

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INTEL CORPORATION

Petitioner

v.

AX WIRELESS LLC,

Patent Owner.

IPR2023-01146

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

**DECLARATION OF THOMAS LA PORTA, PH.D.
IN SUPPORT OF INTER PARTES REVIEW OF U.S. 11,212,146**

I. Introduction

I, Thomas LaPorta, Ph.D., declare as follows:

1. I have been retained by Perkins Coie LLP on behalf of Intel Corporation (“Petitioner”), to provide this Declaration concerning technical subject matter relevant to the petition for *Inter Partes* Review (“Petition”) of U.S. Patent No. 11,212,146 to Kim, et al (“the ’146 patent”). It is my understanding that the ’146 patent is currently assigned to AX Wireless LLC (“Patent Owner”).

2. I am over 18 years of age. I have personal knowledge of the facts stated in this Declaration and could testify competently to them if asked to do so. I have reviewed and am familiar with the specification and the claims of the ’262 patent. In general, I will cite to the specification of a United States Patent using the following formats: (Patent No., Col:Line Number(s)) or (Patent No., Paragraph Number(s)). For example, the citation (’146 patent, 1:1-10) points to the ’146 patent specification at column 1, lines 1-10. Also, for convenience, I use italics to denote limitations from the challenged claims.

3. All of the opinions contained in this Declaration are based on the documents I have reviewed and my knowledge and professional judgment. In forming the opinions expressed in this Declaration, I reviewed the documents listed in the attached Appendix. I have also reviewed and am familiar with any other document referred to in this Declaration.

4. I have been asked to provide my technical opinions regarding how a person of ordinary skill in the art (“POSITA”) would have understood the claims of the ’146 patent at the time of the alleged invention. For purposes of whether the teachings of the prior art render the claims of the ’146 patent obvious, I have been asked to assume the date of August 21, 2009, for the analysis in this document.

5. I have also been asked to provide my technical opinions on how concepts in the ’146 patent specification relate to claim limitations of the ’146 patent. In reaching the opinions provided herein, I have considered the ’146 patent, its prosecution history, and the references cited in Attachment A, and have drawn as appropriate on my own education, training, research, knowledge, and personal and professional experience.

A. Qualifications and Expertise

6. In formulating my opinions, I have relied on my knowledge, training, and experience in the relevant field, which I will summarize briefly. A more detailed summary of my background, education, experience, and publications is set forth in my curriculum vitae (“CV”), which is provided as INTEL-1004.

7. I have personal knowledge of the facts and opinions set forth in this declaration and believe them to be true. If called upon to do so, I would testify competently thereto. I have been warned that willful false statements and the like are punishable by fine or imprisonment, or both.

8. I am being compensated for my time at my standard consulting rate. I am also being reimbursed for expenses that I incur during the course of this work. My compensation is not contingent upon the results of my study and analysis, the substance of my opinions, or the outcome of any proceeding involving the Challenged Claims. I have no financial interest in the outcome of this matter or in any litigation involving the '146 patent.

9. I am the Director of the School of Electrical Engineering and Computer Science at Penn State University. I am also an Evan Pugh Professor in the Department of Computer Science and Engineering and the Department of Electrical Engineering at Penn State University. I was the founding Director of the Institute of Networking and Security Research at Penn State. I have worked on telecommunications networks since 1986.

10. I received my B.E. and M.E. in Electrical Engineering from The Cooper Union for the Advancement of Science and Art in 1986 and 1987, respectively, and my Ph.D. in Electrical Engineering from Columbia University in 1992.

11. I joined AT&T Bell Labs (which later became Bell Labs, Lucent Technologies) in 1986 after receiving my B.E. degree, and pursued my M.E. degree part-time. In my first job at Bell Labs, I tested the performance and interoperability of many data communication devices within the AT&T network. I

transferred into Bell Labs Research in 1990 to pursue research full-time.

12. Starting in 1994, I performed research directed towards mobile and wireless networks. During this period, I worked extensively on signaling protocols and call processing for mobile telephony networks and mobile data applications. A large portion of my work was directed at architectures, protocols, and software for enabling different types of services on wireless networks. As part of this work I worked on efficient wireless link layer protocols.

13. In 1997, I became the Director of the Mobile Networking Research Department within Bell Labs Research. This group, which included approximately 30 researchers and support developers, carried out basic research on mobile networks including cellular telephony, mobile Internet, integrated networks and mobile data services. In 2000, I was named the Director of the Advanced Mobile Networking Department within the Wireless Business Unit of Lucent Technologies. My role in this job was to work with development organizations to turn technology into products.

14. During both my development and research careers, I interacted extensively with computer scientists and engineers responsible for the design, development, and testing of mobile telephony and data networking products with a focus on wireless networks. As a research manager, I oversaw a department that executed many large-scale joint projects with development organizations to release

products for Lucent Technologies. Examples of such joint projects include, the control software for Lucent Technologies' 3G network access controllers used for interconnecting CDMA base stations, processor overload controls in Lucent Technologies' cellular soft switches, the industry's first multi-protocol Home Location Register, servers and protocols for enabling services and interactive text messaging via cellular networks, the first systems to interwork 2G and 3G networks of different types with all-IP networks, and mobile Internet services. These interactions exposed me to a wide range of computer scientists and engineers working on wireless network technologies and applications.

15. As the Director of both the Networking Research Department in Bell Labs and the Advanced Mobile Networking Department within the Wireless Business Unit of Lucent Technologies, I met extensively with product managers and marketing organizations for the Wireless Business Unit of Lucent Technologies and representatives of many cellular service providers. In these meetings, I would often present new concepts and product directions that the company was advancing in the wireless market.

16. I also taught as an adjunct member of the faculty at Columbia University in 1993 and from 1996-2001. I taught graduate classes in networking protocol design (1993) and mobile computing and networking (1996-2001). As such, I am familiar with the curricula taught to Electrical Engineers and Computer

Scientists from the early 1990s until today.

17. I am a co-inventor on at least 39 United States Patents and 18 foreign patents, of which the large majority pertain to mobile telecommunications. Two of my patents, one of which helped enable the mobile Internet, were awarded the Thomas Alva Edison Patent Award by the Research and Development Council of New Jersey. For my early work I was recognized with an Eta Kappa Nu Outstanding Young Electrical Engineer Award and the Bell Labs Distinguished Staff Award.

18. While at Bell Labs, I led my research department into creating new network, service and software architectures for building some of the first wireless mobile data services. One example was designing a link layer protocol for more efficient wireless transmissions. This led to two patents and two published papers. I performed several other research efforts to improve the efficiency of the use of wireless networks in different types of data systems.

19. After joining Penn State I continued my work on wireless networks and services including several that were related wireless communications. This included work on allocating resources to efficiently use wireless bandwidth in OFDM systems and resulted in several published papers.

20. Because of my expertise on security in wireless networks, I was appointed to The President's National Security Telecommunications Advisory

Committee. My role on this Committee was to identify security risks for current and evolving cellular networks.

21. Based on this experience, and my continuing work at Penn State University, I have intimate knowledge of wireless and mobile networks and services. I have been highly recognized as an expert in such systems. I was recognized with the Bell Labs Distinguished Member of Technical Staff award in 1996. My award letter stated in part, “[y]our contributions to wireless call processing have profoundly impacted Lucent. You are very well-known as demonstrated by your three best paper awards...”. I was named a Bell Labs Fellow in 2000, “[f]or outstanding contributions in mobile wireless networks in the area of call processing, signaling, mobility management, and applications.” I was named an IEEE Fellow in 2002 “for contributions to systems for advanced broadband, mobile data and mobile telecommunication networks.”

22. I previously served as the Editor-in-Chief of IEEE Personal Communications Magazine and was the founding Editor-in-Chief of IEEE Transactions on Mobile Computing. I have published about 300 technical papers in this field.

23. My research is supported primarily by the Department of Defense and the National Science Foundation. I was the Director of a center funded by the U.S. Army Research Lab studying network science as it relates to communication

networks. I also led a recently concluded project funded by the Defense Threat Reduction Agency to improve network reliability against attack by weapons of mass destruction. I am currently the Penn State Principle Investigator on an NSF/DoD funded project on 5G networks.

B. Understanding of Relevant Legal Principles

24. I am not a lawyer and will not provide any legal opinions. Although I am not a lawyer, I have been advised certain legal standards are to be applied by technical experts in forming opinions regarding the meaning and validity of patent claims.

25. I understand that a patent claim is invalid if it is anticipated or obvious in view of the prior art, and that a claim can be unpatentable even if all of the requirements of the claim cannot be found in a single prior-art reference. I further understand that invalidity of a claim requires that the claim be anticipated or obvious from the perspective of a person of ordinary skill in the art at the time the invention was made.

26. I have been informed that a patent claim is invalid if it would have been obvious to a person of ordinary skill in the art. In analyzing the obviousness of a claim, I understand the following factors may be taken into account: (1) the scope and content of the prior art; (2) the differences between the prior art and the claims; (3) the level of ordinary skill in the art; and (4) any so called “secondary

considerations” of non-obviousness, if they are present. I am not aware of any evidence of secondary considerations of non-obviousness relevant to the '950 patent. I reserve the right to supplement this Declaration if Patent Owner (“PO”) introduces evidence of secondary considerations of non-obviousness.

27. I understand that to prove that prior art or a combination of prior art renders a patent obvious, it is necessary to:

- identify the particular references that, singly or in combination, make the patent obvious;
- specifically identify which elements of the patent claim appear in each of the asserted references; and
- explain why a person of ordinary skill in the art would have combined the references, and how they would have done so, to create the invention(s) claimed in the patent.

28. I further understand that exemplary rationales that may support a conclusion of obviousness include:

- combining prior art elements according to known methods to yield predictable results;
- simple substitution of one known element for another to obtain predictable results;
- use of known technique(s) to improve similar devices (methods or

products) in the same way;

- applying a known technique to a known device (method or product) ready for improvement to yield predictable results;
- “obvious to try” – choosing from a finite number of identified, predictable solutions with a reasonable expectation of success;
- known work in one field of endeavor may prompt variations of the work for use in either the same field or a different field based on design incentives or other market forces if the variations are predictable to a person of ordinary skill in the art; and
- some teaching, suggestion, or motivating in the prior art that would have led a person of ordinary skill in the art to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

29. I have also been informed that, in considering obviousness, hindsight reasoning derived from the patent at issue itself may not be used.

30. I understand that a patent’s disclosure must clearly allow a POSITA to recognize that the inventor invented what is claimed in the patent and had possession of the claimed subject matter as of the filing date. I further understand that a claim is entitled to the priority date of an earlier application only if the earlier specification provides sufficient written description support for the full

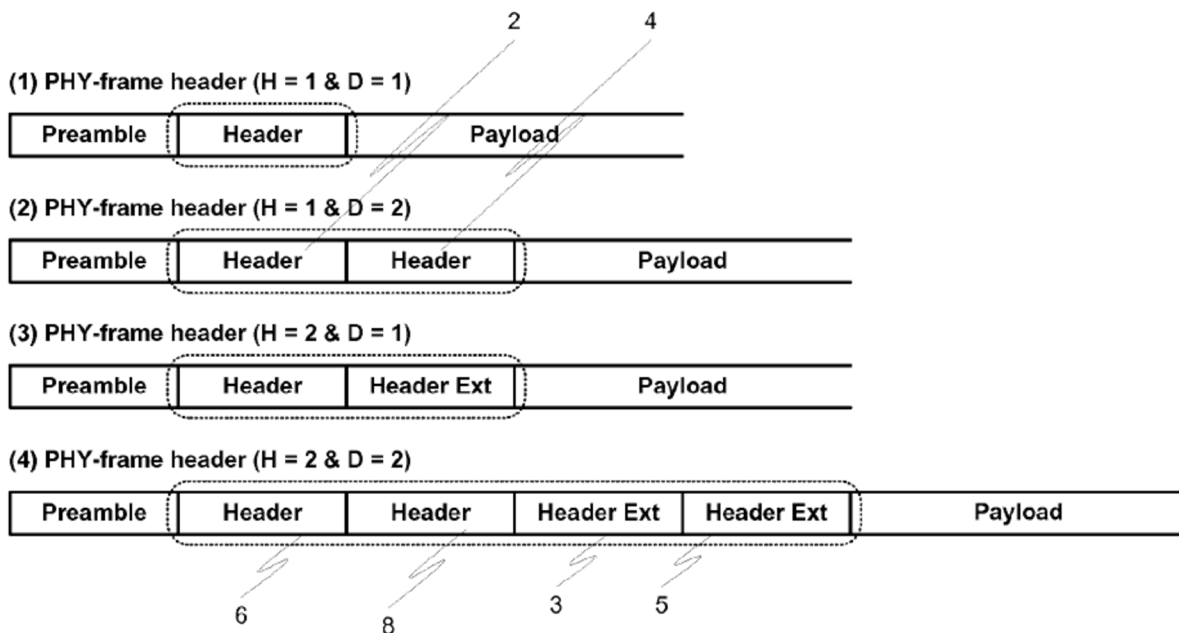
scope of the claim.

II. The '146 Patent

31. The '146 patent relates to “exemplary methods [and] systems . . . directed toward header repetition in a communications environment.” (INTEL-1001, 1:33–36.) According to the specification, “[t]he header contains important control information for the receiver to decode the payload properly, and also provides information about the packet length for virtual carrier sensing,” so “it is essential to decode the header reliably.” (INTEL-1001, 1:55–58.) In the prior art, it was known that a “header containing PHY_H bits (header information block) is carried over one or two OFDM symbols ($D=1$ or 2), and within each symbol, multiple header information blocks are repeated over the entire frequency band.” (INTEL-1001, 1:60–64.) It was further known to extend a header to provide more information by “carrying more than PHY_H bits in the header ($H=1$ or 2).” (INTEL-1001, 1:9–10.)

32. Both prior-art concepts are illustrated in Figure 1 from the '146 patent below, including situations where: (1) a header ($H=1$) is contained within one symbol ($D=1$); (2) a header ($H=1$) is carried in two symbols ($D=2$), where the second symbol repeats the first; (3) a header and a header extension ($H=2$) are each carried in a single symbol ($D=1$); and (4) a header and a header extension ($H=2$) are each carried in two symbols ($D=2$), where the second set repeats the first.

(INTEL-1001, 5:56–6:1, Fig. 1.)



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

instructions from one or more other receivers and/or a domain master,” and the transmitter will “carry, insert or otherwise communicate the value of D in the header so that all nodes know how many OFDM symbols are carrying header information.” (INTEL-1001, 2:51–3:1.) To ascertain the number of header symbols, “[t]he receiver(s) starts processing the header by decoding one OFDM header symbol,” and if successful, “the receiver knows how many more OFDM symbols (D-1) are carrying header information for a given frame.” (INTEL-1001, 3:1–5.) But if unsuccessful “(i.e., the header decoding fails), then the receiver can try to decode two OFDM header symbols, and so on.” (INTEL-1001, 3:5–8.)

34. In other words, the patent specification teaches explicit signaling of the number of OFDM symbols carrying header information—which indicates the packet format—using a value “D” that the receiver decodes. The claims of the ’146 patent, however, more broadly recite a wireless receiver “configured to receive” first and second packet formats—the first format has one header symbol (D=1), and the second format has two header symbols (D=2), where the second symbol repeats the first—where the receiver “distinguishes the second packet format from the first packet format by detecting, from the received wireless packet, the second header field which repeats the first header field.” (*See, e.g.*, INTEL-1001, cl.1.)

A. Technical Background

35. In this section, I first provide a brief technical background of OFDM

wireless communications and physical layer (PHY) packet headers in 802.11 standard-compliant wireless local area networks (WLANs), a high-level overview of the '146 patent and its prosecution history, and a discussion regarding claim construction.

36. The concepts of repeating and extending a header field in a wireless packet, and repeating an extended header field, were not novel prior to the earliest priority date of the '146 patent. In fact, the Applicant, Applied Transform, admitted these concepts were proposed in submissions by other companies during development of the "G.hn" standards mentioned in the '566 patent that were promulgated by the International Telecommunication Union – Telecommunication Standardization Sector (ITU-T). (*See* '146 provisional, 21-22; 09CC-046; 09XC-100; 09XC-119.) I discuss the G.9960 standard and these contributions in §III.A.2. below.

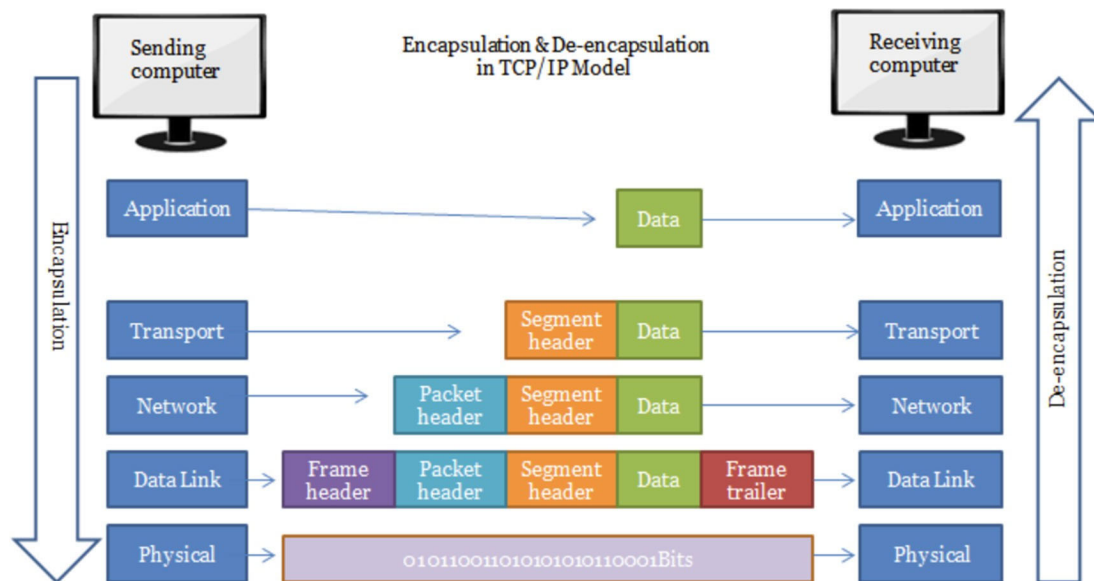
37. The ITU-T G.hn standards group was not the only standards group openly discussing the concepts of repeating and extending a physical layer header prior to the earliest possible priority date of August 2009. Four years before ITU-T G.hn considered these concepts, the IEEE 802.11 TGn working group discussed similar proposals from the TGn Sync and WWiSE industry groups during development of the IEEE 802.11n standard. I discuss these further in my analysis of Ground 1.

1. Communications Systems Overview

38. Computing devices communicate with one another over a network via network communication protocols. These communications generally involve transmitting information in the form of electrical signals (generally frequency waves) that propagate over a physical transmission medium that are subsequently received and processed in order to recover the information at the other end of the channel or link. These networks include wired and wireless networks and examples of transmission mediums include signal lines, coaxial cables and wireless air interfaces.

39. The network communication protocols that are used to communicate over the transmission medium are generally defined in layers, with each layer being responsible for one aspect of the communications. The following figure illustrates this concept with reference to the common Open Systems Interconnection (OSI) model and the Transmission Control Protocol/Internet Protocol (TCP/IP) protocol suite. The application layer, at the top of the stack, handles interactions at the application level. The transport layer provides the flow of data between two computers for the application layer above it. TCP and UDP are two common transport layer protocols. The network layer handles the movement of packets around the network. IP is a common network layer protocol. The data link layer handles the details of physically interfacing with the physical

media (e.g., coax, power line, air, etc.). And the physical layer performs the formatting operation that transforms the information received from the upper layers into a frame (or packet) that can be communicated as signals over the physical medium.



40. When an application sends data to an application running on a different computer, the data is sent down the protocol stack. Each layer adds information to the data by prepending headers (and sometimes trailer information) to the data that it receives, as shown in the figure above. Both the ITU G.hn and IEEE Std. 802.11, referenced by the '146 patent, are focused on the two lowest layers of the protocol stack—the data link layer and the physical layer.

a. Physical Medium

41. The difference between “wired” (e.g., coax) and wireless LANs is the physical communication medium. Unlike wired media, wireless media “are very

difficult to control because the dynamics of the propagated signals over the media are constantly changing.” (O’Hara, 161.) One key consideration in the design of a wireless LAN (WLAN) system is therefore path loss. As transmitting devices transmit signals to receiving devices in an area, “the signal attenuates as a square of the distance (D).” (O’Hara, 166.) And “[a]s the receiver moves away from the transmitter, the receiver’s signal power decays until it reaches the receiver’s noise floor, at which time the bit error rate becomes unacceptable.” (O’Hara, 166.) Additional path losses may occur because of the fading characteristics of the operating environment.

42. Fading is a major problem in WLAN system design. Most 802.11 equipment uses omnidirectional antennas, radiating RF energy in every direction. The waves are reflected, for example, by the ground or buildings and scattered by objects such as trees, people, towers, or other moving and stationary objects present in the area. (See, e.g., Sklar, 771-772.) Reflections of a signal cause a delayed copy of the same transmission to be received on a different path. These environmental conditions contribute to fading. Large-scale fading is due to path loss of signal as a function of an object coming between the transmitter and receiver. (See Sklar, 947; D. Tse, et al., *Fundamentals of Wireless Communication*, 2 (2005) (“Tse”)) Small-scale fading is due to the constructive and destructive interference of the multiple signal paths between the transmitter and receiver.

(Sklar, 947, 953-954; Tse, 2.)

43. One solution to improve performance in a fading channel is to ensure that the information passes through multiple signal paths, each of which fades independently, making sure that reliable communication is possible provided one of the paths is strong. (Tse, §3.1.4.) This technique creates what is called “diversity” for the transmission, and it can dramatically improve the performance of the system over fading channels. (Tse, §3.1.4.) Three main forms of diversity are traditionally exploited in communication systems for fading channels: temporal (repeating transmission information in different time intervals), spectral (repeating transmission information in different frequencies), and spatial diversity (repeating transmission information over different transmit antennas).

44. A simple mechanism for achieving time diversity uses repetition coding. If a transmitted symbol is not repeated, a deep fade can wipe out a transmitted signal. And if the information lost due to the deep fade is part of the packet header, the entire packet cannot be decoded by the receiver. However, if the information is repeated, a deep fade wipes out only one copy of the repeated information, allowing the data to be potentially recovered in the other copy.

b. Idealized system model for orthogonal frequency division multiplexing (OFDM)

45. This section describes an idealized Orthogonal Frequency Division Multiplexing (OFDM) system model. OFDM is a digital multi-carrier modulation

scheme that extends the concept of single subcarrier modulation by using multiple subcarriers within the same single channel. Rather than transmit a high-rate stream of data with a single subcarrier, OFDM makes use of a large number of closely spaced orthogonal subcarriers that are transmitted in parallel. Each subcarrier is modulated with a conventional digital modulation scheme (such as QPSK, 16QAM, etc.) at low symbol rate. This is also referred to as constellation mapping. However, the combination of many subcarriers enables data rates similar to conventional single-carrier modulation schemes within equivalent bandwidths.

