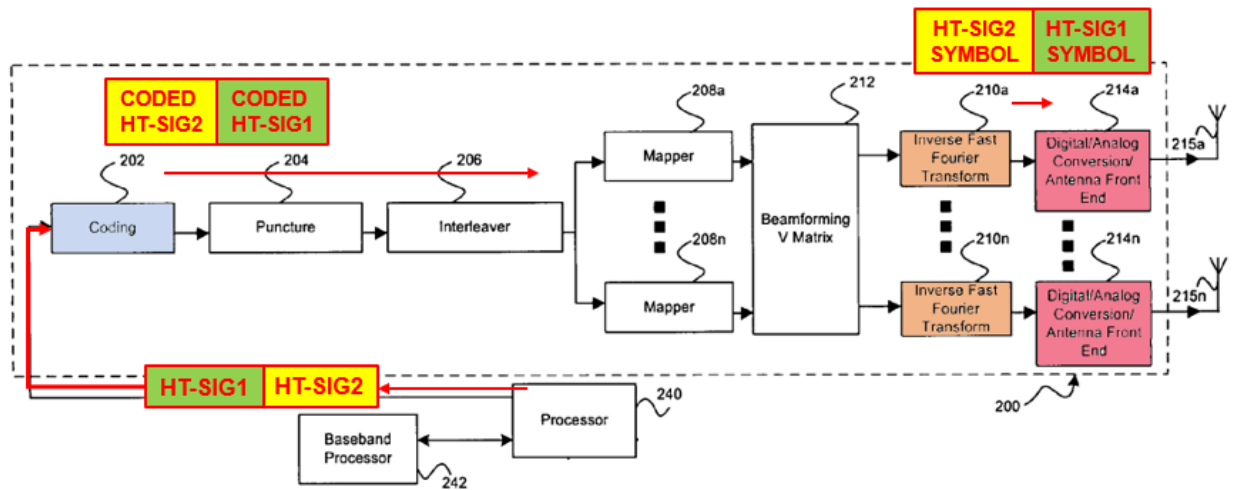
Similarly, the order of the symbols for Signal\*-N in the PPDU indicates the order those symbols are generated. (INTEL-1003, ¶152.)



**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 the “*encoder and [] modulator*” are “*operable to generate [the] first OFDM symbol followed by [the] second OFDM symbol*” [1D] for the Signal\*-N header field of the NR greenfield PPDU illustrated above. (INTEL-1003, ¶153.) 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. (See INTEL-1005, ¶156; INTEL-1006, 60:14-61:10; *see also*, §V.B.3.a.) Coding block 202 applies a FEC technique such as BCC to encode these header bits. (INTEL-1005, ¶44.) The output of coding block 202 is split into two coded bit strings. (INTEL-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. (INTEL-1003, ¶154.)



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<sup>10</sup>. (INTEL-1005, ¶46.) An IFFT 210 (“*modulator*”) then modulates the constellation symbols to “*generate a first OFDM symbol*” (HT-SIG1 symbol). The second

<sup>10</sup> 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. (See, e.g., INTEL-1006, 70:18-21; INTEL-1012, 121:1-122:2; INTEL-1003, ¶155.)

coded bit string (coded HT-SIG2) is similarly processed after the first coded bit string. Coded (and 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) (INTEL-1003 ¶¶155-156.)

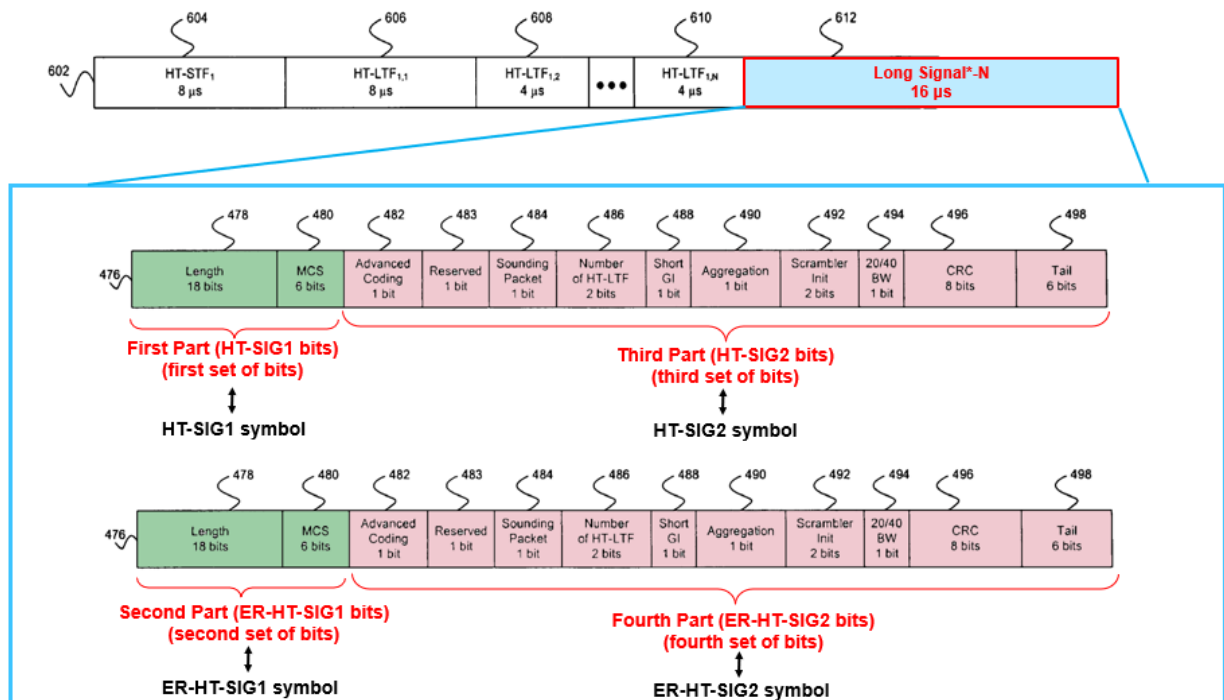
Because the coded bit strings (coded HT-SIG1 and coded HT-SIG2) associated with the first and second parts of Signal\*-N are processed sequentially through the transmission chain, the first OFDM symbol (HT-SIG1 symbol) is generated before the second OFDM symbol (HT-SIG2 symbol). (See INTEL-1012, 133:9-10 (“HTSIG1 shall be transmitted first”).) Thus, the combination of Hansen and July 2005 WWiSE discloses the “*encoder and [] modulator*” is “*operable to generate a first OFDM symbol [HT-SIG1 symbol] followed by a second OFDM symbol [HT-SIG2 symbol]*” [1D] for the “*first header field*” of the NR greenfield packet. (INTEL-1003, ¶157.)

