EXPERT DECLARATION OF DR. KEVIN NEGUS FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 7,924,802

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I. INTRODUCTION

1. I, Dr. Kevin Negus, submit this declaration in support of a Petition for *Inter Partes* Review of United States Patent No. 7,924,802 (the "'802 Patent"), owned by Cobblestone Wireless, LLC ("Cobblestone" or "Patent Owner"). I have been retained in this matter by counsel for Hewlett Packard Enterprise Company and Cisco Systems, Inc ("Petitioners"). I understand that Petitioners are the Real Party-in-Interest to this Petition.

2. I make this declaration based upon my personal knowledge. I am over the age of 21 and am competent to make this declaration.

3. The statements herein include my opinions and the bases for those opinions, which relate to at least the following documents of the pending *inter partes* review petition:

- U.S. Patent No. 7,924,802 by A. Tarighat-Mehrabani et al., entitled "Wireless communication systems and methods" (the "'802 Patent") (Ex. 1001).
- File History for U.S. Patent No. 7,924,802 (Ex. 1002).
- IEEE P802.11n™/D2.00 ("IEEE 802.11n D2.0") (Ex. 1004).
- IEEE Std. 802.11™-2007 ("IEEE 802.11-2007") (Ex. 1005).
- *Next Generation Wireless LANs*, by E. Perahia and R. Stacey, ISBN: 978-0-521-88584-3, Cambridge University Press ("Perahia") (Ex. 1006).
- U.S. Patent Publication No. 2006/0018249 by D. Shearer and M. Webster, entitled "Packet generation systems and methods" ("Shearer") (Ex. 1007).
- "*IEEE 802.11n: Throughput, Robustness, and Reliability Enhancements to WLANs*" by E. Perahia and R. Stacey, publicly presented at IEEE Globecom 2006, San Francisco, USA, Dec. 2006 (Ex. 1008).
- IEEE Std. 802.11a-1999 ("IEEE 802.11a-1999") (Ex. 1009).

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- Cobblestone Preliminary Infringement Contentions to Cisco Systems, Inc. in No. 2:23-cv-00454 (E.D. Tex.) (Ex. 1011).
- Cobblestone Preliminary Infringement Contentions to Hewlett Packard Enterprise Company in No. 2:23-cv-00454 (E.D. Tex.) (Ex. 1012).
- Declaration of Eldad Perahia, Ph.D. (Ex. 1013).
- Declaration of Ingrid Hsieh-Yee, Ph.D. (Ex. 1014).

4. My materials considered for forming my opinions herein have included at least the above-referenced documents.

5. Although I am being compensated for my time at my normal and customary rate in preparing this declaration, the opinions herein are my own, and I have no stake in the outcome of the review proceeding. My compensation does not depend in any way on the outcome of the Petitioner's petition.

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II. QUALIFICATIONS

6. I am qualified by education and experience to testify as an expert in the field of telecommunications. Attached, as Attachment A, is a copy of my resume detailing my experience and education. Additionally, I provide the following overview of my background as it pertains to my qualifications for providing expert testimony in this matter.

7. I am currently a Professor of Electrical Engineering at Montana Tech University in Butte, MT. I lead research programs at Montana Tech that include developing communications solutions for extremely low power sensors in challenging locations such as alpine mountains and watersheds including federally-designated wilderness areas and for control of critical infrastructure distributed continentally and globally including within severe environments such as arctic forests. For example, I am currently the Principal Investigator on a Montana Tech research program funded indirectly by the US military to improve wireless communications under battlefield conditions for the US Army 11th Airborne based in Alaska. I also mentor, supervise and teach both senior undergraduate and graduate students of Electrical Engineering in the general fields of telecommunications and networking with an emphasis on wireless systems.

8. In 1988, I received my Ph.D. in Engineering from the University of Waterloo in Canada. The Departments of Electrical Engineering and Mechanical Engineering jointly supervised my Ph.D. research on the modeling of bipolar semiconductor devices. My graduate course work was primarily in Electrical Engineering and included such subjects as semiconductor device physics and fabrication, wireless circuit design, and wireless propagation analysis. For my Ph.D. work, I received the Faculty Gold Medal in 1988 for the best Ph.D. thesis in the entire Faculty of Engineering across all Departments for that year. My Ph.D. thesis

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research also formed the basis of a paper published in 1989 that won the award for Best Paper in 1989 for the IEEE (Institute of Electrical and Electronic Engineers) journal in which it was published.

9. In 1984 and 1985, respectively, I received the B.A.Sc. and M.A.Sc. Degrees in Mechanical Engineering from the University of Waterloo in Canada. My coursework and research work included, amongst many other topics, extensive embedded firmware development for automation applications and implementation of networks and communications protocols. For my M.A.Sc. Degree research and academic achievements, I received the prestigious University Gold Medal in 1985 for the best Masters thesis in the entire University of Waterloo for that year.

10. In 1986, I joined the Palo Alto Research Center of Fairchild Semiconductor in Palo Alto, CA. At Fairchild, I participated in the development of devices and products for high-speed applications such as wired networking, RISC microprocessors and wireless communications.

11. In 1988, I took the position of Member of the Technical Staff at Avantek, Inc. in Newark, CA. I was hired to develop products for both wireless and wired data networking applications. Some of the components I developed early in my career at Avantek were used for 1st generation wireless local area network (WLAN) products, voice band modem equipment, wired data networking both in the LAN and WAN and 1st generation cellular handsets and base stations based on AMPS or TACS.

12. In 1991, the Hewlett-Packard Company purchased Avantek, Inc. I continued to work for Hewlett-Packard until 1998 in such roles as IC Design Manager, Director of Chipset Development and Principal System Architect. In 1992, Hewlett-Packard assigned me to work on the "Field of Waves" project, which was a major multi-division effort to build WLAN products

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for mobile computers. The project was cancelled in 1993. However, the work I did on the project was leveraged into producing the world's first IEEE 802.11 chipset, which my division at Hewlett-Packard first offered for sale in 1994. I led the project to develop and market this chipset for many early WLAN product companies including Proxim, Symbol (now part of Motorola) and Aironet (now part of Cisco). I also helped coordinate efforts within Hewlett-Packard to guide extensive research projects on WLAN protocols and technology at Hewlett-Packard's central research laboratories in Palo Alto, CA and Bristol, U.K.

13. In 1998, I joined Proxim, Inc. in Mountain View, CA. At that time, Proxim was engaged in the development and sale of wired and wireless products for home and enterprise networking applications based on several different wired and wireless networking protocols. I stayed at Proxim through 2002 and was the Chief Technology Officer for this publicly-traded company at the time of my departure. During my career at Proxim, I led or participated in the development of many WLAN and WWAN products and/or chipsets for network adapters, OEM design-in modules, access points, bridges, switches, and routers that used a wide variety of bus, LAN, or WAN wired interfaces. I have supervised many engineers including those responsible for embedded firmware development to implement various wired and wireless networking, reservation, and security protocols at the MAC layer and above, those responsible for HDL code creation of baseband chips to implement PHY and MAC algorithms, as well as other engineers that developed hardware reference designs, modem algorithms and chipsets.

14. Since 2002, I have been an independent consultant and have provided services to a number of companies including some that have developed IEEE 802.11 products. In particular, from 2002 until 2007 I was Chairman of WiDeFi, Inc. – a company that developed chips and embedded firmware for 802.11 repeater products based on 802.11a, b, g and draft n amendments.

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From 2007-2011, I was Chairman of Tribal Shout – a company that delivered IP voice and audio streaming media using VoIP to any cellular or landline phone including those reachable only by the circuit-switched connections such as the PSTN and 2nd generation cellular radio. From 2010-2016, I was Chairman and Chief Technology Officer of CBF Networks, Inc. (dba Fastback Networks) – a company that developed fiber extension products for backhaul of data networks including Wi-Fi, HSPA, CDMA2000, WiMAX and LTE cellular radio systems.

15. I note that specific to this matter that while I was Chief Technology Officer at Fastback Networks that we developed the world's first non-line-of-sight (NLOS) point-to-point (PTP) cellular backhaul products using multiple beams and MIMO baseband signal processing. These products, which we first developed starting in 2011, were originally based on the 4G LTE standard but used many proprietary extensions that we added for increased performance. These products also utilized many of the same technology elements described and/or claimed in the '511 Patent when offered for sale and/or sold in the USA starting in 2011.

16. I have been a Board Observer on behalf of the venture capital firm Camp Ventures at two companies that develop semiconductor components including one that developed technology specifically to improve the system performance of HSPA and LTE cellular radio systems (Quantance) and another that provides system on a chip (SOC) microcontrollers, OEM design-in modules and firmware with 802.11 and wired interfaces for embedded applications (GainSpan). I have also been a technology and/or business strategy advisor to multiple early stage companies that are developing such products as new wireless communications security systems (AirTight), RFID radio systems (Mojix), time/frequency reference components (SiTime), and application of machine learning to wireless communications (Aira).

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17. I have actively monitored or participated in the IEEE 802.11 standards process continuously since 1989. I am a listed contributor to the highly successful IEEE 802.11g standard published in 2003 that describes a wireless communications protocol in use worldwide by over 5 billion devices. In 2002 and 2003, I participated in the IEEE 802.11 Wireless Next Generation Committee that was responsible for launching the 802.11n standards development process.

18. I am an author or co-author of many papers that have been published in distinguished engineering journals or conferences such as those of the IEEE or ASME. An exemplary list of these publications is included in my resume.

19. I am also a former member of the Federal Communication Commission's Technological Advisory Committee as an appointee of then Chairman Michael Powell. I have also served on the Wyoming Telecommunications Council as an appointee of then Governor Jim Geringer after confirmation by the Wyoming State Senate.

20. I am named as an inventor on numerous U.S. patents all of which have related in at least some way to products for wired and/or wireless networks. I believe that the following is a complete list as of this date for my approximately 88 issued U.S. Patents: 4,839,717, 5,111,455, 5,150,364, 5,436,595, 5,532,655, 6,587,453, 7,035,283, 7,085,284, 7,187,904, 8,095,067, D704174, 8,238,318, 8,300,590, 8,311,023, 8,385,305, 8,422,540, 8,467,363, 8,502,733, 8,638,839, 8,649,418, 8,761,100, 8,811,365, 8,824,442, 8,830,943, 8,872,715, 8,897,340, 8,928,542, 8,942,216, 8,948,235, 8,982,772, 8,989,762, 9,001,809, 9,049,611, 9,055,463, 9,178,558, 9,179,240, 9,226,295, 9,226,315, 9,252,857, 9,282,560, 9,313,674, 9,325,398, 9,345,036, 9,350,411, 9,374,822, 9,408,215, 9,474,080, 9,490,918, 9,572,163, 9,577,700, 9,577,733, 9,578,643, 9,609,530, 9,655,133, 9,712,216, 9,713,019, 9,713,155,

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9,713,157, 9,876,530, 10,051,643, 10,063,363, 10,129,888, 10,135,501, 10,237,760, 10,284,253, 10,306,635, 10,313,898, 10,356,782, 10,506,611, 10,548,132, 10,700,733, 10,708,918, 10,716,111, 10,720,969, 10,735,979, 10,736,110, 10,764,891, 10,785,754, 10,932,267, 10,966,201, 11,134,491, 11,160,078, 11,166,280, 11,271,613, 11,283,192, 11,303,322, 11,343,060, 11,343,684.

21. I have provided expert testimony, reports or declarations in the cases of *Agere v. Sony* (on behalf of plaintiff Agere), *Linex v. Belkin et al.* (on behalf of defendant Cisco), *CSIRO v. Toshiba et al*. (multiple related cases on behalf of plaintiff CSIRO), *Freedom Wireless v. Cingular et al.* (on behalf of plaintiff Freedom Wireless), *Rembrandt v. HP et al*. (on behalf of defendant HP), *DNT v. Sprint et al.* (on behalf of the defendants Sprint, T-Mobile, US Cellular, Verizon and Novatel), *Teles v. Cisco* (on behalf of defendant Cisco), *WiAV v. HP* (on behalf of defendant HP), *SPH v. Acer et al*. (on behalf of defendants Sony, Nokia, Motorola, Novatel, Sierra and Dell), *LSI v. Funai* (on behalf of plaintiff LSI), *WiAV v. Dell and RIM* (on behalf of the defendants Dell and RIM), *Wi-LAN v. RIM* (on behalf of defendant RIM), *LSI v. Barnes & Noble* (on behalf of plaintiff LSI), *Novatel v. Franklin and ZTE* (on behalf of plaintiff Novatel), *LSI v. Realtek* (on behalf of plaintiff LSI), *Wi-LAN v. Apple et al.* (on behalf of defendants Apple, Sierra and Novatel), *EON v. Sensus et al*. (on behalf of defendants Motorola, US Cellular and Sprint), *M2M/Blackbird v Sierra et al*. (multiple related cases on behalf of defendants Sierra and Novatel), *Intellectual Ventures v. AT&T et al*. (on behalf of defendants AT&T, T-Mobile and Sprint), *Intellectual Ventures v. Motorola* (on behalf of defendant Motorola), *TQ Beta v. DISH et al*. (on behalf of defendant DISH), *Qurio v. DISH et al*. (on behalf of defendant DISH), *Fatpipe v. Talari* (on behalf of the defendant Talari), *EON v. Apple* (on behalf of defendant Apple), *Chrimar v. Dell* (on behalf of defendant Dell), *Nokia v. LGE* (on behalf of plaintiff Nokia),

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PanOptis v. Blackberry (on behalf of defendant Blackberry), *Customedia v. DISH et al.* (on behalf of defendant DISH), *Blackberry v. BLU* (on behalf of plaintiff Blackberry), *MTel v. Charter et al.* (on behalf of defendants Charter, Time Warner, Cox and Bright House), *Huawei v. Samsung* (on behalf of plaintiff Huawei), *Alacritech v. Wistron* (on behalf of defendant Wistron), *IPA v. DISH et al.* (on behalf of defendant DISH), *XR v. Ruckus et al.* (on behalf of defendants Ruckus, Netgear and Belkin), *Twilio v. Telesign* (on behalf of plaintiff Twilio), *Hera/Sisvel v. Arris et al.* (on behalf of defendants Arris/Ruckus, Netgear, Amazon, Roku and Belkin), *Intellectual Ventures v. Ericsson et al*. (on behalf of defendants Ericsson, T-Mobile and Sprint), *Sol IP v. AT&T et al*. (on behalf of defendants AT&T, Verizon and Sprint), *Soundview v DISH et al.* (on behalf of defendants DISH and Sling Media), *DISH v Peloton, iFIT and MIRROR* (on behalf of plaintiffs DISH and Sling Media), *XR v. D-Link et al.* (on behalf of defendants D-Link, HP, Netgear and Belkin), *SPV v HP* (on behalf of defendant HP) and *DISH v MG et al.* (on behalf of plaintiffs DISH and Sling Media). I believe that the preceding list includes all cases that I have testified in as an expert at trial or by deposition at least during the past four years.

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III. PERSON OF ORDINARY SKILL IN THE ART

22. I understand that the content of a patent (including its claims) and prior art should be interpreted the way a person of ordinary skill in the art (or "POSITA") would have interpreted the material at the alleged time of invention.

23. I understand that the "alleged time of invention" here is no earlier than the date that the applicants for the '802 Patent first filed an application related to the '802 Patent, namely, Jan. 23, 2008.

24. A person of ordinary skill in the art (referred to herein as a "POSITA") at the alleged time of invention for the '802 Patent would have been a person familiar with wireless communications networks, equipment and integrated circuit chips, and would have had at least a working knowledge of the design of physical layer signal processing and RF systems for wireless communications based at least upon IEEE 802 Standards.

25. For example, such a POSITA would have had at least a Bachelor's degree in Electrical Engineering or an equivalent field, and at least two years of work experience in developing wireless communications products based upon IEEE 802 Standards. Alternatively, a POSITA would have had a more advanced degree, such as a Master's degree in Electrical Engineering or an equivalent field, combined with at least one year of work experience in developing wireless communications products based upon IEEE 802 Standards.

26. In addition to my testimony as an expert, I am prepared to testify as someone who actually practiced in the field from 1986 to present, who actually possessed at least the knowledge of a POSITA within that time period including at the alleged time of invention, and who actually worked with others possessing at least the knowledge of a POSITA within that time period including at the alleged time of invention.

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27. I understand that the POSITA is a hypothetical person who is assumed to be aware of all the pertinent information that qualifies as prior art. In addition, the POSITA makes inferences and takes creative steps.

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IV. LEGAL UNDERSTANDING

28. I have a general understanding of validity based on my experience with patents and my discussions with counsel.

29. I understand that the claims of a patent are presumed valid. I understand that one factor to be considered in challenging this presumption of validity is whether or not prior art references cited by Petitioner are cumulative to one or more prior art references considered by the U.S. Patent and Trademark Office (the "PTO") in allowing the claims at issue. I understand that prior art references not specifically considered by the PTO are presumed to be non-cumulative. I understand that if Patent Owner contends that certain prior art references are cumulative to one or more prior art references considered by the PTO, then Patent Owner has the burden to prove this contention with specificity, and further that Petitioner and/or its experts will be allowed to rebut the Patent Owner's contention.

30. I have a general understanding of prior art and priority date based on my experience with patents and my discussions with counsel.