46. OFDM is based on the well-known technique of Frequency Division Multiplexing (FDM). In FDM different streams of information are mapped onto separate parallel frequency channels. Each FDM channel is separated from the others by a frequency guard band to reduce interference between adjacent channels. The OFDM scheme differs from traditional FDM in the following interrelated ways: (i) multiple carriers (called subcarriers) carry the information stream; (ii) the subcarriers are orthogonal to each other, and (iii) a guard interval is added to each symbol to minimize the channel delay spread and intersymbol interference.

47. In the frequency domain, multiple adjacent subcarriers (or tones) are each independently modulated with complex data. An Inverse Fast Fourier Transform (IFFT) function is performed on the frequency-domain subcarriers to

produce the OFDM symbol in the time-domain. Then in the time domain, guard intervals are inserted between each of the symbols to prevent inter-symbol interference at the receiver caused by multi-path delay spread in the radio channel. Multiple symbols can be concatenated to create the final OFDM signal. At the receiver, a Fast Fourier Transform (FFT) is performed on the OFDM symbols in the received packet to recover the original data bits.

48. An OFDM carrier signal is the sum of a number of orthogonal subcarriers, with baseband data on each subcarrier being independently modulated using some type of quadrature amplitude modulation (QAM) or phase-shift keying (PSK) technique. This composite baseband signal is typically used to modulate a main radio frequency (RF) carrier for transmission over the channel, which is a band of frequencies or a “frequency band”.

Transmitter IFFT Modulation

49. An IFFT function is computed on each set of symbols (time samples) to produce a set of complex time domain symbols (i.e., to “modulate” the symbols) which are the time-domain OFDM symbols. In OFDM, “modulation” takes place at the IFFT mapping the streams of data symbols onto OFDM symbols for transmission over the channel. The IFFT is therefore a “modulator” in an OFDM system. The OFDM symbols are transmitted over the channel to the receiver.

Receiver FFT Demodulation

50. At the receiver, a forward FFT function is used to convert the time-domain OFDM symbols back to the frequency domain (*i.e.*, to “demodulate” the symbols). In OFDM, “demodulation” occurs at the FFT converting the received OFDM symbols to data symbols. The FFT is therefore a “demodulator” in an OFDM system. The output of the FFT is mapped onto binary values that are then decoded to produce the binary output data, which is an estimate of the originally transmitted data stream.

c. Simple digital OFDM system implementation using Fast Fourier Transform (FFT)

51. These IFFT/FFT transform functions are well known in the art and are important from the OFDM perspective because the IFFT maps digitally modulated input data (data symbols) onto orthogonal subcarriers (OFDM symbols) for transmission, and vice versa for reception at the FFT. The IFFT is the “modulator” in an OFDM system because it takes frequency-domain input data (complex numbers representing the modulated subcarriers) and converts it into the time-domain output data (analog OFDM symbol waveform).

52. The IFFT takes in N source data symbols at a time. Each of these N input symbols has a symbol period of T seconds. The output of the IFFT is N orthogonal sinusoid waveforms. Thus, the IFFT block provides a simple way to “modulate” data onto N orthogonal subcarriers. The block of N output samples from the IFFT make up an OFDM symbol.

53. At the receiver, an FFT block is used to process the received signals and convert them (*i.e.*, demodulate them) into the frequency domain which is used to ultimately recover the originally transmitted data bits. Figure 2.14 of R. van Nee, et. al., *OFDM for Wireless Multimedia Communications*, 47-48 (2000) (“Van Nee”) below depicts a block diagram of a typical OFDM transceiver (or modem) where the upper path corresponds to the transmitter path and the lower path corresponds to the receiver path. As discussed above, the IFFT “modulates” the input values (*e.g.*, QAM, PSK, etc.) “onto a number of subcarriers” and “[i]n the receiver, the subcarriers are demodulated by an FFT, which performs the reverse operation of an IFFT.” (Van Nee, 47-48.) “An FFT is used to demodulate all subcarriers” and the output of the FFT is “mapped onto binary values and decoded to produce binary output data.” (Van Nee, 48.) In this particular implementation, the same IFFT/FFT hardware is used for both transmitter and receiver.

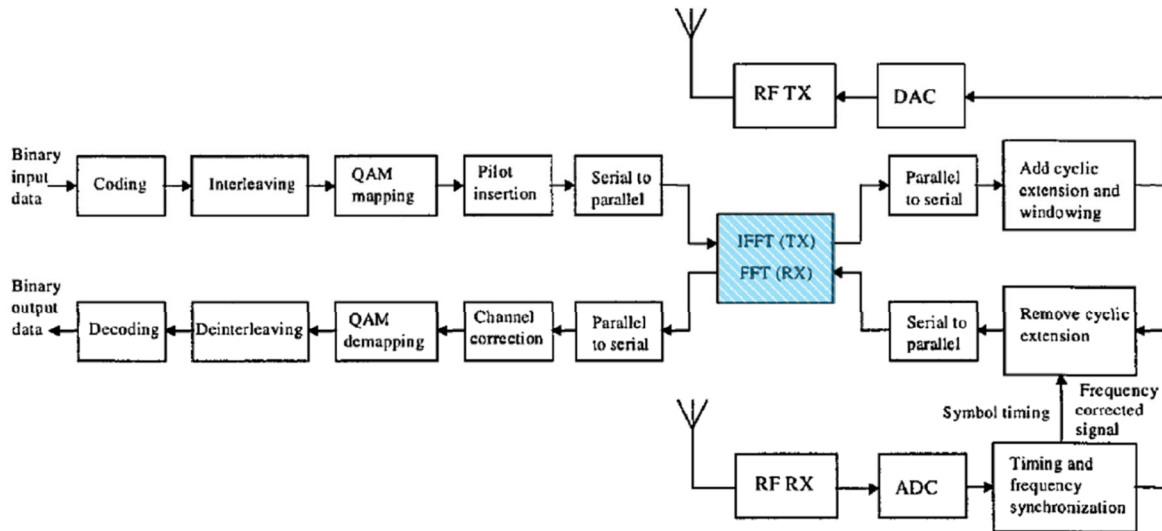


Figure 2.14 Block diagram of an OFDM transceiver.

2. ITU G.hn

54. ITU-T G.hn was tasked with developing standards for a next generation home networking technology that enabled transmission of video, audio and data over existing coax, phone line and power line wires in the home. The '566 patent is drafted using the same terminology as is found in the G.9960 standard specification.

a. G.9960

55. The goal of G.hn is to optimize a single transceiver for multiple types of media. The G.9960 specification defines the physical layers of G.hn. The '566 patent acknowledges the January 2009 version of G.9960 as prior art in its background section. (See, INTEL-1001, 1:46-55 ("In G.9960, which is incorporated herein by reference in its entirety, and **should be familiar to those**

skilled in the art¹”).)

56. The protocol reference model of a transceiver is illustrated in Figure 5-11 below. At the physical layer, the reference model includes (1) the physical coding sub-layer (PCS) which “encapsulates transmit packets into the PHY frame and adds PHY-related control and management overhead”, (2) the physical medium attachment (PMA) sub-layer, and (3) the physical medium dependent (PMD) sub-layer which “modulates and demodulates PHY frames for transmission over the medium using” OFDM. (G.9960 1/09, 24:711-715.)

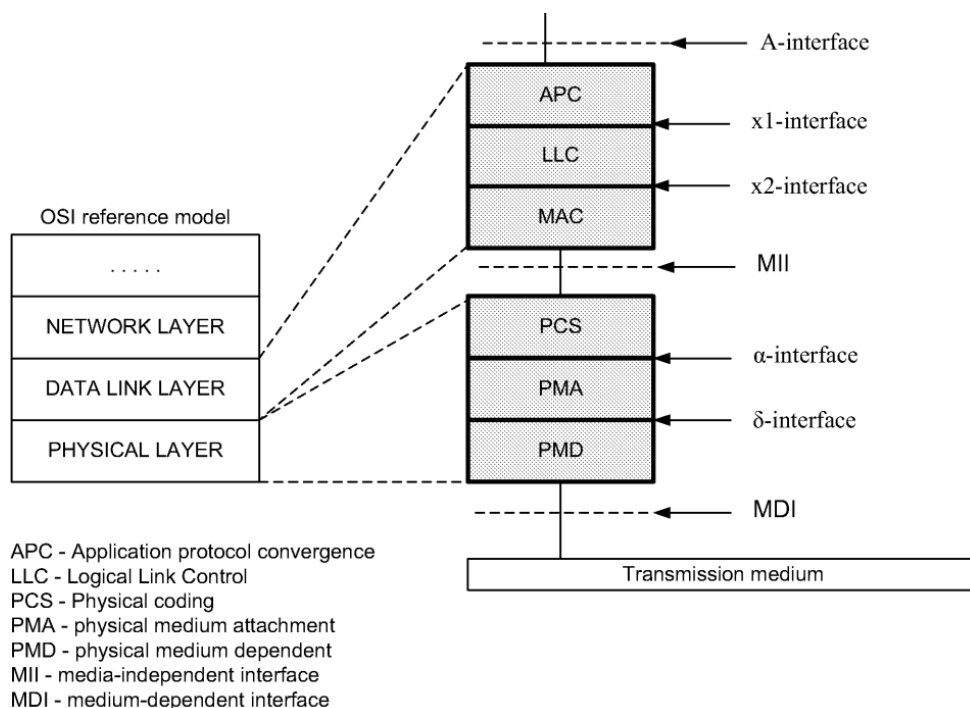


Figure 5-11/G.9960 – Protocol reference model of HN transceiver

57. In the transmit direction, data enters the PHY from the MAC as a

¹ Unless otherwise noted, all emphasis by bold is added.

block of data called a MAC protocol data unit (MPDU). (G.9960 1/09, 30:854-855.) The incoming MPDU “is mapped into the PHY frame originated in the PCS, scrambled and encoded in the PMA, modulated in the PMD, and transmitted over the medium using OFDM modulation with relevant parameters.” (G.9960 1/09, 30:855-858.) In the PMD, the “preamble is added to assist synchronization and channel estimation in the receiver.” (G.9960 1/09, 30:858-859.)

(i) Physical Coding Sub-Layer (PCS)

58. The functional model of the PCS is shown in Figure 7-2 of G.9960, reproduced below. In the transmit direction, “the incoming MPDU is mapped into a payload field of a PHY frame” and the PHY-frame header “is added to form a TX PHY frame.” (G.9960 1/09, 31:869-871.) The TX PHY frame is passed over the a-interface to the PMD sublayer. (G.9960 1/09, 31:879.) In the receive direction, the decoded PHY-frame payload and header are processed and the MPDU provided to the MAC layer. (G.9960 1/09, 31:872-874.)

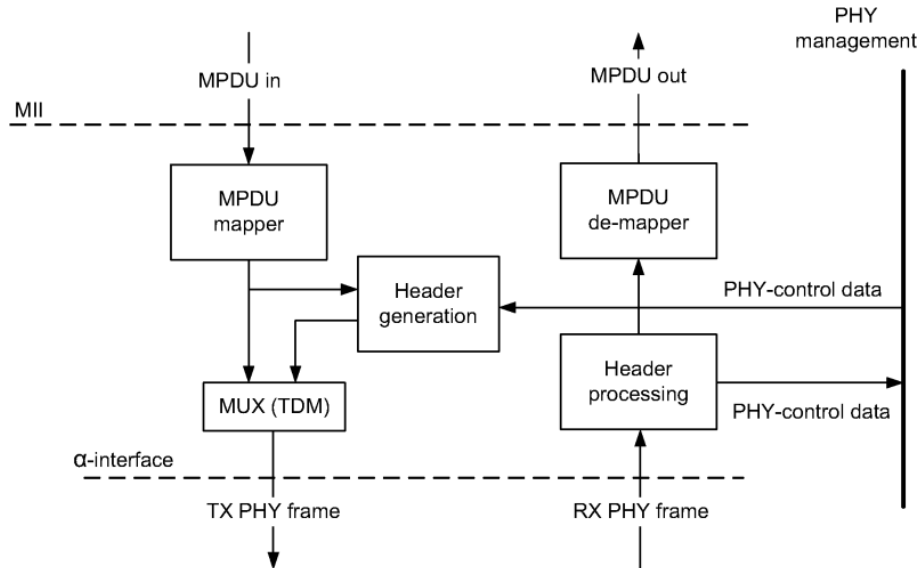


Figure 7-2/G.9960 – Functional model of PCS

59. The PHY frame (illustrated below) includes a preamble, header and payload. At the interface, the PHY frame includes only header and payload because the preamble is added in the PMD. (G.9960 1/09, 31:877-32:882.) The PHY-frame header is a two-part header. It is PHY_H bits long and is composed of (1) a common part (containing fields that are common for all PHY-frame types) and (2) a variable part that contains fields according to the PHY-frame type. (G.9960 1/09, 32:895-897.)

Preamble	Header	Channel estimation	Payload
Added in the PMD	1 or 2 symbol frames	Added in the PMD	Integer number of symbol frames; Variable length Variable inter-frame coding rate Variable inter-frame bit loading

Figure 7-3/G.9960 – Format of the PHY frame

(ii) Physical Medium Attachment (PMA) Sub-Layer

60. The functional model of the PMA is illustrated in Figure 7-4 of G.9960, reproduced below. As shown, in the transmit direction, the header bits and payload bits for the incoming PHY frame (except for preamble and channel estimation symbols) are scrambled are then encoded. After encoding, the header and payload are each segmented into an integer number of symbol frames and submitted to the PMD for modulation and transmission over the medium. (G.9960, 42:1101-1103.) In the receive direction, the inverse operations of decoding and de-scrambling are performed on received symbol frames.

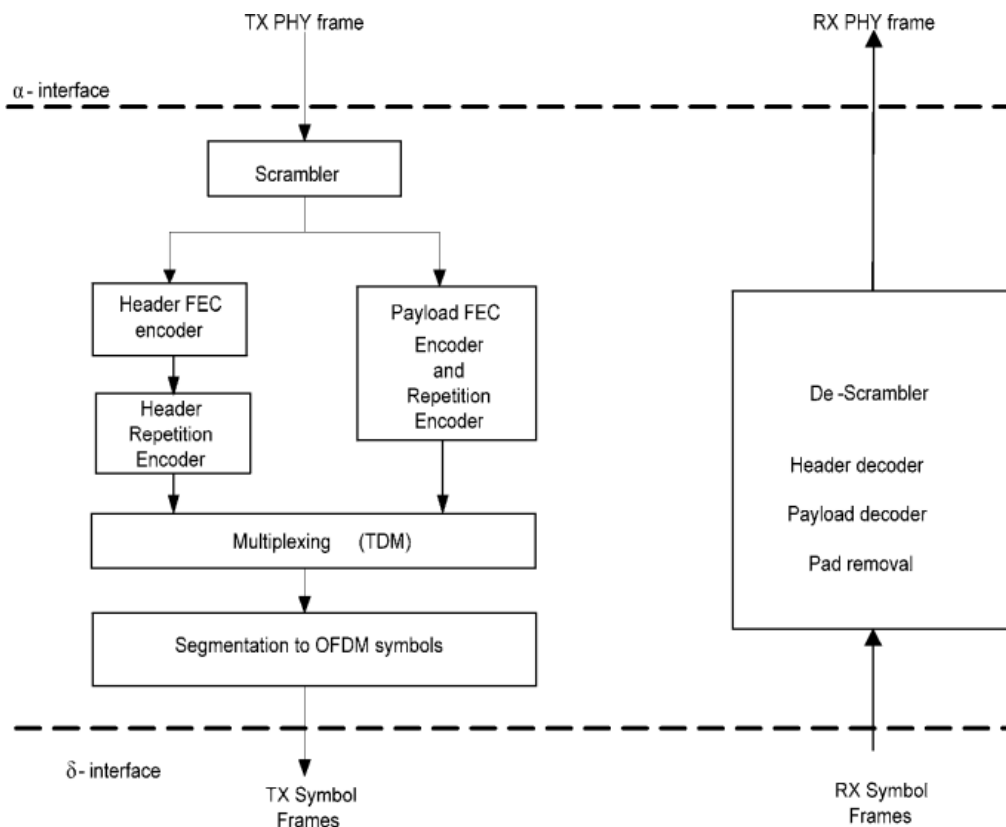


Figure 7-4/G.9960 – Functional model of PMA

(iii) Physical Medium Dependent (PMD) Sub-Layer

61. The functional model of the PMD is illustrated in Figure 7-11 from G.9960, reproduced below. In the transmit direction, the tone mapper divides the incoming symbol frames into groups of bits and associates each group of bits with a specific sub-carrier onto which this group shall be loaded. (G.9960, 52:1397-1399.) The constellation encoder converts every group of incoming bits “into complex numbers which are, respectively, the real and imaginary part of the constellation point on which the particular group of bits is loaded for this subcarrier.” (G.9960, 52:1400-1402.) The OFDM modulator “converts the stream of the N complex numbers at its input into a stream of N time domain samples.” (G.9960, 53:1407-1408.) After adding the preamble, the transmit signal is up-shifted to fit the required spectrum of the transmit signal. (G.9960, 53:1408-1410.)

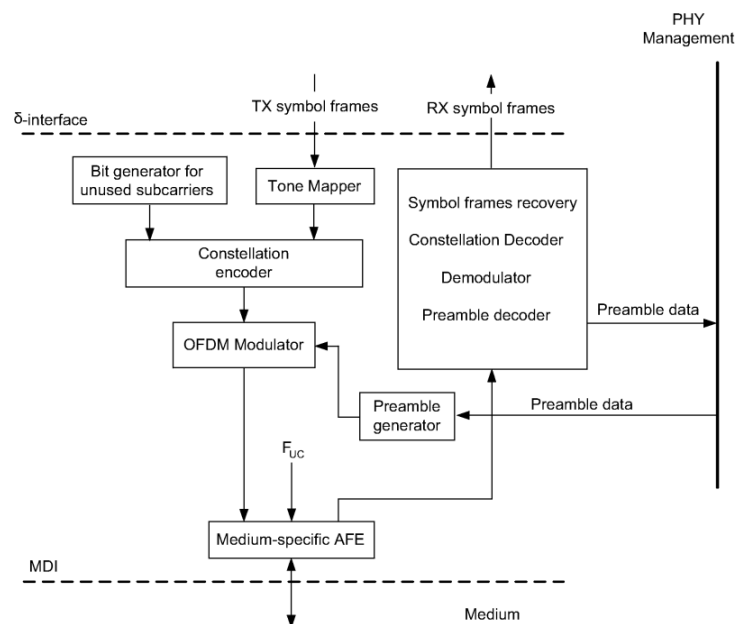


Figure 7-11/G.9960 – Functional model of the PMD

**b. “G.hn: Extended PHY Frame Header” Contribution
(July 2009)**

62. The '146 provisional admits that the G.hn group agreed in April 2009 that “G.hn shall specify means to extend the PHY-frame header.” (Prov., 2.) The contribution, “G.hn: Extended PHY frame header”, from Intellon Corporation published in July 2009 proposed a technique for the header extension “add[ing] an option for supporting extended PHY frame headers that contain $2 \times \text{PHY}_H$ information bits.” (G.hn 09XC-119, 1.) The '146 patent further admits that this contribution is prior art in its background section. (INTEL-1001, 2:9-14.)

63. Intellon’s contribution also notes that the current draft of G.9960 alludes to PHY frame headers that contain more than one symbol (although the reference does not specify whether these additional symbols are for PHY frame header symbol repetition or to support additional frame header information bits). (G.hn 09XC-119, 1.) The contribution proposes to define two one-bit fields in the PHY header: (1) an extended header indication (EHI) which indicates whether the header contains an extended number of bits and (2) an immediate response frame extended header indication (IREHI) which tells receivers if they should respond with a header containing PHY_H or $2 \times \text{PHY}_H$ bits. (G.hn 09XC-119, 2.)

c. “G.hn: Using Two Symbols for the Header of a PHY

frame on Coax” Contribution

64. The contribution, “G.hn: Using Two Symbols for the Header of a PHY frame on Coax,” by CopperGate Communications in July 2009 “proposes that the number of symbols used for the header of the PHY frame on coax” be fixed to exactly two because a single symbol does not provide adequate reliability. (G.hn 09XC-100, 1.) The ’566 patent also admits that the CopperGate contribution was prior art. (INTEL-1001, 1:46-62.) And the ’566 provisional admits that this contribution was provisionally agreed to at the July 30, 2009 meeting. (Prov., 2.)

65. The CopperGate contribution notes that the PHY-header “contain[s] important information necessary in order to process the payload.” (09XC-100, 1.) The effective number of repetitions of the header “depends on the number of active subcarriers and on the number of header symbols.” (09XC-100, 1.) CopperGate proposes to always use two header symbols on the coax medium. The contribution also describes a Header Encoder which includes a Header FEC encoder followed by a Header repetition encoder, which copies the FEC codeword. (09XC-100, 2.)

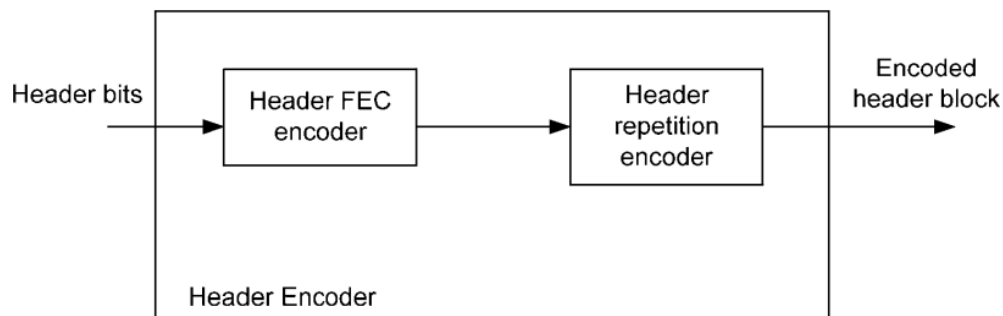
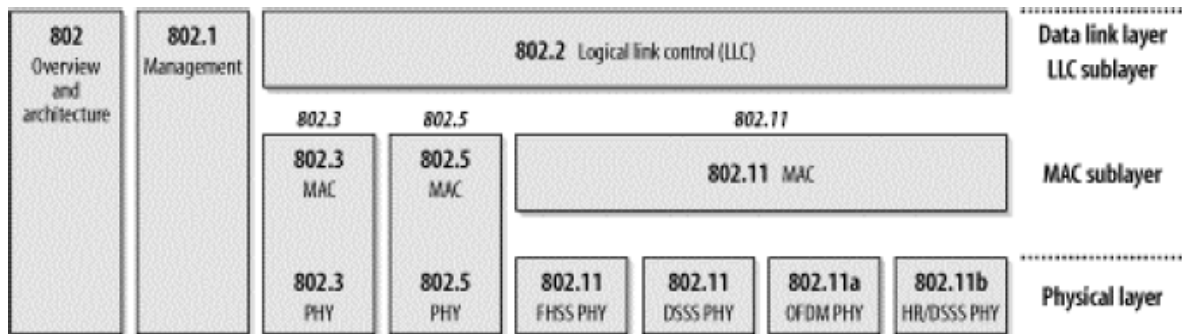


Figure 7-10/G.9960 – Functional diagram of the Header Encoder

3. IEEE 802

66. IEEE 802.11 is a member of the IEEE 802 family, illustrated below, which is a series of specifications for local area network (LAN) technologies. The base 802.11 specification includes two physical layer specifications: a frequency-hopping spread spectrum (FHSS) physical layer and a direct-sequence spread-spectrum (DSSS) layer. (Gast, 8.) A later revision, 802.11a, added a physical layer based on orthogonal frequency division multiplexing (OFDM). (Gast, 8.) Because the '566 patent relates to an OFDM physical layer, Petitioner describes 802.11a further below.