**(iii) “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

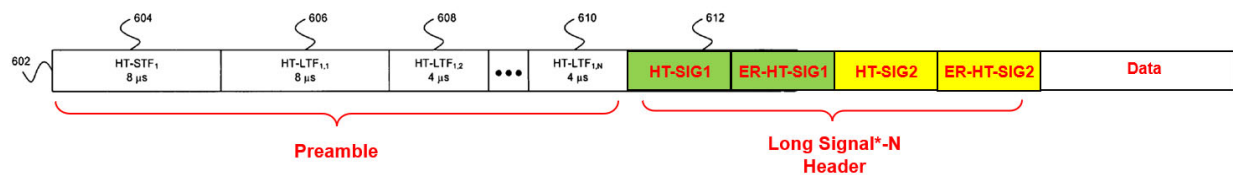
ER greenfield PPDU into OFDM symbols for transmission over the wireless medium. (See §V.B.3.a.(ii).)

As discussed in §V.B.2.a, the Signal\*-N field comprises “comprise[s] 2 OFDM symbols”, HT-SIG1 symbol and HT-SIG2 symbol. (INTEL-1005, ¶97; INTEL-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. (INTEL-1003, ¶159; *see* INTEL-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. (See §V.B.2.a.)



Thus, 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 second header field [HT-SIG1 bits]*”, a “*second OFDM symbol [ER-HT-SIG2 symbol] is used to transmit the second part of the second header field [ER-HT-SIG1 bits]*”, a “*third OFDM symbol [HT-SIG2 symbol] is used to transmit the third part of the second header field [HT-SIG2 bits]*”, and a “*fourth OFDM symbol [ER-HT-SIG2 symbol] is used to transmit the fourth part of the second header field [ER-HT-SIG2 bits]*.” (INTEL-1003, ¶¶158-160.)

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. (INTEL-1003, ¶¶161.)



### 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. Because TGn Sync requires that

“HTSIG1 shall be transmitted first in time” (INTEL-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. (INTEL-1003, ¶¶162.) *See KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007).

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. (INTEL-1003, ¶163.) 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. (INTEL-1003, ¶163.) In fact, the G.9960 standard, which is admitted by the ’361 patent to be prior art, discloses repetition coding for header bits. (INTEL-1018, 51:1331-1358; INTEL-1001, 1:50-52 (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. (INTEL-1003, ¶164, *citing* INTEL-1006, 67:1-69:17 (illustrating

PPDUs); INTEL-1012, 121:1-2 (Figure 55, illustrating PPDU format); INTEL-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. (INTEL-1003, ¶164.)

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. (INTEL-1003, ¶165.) 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**.” *See Perfect Web Techs., Inc. v. InfoUSA, Inc.*, 587 F.3d 1324, 1331 (Fed. Cir. 2004), *quoting KSR*, 550 U.S. at 421. Moreover, a POSITA is an individual with experience with wireless communication protocols. (*See* §IV.A.) 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. *See Id.* (INTEL-1003, ¶165.)

Second, July 2005 WWiSE suggests the above ordering. As discussed in §V.B.3.a.(ii), TGn Syn requires that “HTSIG1 shall be transmitted first in time.” (*See* INTEL-1012, 133:9-10.) July 2005 WWiSE teaches repeating a header symbol, placing the repeated (duplicated) symbol immediately after the original symbol. (INTEL-1006, 69:16-18, 67:1-69:17 (Figures 007, 009, 011, 013, and 15

showing greenfield operation); INTEL-1003, ¶166.) 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. (INTEL-1003, ¶166.)

Third, a POSITA would have been motivated to pursue the above ordering to improve efficiency in both the reception chain and transmission chain. (INTEL-1003, ¶167.) 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. (INTEL-1003, ¶168.)

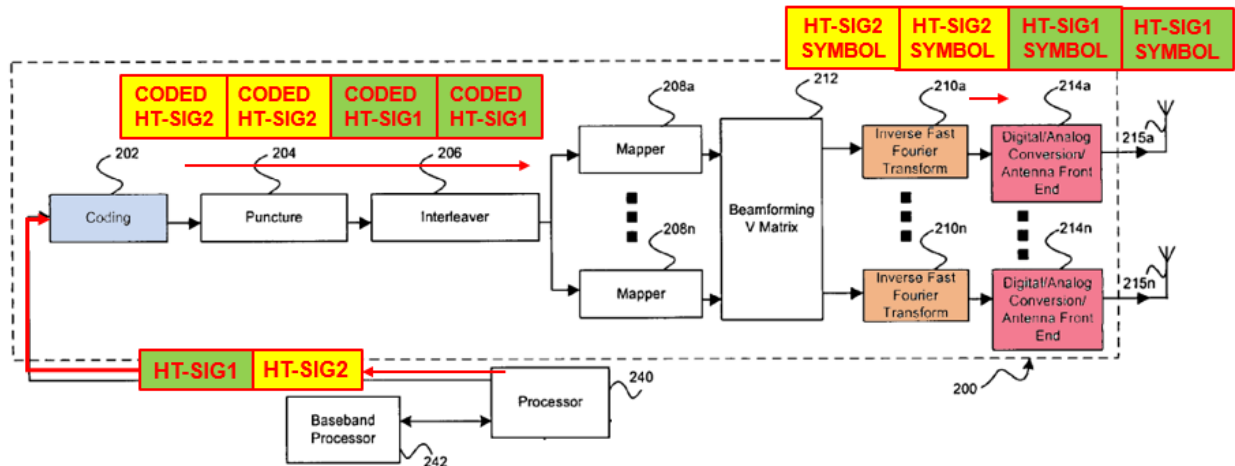
A POSITA would have understood that generating the repeated header fields for ER packets could be efficiently implemented by merely reading the HT-SIG1