31. I understand that inventors may be entitled to a priority date earlier than an actual date of filing of a patent application that provides written description support for a particular claim to the extent that they can show complete possession of such a particular claimed invention at such an earlier priority date and reasonable diligence to reduce such a particular claimed invention to practice between such an earlier priority date and such an actual date of filing. I understand that if Patent Owner contends that particular claims are entitled to such an earlier priority date than such an actual date of filing, then Patent Owner has the burden to prove this contention with specificity.

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32. I understand that an invention by another must be made before the priority date of a particular patent claim in order to qualify as "prior art" under 35 U.S.C. § 102 or § 103, that a printed publication must be publicly available before the priority date of a particular patent claim in order to qualify as "prior art" under 35 U.S.C. § 102(a), that a printed publication must be publicly available more than one year prior to the actual date of filing of a patent application that provides written description support for a particular claim in the United States in order to qualify as "prior art" under 35 U.S.C. § 102(b), or that the invention by another must be described in an application for patent filed in the United States before the priority date of a particular patent claim in order to qualify as "prior art" under 35 U.S.C. § 102(e). I understand that Petitioner has the burden of proving that any particular reference or product usage or offer for sale is prior art.

33. I have a general understanding of obviousness based on my experience with patents and my discussions with counsel.

34. I understand that a patent claim is invalid under 35 U.S.C. § 103 as being obvious only if the differences between the claimed invention and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person of ordinary skill in that art. An obviousness analysis requires consideration of four factors: (1) scope and content of the prior art relied upon to challenge patentability; (2) differences between the prior art and the claimed invention; (3) the level of ordinary skill in the art at the time of the invention; and (4) the objective evidence of non-obviousness, such as commercial success, unexpected results, the failure of others to achieve the results of the invention, a long-felt need which the invention fills, copying of the invention by competitors, praise for the invention, skepticism for the invention, or independent development.

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35. I understand that a prior art reference is proper to use in an obviousness determination if the prior art reference is analogous art to the claimed invention. I understand that a prior art reference is analogous art if at least one of the following two considerations is met. First a prior art reference is analogous art if it is from the same field of endeavor as the claimed invention, even if the prior art reference addresses a different problem and/or arrives at a different solution. Second, a prior art reference is analogous art if the prior art reference is reasonably pertinent to the problem faced by the inventor, even if it is not in the same field of endeavor as the claimed invention.

36. I understand that it must be shown that a person of ordinary skill in the art at the time of the invention would have had a reasonable expectation that a modification or combination of one or more prior art references would have succeeded. Furthermore, I understand that a claim may be obvious in view of a single prior art reference, without the need to combine references, if the elements of the claim that are not found in the reference can be supplied by the knowledge or common sense of a person of ordinary skill in the relevant art. However, I understand that it is inappropriate to resolve obviousness issues by a retrospective analysis or hindsight reconstruction of the prior art and that the use of "hindsight reconstruction" is improper in analyzing the obviousness of a patent claim.

37. I further understand that the law recognizes several specific guidelines that inform the obviousness analysis. First, I understand that a reconstructive hindsight approach to this analysis, i.e., the improper use of post-invention information to help perform the selection and combination, or the improper use of the listing of elements in a claim as a blueprint to identify selected portions of different prior art references in an attempt to show that the claim is obvious, is not permitted. Second, I understand that any prior art that specifically teaches away from the

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claimed subject matter, i.e., prior art that would lead a person of ordinary skill in the art to a specifically different solution than the claimed invention, points to non-obviousness, and conversely, that any prior art that contains any teaching, suggestion, or motivation to modify or combine such prior art reference(s) points to the obviousness of such a modification or combination. Third, while many combinations of the prior art might be "obvious to try", I understand that any obvious to try analysis will not render a patent invalid unless it is shown that the possible combinations are: (1) sufficiently small in number so as to be reasonable to conclude that the combination would have been selected; and (2) such that the combination would have been believed to be one that would produce predictable and well understood results. Fourth, I understand that if a claimed invention that arises from the modification or combination of one or more prior art references uses known methods or techniques that yield predictable results, then that factor also points to obviousness. Fifth, I understand that if a claimed invention that arises from the modification or combination of one or more prior art references is the result of known work in one field prompting variations of it for use in the same field or a different one based on design incentives or other market forces that yields predicable variations, then that factor also points to obviousness. Sixth, I understand that if a claimed invention that arises from the modification or combination of one or more prior art references is the result of routine optimization, then that factor also points to obviousness. Seventh, I understand that if a claimed invention that arises from the modification or combination of one or more prior art references is the result of a substitution of one known prior art element for another known prior art element to yield predictable results, then that factor also points to obviousness.

38. I understand that a dependent claim incorporates each and every limitation of the claim from which it depends. Thus, my understanding is that if a prior art reference fails to

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anticipate an independent claim, then that prior art reference also necessarily fails to anticipate all dependent claims that depend from the independent claim. Similarly, my understanding is that if a prior art reference or combination of prior art references fails to render obvious an independent claim, then that prior art reference or combination of prior art references also necessarily fails to render obvious all dependent claims that depend from the independent claim.

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V. THE '802 PATENT

39. The '802 Patent, entitled "Wireless communication systems and methods" relates "to wireless electronics, and in particular, to wireless communication systems and methods" (see, for example, Ex. 1001 at 1:6-7).

A. Overview of the '802 Patent

40. In the "**Background**" section, the '802 Patent observes that at the time of the invention that "*Communication systems generally contain one or more transmission channels* to transmit data from the transmitter to the receiver" (emphasis added, see, for example, Ex. 1001 at 1:12-14).

41. According to the '802 Patent, *prior art* "FIG. 1 illustrates an example of a *transmitter* **100** used in a *wireless communication system*" (emphasis added, see, for example, Ex. 1001 at 1:17-18, FIG. 1 as reproduced below).

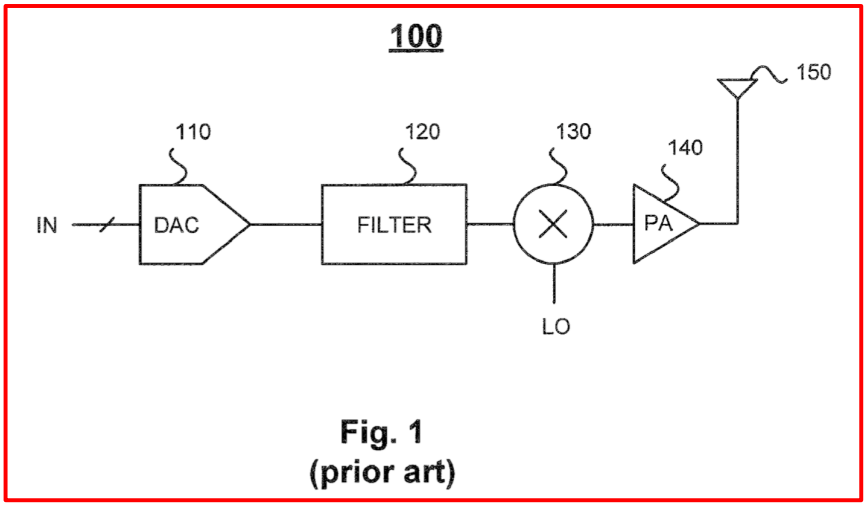


Fig. 1
(prior art)

42. In reference to prior art FIG. 1 shown above, the '802 Patent explains that "a *digital-to-analog converter* ("*DAC*") **110** receives a *digital input signal* ("**IN**")" and "converts a digital signal to an analog signal" wherein this "DAC is *coupled to the input of filter* **120**" which

"may be used to *remove undesirable frequencies and signal images*" (emphasis added, see, for example, Ex. 1001 at 1:18-24).

43. Additionally, the '802 Patent explains that this "*filter* is then *coupled to mixer* **130**" which "may be used to *up-convert the frequency of the signal* by combining it with a *local oscillator signal* ("LO")" wherein the "*output of the mixer* is *coupled to power amplifier* **140** to *amplify the signal for transmission* before it is sent *through antenna* **150**" (emphasis added, see, for example, Ex. 1001 at 1:24-29).

44. In further reference to prior art FIG. 1 shown above, the '802 Patent alleges that this prior art "*transmitter* **100** is *limited to up-converting a signal to one center frequency* (or modulation frequency), which is the LO frequency" wherein "the *amount of information transmitted* around the center frequency is *limited by the bandwidth of the transmitter* around the center frequency" which thus "*limits the amount of data* that can be transmitted" (emphasis added, see, for example, Ex. 1001 at 1:29-35).

45. The '802 Patent further alleges that "*prior art approaches* to *improving the information capacity* in a wireless communication system involve *maximizing the bandwidth around the center frequency* to increase the amount of information that may be modulated onto the carrier frequency" (emphasis added, see, for example, Ex. 1001 at 1:35-40).

46. In the "**Detailed Description**" section, the '802 Patent states that "FIG. 2 illustrates a *wireless communication system* according to one embodiment of the *present invention*" wherein "System **200** includes *digital-to-analog converter* (DAC) **201**, *DAC* **202**, *filter* **203**, *filter* **204**, *up-converter* **205** (such as a mixer), *up-converter* **206**, *synthesizer* **207**, *power amplifier* **208**, and *antenna* **209**" (emphasis added, see, for example, Ex. 1001 at 5:53-58, FIG. 2 as reproduced below).

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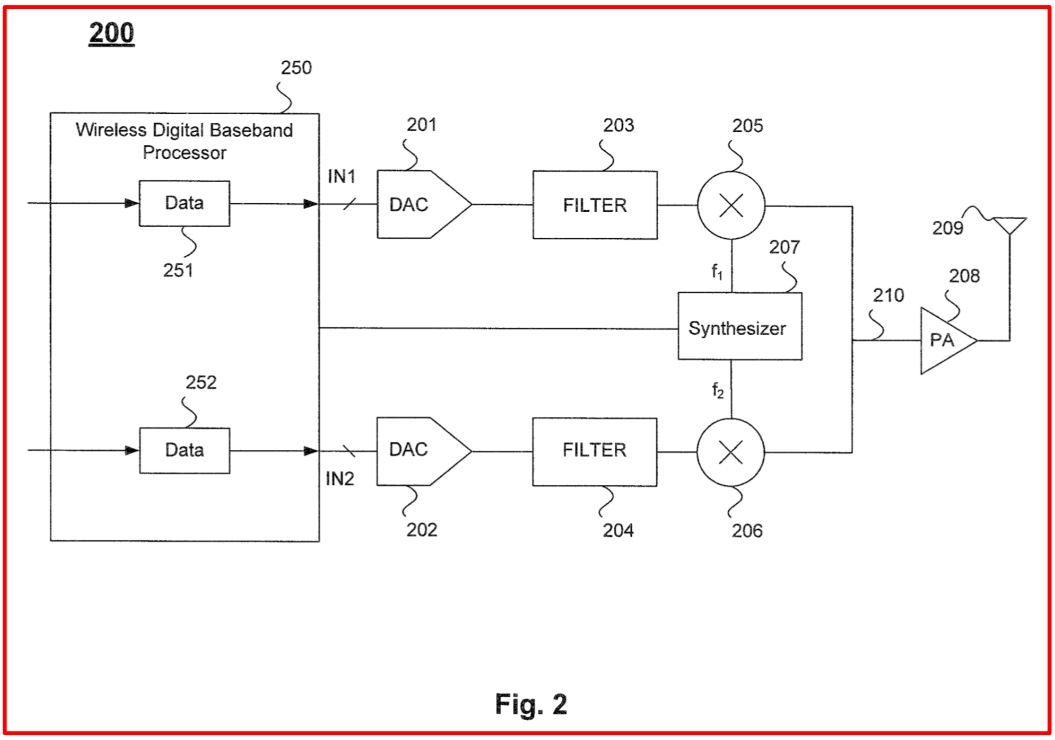


Fig. 2

47. Additionally, the '802 Patent states that "FIG. 3 illustrates an example of the *frequency content of the transmitted signal* **300** which may *result from system* **200**" (emphasis added, see, for example, Ex. 1001 at 5:58-60, FIG. 3 as reproduced below).

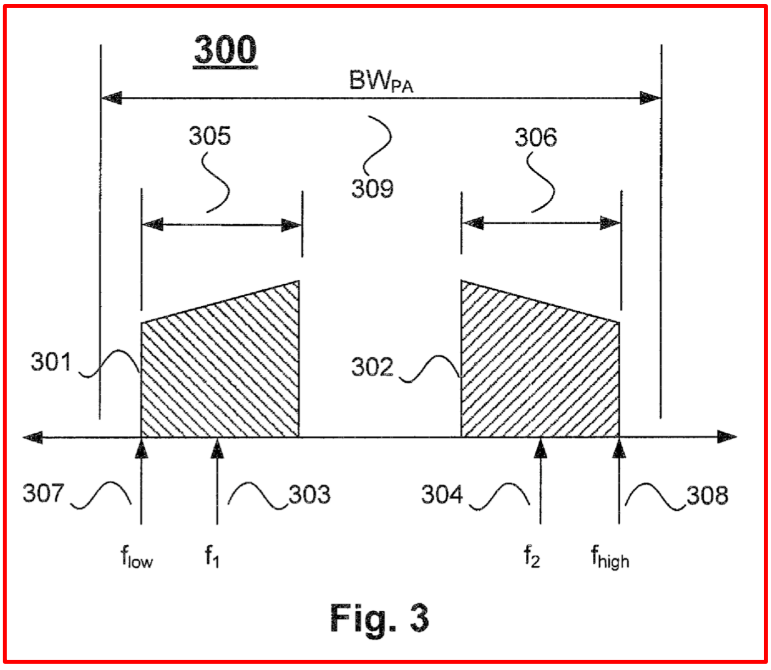


Fig. 3

48. In reference to FIG. 2 shown above, the '802 Patent explains that "*Information* (*i.e., data*) to be transmitted may be received in a *baseband digital system* **250**, such as a wireless digital baseband processor" that "provides a *first digital signal that comprises first digital data* **251** to be transmitted to "**IN1**" and provides a *second digital signal that comprises second digital data* **252** to be transmitted to "**IN2**"" wherein "data **252** and data **252** may be *packets of data that conform to* a specific *wireless communication protocol*" (emphasis added, see, for example, Ex. 1001 at 5:60-6:1).

49. More specifically, the '802 Patent explains that "Baseband digital system **250** may *deserialize a data stream* (e.g., using a demultiplexing function) to *divide data packets between the two transmitter channels*" such that "the original information *data may be passed through an encoder* and the output of the encoder would be s*plit into two streams* providing inputs **251** and **252**" and thus "The data of the *first digital signal* and the data of the *second digital* may be *unrelated data steams* or may be *data from the same data stream*" (emphasis added, see, for example, Ex. 1001 at 6:1-9).

50. In continued reference to FIG. 2 shown above, the '802 Patent explains that "the *input of DAC* **201** is coupled to a *first data output of the baseband processor* **250**, and the first digital signal is *converted to a first analog signal* by DAC **201**" while "Similarly, the *input of DAC* **202** is coupled to a *second data output of baseband processor* **250**, and the second digital signal is *converted to a second analog signal* by DAC **202**" so that "The *output of DAC* **201** is coupled to the *input of filter* **203**, and the *first analog signal* is filtered by filter **203** to *remove unwanted frequency content* (e.g., remove aliasing)" while "Similarly, the *output of DAC* **202** is coupled to the *input of filter* **204**, and the *second analog signal* is filtered by filter **204** to *remove unwanted frequency content*" (emphasis added, see, for example, Ex. 1001 at 6:10-21).

51. Additionally, the '802 Patent explains that the "first *input of up-converter* **205** is coupled to the *output of filter* **203** to receive the first analog signal and a second *input of up-converter* **205** is coupled to *synthesizer* **207** to receive a *first modulation signal having a first RF center frequency* **303** (f_1) as shown in FIG. 3" such that "the first *up-converted frequency range* is from the first RF frequency **303** *minus one-half the first up-converted frequency range to* the first RF frequency *plus the one-half the first up-converted frequency range*" (emphasis added, see, for example, Ex. 1001 at 6:22-34).

52. Similarly, the '802 Patent explains that the "first *input of up-converter* **206** is coupled to the *output of filter* **204** to receive the second analog signal and a second *input of up-converter* **206** is coupled to *synthesizer* **207** to receive a *second modulation signal having a second RF center frequency* **304** (f_2) as shown in FIG. 3" such that "the *second up-converted frequency range* is from the second RF frequency **304** *minus one-half the second up-converted frequency range to* the second RF frequency *plus the one-half the second up-converted frequency range*" (emphasis added, see, for example, Ex. 1001 at 6:35-48).

53. Accordingly, the '802 Patent further states that "FIG. 3 illustrates that a *frequency difference between the first RF center frequency and the second RF center frequency* is *greater than the sum of one-half the first frequency range and one-half the second frequency range* so that the *up-converted signals do not overlap and thereby cause distortion*" (emphasis added, see, for example, Ex. 1001 at 6:48-53).

54. Additionally, the '802 Patent informs that "*either two synthesizers* can be used to *generate* f**1** and f**2**, or a *single synthesizer* with the capability of *producing* f**1** and f**2** *simultaneously*" (emphasis added, see, for example, Ex. 1001 at 6:53-56).