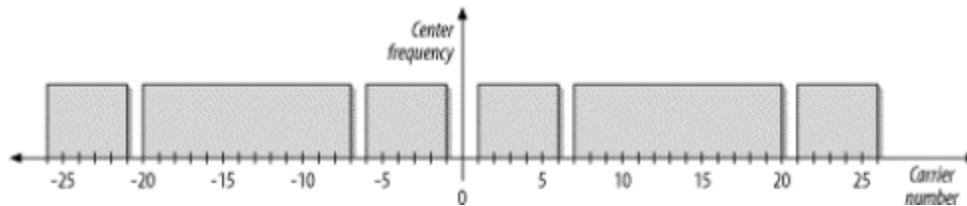


a. OFDM PHY (802.11a)

(i) Operating Channels

67. The OFDM PHY organizes the available spectrum “into operating channels.” (Gast, 206.) For example, the operating channels in 802.11a “are specified as 20 MHz wide.” (Gast, 206.) In the United States, channels in the 5-GHz band are numbered starting every 5 MHz and therefore each 20 MHz 802.11a channel “occupies four channels” shown in the following Table. (Gast, 207). Each

20-MHz 802.11a channel is composed of 52 subcarriers. Four of the subcarriers are used as pilot carriers and 48 subcarriers are used to transmit data. The subcarriers are numbered from -26 to 26, as shown below. Subcarrier 0 is not used. Pilot carriers are assigned to subcarriers -21, -7, 7, and 21.



Gast, Figure 11-8

(ii) Physical Layer

68. The physical layer in 802.11 is divided into two sublayers: the Physical Layer Convergence Procedure (PLCP) sublayer and the Physical Medium Dependent (PMD) sublayer. (Gast, 151.) The PLCP is “the glue between frames of the MAC and radio transmissions in the air.” (Gast, 151.) The PMD is responsible for transmitting any bits it receives from the PLCP over the air using the antenna. (Gast, 151.)

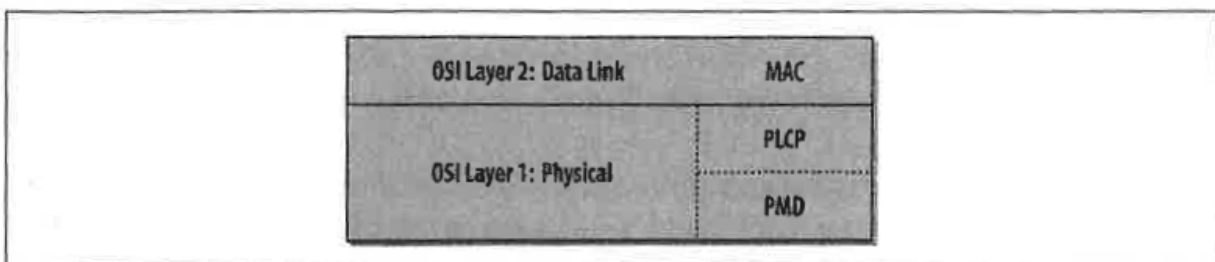


Figure 9-1. Physical layer logical architecture

69. The OFDM PHY layer creates a frame, referred to as the physical protocol data unit (PPDU), by adding a preamble and header to the data received for transmission from the MAC layer, as illustrated in Figure 122 from 802.11a standard. (Gast, 208.) The 802.11a PPDU, illustrated below, includes a preamble that “synchronizes various timers between the transmitter and the receiver.” (Gast, 209.) The PLCP header is transmitted in the Signal field. (Gast, 209.) The header includes information regarding the data rate and number of bytes of the embedded MAC frame (length). (Gast, 210.)

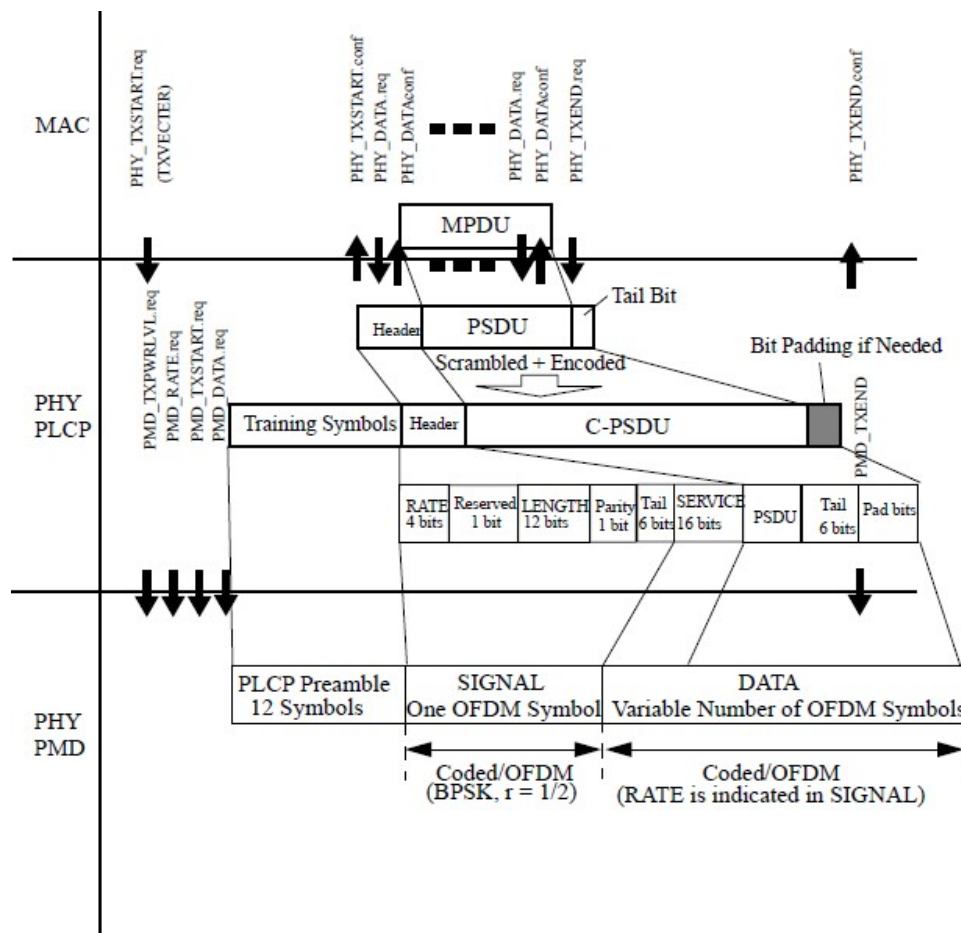


Figure 122—PLCP transmit procedure

b. IEEE 802.11n

70. In 2004, IEEE created the IEEE 802.11n task group (TGn) and charged the group with crafting a standard for WLANs that can sustain up to 100 Mbits/second throughput. This new standard, 802.11n, builds upon previous 802.11 standards, especially 802.11a. Two competing proposals emerged during the deliberations of TGn^{3/4} a proposal from the World-Wide Spectrum Efficiency (WWiSE) group and a proposal from the TGn Sync group. As discussed in further detail in §IV.A.1., the TGn Sync proposal included support for an extended physical layer header. The WWiSE proposal included support for an extended range mode which duplicates (repeats) the physical layer header. (*See*, §IV.A.1.)

B. Level Of Ordinary Skill In The Art

71. I understand that certain issues relating to the validity of the '146 patent must be judged from the perspective of a person of ordinary skill in the relevant art, as I discuss below. I have been asked to define the level of a “person of ordinary skill in the art” or “POSITA” at the time the alleged invention was made. In deciding the level of ordinary skill, I have considered the following factors, which I have been informed are relevant to the determination of ordinary skill in the art:

- the level of education and experience of persons working in the field;
- the types of problems encountered in the art;

- the prior art solutions to these problems;
- the rapidity with which innovations are made; and
- the sophistication of the technology.

72. In my opinion, a person of ordinary skill in the art (“POSITA”) at the time of the purported invention described in the ’146 patent 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. My opinion below explains how a POSITA would have understood the technology described in the references identified in this declaration as of the priority date of the ’146 patent.

C. Claim Construction

73. I understand that “claim construction” is the process of determining a patent claim’s meaning. I understand that the Patent Office applies the same claim construction standard used in district courts which seeks to give claim terms their plain and ordinary meaning to a POSITA at the time of the claimed invention in view of the claims, specification, and prosecution history. I also understand that if the patent applicant gave a term a special meaning in the specification or during prosecution, then the special meaning should be used.

74. I do not believe that any terms require explicit construction.

Therefore, I apply the plain and ordinary meaning to the recited claim terms.

D. The Challenged Claims are Not Entitled to §120 Priority to the 2010 Application

75. In my opinion, Patent Owner cannot show written description support in the specification² for the full scope of the challenged claims. Although the '146 patent identifies alleged priority applications dating as far back as August 21, 2009, its claims are not entitled to that priority because none of the earlier applications disclose a receiver that distinguishes packet formats by detecting the repetition of a header field in the received packet (*i.e.*, “*detecting ... the second header field which repeats the first header field*”).

1. The Claimed Invention Distinguishes Packet Formats by Detecting a Repeated Header Field

76. The '146 patent includes two independent claims, reproduced below:

1. A wireless communication device, comprising:	6. A wireless communication method comprising:
a wireless receiver configured to receive a wireless packet through a communication channel, formats of the wireless packet including a	receiving a wireless packet through a communication channel, formats of the wireless packet including a
first packet format and a second packet format , the first packet format comprising a first header field carried by a first orthogonal	first packet format and a second packet format , the first packet format comprising a first header field carried by a first orthogonal

² The '146 patent and its ancestors in the chain of priority share the same specification.

frequency division multiplexing (OFDM) symbol,	frequency division multiplexing (OFDM) symbol,
the second packet format comprising both the first header field carried by the first OFDM symbol and a second header field carried by a second OFDM symbol which follows the first OFDM symbol, and the second header field being a repetition of the first header field; and	the second packet format comprising both the first header field carried by the first OFDM symbol and a second header field carried by a second OFDM symbol which follows the first OFDM symbol, and the second header field being a repetition of the first header field; and
a demodulator configured to demodulate the received wireless packet,	demodulating the received wireless packet,
wherein the wireless receiver distinguishes the second packet format from the first packet format by detecting, from the received wireless packet, the second header field which repeats the first header field.	wherein the second packet format is distinguished from the first packet format by detecting, from the received wireless packet, the second header field which repeats the first header field.

77. A POSITA would understand that the PPDU's described in the accused 802.11ax standard are wireless packets. As shown below, a physical layer protocol data unit (PPDU) includes a preamble, header, and data fields, consistent with the usage of the term in the art and in the '146 patent. (*See* INTEL-1001, 1:45–46 (“A packet is usually formed by a preamble, header, and payload.”); IEEE Std. 802.11a-1999, 7 (Fig. 107).)

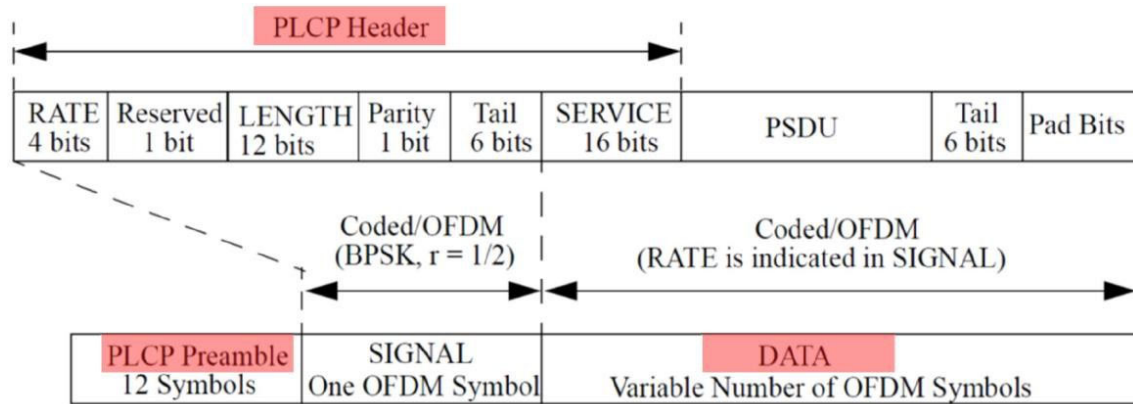
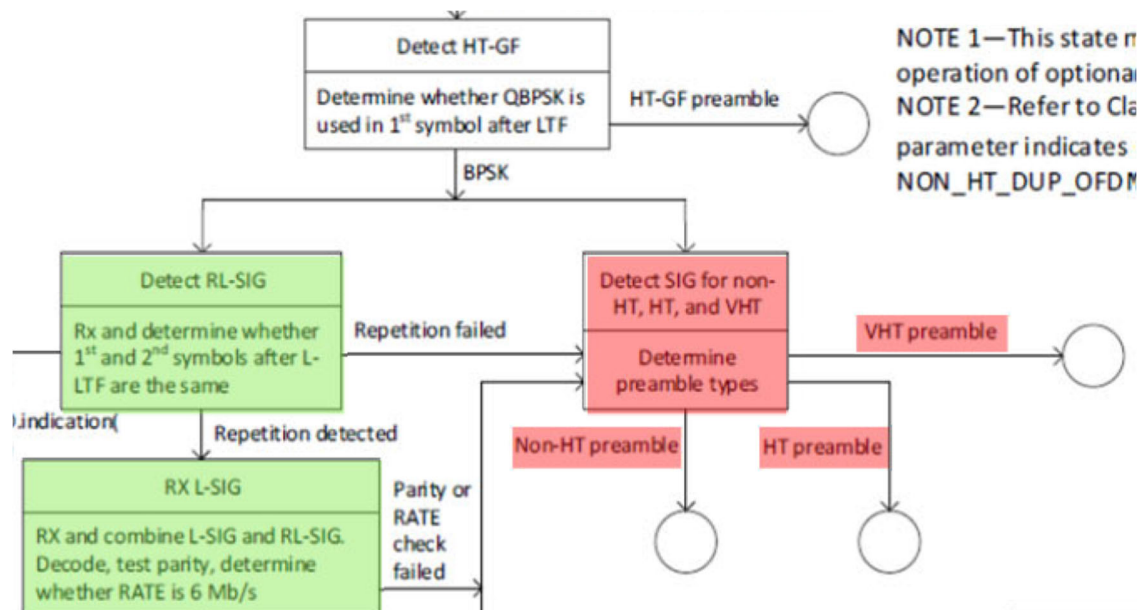


Figure 107—PPDU frame format

78. An annotated excerpt of Figure 27-63 is reproduced below. (IEEE Std. 802.11ax, 654.) Figure 27-63 provides the mechanism for detecting repeated header fields that is accused of infringement in the litigation, namely detecting RL-SIG by “determine[ing] whether 1st and 2nd symbols after L-LTF are the same.” (IEEE Std. 802.11ax, Fig. 27-63.)



79. In 802.11ax’s high efficiency (HE) packet formats, the 1st and 2nd

symbols following L-LTF are the L-SIG and RL-SIG, as shown below. (IEEE Std. 802.11ax, Figs. 27-8, 27-9, 27-10.)

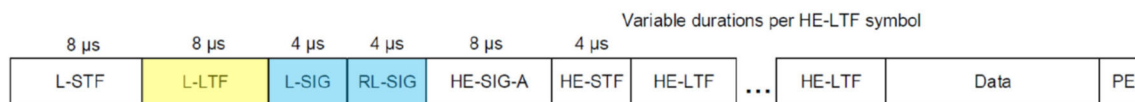


Figure 27-8—HE SU PPDU format

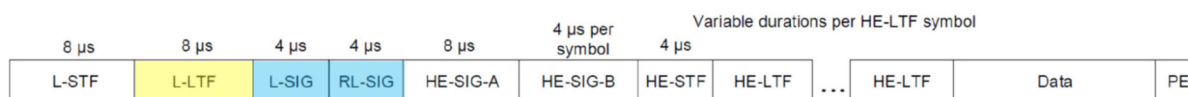


Figure 27-9—HE MU PPDU format



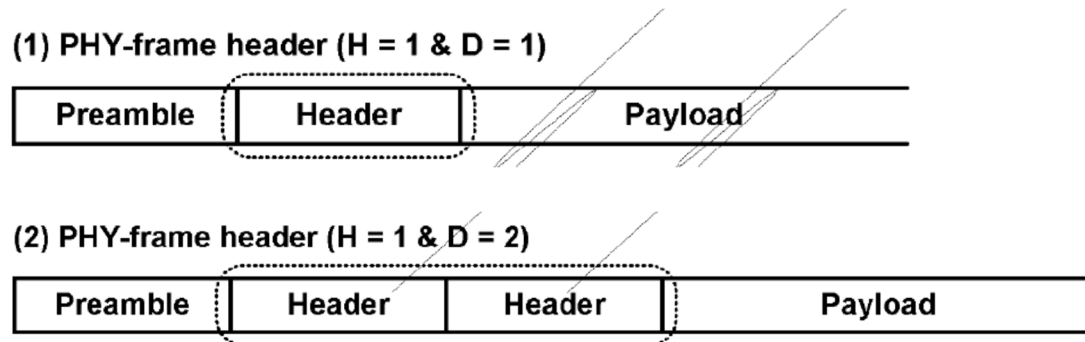
Figure 27-10—HE ER SU PPDU format

80. Thus, 802.11ax describes repetition detection by determining whether the two symbols L-SIG and RL-SIG following L-LTF “are the same” and distinguishing 802.11ax High Efficiency (HE) packets from other non-HE packet formats on that basis. As a result, consistent with PO’s allegations in district court, the independent claims of the ’146 patent require detecting the presence or absence of a repeated header field at the receiver and distinguishing between packet formats on that basis.

2. Distinguishing Packet Formats by Detecting a Repeated Header Field is Not Disclosed in the ’146 Patent’s Specification

81. The ’146 patent does not provide any disclosure of detecting the presence or absence of a repeated header field to distinguish packet formats.

The '146 patent's specification describes a packet with a single header field carried by a single OFDM symbol and a packet with both a header field and a repeated header field carried by two OFDM symbols, which is shown in the first and second rows of Figure 1 below. (INTEL-1001, 5:57–61, Fig. 1.)



82. But the receiver never *detects* the presence or absence of the repeated header field. Instead, the value of D is explicitly communicated to the receiver by the transmitting device so that “the receiver knows how many more OFDM symbols (D–1) are carrying header information for a given frame.” (INTEL-1001, 2:65–3:5.) The number of OFDM symbols carrying header information is explicitly communicated to the receiver by encoding the value of D into a bit field of the header that the receiver can then decode to obtain D and learn how many times the header is repeated in the received packet. (INTEL-1001, 3:1–8, 6:60–62, 7:12–13, 7:17–18, 8:1–2, 8:22–24, 8:42–44, 8:65–67, 9:10–14, 9:44–45, 10:4–5, 10:30–32, Figs. 4–5).

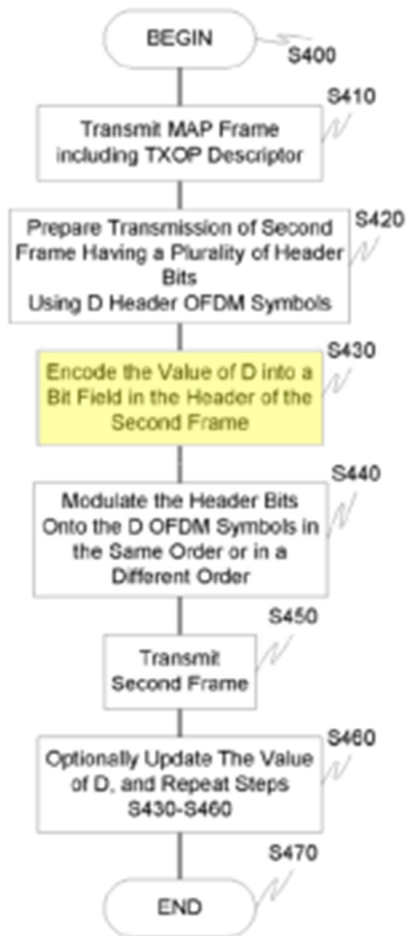


Fig. 4

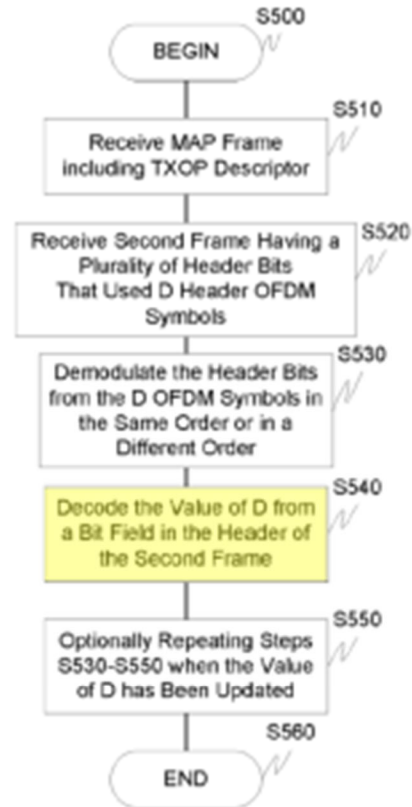


Fig. 5

83. The specification discusses several variations of how the value D might be communicated to the receiver (*e.g.*, the transmitter may “carry, insert or otherwise communicate the value of D in the header”), but it does not disclose any means by which a receiver might distinguish between packet formats other than by decoding the packet to obtain the value of D. (INTEL-1001, 2:65–66.) Indeed, the fact that the value of D is explicitly communicated to the receiver pervades the specification—it appears in every exemplary embodiment, every figure, and every

description of every figure.

84. But the specification does not teach or suggest the idea that a receiver might distinguish packet formats by drawing an inference based on the existence of a repeated header field. Explicitly communicating the number of header symbols to the receiver so that the receiver learns the packet format (which requires decoding) does not disclose detecting a repeated header field (which does not require decoding) and distinguishing packet formats on that basis. In fact, there would be no need for the receiver to *detect* repeated header fields in cases where the number of header repetitions D is explicitly communicated by the transmitter in the packet header.