and HT-SIG2 fields out of a buffer twice, instead of re-generating them from scratch. A POSITA would have 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. (INTEL-1003, ¶169.)

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. (INTEL-1003, ¶¶170.)

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”*). (See §V.B.2.b.) 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 generate coded ER-HT-SIG2. (INTEL-1003, ¶171.) 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. (INTEL-1003, ¶171.)



**Hansen, Annotated Figure 2b**

The combination of Hansen and July 2005 WWiSE therefore renders the limitation the “*encoder and [] modulator*” are “*operable to generate a first OFDM symbol followed by a second OFDM symbol followed by a third OFDM symbol followed by a fourth OFDM symbol*” [1J] obvious. (INTEL-1003, ¶172.)

**b. “Wireless OFDM Communications Transmitter” Limitations**

Claim 1 recites the following “*wireless OFDM communications transmitter*” limitations:

**[1A]** *a wireless OFDM communications transmitter operable to generate a first packet comprising a first header field,*

**[1F]** *the wireless OFDM communications transmitter further operable to transmit the first packet type over a wireless communication channel,*

**[1G]** *the wireless OFDM communications transmitter further operable to generate a second packet type comprising a second header field,*

**[1N]** *the wireless OFDM communications transmitter further operable to transmit the second packet type over the wireless communication channel,*

Outside of the claims, the '361 patent does not mention the generation of the recited packet types.<sup>11</sup> Regardless, the combination of Hansen and July 2005 WWiSE discloses these “*wireless OFDM communications transmitter*” limitations. (INTEL-1003, ¶173.)

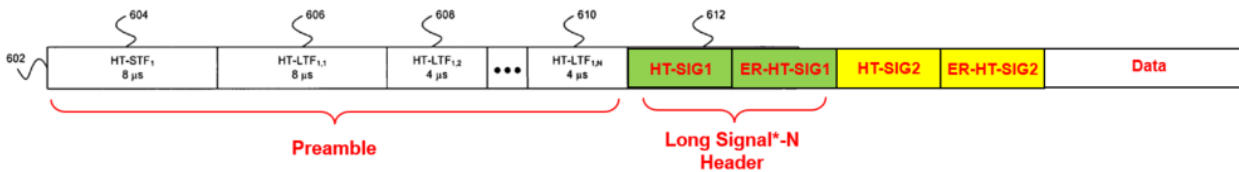
The NR greenfield PPDU (“*first packet type*”) and ER greenfield PPDU (“*second packet type*”) in the combination of Hansen and July 2005 WWiSE are illustrated below. (See §§V.B.3.a.(ii), V.B.3.a.(iii).) As discussed in §V.B.2.a, “*the first packet type compris[es] a first header field*” [1A] and as discussed in §V.B.2.b, “*second packet type compris[es] a second header field*” [1B].

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<sup>11</sup> Petitioner reserves the right to challenge these claims under 35 U.S.C. §112 in another forum.



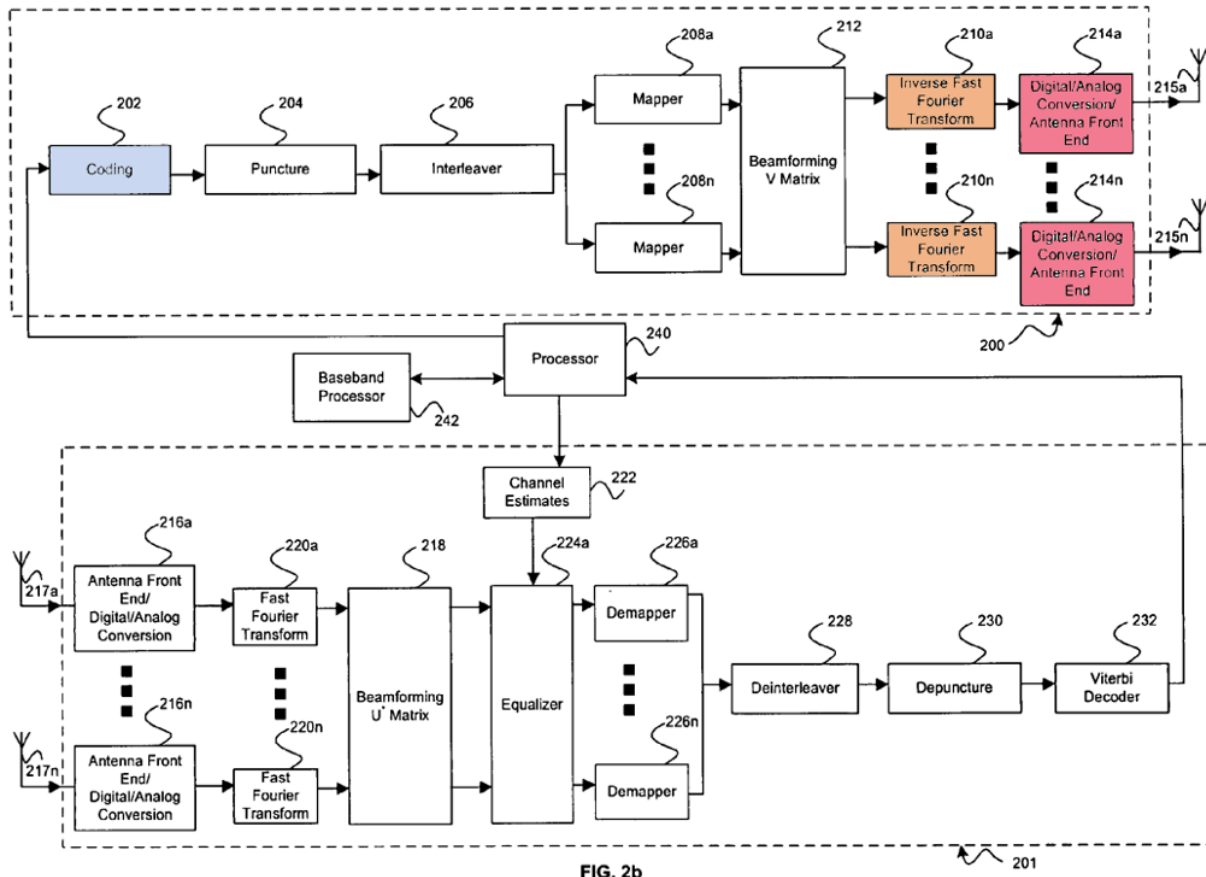
**NR Greenfield PPDU (“*First Packet Type*”)**  
(Combined Hansen Figure 3a, Excerpt from Figure 6a,  
with HT-SIG symbols added)