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55. In continued reference to FIG. 2 shown above, the '802 Patent explains for the "*power amplifier* **208** (*PA*)" that "the *first and second up-converted analog signals are combined at the input of amplifier* **208** before amplification to produce a *combined up-converted signal*" such that "*antenna* **209** is *coupled to the output of amplifier* **208** to transmit the amplified ups converted signal as an *electromagnetic signal*" (emphasis added, see, for example, Ex. 1001 at 6:57-58, 7:4-11).

56. For example, in reference to FIG. 3 shown above, the '802 Patent explains that "the *bandwidth* **309** (BW_{PA}) of the *PA* **208** is *greater than the difference between a lowest frequency* **307** (f_{low}) in the first up-converted frequency range **305** *and highest frequency* **308** (f_{high}) in the second up-converted frequency range **306**" (emphasis added, see, for example, Ex. 1001 at 6:66-7:2).

57. The '802 Patent states that "When the bandwidth **309** of *PA* **208** *covers a wide bandwidth*, *many up-converted signals* may be *transmitted using the single power amplifier* **208** and a *single antenna* **209**" and then alleges that "*Since only a single antenna* is utilized, the application may *not require multiple power amplifiers and antennas*, which *reduces area and cost* while *increasing data throughput* or, as illustrated below, *reliability*" (emphasis added, see, for example, Ex. 1001 at 7:11-18).

58. Additionally, the '802 Patent informs that "*Embodiments* of the present invention *transmit multiple signals simultaneously over a communication channel at different center frequencies*, and *may use a single power amplifier and antenna*" while "In *another embodiment*, *two or more power amplifiers may be used* as part of the power amplifier implementation" (emphasis added, see, for example, Ex. 1001 at 6:60-65).

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59. According to the '802 Patent, "FIG. 4 illustrates an example of how the *frequency content can move*" when "*synthesizer* **207** may receive instructions from the baseband processor **250**, for example, to *change the first RF center frequency* **403** (f_{1A}) and *second frequency RF center frequency* **404** (f_{2A}) *within a bandwidth* **440** (BW_{PA})" wherein such "*change in frequency* may occur *concurrently*" (emphasis added, see, for example, Ex. 1001 at 7:19-28, FIG. 4 as reproduced below).

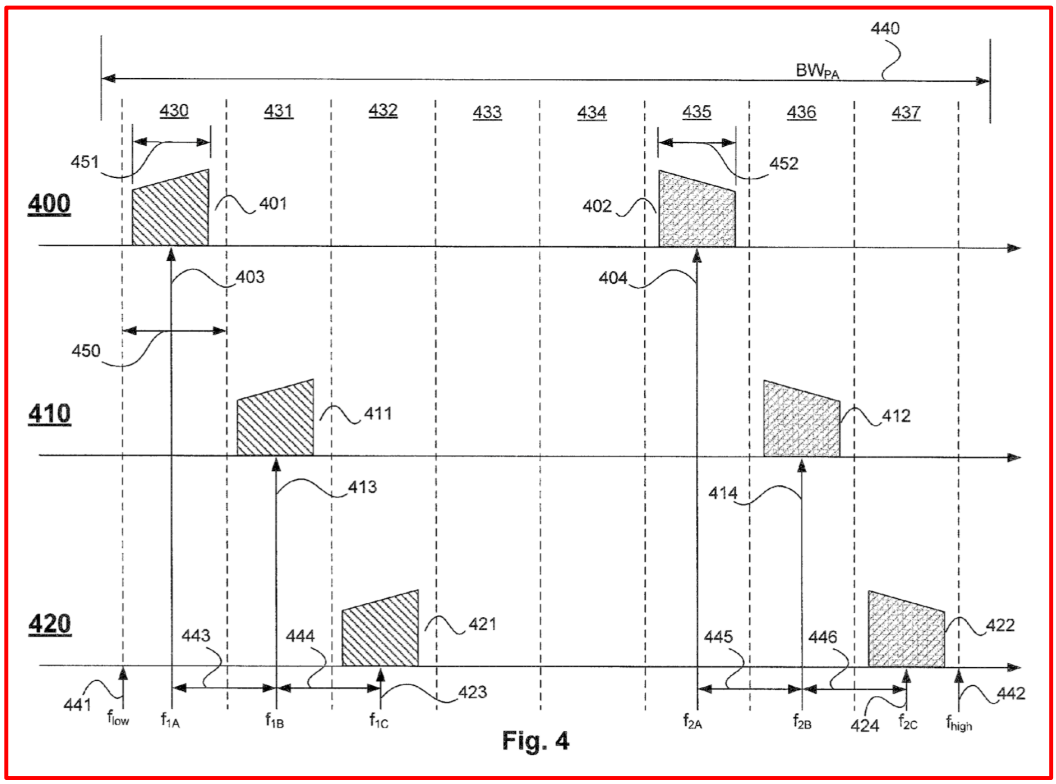


Fig. 4

60. In reference to FIG. 4 shown above, the '802 Patent explains that such a "*change in frequency*" may "result in a *new frequency content* **410** in which the signal **401** has *moved in frequency* as illustrated by signal **411** having an *RF center frequency* **413** (f_{1B}), and the signal **402** has moved in frequency as illustrated by signal **412** having an RF center frequency **414** (f_{2B})" (emphasis added, see, for example, Ex. 1001 at 7:29-33).

61. Additionally, the '802 Patent states that "*Some time later* the *RF frequencies can change again*" or "may *return the RF signals to the original locations in frequency* illustrated in frequency content **400**" wherein "This *cycle may repeat* itself again or begin a *different cycle*" (emphasis added, see, for example, Ex. 1001 at 7:33-42).

62. For example, the '802 Patent informs that "changes may *move the RF signals to adjacent or non-adjacent locations*, or the signal **401** may be *moved to higher frequencies* than signal **401**" while such "changes in RF frequency can happen at irregular intervals or at regular intervals (periodically)" and while "*spacing between the two RF center frequencies may remain the same or may vary*" (emphasis added, see, for example, Ex. 1001 at 7:44-48, 7:55-57).

63. Moreover, the '802 Patent informs that "*One or more data streams from the same or different sources* may be transmitted using a single power amplifier" and "may *utilize a first wireless protocol to encode the first digital data* and *utilize a second wireless protocol to encode the second digital data*" wherein "Almost *any existing protocol may be used* as the first protocol or second protocol" including "wireless local area network (*WLAN*) protocol such as *802.11.g*" and "Orthogonal frequency domain multiplexing (*OFDM*)" (emphasis added, see, for example, Ex. 1001 at 7:57-8:3).

64. According to the '802 Patent, "FIG. 5 illustrates a *wireless communication system*" wherein "System **500** includes an *antenna* **501**, *low noise amplifier* **502** (LNA), a *down-converter* **504**, a *down-converter* **505**, a *synthesizer* **503**, *filters* **506** and **507**, and *analog-to-digital converters* (ADC) **560** and **570**" wherein the "*Frequency content* **510**" that "may be *transmitted as the first electromagnetic signal described above* and received by antenna **501**" is "*including signals* **511** and **512**" (emphasis added, see, for example, Ex. 1001 at 8:6-16, FIG. 5 as reproduced below).

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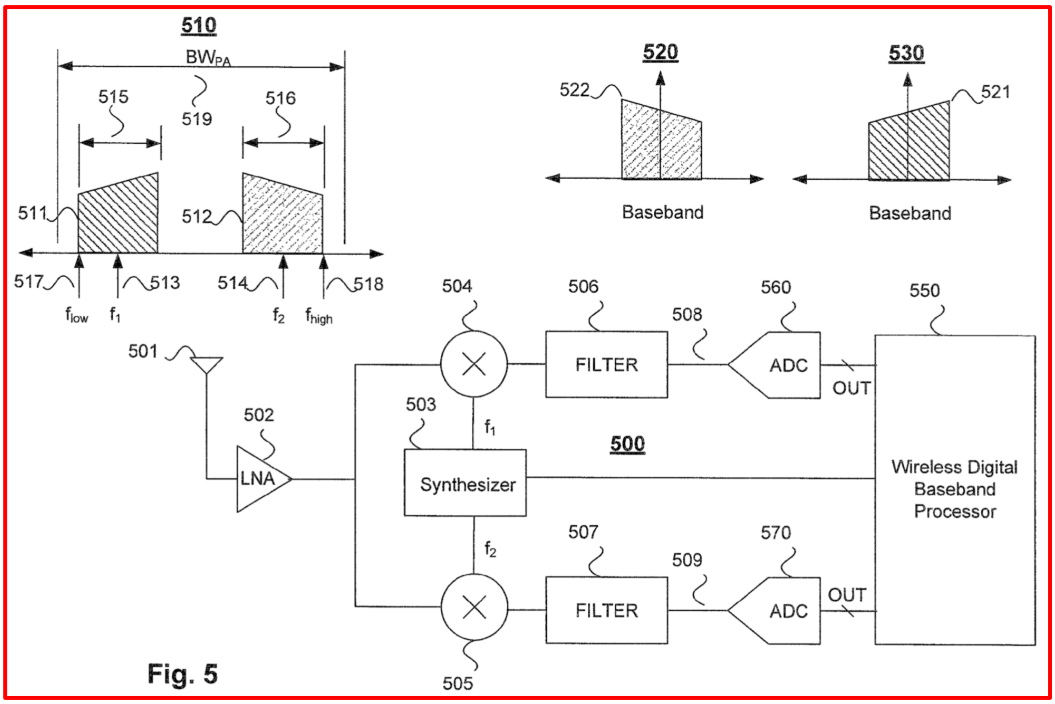


Fig. 5

65. In reference to FIG. 5 shown above, the '802 Patent explains that "Signal **511** may be an analog signal up-converted to a *first RF center frequency*, and signal **512** may an analog signal up-converted to a *second RF center frequency*" wherein "signals **511** and **512** carry *different data from a common data stream* or *from different data streams*, data *corresponding to different protocols*, or even the *same data*" (emphasis added, see, for example, Ex. 1001 at 8:16-22).

66. Additionally, the '802 Patent explains that "The *first down-converter* **504** outputs a *first down-converted analog signal*" that "*corresponds to* the analog signal carrying *information across frequency range* **515**, which was *provided to an up-converter in the transmitter that generated signal* **510**" while "The *second down-converter* **505** outputs a *second down-converted analog signal*" that "*corresponds to* an analog signal carrying *information across frequency range* **516**, which was *provided to an up-converter in the transmitter that generated signal* **510**" (emphasis added, see, for example, Ex. 1001 at 8:32-36, 8:41-46).

67. The ‘802 Patent also notes that “While the above examples illustrate transmission and reception using *direct up and down conversion to and from RF center frequencies*, it is to be understood that in *other implementations* the signals could be *up/down-converted to intermediate frequencies in intermediate steps* between baseband processing” (emphasis added, see, for example, Ex. 1001 at 8:56-61).

68. Additionally, the ‘802 Patent notes in reference to FIG. 5 shown above that “the *digital signals may be serialized back into a single data stream* (e.g., using a MUX), *processed independently according to different protocol requirements*, or, if the *data is the same data*, *combined digitally to improve the reliability* of the transmission” (emphasis added, see, for example, Ex. 1001 at 9:3-7).

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B. Prosecution File History of the '802 Patent

69. I understand that on Jan. 23, 2008 that U.S. Patent Application No. 12/018,370 by A. Tarighat-Mehrabani et al., entitled "Wireless communication systems and methods" was filed (see, for example, Ex. 1001 at [22]).

70. I understand that in Dec. 2010 that the US PTO notified the applicants of U.S. Patent Application No. 12/018,370 that then-pending claims, as amended by the examiner, were allowable (see, for example, Ex. 1002 at pp. 59-65).

71. I understand that the examiner allowed Claim 1 of U.S. Patent Application No. 12/018,370 because the "closest prior art of record … fails to disclose the inventive method steps of "*simultaneously transmitting second information across a second frequency range* using same wireless transmitter, sane frequency range having a *second center frequency greater than the first center frequency*, a second highest frequency, and a second lowest frequency (*claim 1*); *Up-converting first analog signal, second analog signal to a second RF center frequency greater than first center RF frequency* to produce a second up-converted analog signal wherein the *frequency difference* between the RF center frequency and the second RF center frequency is *greater than the sum of on-half the first frequency range and one-half the second frequency range* (*claims 10 and 17*); and *first and a second downconverter to receive up-converted signal outputting sown-converted signal modulated at the RF frequency wherein a filter receiving down-converted signals* (*claim 24*)" (emphasis added, see, for example, Ex. 1002 at pp. 63-64).

72. I understand that U.S. Patent Application No. 12/018,370 issued as U.S. Patent No. 7,924,802 on Apr. 12, 2011 (see, for example, Ex. 1001 at [45]).

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C. Asserted Claims and Priority Date

73. The ‘802 Patent includes 20 claims. I understand that at least Claims 1-4 and 7-9 of the ‘802 Patent are asserted in the District Court litigation (see, for example, Ex. 1011 at pp. 1-2). However, I understand that Claims 1-9 of the ‘802 Patent are subject to this *Inter Partes* Review petition. I may refer to Claims 1-9 of the ‘802 Patent as the “challenged claims” herein.

74. The ‘802 Patent was filed on Jan. 23, 2008 (see, for example, Ex. 1001 at [22]). and I understand that in the District Court litigation that the Patent Owner alleges the priority date of at least the challenged claims of the ‘802 Patent to be Jan. 23, 2008 (see, for example, Ex. 1011 at p. 4).

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D. Objective Indicia of Non-obviousness

75. I understand that in the District Court litigation, Patent Owner has not yet provided any information regarding this topic. As of this writing, I am unaware of any information that would provide objective indicia of non-obviousness for any of the challenged claims of the '802 Patent. However, to the extent that Patent Owner (or its expert) provides opinions and/or analysis with respect to this topic, I reserve the right to supplement my opinions and analyses on this topic.

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VI. CLAIM CONSTRUCTION

76. I understand that claim construction is a matter of law. I further understand that in a *Inter Partes* Review proceeding that the claims are to be given their ordinary and customary (or "plain and ordinary") meaning, as would be understood by a POSITA in the context of the entire disclosure and intrinsic record. I also understand that limitations from the specification of the patent are not to be read into the claims, and that conversely, not all claims necessarily encompass all material disclosed within the specification. The specification, however, can inform a POSITA as to the plain and ordinary meaning of the claims. In addition, I understand that a POSITA would look to statements made by the applicants during the prosecution file history to inform as to the plain and ordinary meaning of the claims.

77. I understand that at least indefiniteness and lack of written description and/or enablement are potential invalidity issues that cannot be addressed as part of an *Inter Partes* Review proceeding. Therefore, solely for the purposes of my prior art invalidity analyses herein as relevant to this *Inter Partes* Review proceeding, I have assumed claim constructions as appropriate for an *Inter Partes* Review proceeding even for such claims and/or claim elements that I may otherwise believe to be indefinite, lacking written description and/or non-enabled as may be set forth in the District Court litigation.

78. I understand that in the District Court litigation involving the Petitioner that Patent Owner has not, as of this writing, identified any claim terms alleged to require constructions nor proposed any claim constructions thereof for the '802 Patent. However, Patent Owner has provided an allegation of infringement for at least the challenged claims of the '802 Patent. Thus, Patent Owner appears to believe that the claim terms of the challenged claims of

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the ‘802 Patent are at least as broad as would be necessary for such allegation of infringement to apply.

79. I have applied a plain and ordinary meaning to all claim terms for the purposes of this *Inter Partes* Review proceeding. In my opinion, my analyses of obviousness herein would apply to any reasonable construction of the claim terms as well.

80. In the event that one or more of these constructions is changed, or in the event that additional terms not specifically construed herein receive a proposed construction, I reserve the right to revisit my analysis under such additional construction(s).

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VII. STATE OF THE ART

81. As of the possible priority date of the '802 Patent, the state of the art in the field of wireless communications already fully encompassed the elements of the asserted claims of the '802 Patent, as evidenced in even the small sample of the art described herein.

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A. IEEE 802.11n D2.0 (Ex. 1004)

82. For example, amongst the numerous prior art references in this field, IEEE P802.11n™/D2.00 ("IEEE 802.11n D2.0") was completed in Feb. 2007 and published in Mar. 2007 (see, for example, Ex. 1004 at every page, https://www.ieee802.org/11/LetterBallots.shtml at #97, https://grouper.ieee.org/groups/802/11/Reports/802.11_Timelines.htm at IEEE Std P802.11n-2009, ¶¶ 182-184 below, Ex. 1014 at § II). Thus, I understand that IEEE 802.11n D2.0 qualifies as prior art to the '802 Patent at least under 35 U.S.C. § 102(a).