85. A POSITA would understand detection and decoding to be two different processes disclosed in the '146 patent and that the claimed detection is performed in addition to the process of decoding. In the specification, decoding is the process whereby the receiver learns the information contained in the fields of the received wireless packet, whereas the claimed “detecting” is a means by which the receiver differentiates between packet formats. There are numerous places in the specification confirming that the patentee used the word “decode” (not “detect”) to refer to the process of learning the information contained in the header field. (*See, e.g.*, INTEL-1001, 7:11–13; 7:35–38; 8:22–24; 8:49–52; 9:20–21; and 9:54–55.).

86. Accordingly, in my opinion, this claim limitation is not supported by the specification of any of the '146 patent's ancestor applications.

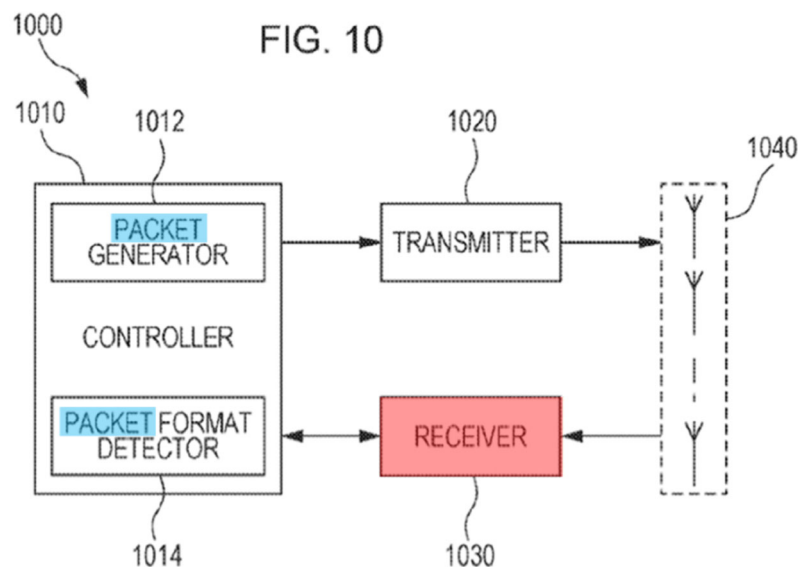
III. GROUND 1: Claims 1-10 are Obvious Based On Huang.

A. Huang Overview

87. Huang discloses a “wireless communication system” for “detection of different packet formats.” (INTEL-1005, 1:9–11.) Huang was filed during the development of the IEEE 80211.ax standard which uses a High Efficiency (HE) packet format to support “multiuser transmission” and “to achieve substantial increase in the real-world throughput ... in high density scenarios while keeping backward compatibility with legacy 802.11a/g/n/ac standards.” (INTEL-1005, 1:15–21.) With the “packet format detection” disclosed in Huang, “it is possible for a receiver to receive and decode packets in an efficient fashion when the receiver can receive packets in different formats.” (INTEL-1005, 2:7–11.) Thus, “802.11ax packets may co-exist with legacy 802.11a/g/n/ac packets in a[n] 802.11 wireless network.” (INTEL-1005, 1:54–55.)

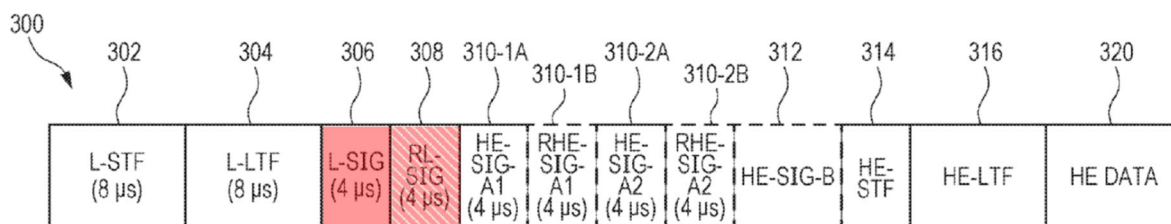
88. As shown in Figure 10 below, Huang describes a “wireless communication apparatus” that “can be an access point in a centralized wireless network, a station in a centralized wireless network, or a node in a peer-to-peer wireless network.” (INTEL-1005, 14:19–24, Fig. 10.) Huang's apparatus comprises a controller, a transmitter, a receiver, and a plurality of antennas.

(INTEL-1005, 14:24–27, Fig. 10.) Huang’s wireless receiver is configured to receive packets in different packet formats sent from both legacy (e.g., 802.11a/g/n/ac) and 802.11ax systems through a wireless OFDM communication channel in the same wireless network. (INTEL-1005, 1:15–32, 2:7–11, 3:6–13, 6:23–31, Figs. 1A–1C, 3.)



89. However, unlike the legacy packet formats of 802.11a/g/n/ac, Huang’s 802.11ax packet format includes a repeated L-SIG header field referred to as “RL-SIG” (for repeated L-SIG) that, when detected by the receiver in a received wireless packet, indicates that an 802.11ax packet has been received. (INTEL-1005, 3:40–43, 6:23–31, 6:38–42, 8:15–21.) This configuration with RL-SIG following L-SIG is shown in Figure 3.

FIG. 3



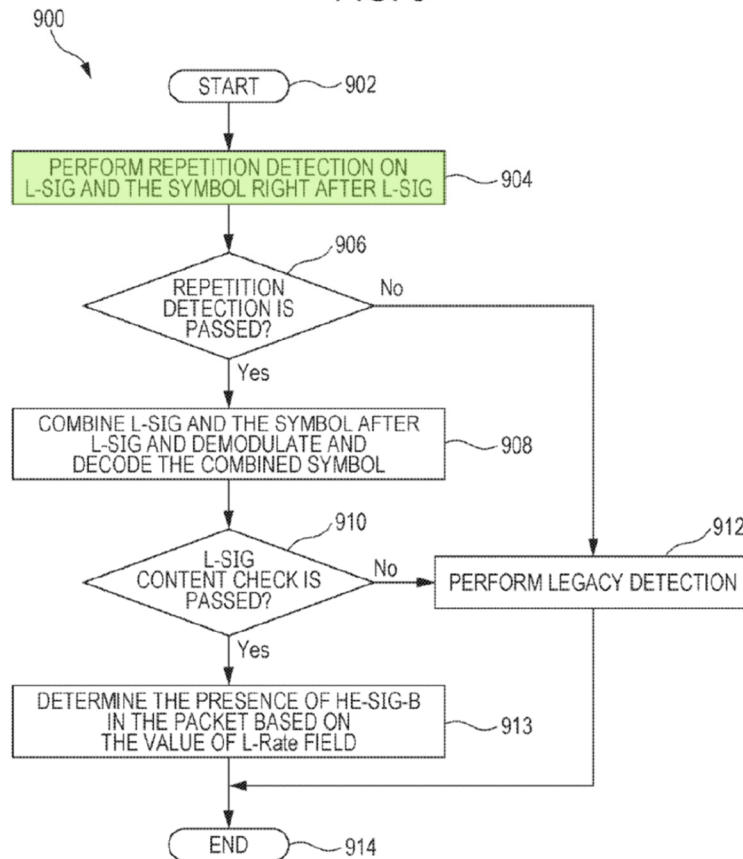
(INTEL-1005, Fig. 3.) Huang’s wireless receiver performs repetition detection based on determining whether the symbol following L-SIG in the wireless packet is a repetition of L-SIG, *i.e.*, includes the same information, and uses the detection of RL-SIG to distinguish 802.11ac packets from packets of other legacy wireless protocols (*e.g.*, 802.11a/g/n/ac). (See INTEL-1005, 6:38–39 (“The RL-SIG 308 is used to assist in detecting the format of the HE packet 300”).

90. “FIG. 9 illustrates a method 900 for detecting packet format at a wireless communication apparatus” such as the one shown in Huang’s Figure 10 above. (INTEL-1005, 13:2–3, Fig. 9.) As shown, “[a]t step 904, the wireless communication apparatus performs repetition detection to determine whether the symbol right after the L-SIG in an incoming packet has the same content as the L-SIG.” (INTEL-1005, 13:5–8.) Huang teaches that it is preferable to perform the repetition detection using “correlation over data subcarriers between the L-SIG and the symbol right after the L-SIG” (INTEL-1005, 13:8–11.)

91. When RL-SIG is detected (repetition detection passed) at step 906, the receiver determines that the received wireless packet is an 802.11ax packet and the

method continues to step 908 where L-SIG and RL-SIG are combined, demodulated, and decoded by the receiver according to the 802.11ax format. (INTEL-1005, 13:15–18, Fig. 9.) Otherwise, the method continues to step 912 where “the wireless communication apparatus performs the legacy 802.11a/g/n/ac packet detection” (INTEL-1005, 13:21–23.) Huang’s wireless communication apparatus then “checks the content of the decoded L-SIG” to confirm “the parity check is ok,” and then at step 913, “determines that the packet has a[n] 802.11ax format and determines the presence of the HE-SIG-B 312 in the HE packet 300 according to the value of the L-Rate used at step 910.” (INTEL-1005, 13:24–27.)

FIG. 9



B. Independent Claims 1 and 6³

[1P] A wireless communication device, comprising:

[1A] a wireless receiver configured to receive a wireless packet through a communication channel, formats of the wireless packet including a first packet format and a second packet format, the first packet format comprising a first header field carried by a first orthogonal frequency division multiplexing (OFDM) symbol, the second packet format comprising both the first header field carried by the first OFDM symbol and a second header field carried by a second OFDM symbol which follows the first OFDM symbol, and the second header field being a repetition of the first header field; and

[1B] a demodulator configured to demodulate the received wireless packet,

[1C] wherein the wireless receiver distinguishes the second packet format from the first packet format by detecting, from the received wireless packet, the second header field which repeats the first header field.

92. In my opinion, Huang renders these claims obvious, as I have set forth below.

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

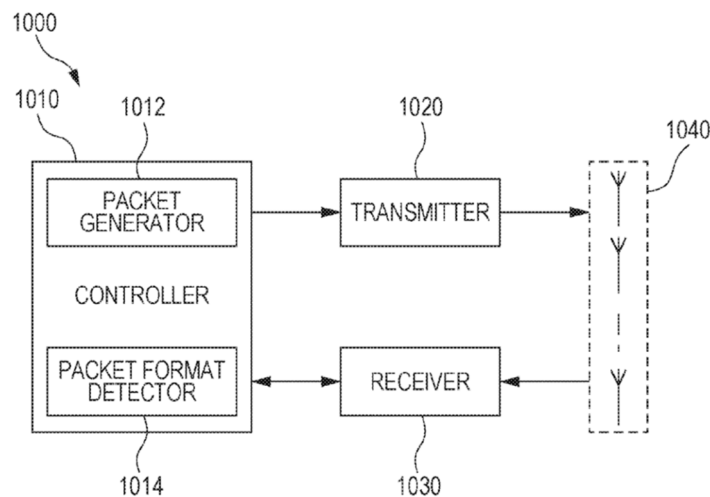
a. *Wireless Communication Device*

93. In my opinion, Huang discloses the preamble. Huang discloses a

³ Given the repeated subject-matter among the claims, I have addressed overlapping claims together. To the extent there are any substantive differences between claims or the corresponding analysis, I have noted that herein. Claim 1 is shown here in its entirety as an example.

“wireless communication system” that includes a “wireless communication apparatus” such as the one shown in Figure 10 below, which comprises a “*wireless communication device*.” (INTEL-1005, 1:9–11, 2:60–62, 14:19–21, Fig. 10 (below).) Huang’s wireless communication apparatus “can be an access point in a centralized wireless network, a station,” or “a node in peer-to-peer” networks, and “comprises a controller 1010, a transmitter 1020, a receiver 1030, and a plurality of antennas 1040.” (INTEL-1005, 14:21–27.) The controller is configured to generate packets to be “transmitted through the antenna” by the transmitter via a wireless communication channel to an intended receiver, and to “analyze and process packets which are received through the antenna 1040 after receiver processing by the receiver 1030.” (INTEL-1005, 14:27–42.)

FIG. 10

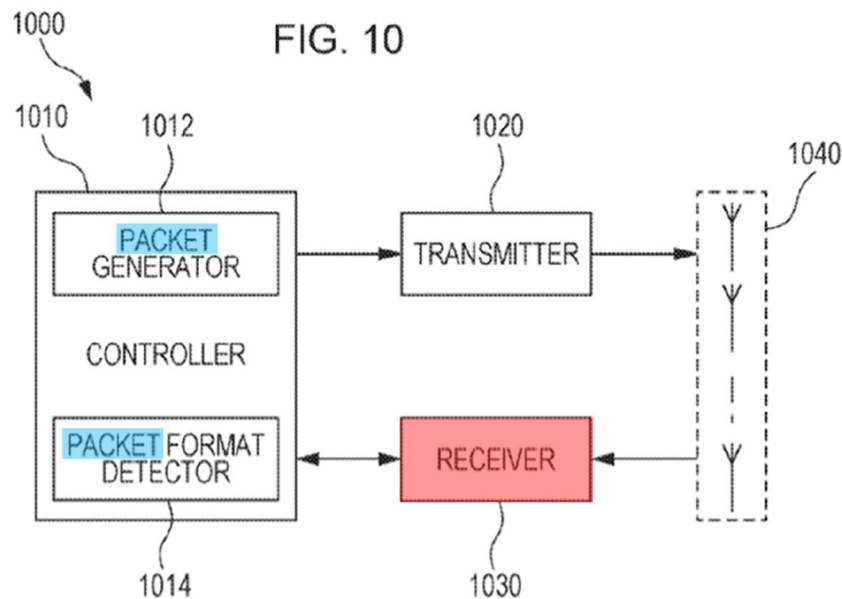


2. Claim Limitations [1A] and [6A]

94. In my opinion, Huang renders these limitations obvious.

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

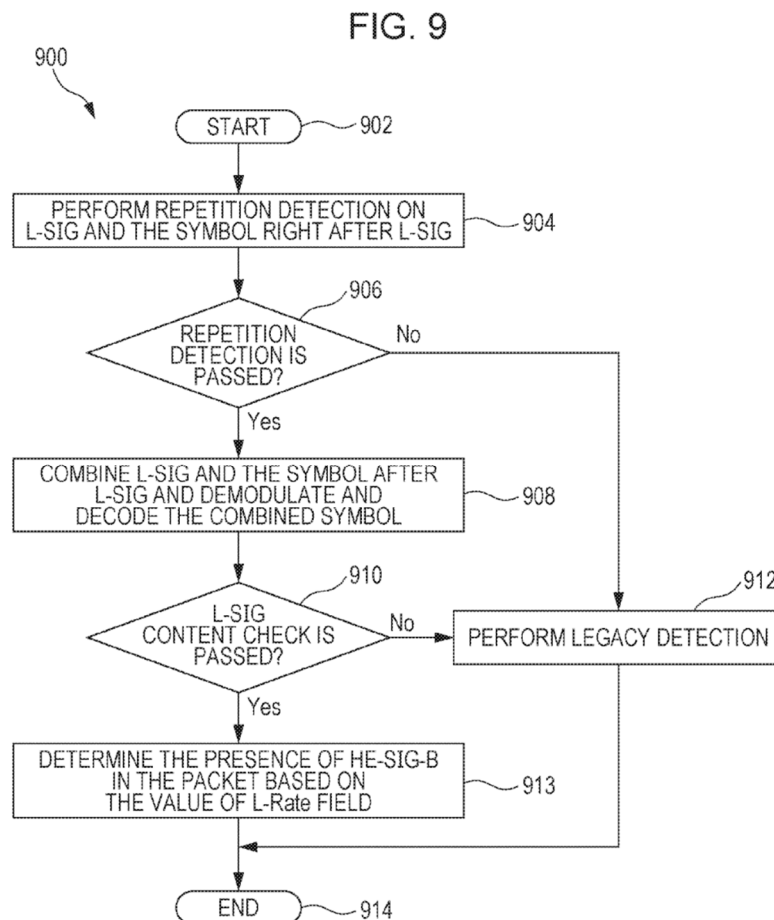
95. Huang's "wireless communication system" includes a "wireless communication apparatus" operating in an 802.11 standard wireless local area network (WLAN) which is packet-based. (INTEL-1005, Title, 1:9–21, Fig. 10 (below).) As shown in Figure 10 below, Huang's "wireless communication apparatus" includes a wireless OFDM "receiver to receive and decode packets ... in different formats," including 802.11ax standard packet formats, as well as formats for "backward compatibility with legacy 802.11a/g/n/ac standards." (INTEL-1005, 1:15–21, 2:7–11, Figs. 1A, 1B, 1C.)



96. Huang discloses that the same wireless communications apparatus is configured to receive both the 802.11ax HE packet format 300 and 802.11a/g/n/ac legacy packet formats. (INTEL-1005, 1:15–21, 2:7–11, Figs. 1A–1C, 3.) Huang

discloses that receiver 1030 works together with packet format detector 1014 to perform packet format detection as described and shown in Huang's Figure 10.

97. Figure 10 depicts a “block diagram illustrating [an] example architecture of a wireless communication apparatus 1000 according to the present disclosure” that is configured to perform the methods set forth in the disclosed embodiments, including the “method 900 [of Figure 9] for detecting packet format at a wireless communication apparatus according to the third embodiment of the present disclosure.” (INTEL-1005, 14:19–21, 13:2–4, Fig. 9 (below).)



In the method of Figure 9, Huang's wireless communication device “performs

repetition detection” to “determine[] that the packet has a[n] 802.11ax format” and processes the received wireless packet accordingly; and if not, Huang’s device performs legacy packet format detection (e.g., 802.11a/g/n/ac packets). (INTEL-1005, 13:4-25.) Thus, Huang discloses a wireless communications device (HE capable device) configured to receive and perform packet detection on both an 802.11ax HE packet format of the present disclosure as well as 802.11a/g/n/ac legacy packet formats.

98. Also, as shown in Figure 10 above, Huang’s wireless OFDM receiver is coupled to a “plurality of antennas 1040” and is capable of multiple-input multiple-output (“MIMO”) communications “in order to allow multiple spatial stream transmission through multiple antenna” for HE packets. (INTEL-1005, 6:36–37, 14:26–27; *see also id.*, 4:37–39.) And Huang further discloses that receiver 1030 is operable to “receive and decode packets.” (INTEL-1005, 2:9.) Therefore, in order to facilitate MIMO reception, a POSITA would understand that Huang’s wireless receiver 1030 includes multiple antenna front end blocks coupled respectively to each of the plurality of antennas in order to receive the RF signals associated with an incoming wireless packet.

99. Notably, Huang describes receiver 1030 in general terms that would include one or more antenna front ends, demodulators and decoders within receiver 1030. (INTEL-1005, 2:7–11 (receiver “receive[s]” and “decode[s]” packets).) And

Huang's Figure 10 illustrates packet format detector 1014 and receiver 1030 as a separate components, which contrasts with the '146 patent's disclosure and independent claims that describe and claim the receiver and demodulator as separate components and do not describe a packet format detector. (*See, e.g.*, INTEL-1001, 6:20–27 (Fig. 2), 9:15–18 (Fig. 5), cl. 1.)) Petitioner disputes that including the demodulator or other components—such as a packet detector—in the claimed “*wireless receiver*” is consistent with the plain and ordinary meaning of these terms as recited in the claims

100. But Huang's description is nevertheless consistent with PO's apparent interpretation and application of the claims in the district court case, in which PO points to the same PHY-layer disclosures of the accused 802.11ax wireless standard as satisfying both the “*wireless receiver*” ([1A]/[6A]) and “*demodulator*” ([1B]/[6B]) limitations. (*Compare* INTEL-1007, 3–15 (relying upon excerpts from §§17.3, 19.3, 21.3, and 27.3 of IEEE Std. 802.11ax as evidence of the claimed “*wireless receiver*”) with *id.*, 31–32 (relying on excerpts from §§17.3, 19.3, 21.3, and 27.3 of IEEE Std. 802.11ax as evidence of the claimed “*demodulator*”).) This indicates that, under PO's infringement theory, the accused wireless receiver incorporates the entire chain of components in the receive path. Therefore, if the Board adopts PO's interpretation, Huang's receiver 1030 and packet format detector 1014 together satisfy the requirements of independent claims 1 and 6.

Huang therefore discloses the “*wireless receiver*” of claim 1 and the “*receiving*” step of claim 6

101. Furthermore, it is well known that 802.11 packets are communicated “*through a wireless communication channel.*” Huang teaches 802.11 standard wireless communications using orthogonal frequency division multiplexing (OFDM), which “subdivides” the bandwidth of a communication channel “into a plurality of orthogonal frequency subcarriers.” (INTEL-1005, 1:25–27.) The “input data stream” is correspondingly “divided into several parallel substreams” for transmission over the subcarriers. (INTEL-1005, 1:28–30.) In addition, Huang teaches that the bandwidth of the communication channel to be used for communications is designated in 802.11 packets. For example, the “HE-SIG-A” field in an 802.11ax packet “carries common information required to interpret the remaining HE packet [], e.g., **channel bandwidth**, etc.” (INTEL-1005, 6:43–45.) As discussed, Huang’s wireless communication apparatus includes a controller configured to generate packets to be “transmitted through the antenna” to an intended receiver and to “analyze and process packets which are received through the antenna” at the receiver. (INTEL-1005, 14:27–45.) A POSITA would understand that a wireless communication channel is formed between the transmitting and receiving antennas such as the ones shown in Huang’s Figure 10 above.

102. Huang therefore discloses a “*wireless receiver*” (e.g., the 802.11ax receiver of Fig. 10) “*configured to receive a wireless packet*” (e.g., the receiver can receive and decode wireless packets) “*through a communication channel*” (e.g., 802.11 wireless channel).

b. *Formats of the wireless packet include a first and second packet format*

103. As I have set forth below, Huang discloses that the same wireless communication device is configured to receive both a “*first packet format*” [802.11a/g/n/ac packet formats] and a “*second packet format*” [802.11ax packet format]. Huang’s wireless communication device is configured to transmit and receive 802.11ax packet formats as well as “various formats of legacy 802.11a/g/n/ac packets.” (INTEL-1005, 3:6–13 (Figs. 1A–1C (below)); 6:23–31(Fig. 3 (below)).) Huang also teaches a method of distinguishing between 802.11ax and legacy packet formats such as 802.11a/g/n/ac. (See, e.g., INTEL-1005, 13:2–21.)