**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*”). (INTEL-1006, 61:37-39; (INTEL-1003, ¶174.) 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. (INTEL-1003, ¶175, *citing* INTEL-1015, 8 (step m); INTEL-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).

(INTEL-1005, ¶49.) Specifically, the digital signal representation is “converted to an analog RF signal that may be amplified and **transmitted via an antenna.**” (*Id.*; INTEL-1003, ¶175.)



**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.*” (INTEL-1003, ¶176.) 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). (INTEL-1003, ¶176.)

Hansen’s D to A conversion and antenna front end block(s) utilize an antenna “to transmit one RF signal via **an RF channel**.” (INTEL-1005, ¶49; *see also*, INTEL-1005, ¶31 (describing wireless communication “via an RF channel” by the system), ¶15 (referring to the system of Figure 2b as a “transceiver”); INTEL-1003, ¶177.) Accordingly, the combination of Hansen and July 2005 WWiSE discloses “a wireless OFDM communications transmitter operable to generate a first packet type [NR greenfield PPDU] comprising a first header field [Signal\*-N]” [1A] and “the wireless OFDM communications transmitter further operable to transmit the first packet type [NR greenfield PPDU] over a wireless communication channel” [1F]. (INTEL-1003, ¶178.)

The combination of Hansen and July 2005 WWiSE also discloses “the wireless OFDM communications transmitter further operable to generate a second packet type [ER greenfield PPDU] comprising a second header field [Long Signal\*-N]” [1G] and “the wireless OFDM communications transmitter further operable to transmit the second packet type [ER greenfield PPDU] over the wireless communication channel” [1N]. (INTEL-1003, ¶179.)

The combination of Hansen and July 2005 WWiSE discloses that the same device is operable to transmit both the “*first packet type*” [NR greenfield PPDU]

and the “*second packet type*” [ER greenfield PPDU]. (INTEL-1003, ¶180.) 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.” (INTEL-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. (*See, e.g.*, INTEL-1006, 69:29-31, 70:6-7, 50:9-1.) Thus, the combination of Hansen and July 2005 WWiSE discloses that a “*transceiver*” (ER capable device) is operable to generate and transmit both the “*first packet type*” (NR greenfield PPDU) and the “*second packet type*” (ER greenfield PPDU). (INTEL-1003, ¶180.)

**c. “Transmission in a Different Order” Limitations [1L]/[1M]**

The combination of Hansen and July 2005 WWiSE discloses “*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*” [1L] and “*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*” [1M]. (INTEL-1003, ¶181.)

Outside of the claims, the '361 patent does not mention or describe the **transmission** of header bits of one symbol in a different order than the same header bits repeated in a different symbol. At most, the '361 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. (INTEL-1001, 10:24-25; INTEL-1003, ¶182.)

July 2005 WWiSE describes the same type of OFDM subcarrier frequency premutation as described in the '361 patent. (INTEL-1003, ¶183.) 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).”

(*Id.*; INTEL-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. (INTEL-1003, ¶183.) 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. (INTEL-1003, ¶184.) Notably, PO argues 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." (INTEL-1032 (Infring. Con), 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. (INTEL-1003, ¶185.)

The combination of Hansen and July 2005 WWiSE therefore discloses limitations [1L] and [1M] 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. (INTEL-1003, ¶186.)

### C. Independent Claim 9

Claim 9 is substantially the same as claim 1 with the primary difference being that claim 1 is recited as a system claim whereas claim 9 is recited as a method claim. Hansen “relate[s] to a method and system for compromise greenfield preambles for 802.11n.” (See INTEL-1005, ¶7, claim 1.) For this reason and the reasons discussed in §V.B.1, combination of Hansen and July 2005 WWiSE discloses a “*method of operating a wireless OFDM (Orthogonal Frequency Division Multiplexing) transceiver*” [9P]. (INTEL-1003, ¶188.)

Limitations [9B]-[9C], [9E], [9H], [9I], [9K], [9L], and [9M] are identical to limitations [1B]-[1C], [1E], [1H], [1I], [1K], [1L], and [1M]. Accordingly, for the reasons discussed in sections listed in the table below, the combination of Hansen and July 2005 WWiSE renders limitations [9B]-[9C], [9E], [9H], [9I], [9K], [9L], and [9M] obvious. (INTEL-1003, ¶189.)