83. I note that 802.11n D2.0 was the output of the IEEE 802.11 Task Group "TGn" and that this published version was the WG Letter Ballot version that was circulated for approval in Mar. 2007 as shown by the excerpt below from https://grouper.ieee.org/groups/802/11/Reports/802.11_Timelines.htm:

SUPERSEDED OR WITHDRAWN - Standards, Amendments, and Recommended Practices

IEEE Project and Final Document	Final Doc Type	Project Authorization Request (PAR)	Task Group and Activity	Documentation: Session End Snapshot: Format & Version	Documentation: Session End Snapshot: Incorporated Baselines	Current Status	PAR Approved, Modified, or Extended [Expires]	WG Letter Ballots: Draft: Predicted Initial	WG Letter Ballots: Date: Predicted Recirc	WG Letter Ballots: Result: Predicted Recirc	Form SA Ballot Pool / Reform	MEC / MDR Done	IEEE SA Ballots: Draft: Predicted Initial	IEEE SA Ballots: Date: Predicted Initial	IEEE SA Ballots: Result: Predicted Recirc	Final 802.11 WG Approval	Final or Conditional 802 EC Approval	RevCom & Standards Board Final or Continuous Process Approval	ANSI Approved	Superseded or Withdrawn by Standards Board
IEEE Std P802.11n-2009	A	High Throughput	TGn		802.11-2007 802.11k-2008 802.11r-2008 802.11y-2008 802.11w-2009	Actual	2003-09-11 [2007-09-27]	D1.0 D2.0 D3.0 D4.0 D5.0 D6.0 D7.0 D7.0	2006-04-29 2007-03-09 2007-10-27 2008-04-12 2008-06-12 2008-08-05 2008-09-30 2008-12-02	47% 83% 85% 88% 90% 91% 94% 95%	2008-12-11	2008-12-11	D7.0 D8.0 D9.0 D10.0 D11.0 D11.0	2009-01-10 2009-03-06 2009-04-04 2009-05-30 2009-07-03 2009-06-20	78% 80% 81% 88% 91% 90%	C	C	2009-09-11		2012-03-01

84. In greater detail, the excerpts above can also be viewed as:

IEEE Project and Final Document	…	Task Group and Activity	…	WG Letter Ballots: Draft	WG Letter Ballots: Date: Predicted Initial	WG Letter Ballots: Result: Predicted Recirc
IEEE Std P802.11n-2009	…	TGn	…	D1.0	2006-04-29	47%
				D2.0	2007-03-09	83%
				D3.0	2007-10-27	85%
				D4.0	2008-04-12	88%
				D5.0	2008-06-12	90%
				D6.0	2008-08-05	91%
				D7.0	2008-09-30	94%
				D7.0	2008-12-02	95%

85. IEEE 802.11n D2.0 recites that "This amendment specifies *enhancements to the following draft standard* and draft amendments, in order to *obtain higher throughput*:" wherein

the first such listed "*draft standard*" is "*IEEE P802.11 REV-ma D9.0*", which is substantially identical to IEEE Std. 802.11™-2007 as noted herein (emphasis added, see, for example, Ex. 1004 at p. v, ¶¶ 123-125 and 182-184 below).

86. IEEE 802.11n D2.0 recites that "Clause 20 (*High Throughput (HT) PHY specification*) specifies the PHY Entity for a high throughput (HT) *orthogonal frequency division multiplexing (OFDM) system*" wherein such "HT features are *applicable to operation* in either the *2.4 GHz band* or the *5 GHz bands*, or *both*, as specified in 20.3.14 (*Channel numbering and channelization*)" (emphasis added, see, for example, Ex. 1004 at § 20.1).

87. IEEE 802.11n D2.0 informs that "The *HT OFDM PHY is based on* the *OFDM PHY defined in Clause 17*, with extensibility up to 4 spatial streams, operating in 20 MHz bandwidth" but "Additionally, transmission using 1 to 4 spatial streams is also *defined for operation in 40 MHz bandwidth*" such that "These features are capable of *supporting data rates up to 600 Mb/s* (4 spatial streams, *40 MHz bandwidth*)" (emphasis added, see, for example, Ex. 1004 at § 20.1).

88. Additionally, IEEE 802.11n D2.0 informs that "The *HT STA* shall be *compliant with PHY specifications* as defined in *Clause 17* for operation in the *5 GHz bands*, and *Clauses 18 and 19* for operation in the *2.4 GHz bands*" and further that "The HT PHY supports *non-HT operation in the 2.4 GHz band* as defined by *Clause 19*" and "supports *non-HT operation in the 5 GHz bands* in as defined by *Clause 17*" (emphasis added, see, for example, Ex. 1004 at § 20.1).

89. Therefore, in my opinion, a POSITA would understand even before considering the detailed disclosure of IEEE 802.11n D2.0 to follow that IEEE 802.11n D2.0 is from the same field of endeavor as the '802 Patent and that IEEE 802.11n D2.0 is reasonably pertinent to the

problem faced by the '802 Patent (see, for example, ¶¶ 39-40 and 63 above). Accordingly, IEEE 802.11n D2.0 is analogous art to the '802 Patent.

90. IEEE 802.11n D2.0 teaches that the "*operation of the PHY in the frequency domain* is determined by the *CH_BANDWIDTH and CH_OFFSET parameters*" wherein "*Table n55* (PPDU format as a function of CH_BANDWIDTH and CH_OFFSET parameters) *shows* the combination of CH_BANDWIDTH and CH_OFFSET *parameters that are supported*" (emphasis added, see, for example, Ex. 1004 at § 20.1.3).

91. For example, IEEE 802.11n D2.0 at "*Table n55*" describes that when "*CH_BANDWIDTH*" is set to "*HT_CBW40*" and "*CH_OFFSET*" is set to "*CH_OFF_40*" then "When *MCS is set to 32*:" the HT PHY uses "*HT duplicate format*" such that "a PPDU of this format *occupies a 40 MHz channel composed of two adjacent 20 MHz channels* and transmits an HT Mixed or greenfield format packet on *a single spatial stream*" which thereby "provides the *lowest HT transmission rate in 40 MHz*" (emphasis added, see, for example, Ex. 1004 at § 20.1.3, Table n55).

92. For example, IEEE 802.11n D2.0 at "*Table n55*" describes that when "*CH_BANDWIDTH*" is set to "*NON_HT_CBW40*" and "*CH_OFFSET*" is set to "*CH_OFF_40*" then the HT PHY uses "*Non-HT duplicate format*" such that "The STA *operates in a 40 MHz channel composed of two adjacent 20 MHz channels*" wherein "The packets to be sent are in the *Clause 17 format* (Ed: CID 3432) in each of the 20 MHz channels" except that "The *upper channel (higher frequency) is rotated by +90° relative to the lower channel*" (emphasis added, see, for example, Ex. 1004 at § 20.1.3, Table n55).

93. IEEE 802.11n D2.0 also describes "an *HT duplicate format* (specified in 20.3.10.10.4) used for *MCS 32* that provides the lowest rate in a *40 MHz channel*" and "a *non-*

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HT duplicate format (specified in 20.3.10.11 (Non-HT duplicate transmission)) that *duplicates the 20 MHz non-HT packet in two 20 MHz halves of a 40 MHz channel*" wherein the "Non-HT PPDU format is defined in 17.3.3 and 17.3.2" (emphasis added, see, for example, Ex. 1004 at § 20.3.2).

94. IEEE 802.11n D2.0 recites that "Table n58 (*Timing related constants*) defines the timing related parameters" subject to "NOTE 1—*Data and pilot tones are replicated in upper and lower 20 MHz portions of 40 MHz signal* to make a total of 104 tones used in *HT duplicate and non-HT duplicate formats*" (emphasis added, see, for example, Ex. 1004 at § 20.3.6, Table n58 as excerpted below).

Table n58—Timing related constants

Parameter	Value in non-HT 20 MHz channel	Value in 20 MHz HT channel	Value in 40 MHz channel	
			HT for-mat	HT and Non-HT duplicate
N_{SD}: Number of data sub-carriers	48	52	108	48
N_{SP}: Number of pilot sub-carriers	4	4	6	4
N_{ST}: Total Number of sub-carriers	52	56	114	104 See NOTE 1
N_{SR}: The highest data sub-carrier index	26	28	58	58
Δ_F : subcarrier frequency spacing	312.5kHz (20 MHz/64)	312.5kHz	312.5kHz (40 MHz/128)	
T_{DFT}: IDFT/DFT period	3.2 µs	3.2 µs	3.2 µs	
T_{GI}: Guard Interval duration	0.8 µs= T_{DFT}/4	0.8 µs	0.8 µs	
T_{SYM}: Symbol Interval	4 µs= T_{DFT}+T_{GI}	4 µs	4 µs	

95. IEEE 802.11n D2.0 teaches that "In the case of the *HT duplicate and Non-HT duplicate formats*, the *same data* are *transmitted over two adjacent 20 MHz channels*" such that "In this case, the *40 MHz channel is divided into 128 sub-carriers* and the *data are transmitted on carriers -58 to -6 and 6 to 58*" (emphasis added, see, for example, Ex. 1004 at § 20.3.7).

96. Additionally, IEEE 802.11n D2.0 teaches that "The *transmitted signal* is described in *complex base-band signal notation*" wherein "The *actual transmitted signal* is related to the complex baseband signal by the *following relation*:" given by Eq. (20-1) (emphasis added, see, for example, Ex. 1004 at § 20.3.7, Eq. (20-1) as reproduced below).

$$r_{RF}(t) = \mathrm{Re}\{r(t)\exp(j2\pi f_c t)\}$$

97. In reference to Eq. (20-1) shown above, IEEE 802.11n D2.0 explains that "Re{·} represents the *real part of a complex variable*" and "f_c is the *center frequency of the carrier*" (emphasis added, see, for example, Ex. 1004 at § 20.3.7).

98. Also, IEEE 802.11n D2.0 notes that when this "*transmitted RF signal* is *derived by modulating the complex baseband signal*, which consists of *several fields*" then "The *timing boundaries* for the various fields are shown in Figure n65" (emphasis added, see, for example, Ex. 1004 at § 20.3.7, Figure n65 as reproduced below).

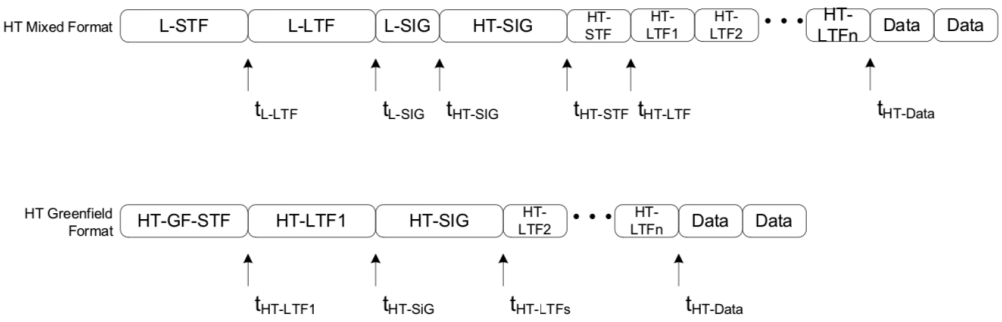


Figure n65—Timing boundaries for PPDU fields

99. IEEE 802.11n D2.0 also explains that the "*baseband waveform*", or "$r(t)$" in Eq. (20-1) shown above, is "defined via the *discrete Fourier transform*" in a "*general representation*" that "holds for *all fields*" for "the *transmitted signal on transmit chain* i_{TX}" as given by Eq. (20-4) (emphasis added, see, for example, Ex. 1004 at § 20.3.7, Eq. (20-4) as reproduced below).

$$r_{\text{Field}}^{(i_{TX})}(t) = \frac{1}{\sqrt{N_{\text{Field}}^{\text{Tone}} \cdot N_{TX}}} w_{T_{\text{Field}}}(t) \sum_{k} \Upsilon_k X_k^{(i_{TX})} \exp\left(j2\pi k \Delta_f t\right)$$

100. IEEE 802.11n D2.0 also explains that "The *frequency-domain symbols* $X_k^{(i_{TX})}$ represent the output of any spatial processing in *subcarrier* k for *Tx chain* i_{TX} required for the field", "the *windowing function*, $w_{T_{\text{Field}}}(t)$, is given in 17.3.2.4", and "The *function* Υ_k is used to *represent a rotation of the upper tones in a 40 MHz channel*" wherein "$\Upsilon_k = 1$" for "$k \leq 0$" and "$\Upsilon_k = j$" for "$k > 0$" (emphasis added, see, for example, Ex. 1004 at § 20.3.7).

101. In further reference to Eq. (20-1) shown above, IEEE 802.11n D2.0 explains that "*When transmitting in the upper/lower 20 MHz portion of a 40 MHz channel*, the mathematical *definition of transmission shall follow* that of a 20 MHz channel with f_c in *Equation (20-1) replaced by* $f_c \pm 10MHz$" (emphasis added, see, for example, Ex. 1004 at § 20.3.8).

102. More specifically, IEEE 802.11n D2.0 teaches that "*HT duplicate format* provides the lowest transmission rate in 40 MHz" and "*shall only be used for one spatial stream* and only *with BPSK modulation and rate-½ coding*" such that "the *following equation defines the signal*:" given by Eq. (20-60) (emphasis added, see, for example, Ex. 1004 at § 20.3.10.10.4, Eq. (20-60) as reproduced below).

$$r_{HT-DATA}^{i_{TX}}(t) = \frac{1}{\sqrt{N_{Duplicate}^{Tone}}} \sum_{n=0}^{N_{SYM}-1} w_{T_{SYM}}(t - nT_{SYM})$$

$$\cdot \sum_{k=-N_{SR}}^{N_{SR}} (D_{k,n} + p_{n+z}P_k)([Q_{k-32}]_{i_{TX},1} \exp\left(j2\pi(k-32)\Delta_F(t - nT_{SYM} - T_{GI})\right)$$

$$+ j[Q_{k+32}]_{i_{TX},1} \exp\left(j2\pi(k+32)\Delta_F(t - nT_{SYM} - T_{GI})\right))$$

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103. In reference to Eq. (20-60) shown above, IEEE 802.11n D2.0 explains that "z is defined in 20.3.10.10.2" (i.e. either 2 or 3), "P_k and p_n are defined in 17.3.5.9" (i.e. modulation values for pilot subcarriers k with polarity based upon symbol number n per Clause 17 of IEEE 802.11-2007), "$D_{k,n}$ is defined in 20.3.9.4.3" (i.e. modulation values for data subcarriers k at symbol number n), "N_{SR} has the value defined for non-HT 20 MHz transmission" (i.e. 26), and "$[Q_k]_{i_{TX},1}$ is an element from a vector of length N_{TX}, which may be frequency dependent" (see, for example, Ex. 1004 at §§ 20.3.9.4.3, 20.3.10.10.2, 20.3.10.10.4, ¶¶ 94 above and 152-156 below).

104. Additionally, IEEE 802.11n D2.0 teaches that "*Non-HT duplicate transmission* is used to *transmit to Clause 17 STAs* that may be present in either the *upper or lower halves of the 40 MHz channel*" wherein "*Data transmission is defined* in Equation (20-61)" (emphasis added, see, for example, Ex. 1004 at § 20.3.10.11, Eq. (20-61) as reproduced below).

$$r_{LEG-DUP}^{i_{TX}}(t - nT_{SYM}) = \frac{1}{\sqrt{N_{Duplicate}^{Tone}}} \sum_{n=0}^{N_{SYM}-1} w_{T_{SYM}}(t - nT_{SYM})$$

$$\cdot \sum_{k=-26}^{26} (jD_{k,n} + p_n P_k)(\exp\left(j2\pi(k-32)\Delta_F\left(t - nT_{SYM} - T_{GI} - T_{CS}^{i_{TX}}\right)\right)$$

$$+j\exp\left(j2\pi(k+32)\Delta_F\left(t - nT_{SYM} - T_{GI} - T_{CS}^{i_{TX}}\right)\right))$$

105. In reference to Eq. (20-61) shown above, IEEE 802.11n D2.0 explains that "P_k" and "p_n" are "defined in 17.3.5.9" (i.e. modulation values for pilot subcarriers k with polarity based upon symbol number n per Clause 17 of IEEE 802.11-2007), "$D_{k,n}$ is defined in 20.3.9.4.3" (i.e. modulation values for data subcarriers k at symbol number n), and "$T_{CS}^{i_{TX}}$

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represents the cyclic shift of the transmit chain i_{TX} and is defined in Table n61" (see, for example, Ex. 1004 at §§ 20.3.9.4.3, 20.3.10.11, ¶¶ 152-156 below).

106. IEEE 802.11n D2.0 specifies that "*Channel center frequencies* are defined at every integral multiple of 5 MHz in the 2.4 GHz band" wherein "The *relationship between center frequency and channel number* is given by" Equation (20-87) where "$n_{ch} = 1, 2, \ldots, 13$" (emphasis added, see, for example, Ex. 1004 at § 20.3.14.1, Eq. (20-87) as reproduced below).

$$\text{Channel center frequency} = 2407 + 5 \times n_{ch}(\text{MHz})$$

107. Similarly, IEEE 802.11n D2.0 specifies that "*Channel center frequencies* are defined at every integral multiple of 5 MHz above 5 GHz" wherein "The *relationship between center frequency and channel number* is given by" Equation (20-88) where "$n_{ch} = 0, 1, \ldots, 200$" and "Channel starting frequency" is "defined as 5 GHz" for operation in the USA (emphasis added, see, for example, Ex. 1004 at § 20.3.14.2, Eq. (20-88) as reproduced below).

$$\text{Channel center frequency} = \text{Channel starting frequency} + 5 \times n_{ch}(\text{MHz})$$

108. IEEE 802.11n D2.0 teaches that "The *40 MHz channels are specified by two fields*: (Nprimary_ch, Secondary)" wherein "The *first field represents the channel number* of the *primary channel*, and the *second one indicates whether the secondary channel is above or below* the primary channel (1 -> above, -1 -> below)" and thus "The secondary channel number shall be Nprimary_ch + Secondary*4" (emphasis added, see, for example, Ex. 1004 at § 20.3.14.3).