FIG. 1A

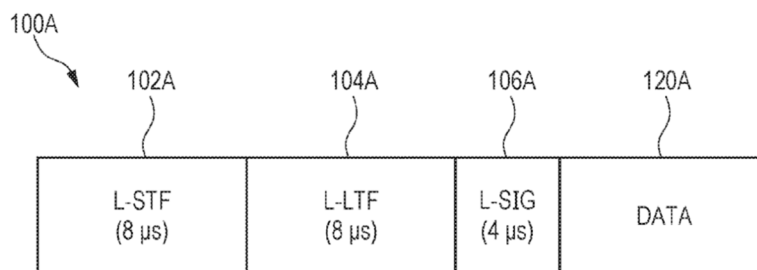


FIG. 1B

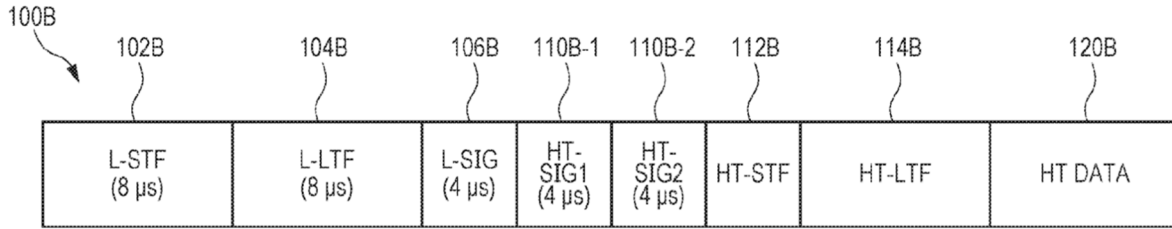


FIG. 1C

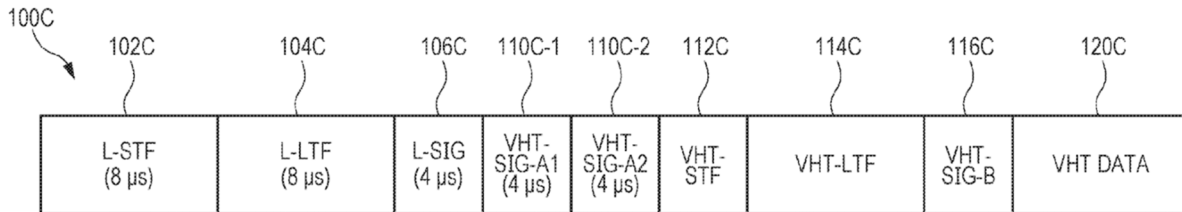
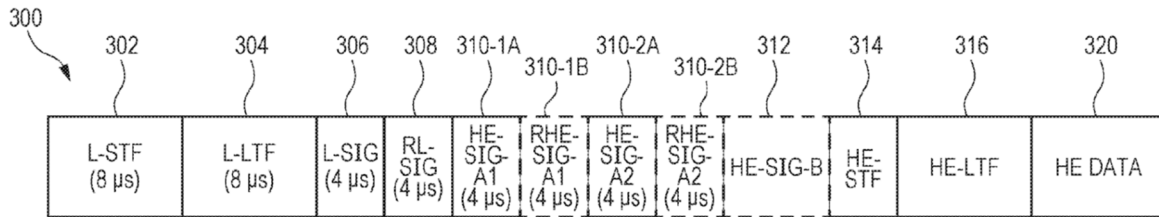


FIG. 3

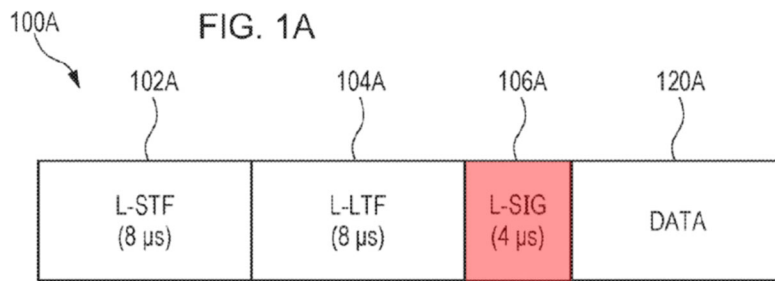


104. Thus, Huang discloses a wireless communications apparatus (High Efficiency (HE)-capable device) that is configured to receive both the “*first packet format*” (802.11a/g/n/ac packet formats) and the “*second packet format*” (802.11ax packet format).

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

105. Huang discloses a “*first packet format*” that comprises a “first header field” carried by a “first OFDM symbol.” For example, Huang’s disclosure of an

802.11a/g packet format in Figure 1A below includes an “L-SIG” field which is a packet header field carried by one OFDM symbol. (INTEL-1005, 3:14–19, Fig. 1A.)



Other examples include the 802.11n and 802.11ac packet formats, each of which also include an L-SIG field carried by one OFDM symbol. (See INTEL-1005, Figs. 1B–1C.)

FIG. 1B

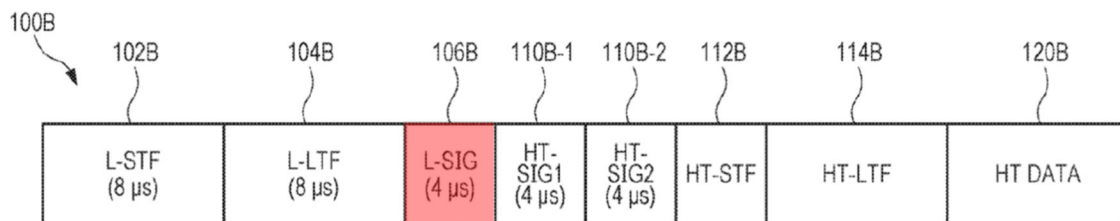
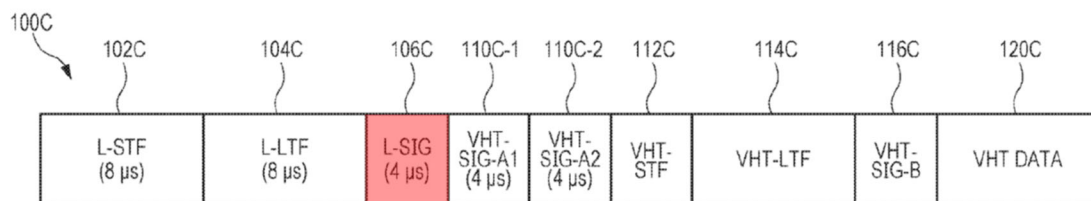


FIG. 1C

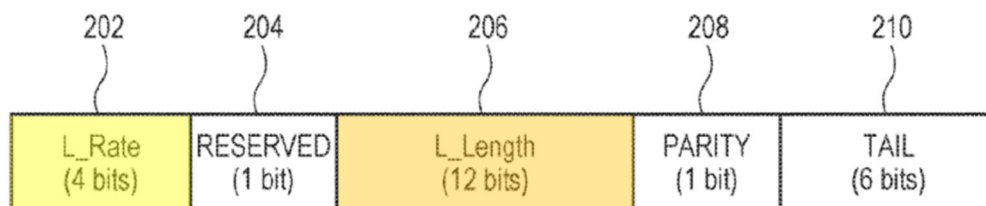


106. Thus, Huang discloses a “*first packet format*” that comprises a legacy 802.11a/g/n/ac packet format, *e.g.*, a format having a legacy signal field L-SIG

carried by one OFDM symbol.

107. A POSITA would understand that L-SIG field is a “*header field*” because, consistent with the description of a “header” in the patent specification, it precedes the packet payload and includes “important control information for the receiver to decode the payload properly, and also provides information about the packet length for virtual carrier sensing.” (INTEL-1001, 1:55–58.) As shown in Figure 2A below, the L-SIG field has a number of subfields, for example the “L_Length and L_Rate fields,” that include important control information for receiving and correctly decoding the packet. (INTEL-1005, 3:24–27, Fig. 2A (below).)

FIG. 2A



108. According to Huang, the L_Rate field “conveys information about the modulation type and coding rate as used in the data field” and the L-Length field “indicates the amount of data in the data field [] in octets.” (INTEL-1005, 3:27–29, 3:30–32.) A POSITA would understand that these field include “information about the packet length for virtual carrier sensing,” and are designed so that an “802.11a/g device receiving the HT packet 100B or the VHT packet 100C will

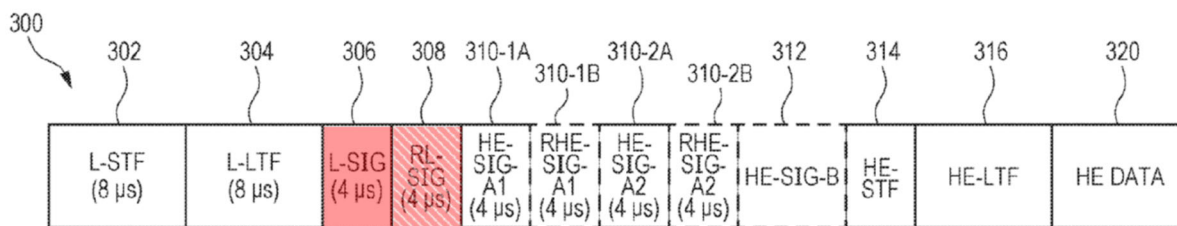
defer [the channel] for the duration indicated by the L_Length and L_Rate fields in the L-SIG.” (INTEL-1005, 6:3–8; INTEL-1001, 1:57–58.)

109. In addition, Huang teaches that L-SIG is carried by “*a first OFDM symbol*.” For example, as shown in Figure 2C, Huang’s “transmitter 250 for L-SIG 106A in the 802.11a/g packet 100A ... generates an OFDM symbol which is 3.2 microseconds in length,” which, after prepending “a 0.8 microsecond cyclic prefix into the OFDM symbol,” forms a “4 microsecond OFDM symbol” for L-SIG 106A. (INTEL-1005, 3:44–45, 3:64–4:3.)

- d. ***Second packet format comprises both the first header field carried by the first OFDM symbol and a second header field carried by a second OFDM symbol which repeats the first OFDM symbol***

110. Huang discloses “an HE packet 300 complying with the IEEE 802.11ax specification framework” (“*second packet format*”) that includes an L-SIG field and a repeated L-SIG field (“RL-SIG” for *repeated* legacy signal field) which follows L-SIG in the packet as shown in Figure 3. (INTEL-1005, Fig. 3, 6:23–31.)

FIG. 3



As discussed in §III.B.2.c.–d., *supra*, L-SIG is a “*header field*” because it contains

important control information for the receiver to decode the packet payload properly, as well as packet length information for virtual carrier sensing. (INTEL-1001, 55–58.) “L-SIG 306 in the HE packet 300 is defined and transmitted in the similar manner as L-SIG 106A in the 802.11a/g packet 100A as illustrated in FIG. 2A, FIG. 2B and FIG. 2C.” (INTEL-1005, 6:32–35.)

111. In addition, L-SIG and RL-SIG are each carried by an OFDM symbol. “The RL-SIG 308 repeats the content of the L-SIG 306 and [is] transmitted in the similar manner as the L-SIG 306, resulting that the RL-SIG 308 **is also a 4 microsecond OFDM symbol.**” (INTEL-1005, 6:38–42.)

112. Therefore, Huang discloses “*a first packet format*” (e.g., legacy 802.11a/g/n/ac packets) and “*a second packet format*” (e.g., 802.11ax packets), “*the first packet format comprising a first header field*” (e.g., L-SIG) “*the second packet format comprising both the first header field ... and a second header field ... which follows the first ..., and the second header field being a repetition of the first header field*” (e.g., L-SIG followed by RL-SIG in 802.11ax HE packets).

These header fields are “*carried by a first OFDM symbol*” and “*a second OFDM symbol which follows the first OFDM symbol*” (L-SIG and RL-SIG are carried by separate OFDM symbols in the 802.11ax HE packet format).

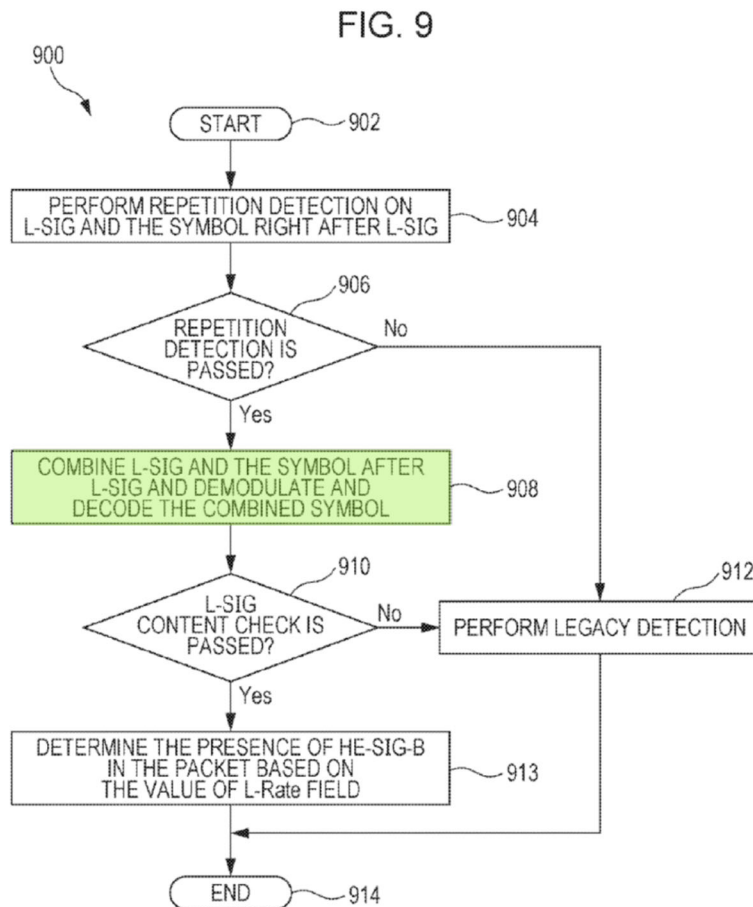
3. Claim Limitations [1B] and [6B]

113. In my opinion, Huang discloses these limitations.

a. Demodulator to demodulate the received wireless packet

114. Huang discloses demodulating the L-SIG and RL-SIG header fields.

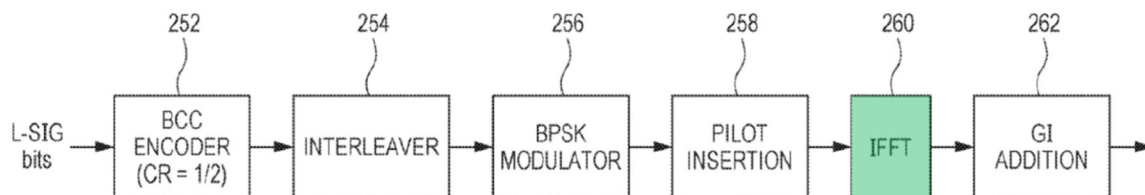
“[T]he wireless communication apparatus performs [maximal ratio combining] on the L-SIG and the symbol right after the L-SIG, followed by demodulating and decoding the combined L-SIG symbol.” (INTEL-1005, 13:15–18.) Further, Huang’s Figure 9 “according to the third embodiment of the present disclosure” includes a demodulation step. (INTEL-1005, 13:2–4, Fig. 9.)



115. A POSITA would therefore understand that Huang requires a “*demodulator*” in the device hardware to demodulate a received wireless packet—

including its header fields—before it can properly decode and process the packet payload. Further, Huang discloses receiving and decoding incoming wireless packets, which a POSITA would understand requires demodulating the packets as well. (INTEL-1005, 2:7–11). Additionally, Huang discloses transmitting the packets via “OFDM modulation” that “may be realized by an efficient IFFT (Inverse Fast Fourier Transform) that makes a plurality of subcarriers usable with little complexity” and that is performed by an “IFFT block.” (INTEL-1005, 1:37–39, 3:49, Fig. 2C.) The IFFT block “performs IFFT operation on 52 information and pilot symbols and generates an OFDM symbol” (INTEL-1005, 3:64–66, Fig. 2C.)

FIG. 2C



116. A POSITA would understand that an IFFT modulated signal transmitted through a wireless communication channel must be demodulated after reception to recover the original information. A POSITA would further understand that Huang’s system requires a corresponding Fast Fourier Transform (FFT) block in the receive chain which performs the reverse operation to demodulate the received wireless packets for further processing.

117. In addition, as discussed above in §III.B.2.a., *supra*, Huang’s wireless OFDM receiver is MIMO-capable, and thus a POSITA would understand it includes a number of demodulator blocks in accordance with the number of MIMO spatial streams that the wireless receiver can receive. These demodulators are the claimed “*demodulator configured to demodulate the received wireless packet.*”

118. Therefore, a POSITA would understand Huang discloses the use of a demodulator to demodulate the received wireless packet.

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

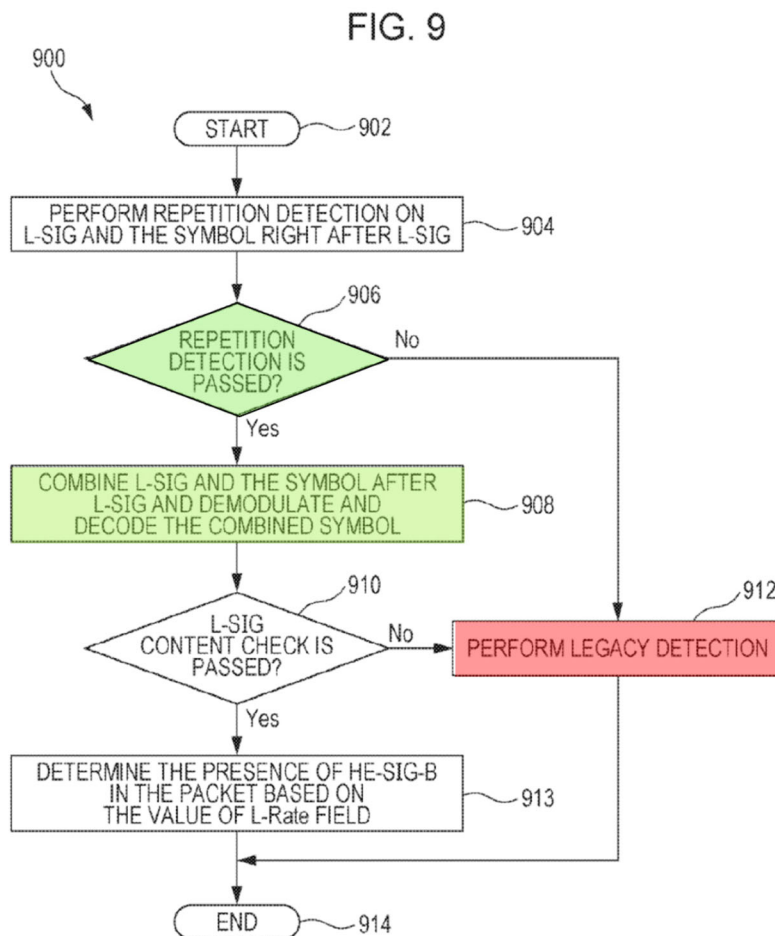
119. In my opinion, Huang discloses these limitations.

a. *Receiver distinguishes the packet format by detecting, from the received wireless packet, the second header field which repeats the first header field*

120. As discussed in §III.B.2.d., *supra*, Huang discloses a second 802.11ax HE packet format with a repeated legacy signal field RL-SIG. Huang teaches that RL-SIG “is transmitted in a similar manner as L-SIG” and “is used to assist in detecting the format of the HE packet 300.” (INTEL-1005, 6:38–41.) Huang also teaches that “the RL-SIG 308 in the HE packets 300” is “instrumental in differentiating 802.11ax packet[s] from legacy 802.11a/g/n/ac packets” (INTEL-1005, 8:45–47.)

121. “FIG. 9 illustrates a method 900 for detecting packet format at a wireless communication apparatus according to the third embodiment of the

present disclosure.” (INTEL-1005, 13:2–4, Fig. 9 (below).) “At step 904, the wireless communication apparatus “performs repetition detection to determine whether the symbol right after the L-SIG in an incoming packet has the same content as the L-SIG” (which is preferably performed using “correlation over data subcarriers between the L-SIG and the symbol right after the L-SIG ...”). (INTEL-1005, 13:5–11.)



122. Huang further teaches that “repetition detection is passed” when “the correlation value is larger than a predefined threshold ...” (INTEL-1005, 13:11–13.) In such cases, the method continues to 908 for HE packet processing. (INTEL-

1005, Fig. 9.) “Otherwise the wireless communication apparatus performs the legacy 802.11a/g/n/ac packet detection at step 912.” (INTEL-1005, 13:21–23.)

123. “At step 908, the wireless communication apparatus performs [maximal ratio combining] on the L-SIG and the symbol right after the L-SIG, followed by demodulating and decoding the combined L-SIG symbol.” (INTEL-1005, 13:15–18.) After the “L-SIG content check is passed” at step 910 (*i.e.*, “the parity check is ok”), Huang’s apparatus “determines that the packet has a[n] 802.11ax format”; “[o]therwise the wireless communication apparatus performs the legacy 802.11a/g/n/ac packet detection at step 912.” (INTEL-1005, 13:21–25.)

124. Thus, Huang discloses a wireless communication device that detects a repeated RL-SIG field and distinguishes an 802.11ax packets format from 802.11a/g/n/ac legacy packet formats on that basis. Based on whether RL-SIG is detected in a received wireless packet, Huang’s wireless communication apparatus distinguishes between 802.11ax and legacy packet formats, and demodulates and decodes the received wireless packet accordingly.

125. Therefore, Huang discloses distinguishing 802.11ax packets from no-802.11ax packet formats. According to PO’s infringement contentions, distinguishing in the manner disclosed in Huang meets the “*distinguish[ing] the second packet format from the first packet format*” limitation because, as alleged, the accused 802.11ax standard distinguishes the 802.11ax packets from non-

126. Therefore, although Petitioner disagrees that distinguishing 802.11ax packets from a *group* of packet formats (*i.e.*, one of the numerous legacy packet formats) is consistent with the plain and ordinary meaning of claims 1 or 6, Huang’s disclosures are nevertheless consistent with PO’s apparent interpretation and application of the claims in PO’s contentions.

127. Claim 1 additionally requires that the “*wireless receiver*” performs the “*detecting*” and “*distinguishing*” operations on the “*received wireless packet*.” As noted in §VI.B.2.a, *supra*, Huang discloses a receiver 1030 that a POSITA would understand includes one or more antenna front ends, demodulators, decoders, as well as a “packet format detector 1014” under PO’s apparent interpretation of the term “*wireless receiver*” that together perform the packet format detection steps 904–910 of Huang’s Figure 9. (INTEL-1005, Figs. 9–10.) This contrasts with claim 1, which claims the receiver and demodulator as separate components and requires the “*wireless receiver*” to perform the “*distinguish[ing]*” step. (INTEL-1001, 6:20–27 (Fig. 2), 9:15–18 (Fig. 5), cl. 1.)

128. Petitioner disagrees that defining the receiver to include the entire chain of components in the receive path (*i.e.*, the demodulator, decoder, and Huang’s packet format detector 1014) is consistent with the plain and ordinary meaning of claim 1 or the ’146 patent’s specification, or that claim 1 permits other components besides the receiver to perform this step. But Huang’s description is

nevertheless consistent with PO's apparent interpretation and application of the claims in the co-pending district court case, which point to the entire receive chain of the 802.11ax standard as being part of the receiver. (INTEL-1007, 3–15, 31–32.)

129. Nonetheless, a POSITA would understand that demodulation is part of the receive chain consistent with how PO is reading the claims, and if the Board adopts PO's expansive view that the scope of the claimed "*wireless receiver*" encompasses the entire receive chain, then Huang discloses it. (See §VI.B.2.a, *supra*.) Huang's wireless communication device includes a demodulator and a decoder in the receive chain that "demodulat[e] and decod[e] the combined L-SIG symbol." (INTEL-1005, 13:15–18, Fig. 9.) Huang likewise discloses that the packet format detector 1040 is used in conjunction with receiving packets. (INTEL-1005, 14:39–45.)