For the encoder and modulator limitations, limitations [9D] and [9J] recite “*generating, by the encoder and the modulator, ...*” whereas limitations [1D] and [1J] recite an “*encoder and [ ] modulator operable to generate.*” The difference between the limitations is immaterial because the “*encoder*” and “*modulator*” of the combination of Hansen and July 2005 WWiSE both “*generate[s]*” and “*is operable to generate*” the OFDM symbols in the order recited. The combination of

Hansen and July 2005 WWiSE therefore renders limitations [9D] and [9J] obvious for reasons discussed in sections listed below. (INTEL-1003, ¶190.)

For the wireless OFDM communication transmitter limitations, limitations [9A], [9G] recite “*generating, by a wireless OFDM communications transmitter*” and limitations [9F], [9N] recite “*transmitting, by the OFDM communications transmitter*” whereas limitations [1A], [1G] recite a “*wireless OFDM communications transmitter [ ] operable to generate*” and limitations [1F], [1N] recite “*further operable to transmit.*” The difference between the limitations is immaterial because the “*wireless OFDM communication transmitter*” of the combination of Hansen and July 2005 WWiSE both “*generate[s]*” and “*transmits*” and “*is operable to generate*” and “*is operable to transmit*” the first and second packet types. The combination of Hansen and July 2005 WWiSE therefore discloses limitations [9A], [9F], [9G], and [9N] for the same reasons discussed in the sections listed below. (INTEL-1003, ¶191.)

| Claim 9                                                                                                                                                                                                                   | Section  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| [9P] A method of operating a wireless OFDM (Orthogonal Frequency Division Multiplexing) transceiver comprising:                                                                                                           | §V.B.1   |
| [9A] generating, by a wireless OFDM communications transmitter, a first packet type comprising a first header field,                                                                                                      | §V.B.3.b |
| [9B] 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, | §V.B.2.a |

| Claim 9                                                                                                                                                                                                                                                                                                                                                                                       | Section         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| [9C] 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;                                                                                                                                                                                                                                                | §V.B.2.a        |
| [9D] generating, by an encoder and a modulator, a first OFDM symbol followed by a second OFDM symbol,                                                                                                                                                                                                                                                                                         | §V.B.3.a.i-ii   |
| [9E] 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;                                                                                                                                                                                                     | §V.B.3.a.ii     |
| [9F] transmitting, by the wireless OFDM communications transmitter, the first packet type over a wireless communication channel;                                                                                                                                                                                                                                                              | §V.B.3.b        |
| [9G] generating, by the wireless OFDM communications transmitter, a second packet type comprising a second header field,                                                                                                                                                                                                                                                                      | §V.B.3.b        |
| [9H] 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, | §V.B.2.b        |
| [9I] 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,                                                                                                        | §V.B.2.b        |
| [9J] 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,                                                                                                                                                                                                                     | §V.B.3.a.i, iii |
| [9K] 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,                          | §V.B.3.a.iii    |
| [9L] 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                                                                                                                                                                                           | §V.B.3.c        |

| Claim 9                                                                                                                                                                                                                                                       | Section  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| header field transmitted using the first OFDM symbol,                                                                                                                                                                                                         |          |
| [9M] 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 | §V.B.3.c |
| [9N] transmitting, by the wireless OFDM communications transmitter, the second packet type over the wireless communication channel,                                                                                                                           | §V.B.3.b |

#### D. Dependent Claims

##### 1. Claims 2, 3, 10, 11

Claims 2 and 10 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 11 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.*” The wherein clauses of claims 2, 3, 10, and 11 should not be afforded any patentable weight because each merely recites the intended result of the recited function. *See, e.g., Hoffer v. Microsoft Corp.*, 405 F.3d 1326, 1329 (Fed. Cir. 2005). For this reason, claims 2, 3, 10, and 11 are obvious for the same reasons as independent claims 1 and 9.

The combination of Hansen and July 2005 WWiSE also discloses the subject matter of these claims. (INTEL-1003, ¶193.) 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. (See INTEL-1024, 59; *see also*, INTEL-1025, 130-131; INTEL-1003, ¶193.) This technique “mak[es] sure that reliable communication is possible as long as one of the paths is strong.” (INTEL-1024, 59; *see also*, INTEL-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). (See *Id.*; INTEL-1003, ¶193.) A simple mechanism for achieving time diversity uses repetition coding—repeating the same bits in multiple symbols. (INTEL-1024, 59; INTEL-1003, ¶193.)

As explained in §V.A.3, 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. (INTEL-1003, ¶194.) 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. (INTEL-1003, ¶194, *citing* INTEL-1030 (July TGn Presentation), 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 provides “*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*” [2]/[10]. (INTEL-1003, ¶195.)

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 provides “*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*” [3]/[11]. (INTEL-1003, ¶196.)

## 2. Claims 5, 13

Hansen describes a “system and method for compromise greenfield preambles for **802.11n**.” (INTEL-1005, ¶11; *see also, e.g.*, INTEL-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. (*See, e.g.*, INTEL-1005, ¶¶9, 33; INTEL-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. (*See, e.g.*, INTEL-1005, ¶¶9, 32, 41, 61-62, 66, 111-112.) Thus, the combination of Hansen and July 2005 WWiSE discloses that “*the wireless transceiver supports one or more wireless standards*” [5]/[13]. (INTEL-1003, ¶198.)

## 3. Claims 7 and 8

The combination of Hansen and July 2005 WWiSE provides “*the first header field indicates the type of packet*” [7] and “*the second header field indicates the type of packet*” [8]. (INTEL-1003, ¶203.)