109. For example, IEEE 802.11n D2.0 recites that "a *40 MHz channel* consisting of *40 MHz channel number 36* and Secondary 1 *specifies the primary channel is 36 and the secondary channel is 40*" (emphasis added, see, for example, Ex. 1004 at § 20.3.14.3).

110. IEEE 802.11n D2.0 requires for "*Spectral flatness*" that "In *HT duplicate* format and *non-HT duplicate* format the *average energy of the constellations* in *each of the spectral*

lines -42 to -33, -31 to -6, +6 to +31, and +33 to +42 *shall deviate no more than* ± 2 dB from their average energy" while "The *average energy of the constellations* in *each of the spectral lines* -43 to -58 and +43 to +58 *shall deviate no more than* +2/-4 dB from the average energy of spectral lines -42 to -33, -31 to -6, +6 to +31, and +33 to +42" (emphasis added, see, for example, Ex. 1004 at § 20.3.20.2).

111. IEEE 802.11n D2.0 recites that "The *maximum allowable transmit power* by regulatory domain is *defined in Annex I*" (emphasis added, see, for example, Ex. 1004 at § 20.3.20.3, ¶¶ 161-163 below).

112. IEEE 802.11n D2.0 defines "*high throughput duplicate format* (HT duplicate format)" as "A PPDU format of the HT PHY in which *signals in two halves of the occupied channel width contain the same information*" wherein "This is the HT mode that supports the lowest rate" (emphasis added, see, for example, Ex. 1004 at § 3.n19).

113. IEEE 802.11n D2.0 defines "*non-HT duplicate*" as "A mode of operation of the PHY that *duplicates a 20 MHz non-HT transmission in two adjacent 20 MHz channels*, allowing a non-HT BSS on *either channel to receive the transmission*" (emphasis added, see, for example, Ex. 1004 at § 3.n32).

114. IEEE 802.11n D2.0 teaches that "*HT transmissions shall be protected* if there are other STAs (HT or non-HT) that cannot interpret HT transmissions correctly" wherein for "*40 MHz transmission*" then "use the *non-HT duplicate frames defined in Clause 20*" (emphasis added, see, for example, Ex. 1004 at § 9.13.3.1).

115. IEEE 802.11n D2.0 teaches that "*Phased Coexistence Operation* (PCO) is an optional coexistence mechanism in which a PCO AP *divides time into alternating 20 MHz and 40 MHz phases*" such that "*During the 40 MHz phase*, a *PCO STA shall transmit* data frames

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using a 40 MHz HT PPDU and *control frames using a non-HT duplicate* or a 40 MHz HT PPDU" (emphasis added, see, for example, Ex. 1004 at § 11.16).

116. IEEE 802.11n D2.0 also provides an "*Overview of the PPDU encoding process*" which includes that each one of "*groups* of N_{SD} *complex numbers*" is "*associated with one OFDM symbol* in one spatial stream" such that "In each group, the *complex numbers are indexed* 0 to $N_{SD} - 1$ *and mapped hereafter onto OFDM subcarriers* as described in 20.3.10.10.2 (Transmission in 20 MHz HT format), 20.3.10.10.3 (Transmission in 40 MHz HT Format), *20.3.10.10.4 (Transmission in HT duplicate format)*, and *20.3.10.11 (Non-HT duplicate transmission)*" (emphasis added, see, for example, Ex. 1004 at § 20.3.4.m, ¶¶ 102-105 above).

117. Additionally, IEEE 802.11n D2.0 describes within this "*Overview of the PPDU encoding process*" that "For each *group* of N_{ST} *subcarriers*" to "*convert* the subcarriers to *time domain using inverse Fourier transform*" and then "*Prepend* to the Fourier-transformed waveform a *circular extension* of itself thus forming a GI, and *truncate the resulting periodic waveform to a single OFDM symbol* length by applying time domain windowing" (emphasis added, see, for example, Ex. 1004 at § 20.3.4.r).

118. Subsequently, IEEE 802.11n D2.0 describes next to "*Append the OFDM symbols* associated with each transmit chain *one after another*" and then finally to "*Up-convert the resulting complex baseband waveform* associated with each transmit chain *to an RF signal according to the center frequency of the desired channel and transmit*" and "*Refer to 20.3.7 (Mathematical description of signals) for details*" (emphasis added, see, for example, Ex. 1004 at §§ 20.3.4.s, 20.3.4.t, ¶¶ 95-100 above).

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119. Also, IEEE 802.11n D2.0 notes that "if the FORMAT field is set to NON_HT and CH_BANDWIDTH indicates NON_HT_CBW40, *follow the transmit procedure as in Clause 17 duplicated on both channels*" (emphasis added, see, for example, Ex. 1004 at § 20.3.22).

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B. IEEE 802.11-2007 (Ex. 1005)

120. For example, amongst the numerous prior art references in this field, IEEE Std. 802.11™-2007 ("IEEE 802.11-2007") was completed in Mar. 2007 and published in Jun. 2007 (see, for example, Ex. 1005 at cover and p. i, https://grouper.ieee.org/groups/802/11/Reports/802.11_Timelines.htm at IEEE Std P802.11-2007, ¶¶ 182-184 below, Ex. 1014 at § III). Thus, I understand that IEEE 802.11-2007 qualifies as prior art to the '802 Patent at least under 35 U.S.C. § 102(a).

121. IEEE 802.11-2007 recites that "This revision gives users, in *one document*, the *IEEE 802.11 standard* for wireless local area networks (WLANS) *with all the amendments* that have been *published to date*" wherein "The *original standard was published in 1999* and reaffirmed in 2003" (emphasis added, see, for example, Ex. 1005 at p. iv).

122. For example, IEEE 802.11-2007 lists "*IEEE Std 802.11a™-1999* (Amendment 1)" and "*IEEE Std 802.11h™-2003* (Amendment 5)" as two of the "*documents*" that "have been *rolled into this revision* and are, therefore, *now retired along with the original*, reaffirmed edition of *IEEE Std 802.11*" (emphasis added, see, for example, Ex. 1005 at p. iv).

123. I note that IEEE 802.11-2007 was the output of the IEEE 802.11 Task Group "TGma" and that the published version was approved based upon the draft version IEEE P802.11 REV-ma D9.0 that was submitted for final approval in Nov. 2006 as shown by the excerpt below from https://grouper.ieee.org/groups/802/11/Reports/802.11_Timelines.htm:

SUPERSEDED OR WITHDRAWN - Standards, Amendments, and Recommended Practices

IEEE Project and Final Document	Final Doc Type	Project Authorization Request (PAR)	Task Group and Activity	Documentation: Session End Snapshot: Format & Version	Documentation: Session End Snapshot: Incorporated Baselines	Current Status	PAR Approved, Modified, or Extended [Expires]	WG Letter Ballots: Draft: Predicted Initial	WG Letter Ballots: Date: Predicted Initial	WG Letter Ballots: Result: Predicted Recirc	Form SA Ballot Pool / Reform	MEC / MDR Done	IEEE SA Ballots: Draft: Predicted Initial	IEEE SA Ballots: Date: Predicted Recirc	IEEE SA Ballots: Result: Predicted Recirc	Final 802.11 WG Approval	Final or Conditional 802 EC Approval	RevCom & Standards Board Final or Continuous Process Approval	ANSI Approved	Superseded or Withdrawn by Standards Board
IEEE Std P802.11-2007	STD	802.11 Standard Maintenance Revision	TGma	N/A	802.11-1999 802.11k 802.11a-1999 802.11b-1999 802.11b Cor1-2001 802.11d-2001 802.11g-2003 802.11h-2003 802.11i-2004 802.11j-2004 802.11e-2005	Actual	2003-03-20 [2003-03-20]	D1.0 D2.0 D3.0 D4.0	2005-05-08 2005-07-17 2005-08-19 2005-09-19	91% 94% 95% 96%	2005-08-21	2005-08-21	D5.0 D6.0 D7.0 D8.0 D9.0	2005-11-20 2006-05-10 2006-07-11 2006-09-08 2006-11-07	86% 90% 91% 96% 96%	2006-11-08	2006-11-08	2007-03-08		2012-03-01

124. In greater detail, the excerpts above can also be viewed as:

IEEE Project and Final Document	…	Task Group and Activity	…	IEEE SA Ballots			Final 802.11 WG Approval	Final or Conditional 802 EC Approval	RevCom & Standards Board Final or Continuous Process Approval
				Draft	Date	Result			
				Predicted Initial		Predicted Recirc			
IEEE Std P802.11-2007	…	TGma	…	D5.0 D6.0 D7.0 D8.0 D9.0	2005-11-20 2006-05-10 2006-07-11 2006-09-09 2006-11-07	86% 90% 91% 96% 96%	2006-11-08	2006-11-08	2007-03-08

125. Accordingly, a POSITA would understand that the substantive content of IEEE 802.11-2007 and IEEE P802.11 REV-ma D9.0 are identical and thus that a draft amendment specified as enhancements and/or revisions to IEEE P802.11 REV-ma D9.0 would be equally specified as enhancements and/or revisions to IEEE 802.11-2007.

126. IEEE 802.11-2007 recites that "The *scope of this standard* is to define one medium access control (MAC) and *several physical layer (PHY) specifications for wireless connectivity* for fixed, portable, and moving stations (STAs) within a local area" (emphasis added, see, for example, Ex. 1005 at § 1.1).

127. IEEE 802.11-2007 observes that "*Wireless networks have fundamental characteristics* that make them *significantly different from traditional wired LANs*" such as that "In IEEE Std 802.11, the *addressable unit is a station* (STA)" wherein "The STA is a *message destination, but not (in general) a fixed location*" (emphasis added, see, for example, Ex. 1005 at §§ 5.1.1, 5.1.1.1).

128. Additionally, IEEE 802.11-2007 observes that "The *PHYs used in IEEE Std 802.11* are *fundamentally different* from wired media" at least because they have "*neither absolute nor readily observable boundaries* outside of which STAs with *conformant PHY transceivers are known to be unable to receive network frames*", "Are *unprotected from other*

signals that may be sharing the medium" and "Have *time-varying and asymmetric propagation properties*" (emphasis added, see, for example, Ex. 1005 at § 5.1.1.2).

129. Accordingly, IEEE 802.11-2007 notes that "Because of *limitations on wireless PHY ranges*, *WLANs* intended to cover reasonable geographic distances may be *built from basic coverage building blocks*" but "One of the *requirements* of IEEE Std 802.11 is to handle *mobile as well as portable STAs*" wherein "A *portable STA* is one that is *moved from location to location*, but that is *only used* while at a *fixed location*" while "*Mobile STAs* actually *access the LAN while in motion*" (emphasis added, see, for example, Ex. 1005 at §§ 5.1.1.2, 5.1.1.3).

130. IEEE 802.11-2007 describes Figure 5-7 as the "*Complete IEEE 802.11 architecture*" (emphasis added, see, for example, Ex. 1005 at § 5.3.2, Figure 5-7 as reproduced below).

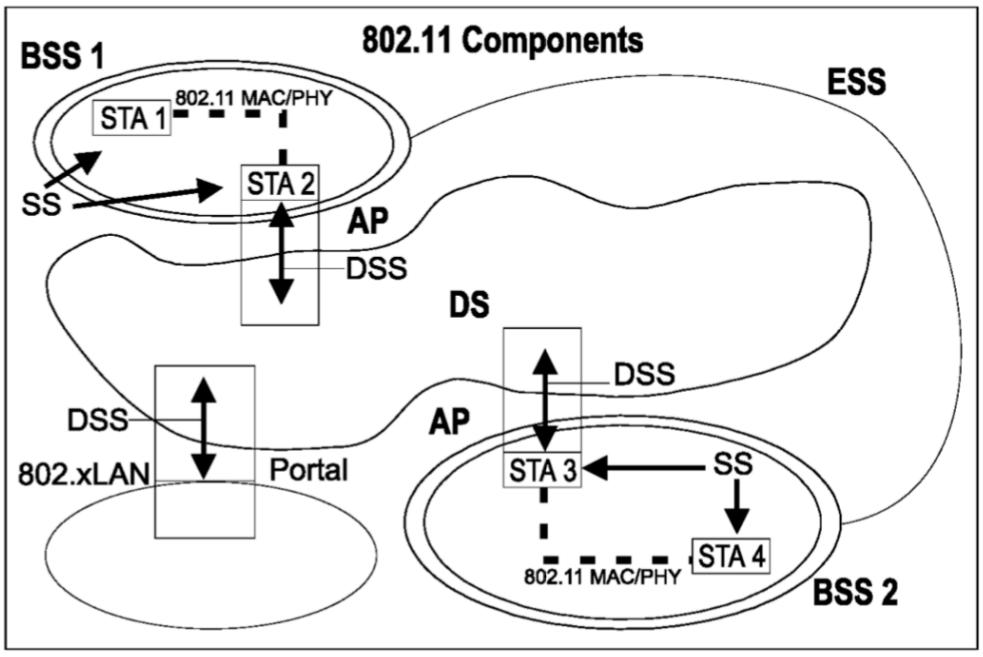


Figure 5-7—Complete IEEE 802.11 architecture

131. IEEE 802.11-2007 explains that "The *basic service set (BSS)* is the basic building block of an *IEEE 802.11 LAN*" and that in relation to Figure 5-7 shown above there are "two BSSs, each of which has two STAs that are members of the BSS" wherein "It is useful to think of the *ovals used to depict a BSS as the coverage area* within which the member STAs of the BSS may remain in communication" such that "*If a STA moves out of its BSA*, it can *no longer directly communicate with other STAs present in the BSA*" (emphasis added, see, for example, Ex. 1005 at § 5.2).

132. Additionally, IEEE 802.11-2007 describes a "*Distribution system* (DS)" that "*enables mobile device support* by providing the logical services necessary to handle address to destination mapping and seamless integration of *multiple BSSs*" wherein as shown in Figure 5-7 "An *access point (AP)* is any entity that *has STA functionality* and *enables access to the DS*, via the WM *for associated STAs*" (emphasis added, see, for example, Ex. 1005 at § 5.2.3).

133. IEEE 802.11-2007 includes a capability for "radio local area networks (RLANs) *operating in the 5 GHz band* to use *transmitter power control*" or "*TPC*" wherein this "TPC service provides for" at least "Specification of regulatory and *local maximum transmit power levels for the current channel*", "Selection of a *transmit power for each transmission in a channel*" and "*Adaptation of transmit power* based on a range of information, including *path loss and link margin estimates*" (emphasis added, see, for example, Ex. 1005 at § 5.4.4.1).

134. IEEE 802.11-2007 also defines "*PHY operational parameters*" that include "aTxRampOffTime" which is described as "The *nominal time* (in microseconds) that the PMD takes to *turn the Transmit Power Amplifier off*" (emphasis added, see, for example, Ex. 1005 at § 10.4.3.2).

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135. Therefore, in my opinion, a POSITA would understand even before considering the detailed disclosure of the Clause 17 OFDM PHY (originally specified as IEEE 802.11a) to follow that IEEE 802.11-2007 is from the same field of endeavor as the '802 Patent and that IEEE 802.11-2007 is reasonably pertinent to the problem faced by the '802 Patent (see, for example, ¶¶ 39-40 and 63 above). Accordingly, IEEE 802.11-2007 is analogous art to the '802 Patent.

136. IEEE 802.11-2007 discloses that "The *Channel Switch Announcement* element is used by an AP in a BSS or a STA in an IBSS to advertise *when it is changing to a new channel and the channel number of the new channel*" wherein "Figure 10-6 depicts the management *process for a channel switch using a Channel Switch Announcement frame*" (emphasis added, see, for example, Ex. 1005 at §§ 7.3.2.20, 10.3.11, Figure 10-6 as reproduced below).