130. Thus, if the Board determines the claimed "*wireless receiver*" should be interpreted to cover the entire receive chain of the wireless device, then Huang discloses this limitation of claim 1 because Huang's receiver and packet format detector together perform the claimed function of distinguishing/detecting packet formats based on the existence of the repeated legacy signal field RL-SIG.

131. Huang therefore discloses a "*wireless receiver*" that "*distinguishes the second packet format*" (e.g., 802.11ax packets) "*from the first packet format*" (e.g., one of the legacy packet formats) "*by detecting, from the received wireless packet,*

the second header field” (RL-SIG) “which repeats the first header field” (L-SIG).

C. Claims 2 and 7

[2] The wireless communication device of claim 1, wherein the wireless receiver determines the received wireless packet as the second packet format when the second header field is detected from the wireless packet.

132. In my opinion, Huang discloses these limitations.

a. *Receiver determines the received wireless packet as the second packet format when the second header field is detected*

133. As discussed above in §III.B.4.a, *supra*, Huang’s receiver distinguishes the format of the received wireless packet by detecting the presence or absence of RL-SIG (the repeated L-SIG field), and demodulates and decodes the wireless packet accordingly. (INTEL-1005, 13:4–18.) When the RL-SIG field (*second header field*) is detected in the received wireless packet (*e.g.*, based on performing “correlation over data subcarriers between the L-SIG and the symbol right after the L-SIG”), the receiver “determines that the packet has a[n] 802.11ax format” (*second packet format*). (INTEL-1005, 13:9–11, 13:24–25.)

D. Claims 3 and 8

[3] The wireless communication device of claim 1, wherein the wireless receiver determines the received wireless packet as the first packet format when the second header field is not detected from the wireless packet.

134. In my opinion, Huang discloses these limitations.

a. *Receiver determines the received wireless packet as the*

first packet format when the second header field is not detected

135. As discussed above in §III.B.4.a., *supra*, Huang’s receiver distinguishes the format of the received wireless packet by detecting the presence or absence of a repeated L-SIG field (RL-SIG), and demodulates and decodes the wireless packet accordingly. (INTEL-1005, 13:5–18.) When RL-SIG (*second header field*) is not detected in the received wireless packet (e.g., based on performing “correlation over data subcarriers between the L-SIG and the symbol right after the L-SIG”), the receiver “performs the legacy 802.11a/g/n/ac packet detection” to determine that a legacy packet such as an 802.11a/g/n/ac packet (*first packet format*) without a repeated legacy header field RL-SIG has been received. (INTEL-1005, 13:9–11, 13:21–23.)

E. Claims 4 and 9

[4] The wireless communication device of claim 1, wherein the first and second header fields contain information for decoding the wireless packet.

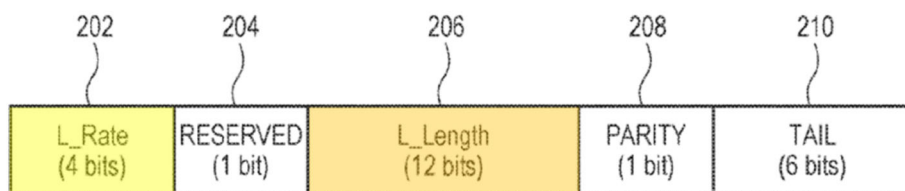
136. In my opinion, Huang discloses these limitations.

a. *The first and second header fields contain information for decoding the wireless packet*

137. As I have discussed above in §III.B.2.c.–d., *supra*, the L-SIG field (and by repetition the RL-SIG field) is a header field precisely because it “contains important control information for the receiver to decode the payload properly,” consistent with the description of a “header” in the specification.

(INTEL-1001, 1:55–58.) The L-SIG field contains “L_Length and L_Rate fields” that provide information about the modulation type, coding rate and packet length, all of which a POSITA would understand are required for the receiver to decode the payload properly. (INTEL-1005, 3:24–32, Fig. 2A (below).) “Note that not only is it important for the intended receiver of the packet 100A to correctly decode the L-SIG 106A, but also nearby stations need to correctly decode the L-SIG 106A in order to properly defer the channel access.”) (INTEL-1005, 3:40–43.)

FIG. 2A



B. Claims 5 and 10

[8] The wireless communication device of claim 1, wherein the first and second header fields contain information related to a length of the wireless packet.

138. Huang discloses these limitations.

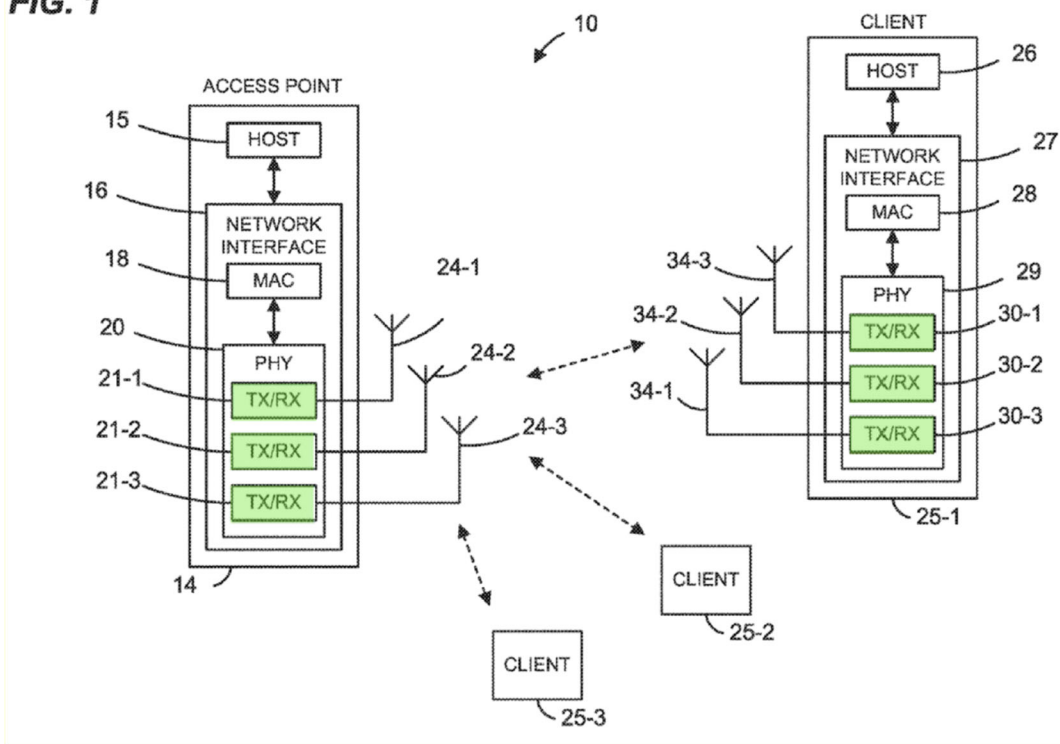
a. *The first and second header fields contain information related to length of the wireless packet*

139. As discussed above in § III.B.2.c.–d., *supra*, the L-Length field in the L-SIG field (and by repetition the RL-SIG field) “indicates amount of data in the data field [] in octets,” which a POSITA would understand is “*information related to a length of the wireless packet.*” (INTEL-1005, 3:30–32.)

IV. GROUND 2: Claims 1–10 are Obvious Based on Sun

A. Sun Overview

140. Sun discloses “wireless local area networks that utilize data unit preambles which indicate a communication protocol.” (INTEL-1006, 1:17–19.) Sun further discloses “a wireless network device” such as an access point (AP) or client station (STA) of a wireless local area network (WLAN) that generates an orthogonal frequency division multiplex (OFDM) data unit ...,” which is a “*wireless communication device.*” (INTEL-1006, 2:55–58.) An example WLAN is shown in Figure 1 below that includes an AP wirelessly communicating with multiple client STAs each having a physical layer (PHY) processor that includes a plurality of transceivers TX/RX (shaded green) coupled to a plurality of antennas. (INTEL-1006, 3:30–32, 4:8–11, Fig. 1.) The transceivers are “configured to transmit the generated data units via the antenna(s)” and “to receive data units via the antenna(s) ...,” and thus include both transmitting and receiving capabilities as shown by the arrows in Figure 1 below. (INTEL-1006 5:1–4, 5:33–36, Fig. 1.)

FIG. 1

141. A POSITA would understand that the “data units” referred to in Sun are wireless network “packets.” In several places, Sun refers to “data units” and network “packets” synonymously. (See INTEL-1006, 5:61–63 (“The *data unit* 200 includes a preamble ... generally used for *packet* detection ...”), 7:61–62 (“the *data unit* 600 omits the data portion 616 (e.g., the data unit 600 is a null-data *packet*).”).) This is consistent with the usage of these terms in the art. For example, a POSITA would understand that data units such as physical layer protocol data units (PPDUs) used in the physical layer (PHY) of 802.11 wireless systems are network packets that include a preamble, header and data fields, consistent with the description of a packet in the ’146 patent specification. (INTEL-1001, 1:45–46 (“A packet is usually formed by a preamble, header, and payload.”); *see also* IEEE Std.

802.11a-1999, 7 (Fig. 107).)

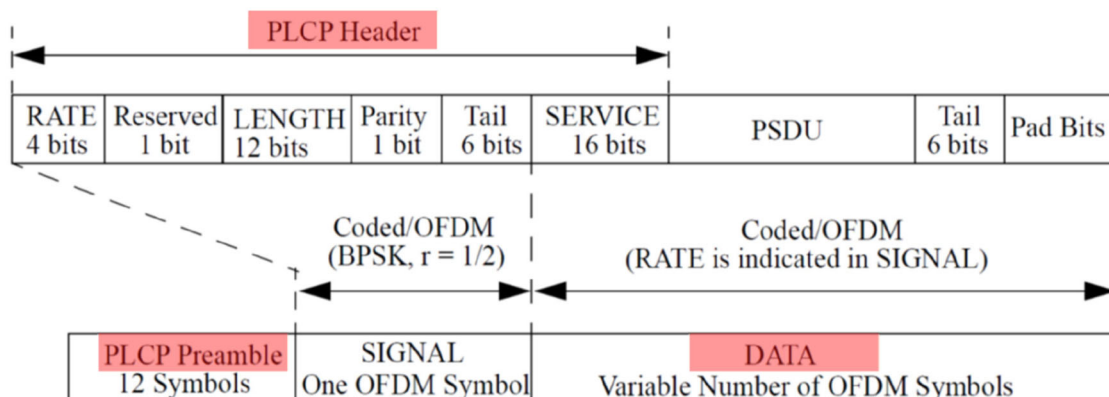
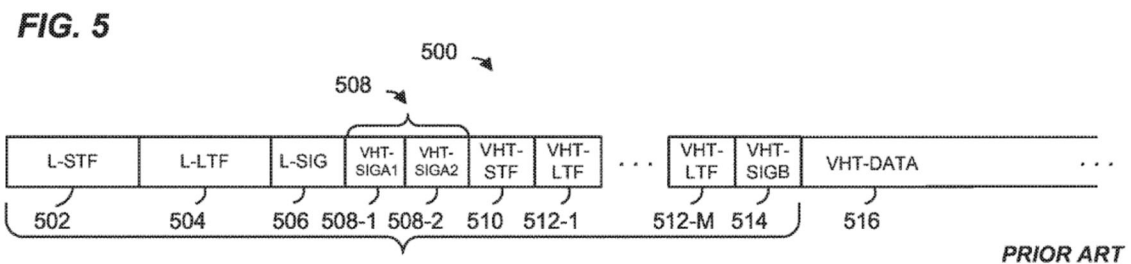
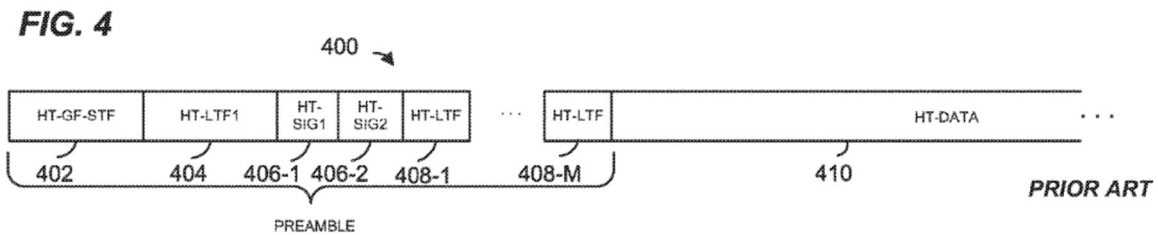
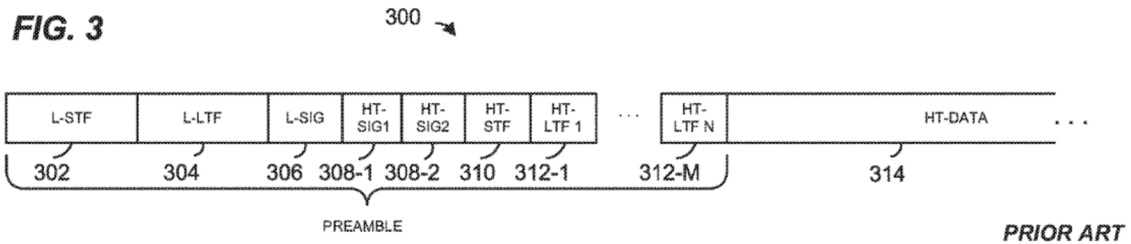
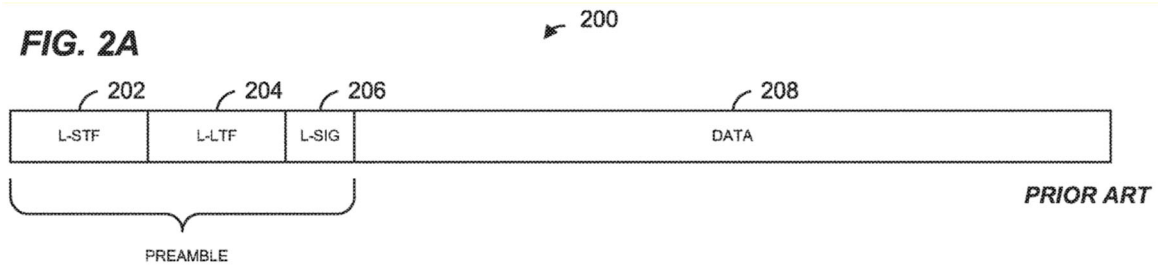
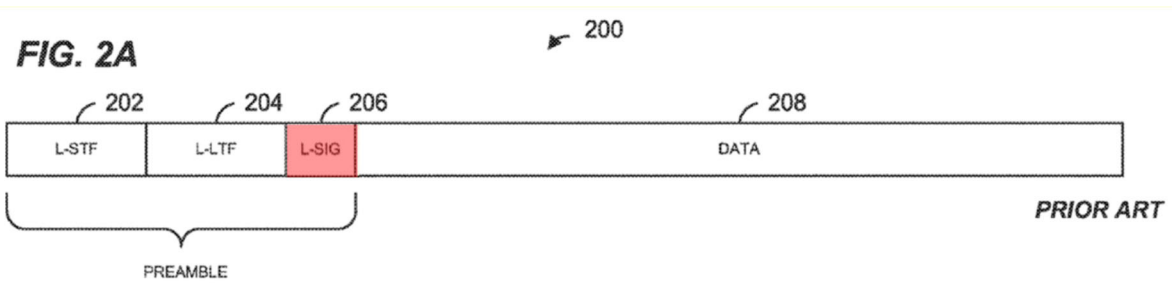


Figure 107—PPDU frame format

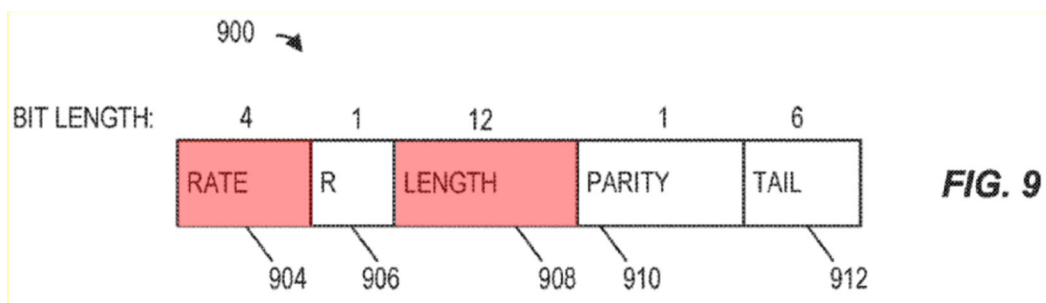
142. Sun discloses communicating wireless packets through a communication channel such as “single input single output (SISO) channel configuration” or a “multiple input multiple output (MIMO) channel configuration.” (INTEL-1006, 6:8–9, 6:25–26.) Sun’s communication device (*e.g.*, AP or STA) is configured to transmit and receive wireless packets (i) “according to a first communication protocol (*e.g.*, a High Efficiency, HE, or 802.11ax communication protocol)” (*see* Figure 7), (ii) “a second communication protocol (*e.g.* according to the IEEE 802.11ac Standard)” (*see* Figure 5), or (iii) “a third communication protocol, and/or a fourth communication protocol (*e.g.*, according to the IEEE 802.11a Standard and/or the IEEE 802.11n Standard)” (*see* Figures 2A, 3–4 (below)). (INTEL-1006, 3:44–56.)



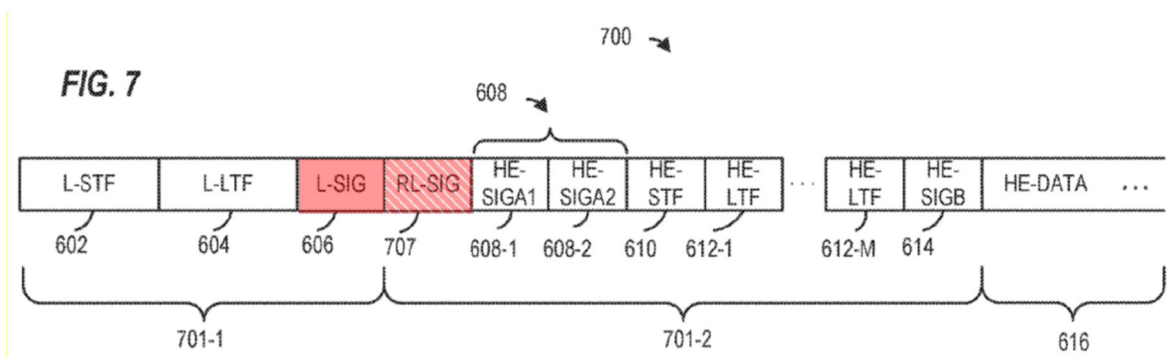
143. For example, Sun discloses an 802.11a/g packet format shown below that includes a legacy signal field “L-SIG.” (INTEL-1006, 5:53–6:2, Fig. 2A.)



144. The “legacy signal field (L-SIG)” is “used to carry certain physical layer (PHY) parameters with the data unit [], such as modulation type and coding rate used to transmit the data unit” (INTEL-1006, 5:66–6:2, Fig. 9.) As shown, the L SIG field includes (i) “a rate subfield 904” for communicating the modulation and coding rate, and (ii) a “length subfield 908” for communicating the packet length. (INTEL-1006, 10:52–53.)



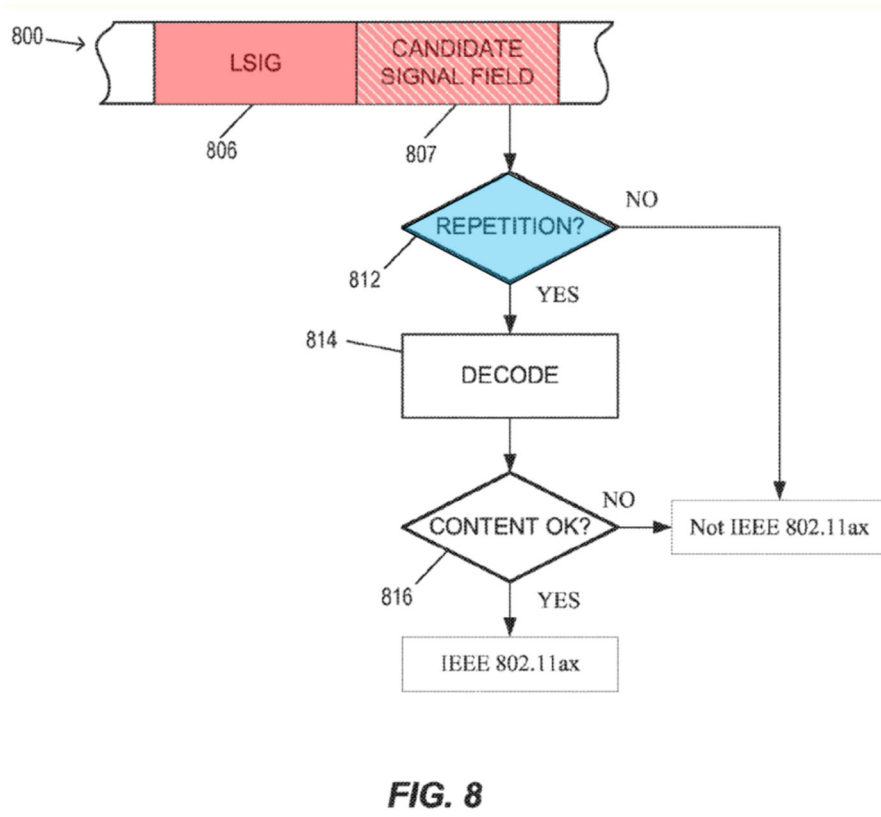
145. Sun further discloses “OFDM data unit 700” which is an 802.11ax HE packet format that includes an L-SIG field and a repeated legacy signal field (“RL SIG”) (shaded red) that follows the L-SIG field in the time domain as shown in Figure 7 below. (INTEL-1005, 8:26–46, Fig. 7.)



146. Both L-SIG and RL-SIG in data unit 700 are carried by one OFDM symbol. For example, “a first OFDM symbol that includes the L-SIG field 806”

and a “second OFDM symbol that follows the first OFDM symbol and includes a second field” which includes a “repeated legacy signal field 707 (see FIG. 7).” Sun discloses a method of distinguishing an 802.11ax packet format from non-802.11ax packet formats such as 802.11a/g/n/ac packet formats based on whether the repeated legacy signal field (RL-SIG) is detected in the received data unit. (See INTEL-1006, 8:31–36 (“[T]he preamble 701 is formatted such that a receiving device that operates according to the HEW communication protocol (e.g., 802.11ax) is able to determine that the preamble 701 is a preamble of the HEW communication protocol rather than another preamble.”).) Sun also discloses that the “repeated legacy signal field generally provides for a more reliable auto-detection of the IEEE 802.11ax protocol.” (INTEL-1006, 3:6–8.)

147. “FIG. 8 is a diagram of an example method for determining whether a received OFDM data unit 800 corresponds to [802.11ax] or another communication protocol” (INTEL-1006, 9:4–7, Fig. 8 (below).) At block 812, the receiving client STA “determines whether the candidate signal field 807 corresponds to a repetition of the L-SIG field 806” (INTEL-1006, 9:40–43.)