In the combination of Hansen and July 2005 WWiSE, the REXT field in SIGNAL\*-N indicates whether the packet is an NR greenfield-type PPDU or an ER greenfield-type PPDU. (*See* INTEL-1006, 69-70.) The REXT field is present in Signal\*-N field in the combination of Hansen and July 2005 WWiSE and therefore

is included in both the “*first header field*” (Signal\*-N) and “*second header field*” (Long Signal\*-N). (See §V.A.3; §V.B.2.a-V.B.2.b.) (INTEL-1003, ¶200.)

The “sounding packet field” in the Signal\*-N header field also “indicate[s] whether the corresponding PSDU may be utilized for closed loop calibration between a transmitter and a receiver.” (Hansen, ¶68.) Thus, this sub-field, which is included in both the “*first header field*” and “*second header field*,” indicates whether the packet is a sounding packet. (See §V.B.2; Hansen, ¶¶67-68; INTEL-1003, ¶201.)

The “*first header field*” and the “*second header field*” likewise each include information describing the modulation and coding schemes to be used for the PPDU’s data payload (the 6-bit “MCS” field), the number of HT-LTF symbols that the PPDU will include (the 2-bit “Number of HT-LTF” field, which also signals the number of spatial streams that will be used for MIMO communications), and the channel bandwidth to be used for the PPDU (the 1-bit “20/40 BW” field). (Hansen ¶¶64, 67-68, Figure 4c, ¶¶87, 97 (describing using HT-SIG field of Figure 4C in greenfield PPDU); §§(V.B.2.a-b).) This information also specifies the type of packet being transmitted. (INTEL-1003, ¶202.)

For each of these reasons, the combination of Hansen and July 2005 WWiSE discloses “*the first header field indicates the type of packet*” [7] and “*the second header field indicates the type of packet*” [8]. (INTEL-1003, ¶203.)

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

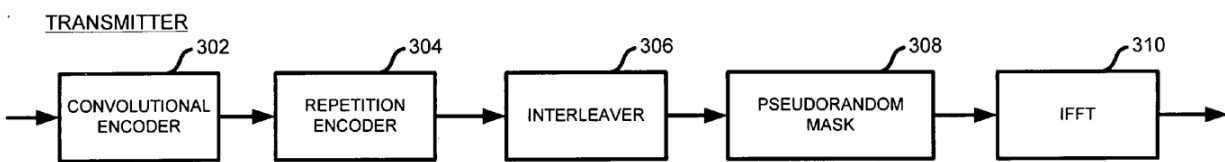
Petitioner established the combination of Hansen and July 2005 WWiSE renders claims 1-3, 5, 7-11, and 13 obvious. (*See* §V.A-V.D.) Should PO contend the combination of Hansen and July 2005 WWiSE does not suggest limitations [1J]/[9J] (the order of symbol generation for the second packet type), these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

**A. Overview and Motivation to Combine**

Choi is directed to “a repetition coding scheme for a wireless system.” (INTEL-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.” (INTEL-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.*; INTEL-1003, ¶¶206-207.)

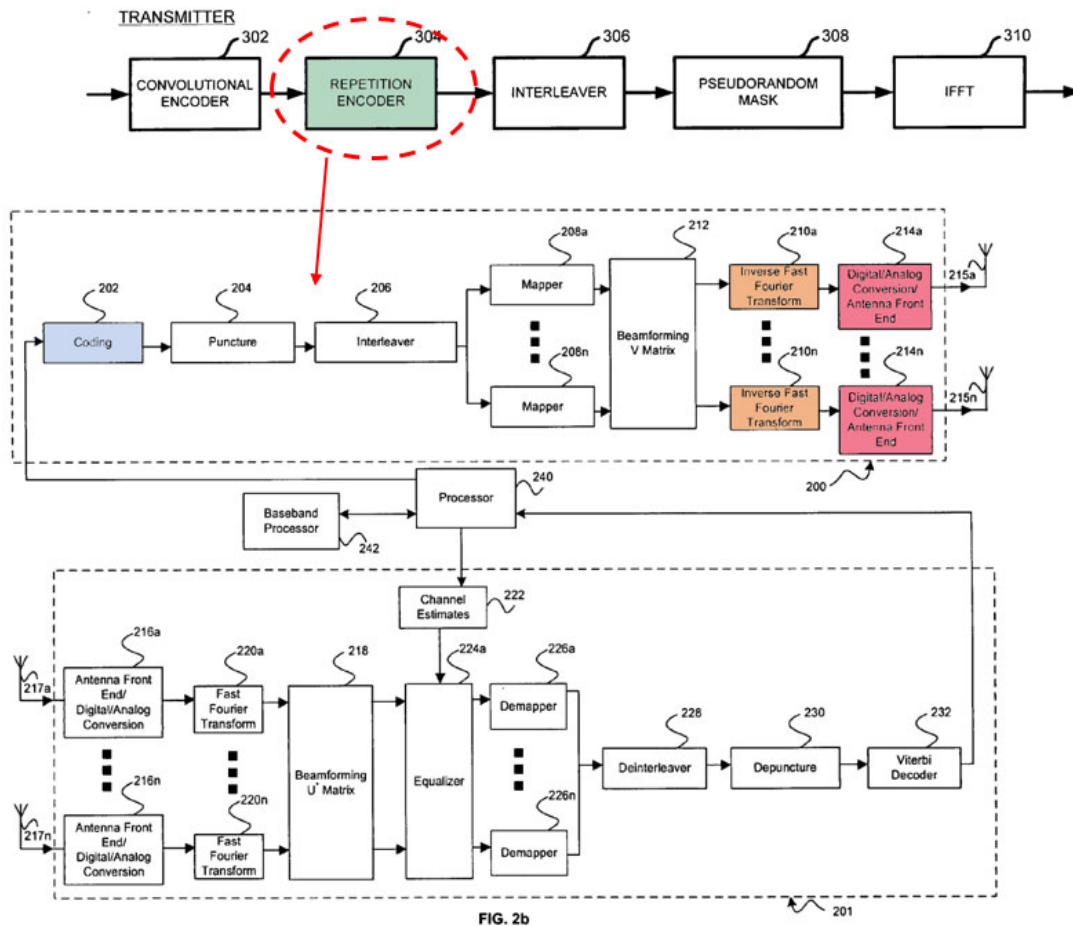
In Choi’s transmitter, illustrated in Figure 2A below, the repetition encoder is placed after the convolutional encoder and “before the input of an interleaver designed to handle repetition coded bits.” (INTEL-1008, ¶26.) The “[i]ncoming data is convolutionally encoded by the convolutional encoder 302.” (*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. (*See* INTEL-1008, ¶18.) The repeated data is subsequently interleaved and modulated. (*See* INTEL-1008, Figure 3A; INTEL-1003, ¶¶208.)