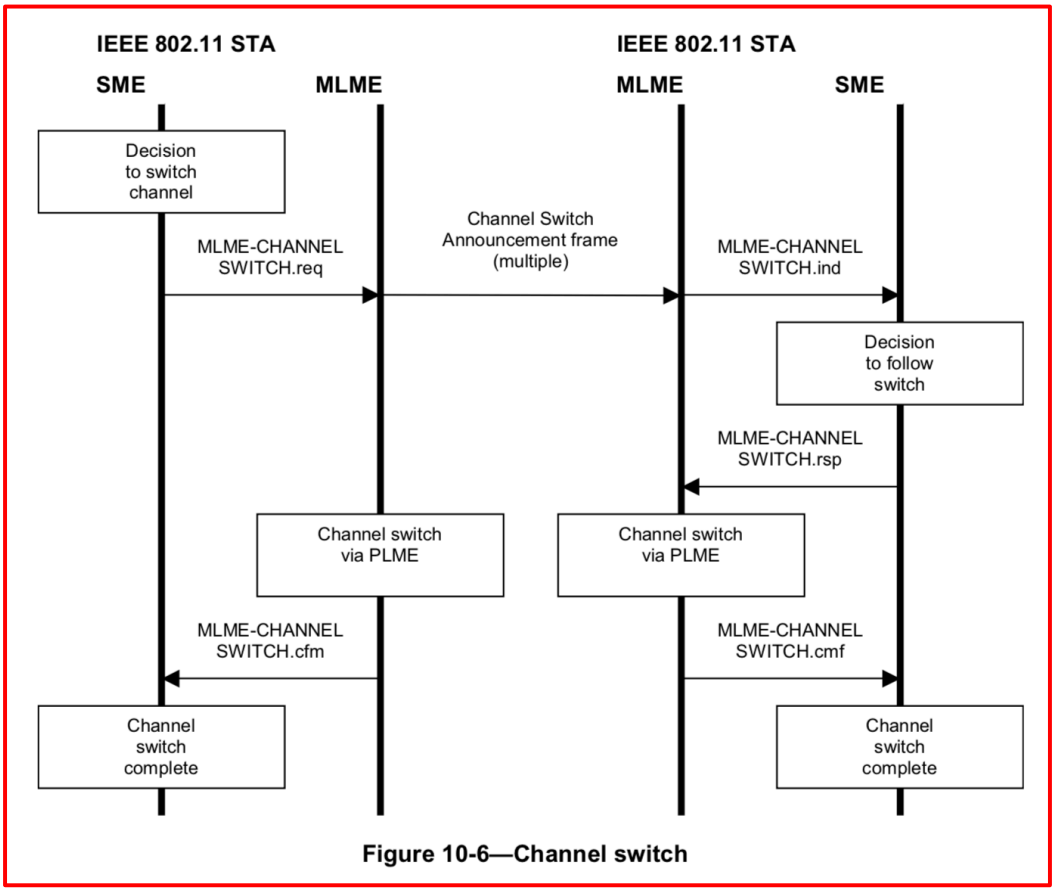


Figure 10-6—Channel switch

137. IEEE 802.11-2007 recites for § 17 that "This clause specifies the PHY entity for an *orthogonal frequency division multiplexing (OFDM) system*" which "*uses 52 subcarriers that are modulated* using binary or quadrature phase shift keying (BPSK or QPSK) or using 16- or 64-quadrature amplitude modulation (16-QAM or 64-QAM)" including for the "*5 GHz band*" (emphasis added, see, for example, Ex. 1005 at § 17.1).

138. IEEE 802.11-2007 provides an "*Overview of the PPDU encoding process*" which includes that each one of "*groups of 48 complex numbers*" is "associated with *one OFDM symbol*" such that "In each group, the *complex numbers* will be numbered 0 to 47 and *mapped hereafter into OFDM subcarriers* numbered –26 to –22, –20 to –8, –6 to –1, 1 to 6, 8 to 20, and 22 to 26" while "The *subcarriers* –21, –7, 7, and 21 are *skipped* and, subsequently, used for *inserting pilot subcarriers*" and "The 0 *subcarrier*, associated with *center frequency*, is *omitted and filled with zero value*" (emphasis added, see, for example, Ex. 1005 at § 17.3.2.1.j, ¶¶ 152-156 below).

139. Additionally, IEEE 802.11-2007 describes within this "*Overview of the PPDU encoding process*" that "*Four subcarriers are inserted as pilots into positions* –21, –7, 7, and 21" such that "The *total number of the subcarriers* is 52 (48 + 4)" (emphasis added, see, for example, Ex. 1005 at § 17.3.2.1.k).

140. Next, IEEE 802.11-2007 describes "For *each group of subcarriers* –26 to 26, *convert* the subcarriers to *time domain using inverse Fourier transform*" and then "*Prepend* to the Fourier-transformed waveform a *circular extension* of itself thus forming a GI, and *truncate the resulting periodic waveform to a single OFDM symbol* length by applying time domain windowing" (emphasis added, see, for example, Ex. 1005 at § 17.3.2.1.l).

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141. Finally, IEEE 802.11-2007 describes within this "*Overview of the PPDU encoding process*" to "*Append the OFDM symbols one after another*", to "*Up-convert the resulting "complex baseband" waveform to an RF according to the center frequency of the desired channel and transmit*", and to "*Refer to 17.3.2.4 and 17.3.8.1 for details*" (emphasis added, see, for example, Ex. 1005 at §§ 17.3.2.1.m, 17.3.2.1.n, ¶¶ 145-147 and 157 below).

142. IEEE 802.11-2007 recites a "list of timing parameters associated with the OFDM PLCP" in Table 17-4 (emphasis added, see, for example, Ex. 1005 at § 17.3.2.3, Table 17-4 as excerpted below).

Parameter	Value (20 MHz channel spacing)
N_{SD}: Number of data subcarriers	48
N_{SP}: Number of pilot subcarriers	4
N_{ST}: Number of subcarriers, total	52 ($N_{SD} + N_{SP}$)
Δ_F: Subcarrier frequency spacing	0.3125 MHz (=20 MHz/64)
T_{FFT}: Inverse Fast Fourier Transform (IFFT) / Fast Fourier Transform (FFT) period	3.2 µs ($1/\Delta_F$)
$T_{PREAMBLE}$: PLCP preamble duration	16 µs ($T_{SHORT} + T_{LONG}$)
T_{SIGNAL}: Duration of the SIGNAL BPSK-OFDM symbol	4.0 µs ($T_{GI} + T_{FFT}$)
T_{GI}: GI duration	0.8 µs ($T_{FFT}/4$)
T_{GI2}: Training symbol GI duration	1.6 µs ($T_{FFT}/2$)
T_{SYM}: Symbol interval	4 µs ($T_{GI} + T_{FFT}$)

143. IEEE 802.11-2007 teaches that "The *transmitted signals* will be described in a *complex baseband signal notation*" wherein "The actual transmitted signal is related to the complex baseband signal by the *following relation*:" given by Eq. (17-1) (emphasis added, see, for example, Ex. 1005 at § 17.3.2.4, Eq. (17-1) as reproduced below).

$$r_{(RF)}\langle t\rangle = Re\{r\langle t\rangle \exp\langle j2\pi f_c t\rangle\}$$

144. In reference to Eq. (17-1) shown above, IEEE 802.11-2007 explains that "Re(.) represents the *real part of a complex variable*" and "f_c denotes the *carrier center frequency*" (emphasis added, see, for example, Ex. 1005 at § 17.3.2.4).

145. IEEE 802.11-2007 also for this Clause 17 OFDM PHY explains that "The *transmitted baseband signal* is composed of contributions from *several OFDM symbols*" across multiple "subframes" wherein "All the subframes of the signal are *constructed as an inverse Fourier transform of a set of coefficients*, C_k, with C_k defined later as *data, pilots, or training symbols* in 17.3.3 through 17.3.5" as given by Eq. (17-3) (emphasis added, see, for example, Ex. 1005 at § 17.3.2.4, Eq. (17-3) as reproduced below).

$$r_{SUBFRAME}(t) = w_{TSUBFRAME}(t) \sum_{k=-N_{ST}/2}^{N_{ST}/2} C_k \exp\left(j2\pi k\Delta_f\right)(t - T_{GUARD})$$

146. In reference to Eq. (17-3) shown above, IEEE 802.11-2007 explains that "The *parameters* Δ_F and N_{ST} are described in *Table 17-4*" and that "The *resulting waveform is periodic* with a period of $T_{FFT} = 1/\Delta_F$" wherein "Shifting the time by T_{GUARD} creates the "*circular prefix*" used in OFDM to *avoid ISI from the previous frame*" (emphasis added, see, for example, Ex. 1005 at § 17.3.2.4, ¶ 142 above).

147. IEEE 802.11-2007 also explains that "The boundaries of the subframe are set by a multiplication by a *time-windowing function*, $w_{TSUBFRAME}(t)$, which is defined as a *rectangular pulse*" and "is typically implemented in order to *smooth the transitions between the consecutive subsections*" wherein "the *binding requirements are the spectral mask* and modulation accuracy requirements, as detailed in 17.3.9.2 and 17.3.9.6" (emphasis added, see, for example, Ex. 1005 at § 17.3.2.4, ¶¶ 159-163 below).

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148. IEEE 802.11-2007 teaches that "The *common way to implement the inverse Fourier transform*, as shown in Equation (17-3), is by an *IFFT algorithm*" wherein "If, for example, a *64-point IFFT* is used, the *coefficients 1 to 26 are mapped to the same numbered IFFT inputs*, while the *coefficients –26 to –1 are copied into IFFT inputs 38 to 63*" and "The *rest of the inputs*, 27 to 37 and the 0 (dc) input, *are set to 0*" using the "mapping" that "is illustrated in Figure 17-3" (emphasis added, see, for example, Ex. 1005 at § 17.3.2.5, Figure 17-3 as reproduced below).

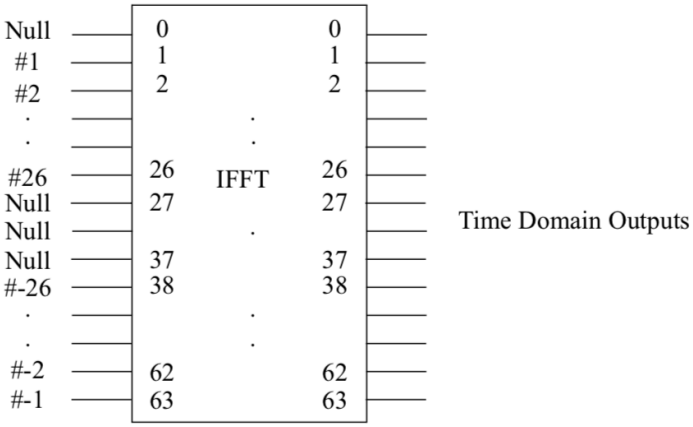


Figure 17-3—Inputs and outputs of inverse Fourier transform

149. According to IEEE 802.11-2007, "Figure 17-4 shows the *OFDM training structure* (PLCP preamble), where t_1 to t_{10} denote *short training symbols* and T_1 and T_2 denote *long training symbols*" and wherein "The *dashed boundaries* in the figure denote *repetitions due to the periodicity of the inverse Fourier transform*" (emphasis added, see, for example, Ex. 1005 at § 17.3.3, Figure 17-4 as reproduced below).

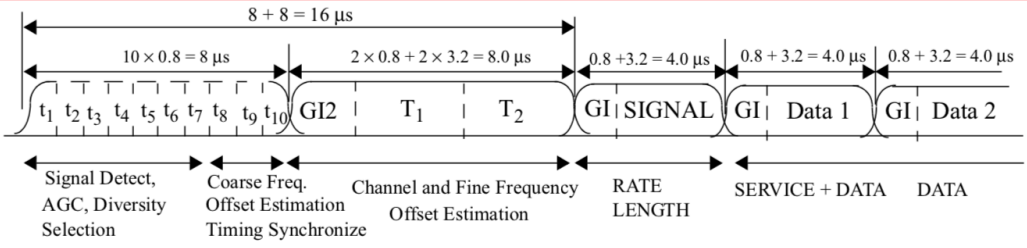


Figure 17-4—OFDM training structure

150. IEEE 802.11-2007 teaches that "The *OFDM subcarriers shall be modulated* by using BPSK, QPSK, 16-QAM, or 64-QAM" wherein "The encoded and interleaved binary serial input *data shall be divided into groups* of N_{BPSC} (1, 2, 4, or 6) bits and *converted into complex numbers*", "d", that "are *formed by multiplying the resulting* (I+jQ) value by a *normalization factor* K_{MOD}, as described in Equation (17-20)" (emphasis added, see, for example, Ex. 1005 at § 17.3.5.7, Eq. (17-20) as reproduced below).

$$d = (I + jQ) \times K_{MOD}$$

151. Additionally, IEEE 802.11-2007 teaches for this Clause 17 OFDM PHY that "In *each OFDM symbol, four of the subcarriers* are *dedicated to pilot signals*" that "shall be put in *subcarriers –21, –7, 7, and 21*" and "shall be *BPSK modulated by a pseudo-binary sequence*" wherein "The contribution of the pilot subcarriers to each OFDM symbol is described in 17.3.5.9" (emphasis added, see, for example, Ex. 1005 at § 17.3.5.8).

152. More specifically, IEEE 802.11-2007 teaches that "The stream of *complex numbers*", or "d" in ¶ 150 above, "is divided into *groups* of $N_{SD} = 48$ complex numbers" wherein each "*complex number*", "$d_{k,n}$", "*corresponds to subcarrier* k of *OFDM symbol* n" where "$k = 0, \ldots, N_{SD} - 1$" and "$n = 0, \ldots, N_{SYM} - 1$" with "$N_{SYM}$" being "The *number of OFDM symbols*" and each "OFDM symbol, $r_{DATA,n}(t)$, is defined" by Eq. (17-22) (emphasis added, see, for example, Ex. 1005 at § 17.3.5.9, Eq. (17-22) as reproduced below).

$$r_{DATA,n}(t) = w_{TSYM}(t)\left(\sum_{k=0}^{N_{SD}-1} d_{k,n}\exp(j2\pi M(k)\Delta_F(t-T_{GI})) + p_{n+1}\sum_{k=-N_{ST}/2}^{N_{ST}/2} P_k\exp(j2\pi k\Delta_F(t-T_{GI}))\right)$$

153. In reference to Eq. (17-22) shown above, IEEE 802.11-2007 explains that "the function, $M(k)$, defines a *mapping from the logical subcarrier number* 0 to 47 *into frequency offset index* -26 to 26, while *skipping the pilot subcarrier locations and the 0th (dc) subcarrier*" as given by Eq. (17-23) (emphasis added, see, for example, Ex. 1005 at § 17.3.5.9, Eq. (17-23) as reproduced below).

$$M(k) = \begin{cases} k-26 & 0 \le k \le 4 \\ k-25 & 5 \le k \le 17 \\ k-24 & 18 \le k \le 23 \\ k-23 & 24 \le k \le 29 \\ k-22 & 30 \le k \le 42 \\ k-21 & 43 \le k \le 47 \end{cases}$$

154. In further to Eq. (17-22) shown above, IEEE 802.11-2007 describes P_k as having a value of "$+1$" for "$k = -21, -7, +7$" and a value of "-1" for "$k = +21$" as well as value "0" for all other k, and describes that "The *polarity of the pilot subcarriers* is controlled by the sequence, p_n" which is a *sequence of 127 elements* given by Eq. (17-25) (emphasis added, see, for example, Ex. 1005 at § 17.3.5.9, Eq. (17-25) as reproduced below).

$p_{0..126v}$ = {1,1,1,1, -1,-1,-1,1, -1,-1,-1,-1, 1,1,-1,1, -1,-1,1,1, -1,1,1,-1, 1,1,1,1, 1,1,-1,1,
1,1,-1,1, 1,-1,-1,1, 1,1,-1,1, -1,-1,-1,1, -1,1,-1,-1, 1,-1,-1,1, 1,1,1,1, -1,-1,1,1,
-1,-1,1,-1, 1,-1,1,1, -1,-1,-1,1, 1,-1,-1,-1, -1,1,-1,-1, 1,-1,1,1, 1,1,-1,1, -1,1,-1,1,
-1,-1,-1,-1, -1,1,-1,1, 1,-1,1,-1, 1,1,1,-1, -1,1,-1,-1, -1,1,1,1, -1,-1,-1,-1, -1,-1,-1} (17-25)

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155. IEEE 802.11-2007 also explains that "The *subcarrier frequency allocation* is shown in Figure 17-11" wherein "To *avoid difficulties in D/A and A/D converter offsets* and *carrier feedthrough* in the RF system, the *subcarrier falling at DC (0th subcarrier) is not used*" (emphasis added, see, for example, Ex. 1005 at § 17.3.5.9, Figure 17-11 as reproduced below).

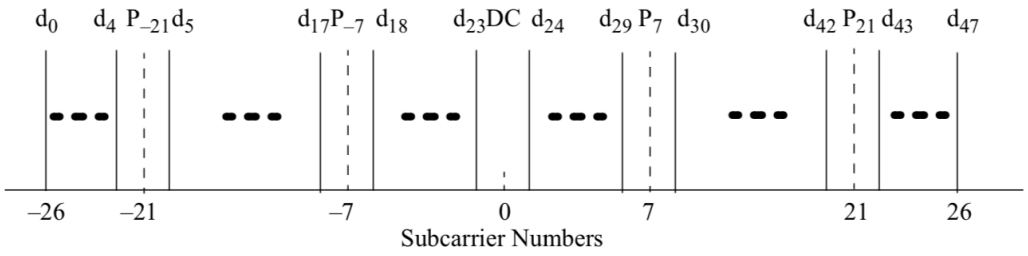


Figure 17-11—Subcarrier frequency allocation

156. Finally, in reference to Eq. (17-22) shown above, IEEE 802.11-2007 explains that "The *concatenation* of N_{SYM} *OFDM symbols* can now be written as" given by Eq. (17-26) (emphasis added, see, for example, Ex. 1005 at § 17.3.5.9, Eq. (17-26) as reproduced below).

$$r_{DATA}(t) = \sum_{n=0}^{N_{SYM}-1} r_{DATA,n}(t - nT_{SYM})$$

157. IEEE 802.11-2007 informs that "The *general block diagram of the transmitter and receiver for the OFDM PHY* is shown in Figure 17-12" while "*Major specifications for the OFDM PHY* are listed in Table 17-11" (emphasis added, see, for example, Ex. 1005 at § 17.3.8.1, Figure 17-12 and excerpted Table 17-11 as reproduced below).