148. In one embodiment, “to determine whether the candidate signal field 807 corresponds to the repetition,” Sun describes using “time-domain correlation” of the first and second OFDM symbols 806 and 807. (INTEL-1006, 9:43–47.) In another embodiment, the client STA “decodes” the first and second OFDM symbols “to obtain respective first and second bit sequences” and “compares ... the bit sequences to determine whether the candidate signal field 807 corresponds to the repetition.” (INTEL-1006, 9:47–52.)

149. Based on whether RL-SIG field is detected, Sun’s receiver distinguishes the 802.11ax packet format from non-802.11ax packet formats, and demodulates and decodes the received wireless packet accordingly. (INTEL-1006,

9:17–19, 10:31–34.) “In response to a determination that the candidate signal field 807 does not correspond to a repetition of the L-SIG field 806 (NO at block 812), the client station 25 determines that the received data unit 800 does not correspond to the ... 802.11ax protocol ...”; and “[i]n response to a determination that the candidate signal 807 corresponds to a repetition of the L SIG field 806 (YES at block 812), the client station 25 proceeds to block 814 and decodes the candidate signal field 807 to obtain the signal field bit sequence” (INTEL-1006, 9:56–67.)

150. This informs 802.11ax receivers that an 802.11ax packet has been received if a content check on the L-SIG field is passed at step 816. To determine whether the content of the L-SIG field corresponds to 802.11ax or another communication protocol, “[a]t block 816, the client station 25 determines whether the signal field bit sequence has a valid content value” (*i.e.*, a “data rate of six megabits per second,” a “length field ... that cannot be divided by three” and “suitable” parity and tail values). (INTEL-1006, 10:9–11, 10:14–24.) “In response to a determination that the content of the L-SIG field 806 corresponds to the [802.11ax] communication protocol, the client station 25 decodes ... the OFDM symbols of the data unit 800 according to the [802.11ax] communication protocol.” (INTEL-1006, 10:30–34.)

151. Thus, Sun’s receiver distinguishes the received wireless packet format

by detecting the presence or absence of a repeated legacy signal field (RL-SIG), and demodulates and decodes the wireless packet accordingly. (INTEL-1006, 9:17–19, 9:32–67, 10:30–34.) When the RL-SIG field is detected in the received data unit, the receiver determines that an 802.11ax data unit has been received. (INTEL-1006, 9:63–67.) On the other hand, when the RL-SIG field (*second header field*) is **not** detected in the received data unit, the receiver “determines that that the received data unit 800 does not correspond to ... the IEEE 802.11ax protocol.” (INTEL-1006, 9:56–62.)

B. Independent Claims 1 and 6⁵

[1P] A wireless communication device, comprising:

[1A] a wireless receiver configured to receive a wireless packet through a communication channel, formats of the wireless packet including a first packet format and a second packet format, the first packet format comprising a first header field carried by a first orthogonal frequency division multiplexing (OFDM) symbol, the second packet format comprising both the first header field carried by the first OFDM symbol and a second header field carried by a second OFDM symbol which follows the first OFDM symbol, and the second header field being a repetition of the first header field; and

[1B] a demodulator configured to demodulate the received wireless packet,

⁵ Given the repeated subject-matter among the claims, this petition addresses overlapping claims together. To the extent there are any substantive differences between claims or the corresponding analysis, that is noted herein.

[1C] wherein the wireless receiver distinguishes the second packet format from the first packet format by detecting, from the received wireless packet, the second header field which repeats the first header field.

152. In my opinion, Sun renders these claims obvious, as I set forth below.

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

153. In my opinion, Sun discloses the preamble.

a. *Wireless Communication Device*

154. Sun discloses “wireless local area networks that utilize data unit preambles which indicate a communication protocol.” (INTEL-1006, 1:17–19.) Sun further discloses a “wireless network device such as an access point (AP) or client station (STA) of a wireless local area network (WLAN)” which is a “*wireless communication device*” that “generates an orthogonal frequency division multiplex (OFDM) data unit” (INTEL-1006, 2:55–58.) An example WLAN is shown in Figure 1 below that includes an AP wirelessly communicating with a number of client STAs, each having a physical layer (PHY) processor that includes a plurality of transceivers TX/RX (shaded green) coupled to a plurality of antennas. (INTEL-1006, 3:30–32, 4:8–10, Fig. 1 (shown below).)

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

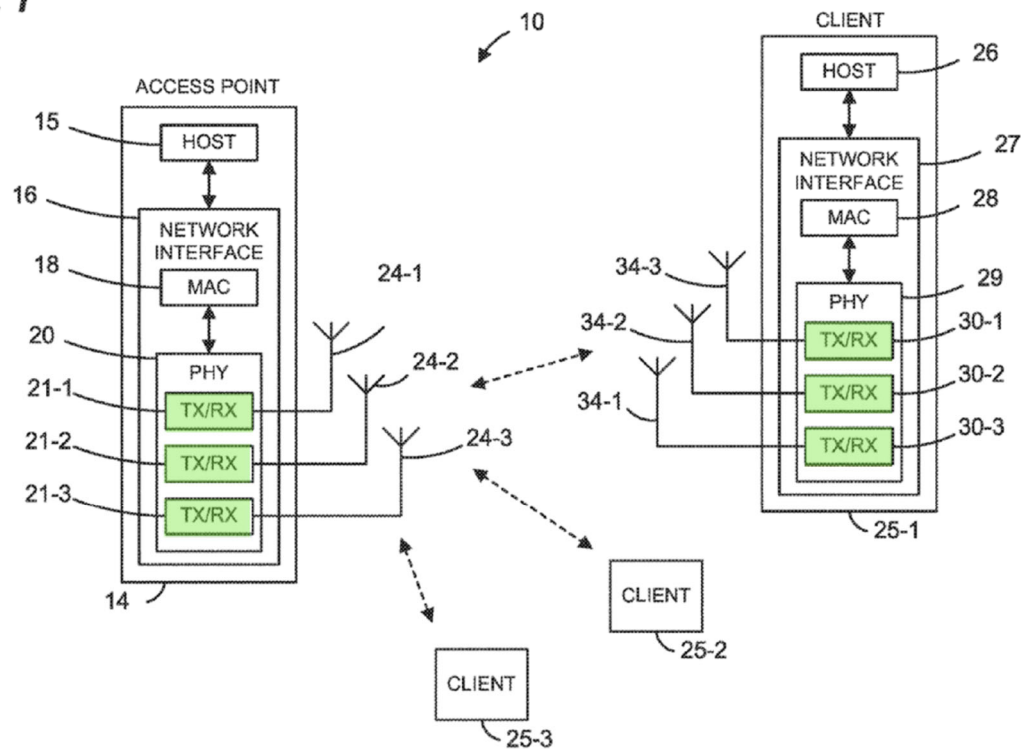
155. In my opinion, Sun discloses these limitations.

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

156. The transceivers in Sun’s APs and STAs include both transmitting and

receiving capabilities as shown by the arrows in Figure 1 below. The transceivers are “configured to transmit the generated data units via the antenna(s)” and “to receive data units via the antenna(s)” (INTEL-1006 5:1–4, 33–36.)

FIG. 1



Sun’s transceivers therefore include a “*wireless receiver*” to perform the receiving functions. Sun further discloses communicating “data units” which, as discussed in §IV.A., *supra*, are network “packets.”

157. Sun discloses that the same wireless network device is configured to receive both the 802.11ax HE data unit 700 and non-802.11ax data units such as those complying with the 802.11a/g/n/ac wireless communication protocols. (See INTEL-1006, 5:53–57 (Fig. 2A), 6:10–13 (Fig. 3), 6:35–38 (Fig. 4), 6:50–53 (Fig.

5), 7:16–19 (Fig. 6) & 8:26–27 (Fig. 7).)

158. Figure 1 depicts a “block diagram of an example wireless local area network (WLAN), according to an embodiment” that includes an AP communicating with a plurality of client STAs (INTEL-1006, 3:23–24, Fig. 1.) The APs and STAs are “wireless network device(s)” configured to perform the methods set forth in the disclosed embodiments, including the “method for determining whether a received OFDM data unit 800 corresponds to the [802.11ax] protocol or a different communication protocol” of Figure 8. (INTEL-1006, 2:55–57, 9:4–12, Fig. 8 (below).) “As shown in FIGS. 2A, 3, 5, and 7, various data units [are] generated according to different communication protocols.” (INTEL-1006, 9:19–21.)

159. In the method of Figure 8, Sun’s wireless communication device (*e.g.*, AP or STA) (i) “receives a second OFDM symbol” (candidate signal field 807) “that follows the first OFDM symbol” (L-SIG 806), and (ii) “determines whether the candidate signal field 807 corresponds to a repetition of the L-SIG field 806” (INTEL-1006, 9:28–32, 9:40–43.) “In one scenario, the data unit 800 corresponds to the IEEE 802.11a protocol ... (see FIG. 2A)” and “[i]n another scenario, the data unit 800 corresponds to the ... IEEE 802.11ax protocol” (INTEL-1006, 9:32–37.)

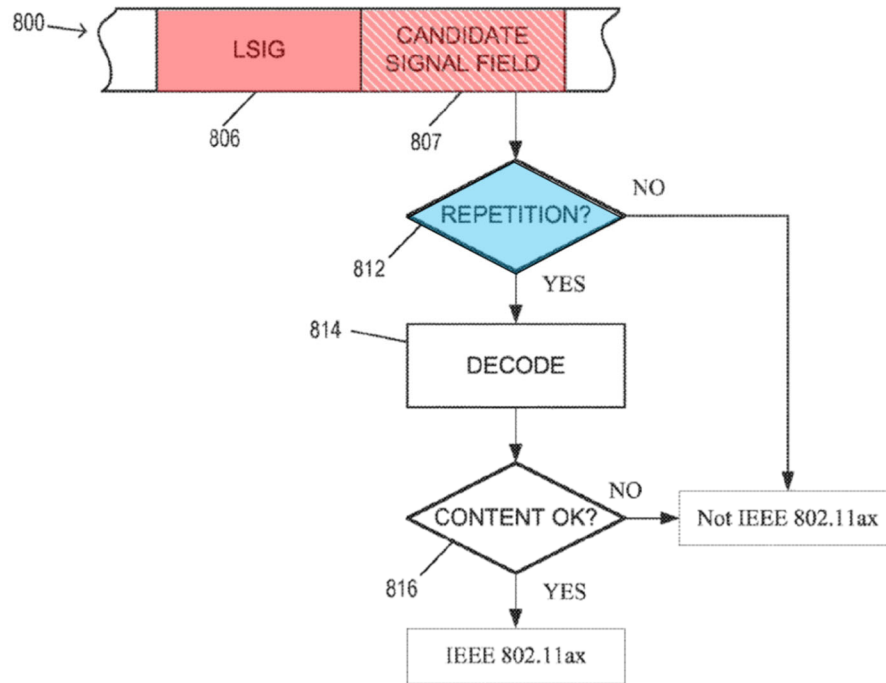


FIG. 8

160. Based on whether candidate signal field 807 is determined to be an 802.11ax HE packet format or a non-802.11ax format (*e.g.*, 802.11a/g/n/ac), Sun’s wireless device performs the appropriate receiving and decoding operations. (INTEL-1006, 9:56–67, 10:30–34.) Thus, Sun discloses a wireless network device (HE capable device) configured to receive and perform packet detection on both 802.11ax HE packets of the disclosed embodiment of Figure 7, as well as non-802.11ax HE packet formats (*e.g.*, 802.11a/g/n/ac formats) of Figures 2A, 3–5.

161. Also, as shown in Figure 1 above, Sun’s wireless OFDM receiver is coupled to a “plurality of antennas” to transmit “a number of spatial streams ... in a multiple input multiple output (MIMO) channel configuration.” (INTEL-1006,

3:32, 4:10, 6:24–27.) In order to facilitate MIMO, a POSITA would understand that Sun’s wireless receiver includes multiple antenna front end blocks coupled respectively to each of the plurality of antennas in order to receive the RF signals associated with incoming wireless packets.

162. Notably, Sun describes transceivers in general terms that a POSITA would understand include one or more antenna front ends, demodulators and decoders that perform the receive operations in the receive chain of the devices. And Sun’s Figure 1 contrasts with the ’146 patent’s disclosure and independent claims that describe and claim the receiver and demodulator as separate components. (*See, e.g.*, INTEL-1001, 6:20–27 (Fig. 2), 9:15–18 (Fig. 5), cl. 1.) Petitioner disputes that including the demodulator or other components—such as a packet detector—in the claimed “*wireless receiver*” is consistent with the plain and ordinary meaning of these terms as recited in the claims.

163. But Sun’s description is nevertheless consistent with PO’s apparent interpretation and application of the claims in the district court case, in which PO points to the same PHY-layer disclosures of the accused 802.11ax wireless standard as satisfying both the “*wireless receiver*” ([1A]/[6A]) and “*demodulator*” ([1B]/[6B]) limitations. (*Compare* INTEL-1007, 3–15 (relying upon excerpts from §§17.3, 19.3, 21.3, and 27.3 of IEEE Std. 802.11ax as evidence of the claimed “*wireless receiver*”) with *id.*, 31–32 (relying on excerpts from §§17.3, 19.3, 21.3,

and 27.3 of IEEE Std. 802.11ax as evidence of the claimed “*demodulator*”).) This indicates that, under PO’s infringement theory, the accused wireless receiver incorporates the entire chain of components in the receive path.

164. Therefore, if the Board adopts PO’s interpretation, Sun’s transceiver satisfies the requirements of independent claims 1 and 6. Sun therefore discloses the “wireless receiver” of claim 1 and the “receiving” step of claim 6

165. Furthermore, it is well known that 802.11 wireless data units/packets are communicated “*through a wireless communication channel.*” Sun discloses communicating wireless packets “*through a communication channel*” such as “single input single output (SISO) channel configuration” or a “multiple input multiple output (MIMO) channel configuration.” (INTEL-1006, 6:8–9, 25–26.) In addition, Sun discloses wireless communications according to various 802.11 wireless standards, and it is well known that 802.11 packets are communicated through a “*wireless communication channel.*” Further, a POSITA would understand that a “*wireless communication channel*” is established between transmitting and receiving antennas in a WLAN such as the ones shown in Sun’s Figure 1 above.

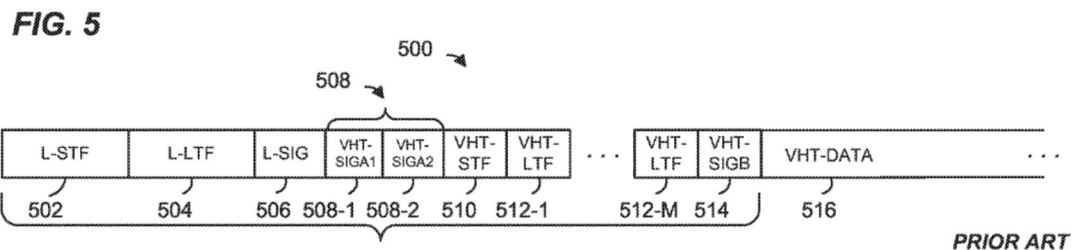
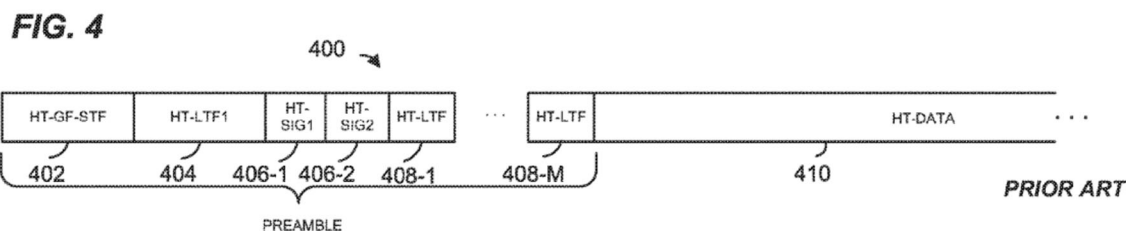
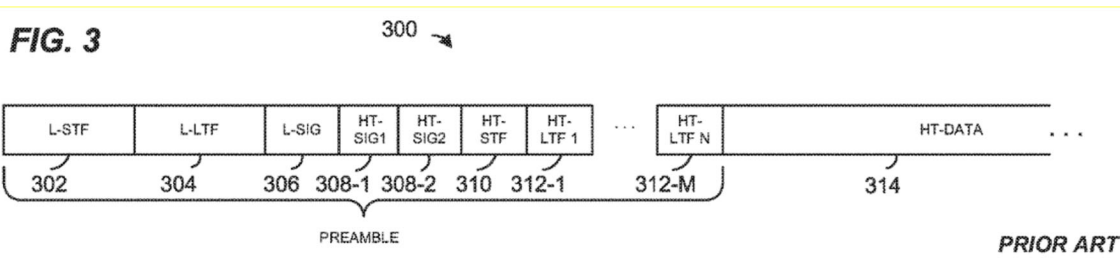
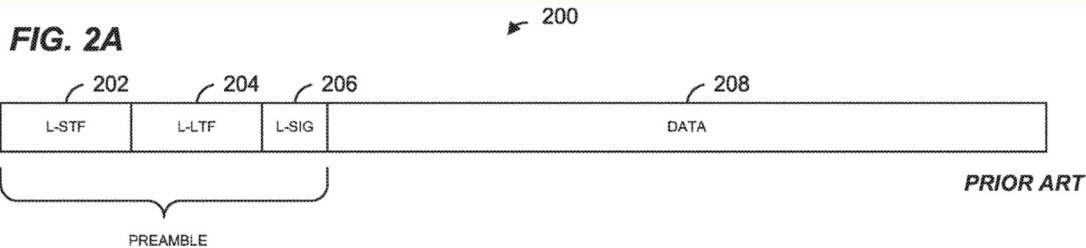
166. Sun therefore discloses a “*wireless receiver*” (e.g., the 802.11ax HE compliant receiver shown in Fig. 1) “*configured to receive a wireless packet*” (e.g. Sun’s wireless receiver receives and decodes wireless packets) “*through a*

communication channel” (e.g., 802.11 wireless OFDM channel).

b. *Formats of the wireless packet include a first and second packet format*

167. As set forth below, Sun discloses that the same wireless network device (e.g., AP or STA) is configured to receive both a “*first packet format*” [802.11a/g/n/ac packet formats] and a “*second packet format*” [802.11ax HE packet format]. Sun’s network device is configured to transmit and receive wireless packets (i) “according to a first communication protocol (e.g., a High Efficiency, HE, or 802.11ax communication protocol),” (ii) “a second communication protocol (e.g. according to the IEEE 802.11ac Standard),” or (iii) “a third communication protocol, and/or a fourth communication protocol (e.g., according to the IEEE 802.11a Standard and/or the IEEE 802.11n Standard).” (INTEL-1006, 3:44–56.)

168. Sun teaches a method of distinguishing an 802.11ax packet format from the various legacy packet formats. (See, e.g., INTEL-1006, Figs. 2A, 3–5 (below), 8:31–36 (“[T]he preamble 701 is formatted such that a receiving device that operates according to the HEW communication protocol (e.g., 802.11ax) is able to determine that the preamble 701 is a preamble of the HEW communication protocol rather than another preamble.”).)

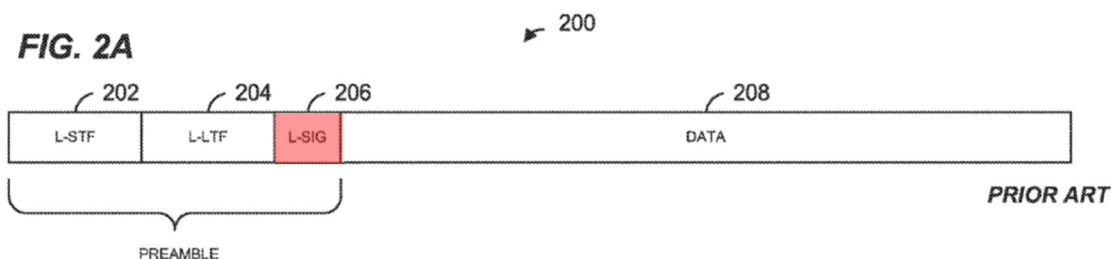


169. Thus, Sun discloses a wireless network device (High Efficiency (HE)-capable device) that is configured to receive both a “*first packet format*” (802.11a/g/n/ac packet formats) and a “*second packet format*” (802.11ax HE packet format).

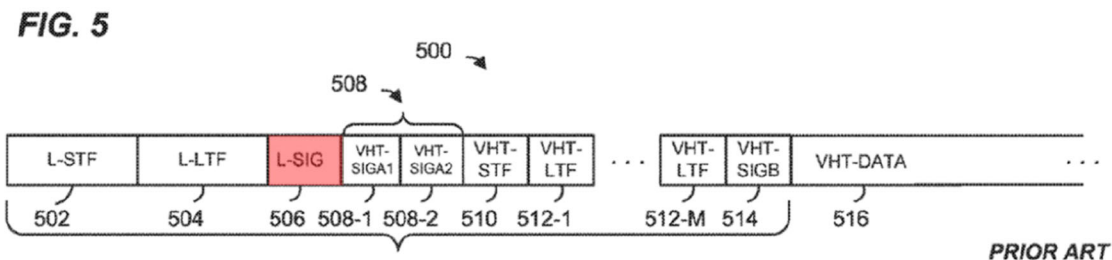
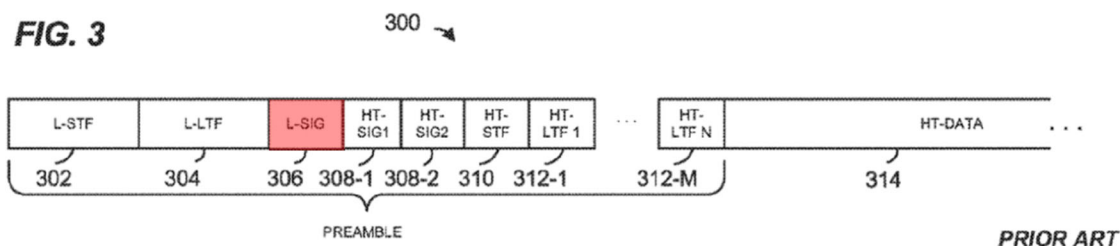
c. *First packet format comprises a first header field carried by a first OFDM symbol*

170. Sun discloses a “*first packet format*” that comprises a “first header

field” carried by a “first OFDM symbol.” For example, Sun’s disclosure of an 802.11a/g packet format shown below includes an “L-SIG” field carried by an OFDM symbol. (INTEL-1006, 5:53–6:2, Fig. 2A.)