**Choi, Figure 3A**

A POSITA would have been motivated to combine Choi’s repetition coding teachings with the combined system of Hansen and July 2005 WWiSE. (INTEL-1003, ¶210.) Specifically, a POSITA would have been motivated to integrate a repetition encoder into the transmission portion of Hansen’s transceiver, as taught by Choi and illustrated below. (INTEL-1003, ¶210.) 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. (INTEL-1003, ¶210, *citing* INTEL-1026, ¶83 (describing repetition of the header), INTEL-1018, 51:1331-1358 (disclosing a repetition encoder for header field); INTEL-1001, 1:50-52 (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 (below)**

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 PPDU's but does not provide details regarding how to implement such repetition in the transmission portion of a transceiver. (INTEL-1003, ¶211.) 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.

(See INTEL-1006, 69; §V.B.3.a.) Additionally, as discussed in §V.B.3, a POSITA would have been motivated to perform repetition post-coding in the combination of Hansen and July 2005 WWiSE for efficiency reasons. (INTEL-1003, ¶¶211.) 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 '361 patent, Hansen, and July 2005 WWiSE—wireless transmission using OFDM. (INTEL-1003, ¶¶211.)

Choi also expressly motivates the combination. (INTEL-1003, ¶212.) First, Choi discloses that its disclosures are applicable to IEEE 802.11 standards, including 802.11a, b, g, and a/g. (See Choi, ¶¶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. (Choi, ¶¶2, 15; INTEL-1003, ¶212; See §V.A.3.) Third, Choi teaches that its repetition coding is beneficial for communication “in noisy environments”, which is a common concern for WLAN systems. (Choi, ¶2; INTEL-1003, ¶212.) 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 according to known methods to yield predictable results. (INTEL-1003, ¶213.) The combination integrates Choi’s repetition encoder in the transmission

chain after coding and prior to interleaving. 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. (INTEL-1003, ¶213, *citing* Transceiver Design book.) The results of the combination would have been predictable and there would be a reasonable expectation of success in the combination. (See INTEL-1018, 51:1331-1358 (disclosing a repetition encoder for header field); INTEL-1003, ¶¶213.)

#### **B. Independent Claim 1**

The combination of Hansen, July 2005 WWiSE, and Choi discloses the “*encoder and [] modulator*” are “*operable to generate a first OFDM symbol followed by a second OFDM symbol followed by a third OFDM symbol followed by a fourth OFDM symbol*” [1J]. (INTEL-1003, ¶214.)

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*.” (See §V.B.3; INTEL-1003, ¶¶215.) The output of coding block 202 is the coded HT-SIG1 followed by the coded HT-SIG2. As discussed in §V.B.3, 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. (INTEL-1003, ¶¶215.) 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. (See Choi, ¶¶26, 18 (repetition applied to a coded block corresponding to an OFDM symbol); INTEL-1003, ¶216.) The coded HT-SIG2 is next provided to the repetition encoder where it is duplicated to generate a second instance of coded HT-SIG2. (See Choi, ¶26; INTEL-1003, ¶216.) 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. (See Choi, ¶26, INTEL-1003, ¶216.)

Thus, the “*encoder and [] modulator*” in the combination of Hansen, July 2005 WWiSE, and Choi are “*operable to generate a first OFDM symbol followed by a second OFDM symbol followed by a third OFDM symbol followed by a fourth OFDM symbol*” [1J]. (INTEL-1003, ¶217.)

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

### **C. Independent Claim 9**

As discussed in §V.C, claim 9 recites substantially the same limitations as claim 1. For the reasons discussed in §VI.B for limitation [1J] and the reasons

discussed in §§V.B for the remaining terms, the combination of Hansen, July 2005 WWiSE, and Choi renders claim 9 obvious.

#### **D. Dependent Claims**

For the reasons discussed in §V.D, the combination of Hansen, July 2005 WWiSE, and Choi renders claims 2-3, 5, 7-8, 10-11, and 13 obvious.

#### **VII. Discretionary Denial Is Not Appropriate.**

The Board should reach the merits in this proceeding because the Petition presents a compelling unpatentability challenge. (*See* Interim Procedure for Discretionary Denials (“Interim Procedure”), 4-5.) As set forth herein, the evidence presented in this Petition, “if unrebutted in trial, would plainly lead to a conclusion that one or more claims are unpatentable by a preponderance of the evidence.” (Interim Procedure, 4.)

The ’361 patent is “directed toward header repetition in a communications environment.” (INTEL-1001, 1:25-28.) The purported novelty of the challenged claims lies in the repetition of the header of a physical layer packet, resulting in a two-part header field, and the repetition of an extended header, resulting in a four-part header field. (*See* INTEL-1002 (Notice of Allowability), 2 (allowance based on Figure 1 (3) and Figure 1 (4).) However, PO acknowledged in its provisional application that the use of repeated headers and repeated, extended headers was publicly proposed during development of the ITU-T G.hn standard, prior its

earliest possible priority date. (See INTEL-1009, 21-22; INTEL-1019; INTEL-1020.) Petitioner further established in §V that these two concepts were also publicly proposed and discussed in the IEEE 802.11 TGn working group, 4 years before the earliest possible priority date of the '361 patent. The compelling merits of this IPR weigh heavily against discretionary denial.