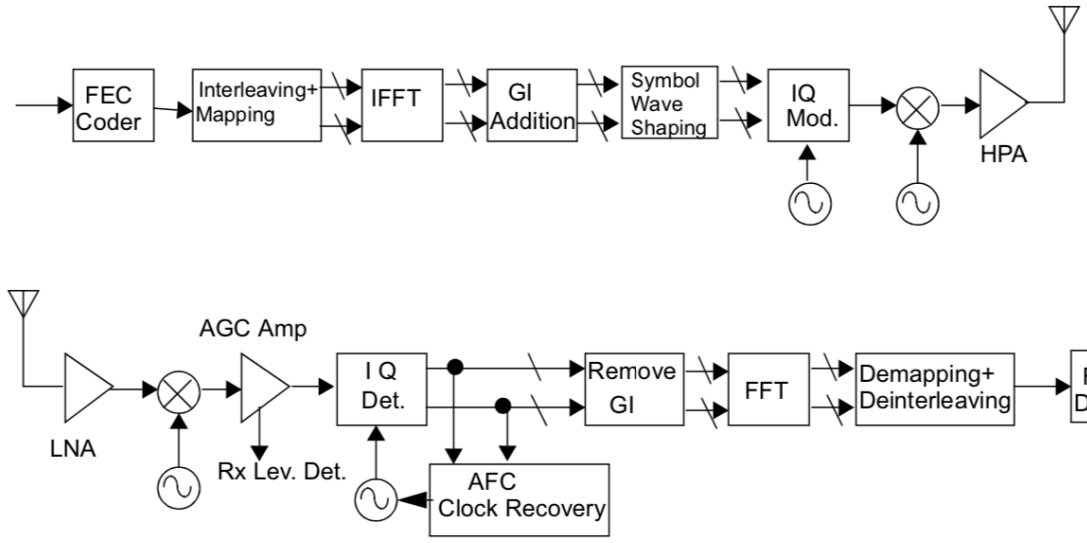


Figure 17-12—Transmitter and receiver block diagram for the OFDM PHY

Table 17-11—Major parameters of the OFDM PHY

Information data rate	**6, 9, 12, 18, 24, 36, 48, and 54 Mb/s (6, 12, and 24 Mb/s are mandatory) (20 MHz channel spacing)**
Modulation	BPSK OFDM QPSK OFDM 16-QAM OFDM 64-QAM OFDM
Error correcting code	K = 7 (64 states) convolutional code
Coding rate	1/2, 2/3, 3/4
Number of subcarriers	52
OFDM symbol duration	4.0 μs
GI	0.8 μs* (T_{GI})
Occupied bandwidth	16.6 MHz

*Refer to 17.3.2.4.

158. IEEE 802.11-2007 specifies that "*Channel center frequencies* are defined at every integral multiple of 5 MHz above Channel starting frequency" wherein "The *relationship*

between center frequency and channel number is given by" Eq. (17-27) where "$n_{ch} = 0, 1, \ldots, 200$" and "Channel starting frequency" is "defined as 5 GHz" for operation in the USA (emphasis added, see, for example, Ex. 1005 at § 17.3.8.3.1, Eq. (17-27) as reproduced below).

$$\text{Channel center frequency} = \text{Channel starting frequency} + 5 \times n_{ch}(\text{MHz})$$

159. IEEE 802.11-2007 recites that "The *maximum allowable transmit power* by regulatory domain is *defined in Annex I*" and that "The *transmit spectrum mask* by regulatory domain is *defined in Annex I*" (emphasis added, see, for example, Ex. 1005 at §§ 17.3.9.1, 17.3.9.2).

160. IEEE 802.11-2007 also recites for "*Transmitter spectral flatness*" that "The *average energy of the constellations in each of the spectral lines* –16.. –1 and +1.. +16 will *deviate no more than ± 2 dB* from their average energy" while "The *average energy of the constellations in each of the spectral lines* –26.. –17 and +17.. +26 will *deviate no more than +2/–4 dB* from the average energy of spectral lines –16.. –1 and +1.. +16" (emphasis added, see, for example, Ex. 1005 at § 17.3.9.6.2).

161. More specifically, Annex I of IEEE 802.11-2007 specifies "*Transmit power level* by regulatory domain" in Table I.4 (emphasis added, see, for example, Ex. 1005 at § I.2.2, Table I.4 as reproduced below).

Table I.4—Transmit power level by regulatory domain

Frequency band (GHz)	United States (Maximum output power with up to 6 dBi antenna gain) (mW)	Europe (EIRP)
5.15–5.25	40 (2.5 mW/MHz)	200 mW
5.25–5.35	200 (12.5 mW/MHz)	200 mW
5.470–5.725	—	1 W
5.725–5.825	800 (50 mW/MHz)	—

162. Additionally, Annex I of IEEE 802.11-2007 specifies the "*Transmit spectrum mask*" such that "For operation using *20 MHz channel spacing*, the *transmitted spectrum* shall have a 0 dBr (decibel *relative to the maximum spectral density* of the signal) bandwidth *not exceeding 18 MHz*, –20 dBr at 11 MHz frequency offset, –28 dBr at 20 MHz frequency offset, and –40 dBr at 30 MHz frequency offset and above" as also described by Figure I.1 (emphasis added, see, for example, Ex. 1005 at § I.2.3, Figure I.1 as reproduced below).

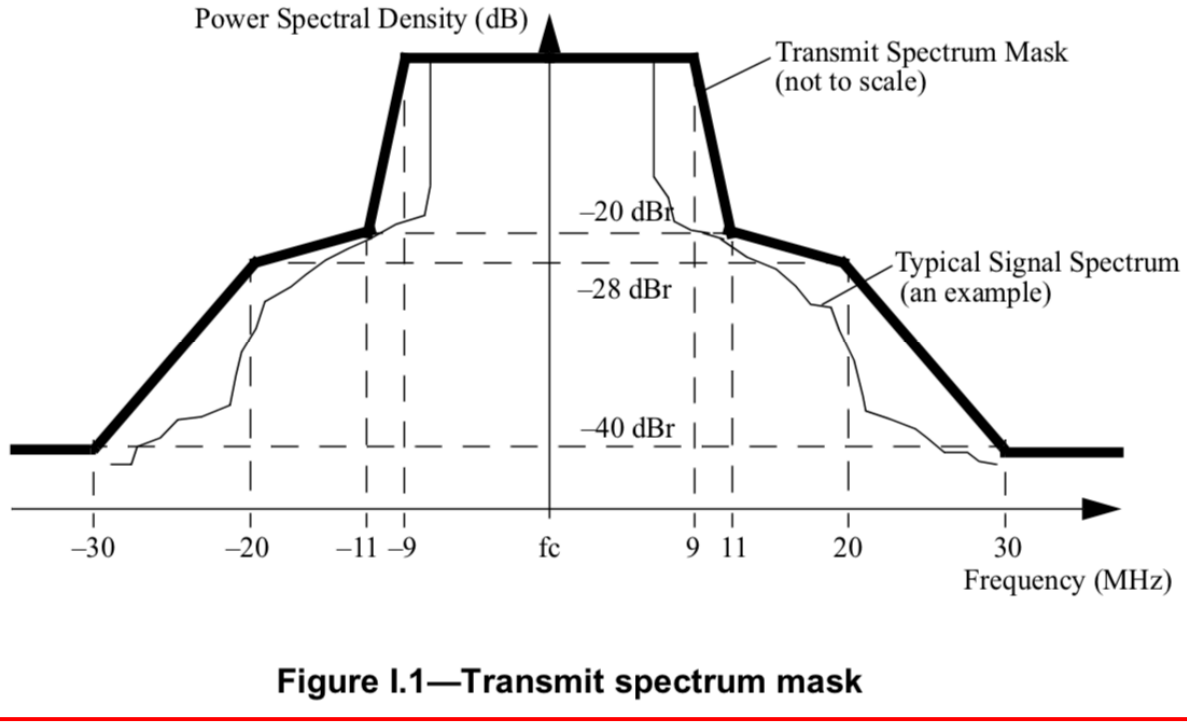


Figure I.1—Transmit spectrum mask

163. Annex I of IEEE 802.11-2007 also explains that "The *transmitted spectral density* of the transmitted signal shall *fall within the spectral mask*, as shown in Figure I.1" wherein "an *example*" of a "*Typical Signal Spectrum*" for the Clause 17 transmission with "*20 MHz channel spacing*" is shown above (emphasis added, see, for example, Ex. 1005 at § I.2.3).

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C. Perahia (Ex. 1006)

164. For example, *Next Generation Wireless LANs*, by E. Perahia and R. Stacey, ISBN: 978-0-521-88584-3, Cambridge University Press ("Perahia") was "First published in print format 2008" and is "© Cambridge University Press 2008" (see, for example, Ex. 1006 at p. iv).

165. The Foreword section of Perahia is dated "6 December 2007" (see, for example, Ex. 1006 at p. xxi).

166. The Preface section of Perahia recites the book originates from "a full day tutorial on the 802.11n physical layer (PHY) and medium access control (MAC) layer at the IEEE Globecom conference held in San Francisco in December 2006" (see, for example, Ex. 1006 at p. xxiii).

167. Every one of the 12 chapters of Perahia concludes with a list of References, but there are none of the approximately 90 total listed references that are dated later than 2007 (see, for example, Ex. 1006 at pp. 19-20, 27-28, 51-52, 98, 135, 172, 202, 224, 237, 265, 302-303, 362-363).

168. I understand that Dr. Perahia states that "Although Next Generation Wireless LANs was not published until 2008, the book reflects knowledge that Mr. Stacey and I gained while working on the 802.11n amendment in the 2006-early 2007 time frame (and specifically, the publication date of 802.11n Draft 2.0 in March 2007), and was the basis for our Globecom presentation in November 2006. Mr. Stacey and I wrote the book primarily in 2007" (see, for example, Ex. 1013 at ¶ 8).

169. See also ¶ 183 below which indicates to a POSITA that the "**time this book went to press**" from the perspective of the authors was approximately October, 2007.

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170. Accordingly, in view of the above, I understand that Perahia is contemporaneous art to the '802 Patent that is at least indicative of the knowledge of a POSITA at the time of the alleged invention of the '802 Patent.

171. In the Foreword section, Perahia discloses that as of "6 December 2007" that "The *Wi-Fi CERTIFIED 802.11n draft 2.0* programme has been *remarkably successful*, with *more than 150 products certified in less than five months*" which "represents a *significantly higher number* of certified products *than for the 802.11g* programme during a *similar period* after launch" (emphasis added, see, for example, Ex. 1006 at p. xx).

172. In the Introduction chapter, Perahia observes that "*shipments of Wi-Fi certified* integrated circuits (IC) reached *200 million per year in 2006*" but "Shipments are *expected to exceed a billion units per year by 2012*" (emphasis added, see, for example, Ex. 1006 at p. 1).

173. Also, Perahia observes that "The *vast majority of WLAN products and systems today* are based on the *802.11b, 802.11g, and 802.11a standard amendments*, which provide throughput enhancements over the original 802.11 PHYs" but "*Progress* in WLAN technology *continues with the development of 802.11n*" (emphasis added, see, for example, Ex. 1006 at p. 2).

174. More specifically, Perahia observes that "In 2004, Atheros demonstrated that *40 MHz devices could be produced at almost the same cost as 20 MHz devices*" and there were "new regulations in the 5 GHz band that added an *additional 400 MHz of unlicensed spectrum* for use by commercial WLANs", which "paved the way for the *broad acceptance of 40 MHz operating modes in 802.11n*" because "When spectrum is free, *increasing the channel bandwidth is the most cost effective way to increase the data rate*" (emphasis added, see, for example, Ex. 1006 at p. 2).

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175. Additionally, Perahia documents that "*Through early 2007*, major improvements and clarifications were made to the *802.11n draft resulting in IEEE 802.11n draft 2.0*" such that "To continue the market momentum and forestall interoperability issues, the IEEE took the unusual step of *releasing 802.11n D2.0 to the public while work continued toward the final standard*" which allowed the Wi-Fi Alliance (or WFA) "to *begin interoperability testing and certification* of devices based on a subset of the *802.11n D2.0 features in May 2007*" (emphasis added, see, for example, Ex. 1006 at p. 3).

176. Perahia discloses that "Interest in a *high data rate extension to 802.11a* began with a presentation to the *Wireless Next Generation Standing Committee* (WNG SC) of IEEE 802.11 in *January 2002*" and "After many additional presentations, the *High Throughput Study Group* (HTSG) was *formed with its first meeting in September 2002*" wherein "The primary objective of HTSG was to *complete two documents necessary for the creation of the High Throughput Task Group* (TGn)" (emphasis added, see, for example, Ex. 1006 at pp. 5-6). I note that I personally attended meetings of WNG SC and HTSG throughout 2002 and these dates are correct according to my recollection.

177. Perahia discloses that subsequently after being "accepted and approved by the 802 working group", "*Task Group n (TGn)*" was created "with the *first meeting* of the task group held in *September 2003*" and then later "The TGn *call for proposals* was issued on *May 17, 2004*, with the *first proposals presented* in *September 2004*" (emphasis added, see, for example, Ex. 1006 at pp. 6-8).

178. Perahia describes that "The *key features* of all *the proposals* were similar, including spatial division multiplexing and *40 MHz channels for increased data rate*, and frame aggregation for improved MAC efficiency" (emphasis added, see, for example, Ex. 1006 at p. 8).

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179. Additionally, Perahia observes that "Over the course of the process *two main proposal teams emerged, TGn Sync and WWiSE*" while "A series of proposal *down-selection and confirmation votes* took place *between September 2004 and May 2005*" such that "The *TGn Sync proposal won the final down-selection vote* between it and WWiSE, but *failed the confirmation vote in May 2005*" (emphasis added, see, for example, Ex. 1006 at pp. 8-9).

180. Next, Perahia documents that "the *Enhanced Wireless Consortium* (EWC)" was formed "in *October 2005* to produce a specification outside the IEEE that would bring products to market faster" such that subsequently "the *EWC specification*, which was essentially a *merger of the TGn Sync and WWiSE proposals*, was adopted as the *joint proposal* and submitted for confirmation to TGn where it was *unanimously passed in January 2006*" (emphasis added, see, for example, Ex. 1006 at p. 10).

181. Perahia further describes that "The *joint proposal* was *converted to a draft 802.11 standard amendment* for higher throughput (*TGn Draft 1.0*)" which then "*entered letter ballot in March 2006* and, not unusually, *failed to achieve the 75% threshold* for adoption" (emphasis added, see, for example, Ex. 1006 at p. 10, ¶¶ 83-84 above).

182. Additionally, Perahia recites that "With resolution of the TGn Draft 1.0 comments, *TGn Draft 2.0 went out for letter ballot vote in February 2007* and this time *passed with 83%* of the votes" wherein "Since TGn Draft 2.0 passed, TGn Draft 3.0 and possible *later drafts only require a recirculation ballot*" (emphasis added, see, for example, Ex. 1006 at p. 10, ¶¶ 83-84 above, excerpt from https://www.ieee802.org/11/LetterBallots.shtml shown below).

LB	Group(s)	Comment(s)	Instructions	Document(s)		Opened	Closed
97	TGn	Technical TGn Draft 2.00	LB# 97	Draft	Draft-P802.11n_D2.0.pdf	2007-02-07	2007-03-09

183. Perahia further states that "*comment resolution for TGn Draft 2.0* continued between *March 2007 and September 2007*, *resulting in TGn Draft 3.0*" which "**At the time this**

book went to press" was "in *recirculation ballot*" (emphasis added, see, for example, Ex. 1006 at p. 10). TGn Draft 3.0 completed "*recirculation ballot*" on Oct. 27, 2007 (see, for example, ¶¶ 83-84 above, excerpt from https://www.ieee802.org/11/LetterBallots.shtml shown below).

LB	Group(s)	Comment(s)	Instructions	Document(s)		Opened	Closed
115	TGn	Recirculation TGn Draft 3.00	LB# 115	Draft	Draft P802.11n_D3.0.pdf	2007-10-07	2007-10-27

184. Note also that Perahia states that "The *reader is referred to* http://grouper.ieee.org/groups/802/11/Reports/802.11_Timelines.htm for the *latest update on the timeline of 802.11n*" wherein this URL is the same as I provided herein for documentation on the timelines of both IEEE 802.11n D2.0 and IEEE 802.11-2007 (emphasis added, see, for example, Ex. 1006 at p. 11, ¶¶ 83 and 123 above).

185. Perahia observes that "In the *development of 802.11n*, three *primary environments* were considered for studying system performance and capabilities: *residential, enterprise, and hotspot*" as illustrated in Figures 1.5, 1.6 and 1.7 (emphasis added, see, for example, Ex. 1006 at p. 11, Figures 1.5, 1.6 and 1.7 as reproduced below).