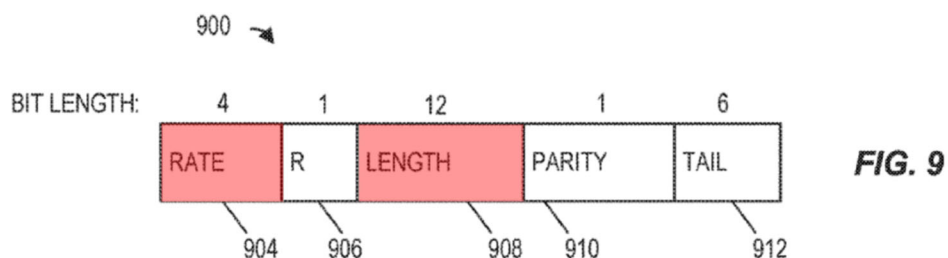
Other examples include the 802.11n and 802.11ac packet formats, each of which also include an L-SIG field carried by one OFDM symbol. (See INTEL-1006, Figs. 3 (802.11n high-throughput (HT) packet format), 5 (802.11ac very high-throughput (VHT) packet format).)



171. Thus, Sun discloses a “*first packet format*” that comprises a legacy 802.11a/g/n/ac packet format, *e.g.*, a format having a legacy signal field L-SIG

carried by one OFDM symbol.

172. The L-SIG field is a “*header field*” because, consistent with the description of a “header” in the patent specification, it includes “important control information for the receiver to decode the payload properly, and also provides information about the packet length for virtual carrier sensing.” (INTEL-1001, 1:55–58.) For example, as shown in Figure 9 below, the “legacy signal field (L-SIG)” is “used to carry certain physical layer (PHY) parameters with the data unit [], such as modulation type and coding rate used to transmit the data unit” (INTEL-1006, 5:66–6:2, Fig. 9.)



173. The L-SIG field includes (i) “a rate subfield 904” for the modulation and coding rate, and (ii) a “length subfield 908” which is used to communicate the packet length. (INTEL-1006, 10:52–53.) A POSITA would understand that the modulation and coding rate is information that is required by the receiver to properly receive and decode the packet payload data and that the packet length is required for virtual carrier sensing.

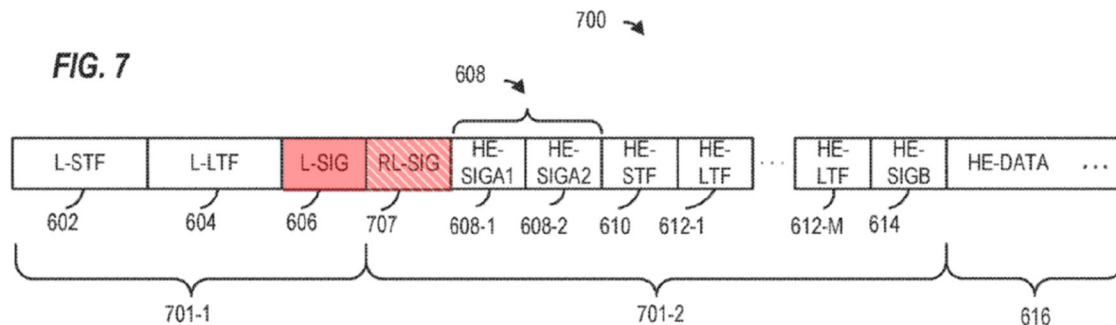
174. In addition, Sun teaches that L-SIG is carried by “*a first OFDM*

symbol.” For example, “Figure 9 is a diagram of example bits for **an OFDM symbol that includes a legacy signal field**, according to an embodiment.”

(INTEL-1006, 2:36–38, Fig. 9 (above).)

- d. *Second packet format comprises both the first header field carried by the first OFDM symbol and a second field carried by a second OFDM symbol which repeats the first OFDM symbol*

175. Sun discloses “OFDM data unit 700” (“*second packet format*”) that includes an L-SIG field and a repeated legacy signal field (“RL-SIG”) (shaded red) which follows L-SIG in the time domain as shown in Figure 7. (INTEL-1005, 8:26–46, Fig. 7.)



This packet is a high-efficiency (HE) packet in accordance with the IEEE 802.11ax protocol. (See INTEL-1005, 3:6–8 (“The repeated legacy signal field generally provides for a more reliable auto-detection of the IEEE 802.11ax protocol.”), 3:44–47 (“high Efficiency, HE, or 802.11ax communication protocol”); 8:31 – 33 (“the preamble 701 is formatted such that a receiving device that operates according to the HEW communication protocol (e.g., 802.11ax) is able to determine that the

preamble 701 is a preamble of the HEW communication protocol”).)

176. As discussed in §IV.B.2.c, *supra*, L-SIG is a “*header field*” because it contains important control information for the receiver to decode the packet payload properly, as well as packet length information for virtual carrier sensing. (INTEL-1001, 55–58.) In addition, both L-SIG and RL-SIG are carried by an OFDM symbol—“a first OFDM symbol that corresponds to a legacy signal field followed by a second OFDM symbol that corresponds to a candidate signal field” which, in the case of data unit 700, is “a repetition of the legacy signal field.” (INTEL-1006, 3:12–17.)

177. Therefore, Sun discloses “*a first packet format*” (e.g., 802.11a/g/n/ac packets) and “*a second packet format*” (e.g., 802.11ax HE packets), “*the first packet format comprising a first header field*” (non-802.11ax HE packets include one L-SIG field) “*the second packet format comprising both the first header field ... and a second header field ... which follows the first ..., and the second header field being a repetition of the first header field*” (802.11ax packets include L-SIG followed by RL-SIG). These header fields are “*carried by a first OFDM symbol*” and “*a second OFDM symbol which follows the first OFDM symbol*” (each of L-SIG and RL-SIG are carried by an OFDM symbol in 802.11ax).

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

178. In my opinion Sun discloses these limitations.

a. *Demodulator to demodulate the received wireless packet*

179. A POSITA would understand that any network device in a wireless LAN such as Sun’s must demodulate the received data units—including its header fields—before they can be properly decoded and processed; and that demodulation requires the use of a “*demodulator*” in the device hardware. Further, Sun does disclose receiving and decoding the data units, which a POSITA would understand requires demodulating the data units as well. (*See, e.g.*, INTEL-1006, 9:7–12.)

180. Further, Sun discloses transmitting the data units via “OFDM modulation” (*see* INTEL-1006, 6:10–13, 6:35–38, 6:50–53, 7:16–19), and using “an inverse discrete Fourier transform (IDFT) processor 1118” to modulate the data units onto a plurality of OFDM subcarriers. (INTEL-1006, 12:6–8.) The IDFT processor “converts a block of constellation points to a time-domain signal” for transmission over the channel. (INTEL-1006, 12:8–9.) A POSITA would understand that an IDFT modulated signal transmitted through a wireless communication channel must be demodulated after reception to recover the original transmitted information. A POSITA would therefore recognize that Sun’s system requires a corresponding discrete Fourier Transform (DFT) processor in the receiver which performs the reverse operation of an IDFT in order to demodulate the received data units for further processing.

181. In addition, as discussed above in §IV.b.2.a., *supra*, Sun’s wireless

OFDM receiver is MIMO-capable, and thus a POSITA would understand it includes a number of demodulator blocks in accordance with the number of MIMO spatial streams that the wireless receiver can receive. These demodulators are the claimed “*demodulator configured to demodulate the received wireless packet.*”

182. Therefore, a POSITA reading Sun would understand that it discloses the use of a demodulator to demodulate the received data units (“*wireless packet*”).

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

183. In my opinion, Sun discloses these limitations.

a. *Receiver distinguishes the packet format by detecting, from the received wireless packet, the second header field which repeats the first header field*

184. As I have discussed above in §IV.B.2.d., *supra*, Sun discloses a second 802.11ax HE packet format with a repeated legacy signal field RL-SIG. Sun teaches that “[t]he repeated legacy signal field generally provides for a more reliable auto-detection of the IEEE 802.11ax protocol.” (INTEL-1006, 3:6–8.) “FIG. 8 is a diagram of an example method for determining whether a received OFDM data unit 800 corresponds to [802.11ax] or another communication protocol” (INTEL-1006, 9:4–7, Fig. 8.) At block 812, the receiving client STA “determines whether the candidate signal field 807 corresponds to a repetition of the L-SIG field 806” (INTEL-1006, 9:40–43.) In one embodiment, Sun teaches using the “time-domain correlation” of the first and second OFDM symbols 806

and 807 “to determine whether the candidate signal field 807 corresponds to the repetition.” (INTEL-1006, 9:43–47.) In another embodiment, the client STA “decodes” the first and second OFDM symbols “to obtain respective first and second bit sequences” and “compares ... the bit sequences to determine whether the candidate signal field 807 corresponds to the repetition.” (INTEL-1006, 9:47–52.)

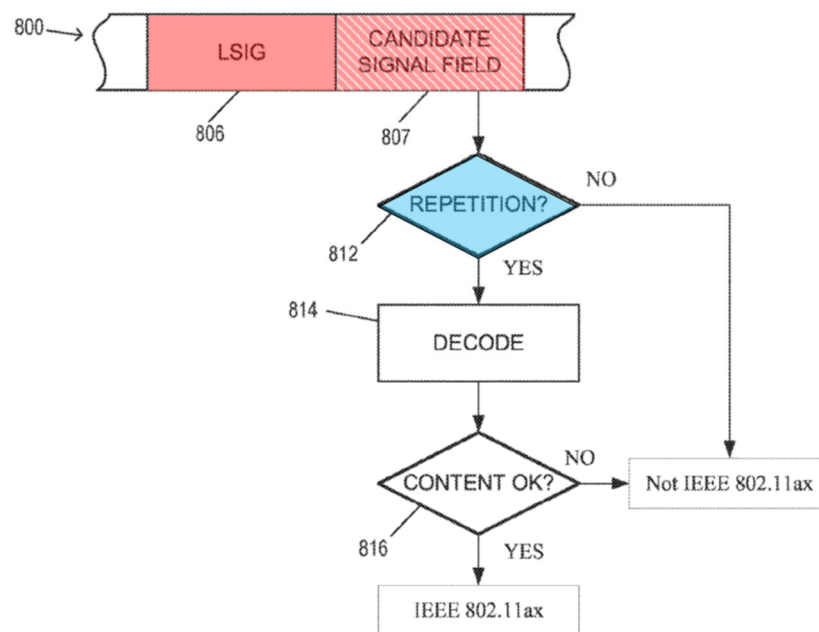


FIG. 8

185. “In response to a determination that the candidate signal field 807 does not correspond to a repetition of the L-SIG field 806 (NO at block 812), the client station 25 determines that the received data unit 800 does not correspond to the ... 802.11ax protocol ...”; and “[i]n response to a determination that the candidate signal 807 corresponds to a repetition of the L SIG field 806 (YES at

block 812), the client station 25 proceeds to block 814 and decodes the candidate signal field 807 to obtain the signal field bit sequence” (INTEL-1006, 9:56–67.) In both instances, the receiver distinguishes an 802.11ax packet format from non-802.11ax packet formats based on detecting the presence or absence of the repeated legacy signal field RL-SIG. As one specific example packet format, Sun discloses distinguishing between an 802.11ax protocol data unit and an 802.11a protocol data unit. (See INTEL-1006, 9:28–39.) Thus, based on whether RL-SIG field is detected, Sun’s receiver distinguishes the 802.11ax HE packet format from non-802.11ax packet formats (e.g., 802.11a/g/n/ac), and demodulates and decodes the received wireless packet accordingly. (INTEL-1006, 9:17–19, 10:31–34.)

186. Further, in order to determine whether the content of the L-SIG field corresponds to 802.11ax or another communication protocol, “[a]t block 816, the client station 25 determines whether the signal field bit sequence has a valid content value” (*i.e.*, a “data rate of six megabits per second,” a “length field ... that cannot be divided by three” and suitable parity and tail values). (INTEL-1006, 10:9–11, 14–24, Fig. 8 (below).) “In response to a determination that the content of the L-SIG field 806 corresponds to the [802.11ax] communication protocol, the client station 25 decodes ... the OFDM symbols of the data unit 800 according to the [802.11ax] communication protocol.” (INTEL-1006, 10:30–34.)

187. Sun’s receiver therefore distinguishes 802.11ax HE packets from non-

802.11ax HE packets (e.g., 802.11a/g/n/ac packets) based on the presence or absence of the repeated legacy field RL-SIG, and demodulates and decodes the received wireless packet accordingly.

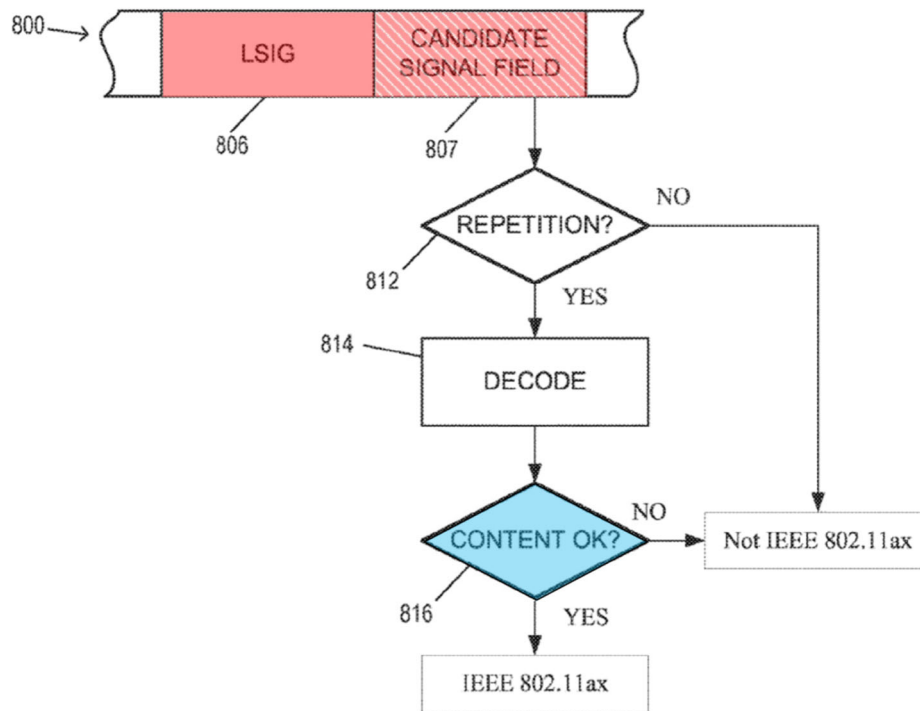


FIG. 8

188. Claim 1 additionally requires that the “wireless receiver” performs the “detecting” and “distinguishing” operations on the “received wireless packet.” As noted in §VII.B.2.a, *supra*, Sun discloses a transceiver that a POSITA would understand includes one or more antenna front ends, demodulators, and decoders under PO’s apparent interpretation of the term “wireless receiver” that together perform the packet format detection steps 812–816 of Sun’s Figure 8. (INTEL-1006, Figs. 1, 8.) This contrasts with claim 1, which claims the receiver and

demodulator as separate components and requires the “*wireless receiver*” to perform the “*distinguish[ing]*” step. (INTEL-1001, 6:20–27 (Fig. 2), 9:15–18 (Fig. 5), cl. 1.)

189. Petitioner disagrees that defining the receiver to include the entire chain of components in the receive path (i.e., the demodulator, decoder) is consistent with the plain and ordinary meaning of claim 1 or the ’146 patent’s specification, or that claim 1 permits other components besides the receiver to perform this step. But Sun’s description is nevertheless consistent with PO’s apparent interpretation and application of the claims in the co-pending district court case, which point to the entire receive chain of the 802.11ax standard as being part of the receiver. (INTEL 1007, 3–15, 31–32.)

190. Nonetheless, if the Board adopts PO’s expansive view that the scope of the claimed “*wireless receiver*” encompasses the entire receive chain, then Sun discloses it. (See VII.B.2.a, *supra*.) While Sun does not explicitly describe the “*detecting*” and “*distinguishing*” operations being performed by a “*wireless receiver*,” Sun does teach that the methods of its embodiments such as in Figure 8 are performed by an AP or client STA, and as discussed above in §VII.B.2.a, *supra*, these devices include a wireless receiver “configured to receive data units via the antenna(s)” (INTEL-1006, 9:4–12, 5:1–4, 5:33–36.)

191. Sun further describes decoding the received data units and a POSITA

would understand that the componentry for decoding data units/packets is associated with the receive chain in wireless network devices. (See INTEL-1006, 9:7–12.) And since, according to Figure 8, the repetition detection disclosed by Sun is performed before (or during) decoding of the received data units, a POSITA would understand that the packet detection componentry resides in the receive chain of the wireless device as well. (INTEL-1006, 9:40–52, Fig. 8.)

192. As a result, Sun’s receiver “*distinguishes the second packet format*” (e.g., 802.11ax) “*from the first packet format*” (e.g., 802.11a/g/n/ac) “*by detecting, from the received wireless packet, the second header field*” (RL-SIG) “*which repeats the first header field*” (L-SIG).

C. Claims 2 and 7

[2] The wireless communication device of claim 1, wherein the wireless receiver determines the received wireless packet as the second packet format when the second header field is detected from the wireless packet.

193. In my opinion, Sun discloses these limitations.

a. *Receiver determines the received wireless packet as the second packet format when the second header field is detected*

194. As discussed above in §IV.B.4.a., *supra*, Sun’s receiver distinguishes the format of the received wireless packet by detecting the presence or absence of a repeated L-SIG field (RL-SIG), and demodulates and decodes the wireless packet accordingly. (INTEL-1006, 9:17–19, 9:32–67, 10:30–34.) When the RL-SIG field

(*second header field*) is detected in the received wireless packet, the receiver determines that an 802.11ax packet (*second packet format*) has been received. (INTEL-1006, 9:63–67.)

D. Claims 3 and 8

[3] The wireless communication device of claim 1, wherein the wireless receiver determines the received wireless packet as the first packet format when the second header field is not detected from the wireless packet.

195. In my opinion, Sun discloses these limitations.

- a. *Receiver determines the received wireless packet as the first packet format when the second header field is not detected*

196. As discussed above in §IV.B.4.a., *supra*, Sun’s receiver distinguishes the format of the received wireless packet by detecting the presence or absence of a repeated L-SIG field (RL-SIG), and demodulates and decodes the wireless packet accordingly. (INTEL-1006, 9:17–19, 9:32–67, 10:30–34.) When the RL-SIG field (*second header field*) is **not** detected in the received wireless packet, the receiver “determines that that the received data unit 800 does not correspond to ... the IEEE 802.11ax protocol.” (INTEL-1006, 9:56–62.) That is, the receiver determines the received wireless packet as one of the legacy packet formats 802.11a/g/n/ac when RL-SIG is not detected because, as shown in Figures 2A and 3–5, each of the legacy packet formats only includes an L-SIG field which is not repeated.

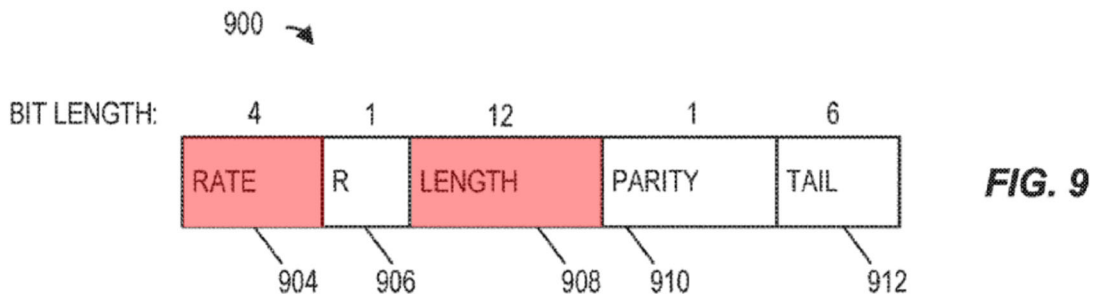
E. Claims 4 and 9

[4] The wireless communication device of claim 1, wherein the first and second header fields contain information for decoding the wireless packet.

197. In my opinion, Sun discloses these limitations.

a. *The first and second header fields contain information for decoding the wireless packet*

198. As discussed above in §IV.B.2.c.–d., *supra*, the L-SIG field (and by repetition the RL-SIG field), is a header fields precisely because it “contains important control information for the receiver to decode the payload properly,” consistent with the description of a “header” in the specification. (INTEL-1001, 1:55–58.) The “legacy signal field (L-SIG)” is “used to carry certain physical layer (PHY) parameters with the data unit [], such as modulation type and coding rate used to transmit the data unit” (INTEL-1006, 5:66–6:2, Fig. 9.)



As shown, the L-SIG field includes (i) “a rate subfield 904” for the modulation and coding rate, and (ii) a “length subfield 908” which is used to communicate the packet length. (INTEL-1006, 10:52–53.) A POSITA would understand that the modulation and coding rate is information that is required by the receiver to

properly decode the packet payload data and that the packet length is required for virtual carrier sensing.

F. Claims 5 and 10

[8] The wireless communication device of claim 1, wherein the first and second header fields contain information related to a length of the wireless packet.

199. In my opinion, Sun discloses these limitations.

a. *The first and second header fields contain information related to length of the wireless packet*

200. As discussed above in §IV.B.2.c.–d., *supra*, the length subfield 908 in the L-SIG field (and by repetition the RL-SIG field) is used to communicate the packet length, which a POSITA would understand is “*information related to a length of the wireless packet.*” (INTEL-1006, 10:52–55.)

V. CONCLUSION

In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

I hereby declare that all statements made herein of my own knowledge are

true and that all statements made on information and belief are believed to be true;
and further that these statements were made with the knowledge that willful false
statements and the like so made are punishable by fine or imprisonment, or both,
under Section 1001 of Title 18 of the United States Code.

Executed this 7th day of July in Greenfield Township, PA.

Respectfully submitted,

A handwritten signature in blue ink, consisting of stylized, overlapping loops and strokes, positioned above a horizontal line.

Tom La Porta, Ph.D.

ATTACHMENT A

Exhibit	Reference
1001	U.S. Patent No. 11,212,146 (“the ’146 patent”)
1002	File History of the ’146 patent
1003	Declaration of Dr. Tom La Porta in Support of Petition for <i>Inter Partes</i> Review of the ’146 patent
1004	Curriculum Vitae of Dr. Tom La Porta
1005	U.S. Patent No. 10,637,706 to Huang et al. (“Huang”)
1006	U.S. Patent No. 10,122,563 to Sun et al. (“Sun”)
1007	Plaintiff AX Wireless LLC’s Preliminary Disclosure of Asserted Claims and Infringement Contentions to Dell, Appendix F, <i>AX Wireless LLC v. Dell Inc., et al.</i> , No. 2:22-cv-00277-RSP (E.D. Tex.)
1008	U.S. Provisional Application 61/235,909 (“the ’909 Provisional”)
1009	Aware, <i>G.hn: PHY-Frame Header Extension</i> , 09CC-046, Concord, CA, as filed in file wrapper of the ’566 patent
1010	CopperGate Communication, <i>G.hn: Using Two Symbols for the Header of a PHY frame on Coax</i> , ITU-T SG15/Q4, 09XC-100, Xian, China July 2009, as filed in file wrapper of the ’566 patent
1011	Intellon Corporation, <i>G.hn: Extended PHY frame header</i> , ITU-T SG15/Q4, 09XC-119, Xian, China, July 2009, as filed in file wrapper of the ’566 patent