The *Fintiv* factors also weigh against discretionary denial. No stay has been requested or denied in the district court case, rendering *Fintiv* factor 1 neutral. Although the Court set a trial date in the co-pending district court litigations involving the listed real parties in interest (See §§VIII.A-B), these dates are tentative considering the pending motion to dismiss for improper venue in the *Lenovo Group* litigation and transfer motion in the *Dell* litigation. Given this uncertainty, *Fintiv* factors 2 and 3 weigh against discretionary denial.

## **VIII. Mandatory Notices**

### **A. Real Party In Interest**

The real parties in interest include Petitioner, as well as Dell Inc., Dell Technologies Inc., and Lenovo Group Ltd.

### **B. Related Matters**

To the best of Petitioner's knowledge, the '361 patent is involved in the following district court litigations:

- *AX Wireless LLC, v. Dell Inc., and Dell Technologies Inc.*, 2-22-cv-00277

(EDTX).

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

### 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), Intel appoints the following lead and backup counsel.

| Lead Counsel                                                                                                                                                                                                    | Back Up Counsel                                                                                                                                                                                        |
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## **IX. Conclusion**

*Inter partes* review of the challenged claims is respectfully requested.

Respectfully submitted,

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**APPENDIX A - LIST OF INDEPENDENT CLAIMS**

| <b>Claim 1</b>                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>[1P]</b> A wireless OFDM (Orthogonal Frequency Division Multiplexing) transceiver comprising:                                                                                                                                                                                                                                                                                                     |
| <b>[1A]</b> a wireless OFDM communications transmitter operable to generate a first packet type comprising a first header field,                                                                                                                                                                                                                                                                     |
| <b>[1B]</b> 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,                                                                                                                                                                     |
| <b>[1C]</b> 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; and                                                                                                                                                                                                                                            |
| <b>[1D]</b> an encoder and a modulator operable to generate a first OFDM symbol followed by a second OFDM symbol,                                                                                                                                                                                                                                                                                    |
| <b>[1E]</b> 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,                                                                                                                                                                                                     |
| <b>[1F]</b> the wireless OFDM communications transmitter further operable to transmit the first packet type over a wireless communication channel,                                                                                                                                                                                                                                                   |
| <b>[1G]</b> the wireless OFDM communications transmitter further operable to generate a second packet type comprising a second header field,                                                                                                                                                                                                                                                         |
| <b>[1H]</b> 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, |
| <b>[1I]</b> 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,                                                                                                        |
| <b>[1J]</b> the encoder and the modulator further operable to generate a first OFDM symbol followed by a second OFDM symbol followed by a third OFDM symbol                                                                                                                                                                                                                                          |

| <b>Claim 1</b>                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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] the wireless OFDM communications transmitter further operable to transmit the second packet type over the wireless communication channel.                                                                                                                                                                                                                       |

| <b>Claim 9</b>                                                                                                                                                                                                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [9P] A method of operating a wireless OFDM (Orthogonal Frequency Division Multiplexing) transceiver comprising:                                                                                                           |
| [9A] generating, by a wireless OFDM communications transmitter, a first packet type comprising a first header field,                                                                                                      |
| [9B] 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, |
| [9C] 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;                                                                            |
| [9D] generating, by an encoder and a modulator, a first OFDM symbol followed by a second OFDM symbol,                                                                                                                     |
| [9E] 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                                                         |

| Claim 9                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| the first header field;                                                                                                                                                                                                                                                                                                                                                                       |
| [9F] transmitting, by the wireless OFDM communications transmitter, the first packet type over a wireless communication channel;                                                                                                                                                                                                                                                              |
| [9G] generating, by the wireless OFDM communications transmitter, a second packet type comprising a second header field,                                                                                                                                                                                                                                                                      |
| [9H] 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, |
| [9I] 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,                                                                                                        |
| [9J] 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,                                                                                                                                                                                                                     |
| [9K] 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,                          |
| [9L] 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,                                                                                                                                     |
| [9M] 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                                                                                                                                 |
| [9N] transmitting, by the wireless OFDM communications transmitter, the second packet type over the wireless communication channel.                                                                                                                                                                                                                                                           |

## APPENDIX B - 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                     |
| EH      | 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                 |

| Acronym | Expansion                         |
|---------|-----------------------------------|
| 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    |

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

Pursuant to 37 C.F.R. §42.24(a), Intel hereby certifies that portions of the above-captioned Petition for *Inter Partes* Review of U.S. Patent No. 9,973,361, in accordance with and reliance on the word count provided by the word-processing system used to prepare this Petition, that the number of words in this paper is 13,998. Pursuant to 37 C.F.R. §42.24(a), this word count is in compliance and excludes the table of contents, table of authorities, mandatory notices under §42.8, certificate of service, certificate of word count, appendix of exhibits, and any claim listing. This word count was prepared using Microsoft Word.

Respectfully submitted,

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Date: June 30, 2023

**CERTIFICATE OF SERVICE**

The undersigned hereby certifies that true copies of the Petition for *Inter Partes* Review of U.S. Patent No. 9,973,361 and supporting materials (Exhibits and Power of Attorney) were served via overnight delivery on the Patent Owner at the correspondence address of record as listed in USPTO records:

Andrew Park  
Park, Kim & Suh, LLC  
2121 Avenue of the Stars, Suite 800  
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and via email to the attorneys of record for Plaintiff in the concurrent *AX Wireless LLC, v. Dell Inc., and Dell Technologies Inc.*, 2-22-cv-00277 (EDTX), *AX Wireless LLC, v. HP Inc.*, 2-22-cv-00279 (EDTX), and *AX Wireless LLC, v. Lenovo Group Ltd.*, 2-22-cv-00280 (EDTX) litigations:

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