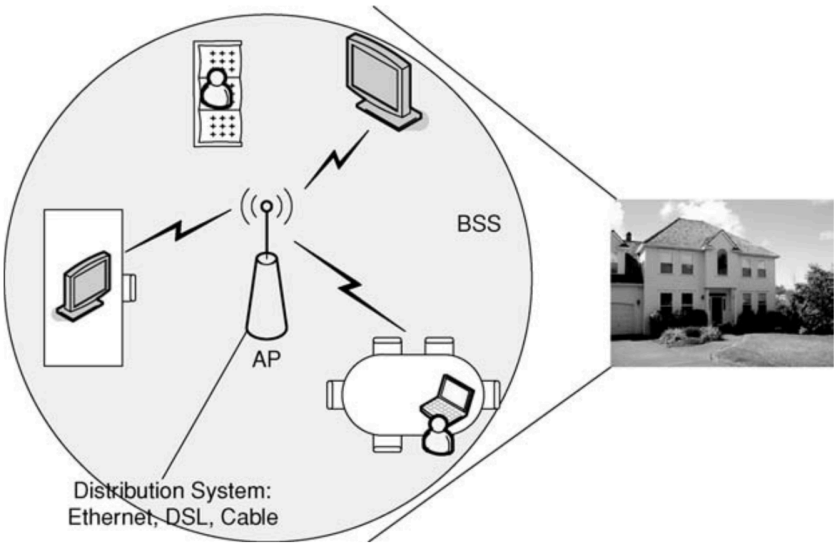


Figure 1.5 Residential usage model.

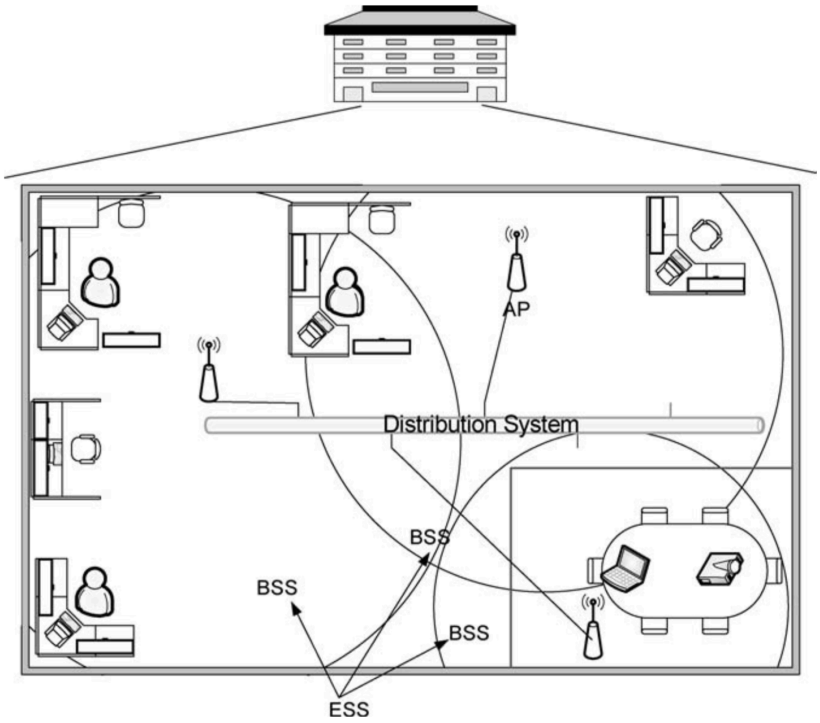


Figure 1.6 Enterprise usage model.

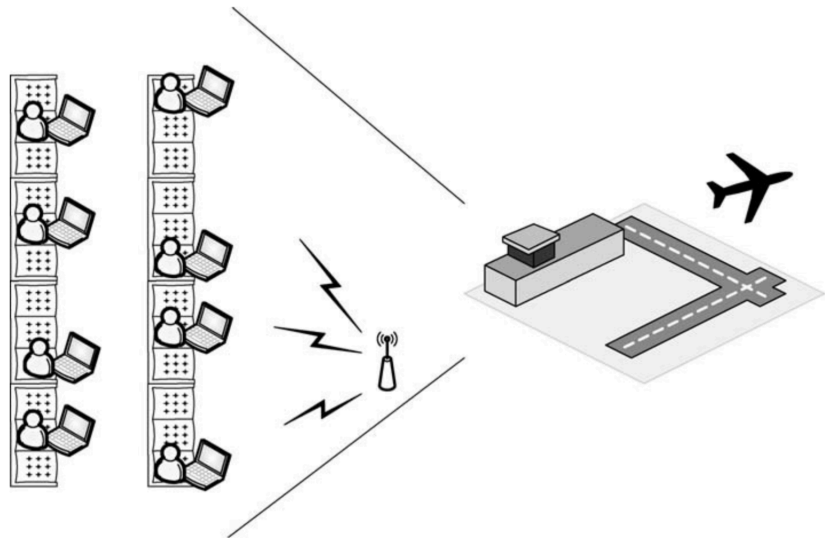


Figure 1.7 Hotspot usage model.

186. Perahia states that "*PHY data rates in 802.11n are significantly improved over 802.11a and 802.11g* primarily through the use of spatial multiplexing using MIMO and *40 MHz operation*" (emphasis added, see, for example, Ex. 1006 at p. 15).

187. More specifically, Perahia states that "**At the time this book went to press**, *two generations of* so called pre-n or *draft 2.0 products have been released*" wherein "The *first generation* of products typically *operate in the 2.4 GHz band only*, with up to two spatial streams and *40 MHz channel width*" while "With *second generation* products, we begin to see *dual-band 2.4 GHz and 5 GHz products*" (emphasis added, see, for example, Ex. 1006 at p. 15).

188. Perahia teaches that "The existence of *40 MHz operation* also creates a number of *coexistence issues*" because "The AP needs to *manage the 40 MHz BSS so that 40 MHz and 20 MHz devices*, both legacy and high throughput, are able to *associate with the BSS and operate*" and thus "Because *40 MHz operation uses two 20 MHz channels*, *mechanisms* are needed to *mitigate the effect* this might have on *neighboring 20 MHz BSSs operating independently* on those *two channels*" (emphasis added, see, for example, Ex. 1006 at p. 16).

189. More specifically, Perahia teaches that "If neighboring BSSs cannot be avoided then a *fallback technique called phased coexistence operation (PCO)* may be used" which "allows the *BSS to alternate between 20 MHz and 40 MHz phases of operation*, with the *40 MHz phase entered after a frame exchange on the two 20 MHz channels* has silenced devices operating there" (emphasis added, see, for example, Ex. 1006 at p. 16).

190. Perahia teaches that "A *power amplifier (PA)* of a certain size, class, and drive current is *most efficiently used when driven to saturation* for maximum output power" but this "*exhibits non-linear behavior* when amplifying the input signal" wherein "The distortion caused by the PA on the transmitted waveform *causes spectral re-growth*" and "impacts the Tx error vector magnitude (EVM), *increasing the packet error rate* at the receiver" (emphasis added, see, for example, Ex. 1006 at pp. 44-45).

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191. More specifically, Perahia explains that "The *802.11n* MIMO/OFDM system is *especially sensitive to PA non-linearity*, since the transmitted waveform has high dynamic range and uses high order modulation" and describes an example of a "*power amplifier (PA)*" whereby "the recommended *transmitted power*, at full saturation, was 25 dBm" but "The total transmit power was *limited to no more than* 17dBm", or hence an "*output backoff* (OBO)" from "full saturation" of "8 dB" (emphasis added, see, for example, Ex. 1006 at p. 45).

192. In reference to the "802.11a packet structure" (or Clause 17 of IEEE 802.11-2007), Perahia explains that "The *Data field* consists of a *stream of symbols*, each data symbol *4 μs in length*" wherein "The waveform uses *52 subcarriers*" such that "The *data bits* are encoded and *modulated on to 48 subcarriers*" while "*Four additional subcarriers are used as pilots* for phase and frequency tracking and training" (emphasis added, see, for example, Ex. 1006 at pp. 58, 65).

193. For example, Perahia describes that "Numbering the subcarrier locations −32, −31, . . . , −1, 0, 1, . . . , 31, the *populated subcarriers are located at* −26, −25, . . . , −2, −1, 1, 2, . . . , 25, 26" while "The *pilot subcarriers are located on subcarriers* −21, −7, 7, 21 with values" given by "$P_k = 1$" for "$k = -21, -7, 7$" and "$P_k = -1$" for "$k = 21$" as well as value "0" for all other k" (emphasis added, see, for example, Ex. 1006 at p. 65).

194. Perahia also explains that "The encoding of the Data field follows the *block diagram in Figure 4.8*" wherein "Each symbol group of *subcarriers* is *transformed into the time domain by an IFFT*" and subsequently "each of the *OFDM symbols* is *appended one after another*" so that "The *digital baseband signal* is *converted to analog* with a DAC, which is then *followed by an up-converter to RF* and a *power amplifier*" (emphasis added, see, for example, Ex. 1006 at pp. 66-68, Figure 4.8 as reproduced below).

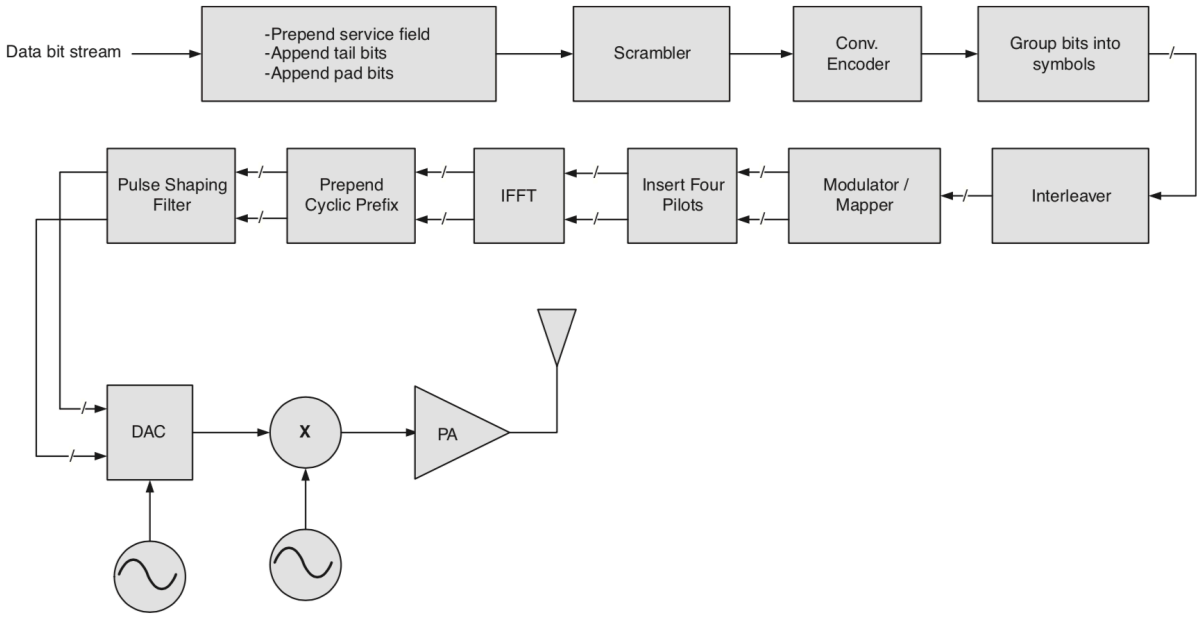


Figure 4.8 Transmitter block diagram for Data field.

195. Perahia observes that "802.11n is the *high throughput amendment* to the 802.11 standard" wherein the "*significant increase in data rate is derived from the new 40MHz channel width*" and further that because "In the *last several years*, regulatory domains have made much *more spectrum available for unlicensed operation* in the 5.47–5.725 GHz band for *wireless local area networking*" then "with *free spectrum* and relatively *no increase in hardware cost*, *doubling the channel bandwidth* is the simplest and *most cost effective way to increase data rate*" (emphasis added, see, for example, Ex. 1006 at p. 101).

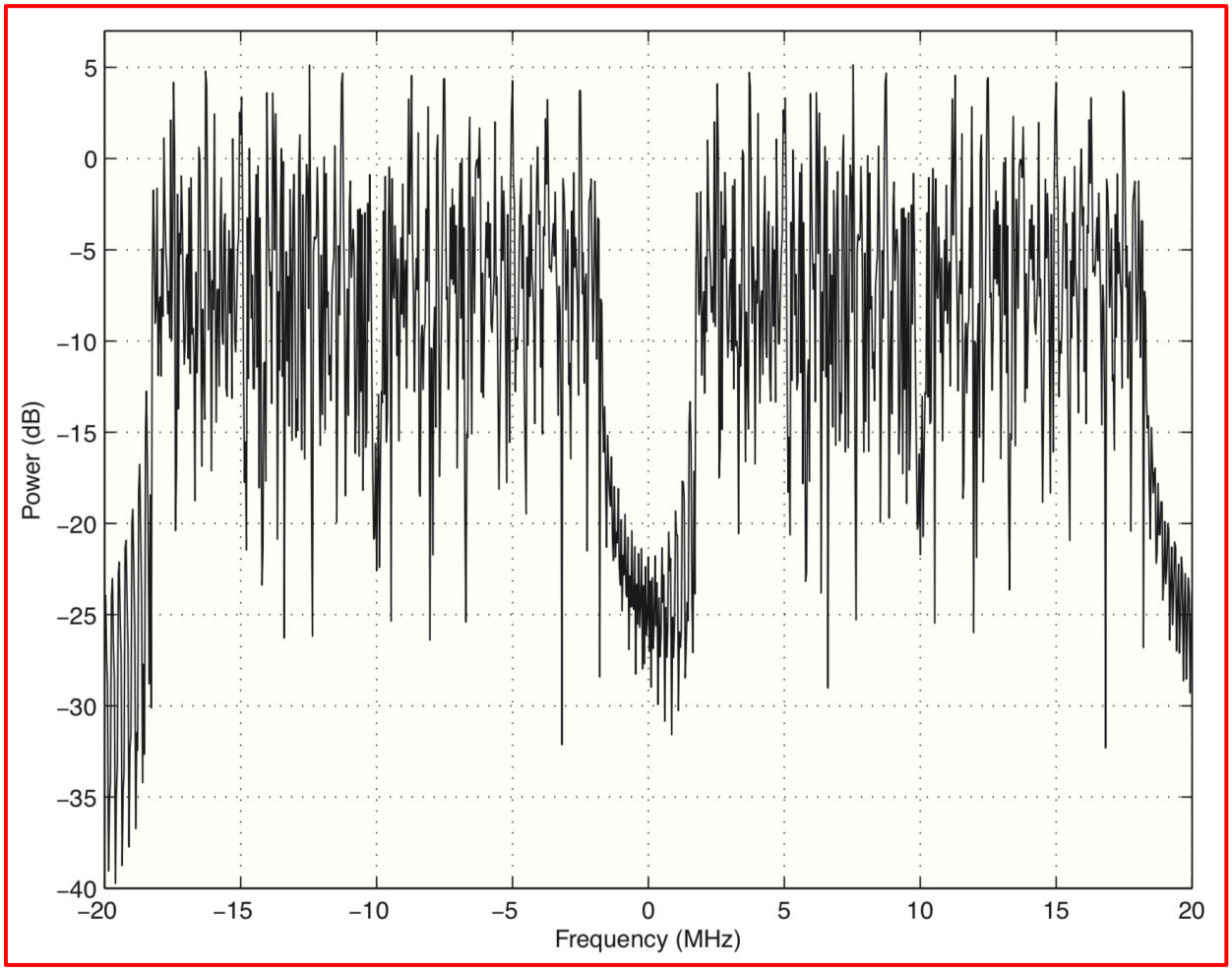
196. Perahia explains that "Fundamental to the design of the *40 MHz channel* is that *only adjacent 20 MHz channels are combined* to form a 40 MHz channel" which "makes *coexistence and interoperability between 20 MHz and 40 MHz devices much simpler*" (emphasis added, see, for example, Ex. 1006 at p. 104).

197. For example, Perahia explains that "In order to interoperate and *coexist with legacy 802.11a/g OFDM devices*" certain fields are "*replicated over the other 20 MHz portion* of

the 40 MHz band" wherein the original "*20 MHz waveform* is *shifted lower by 32 subcarriers*" while "A *copy of the waveform* is *shifted higher by 32 subcarriers* and *phase rotated by 90 degrees* (the *j* term preceding the second summation in Eq. (5.1))" (emphasis added, see, for example, Ex. 1006 at pp. 104-105, Eq. (5.1) as reproduced below).

$$r_{\text{Field}}^{(i_{\text{TX}})}(t) = \frac{1}{\sqrt{N_{\text{TX}} \cdot N_{\text{Field}}^{\text{Tone}}}} \left[\sum_{k=-26}^{26} X_k \exp\left(\text{j}2\pi \, (k-32) \, \Delta_{\text{F}} \left(t - T_{\text{GI}}^{\text{Field}} - T_{\text{CS}}^{i_{\text{TX}}} \right) \right) + \text{j} \sum_{k=-26}^{26} X_k \exp\left(\text{j}2\pi \, (k+32) \, \Delta_{\text{F}} \left(t - T_{\text{GI}}^{\text{Field}} - T_{\text{CS}}^{i_{\text{TX}}} \right) \right) \right] \quad (5.1)$$

198. Perahia further provides an example of the spectrum associated with such duplicated fields by Eq. (5.1) in Figure 5.5 which Perahia describes as "*contains many null subcarriers in the area around DC*" (emphasis added, see, for example, Ex. 1006 at p. 106, Figure 5.5 as reproduced below). Note also that this material in Perahia described above and shown by Figure 5.5 previously appeared in the 2006 tutorial from which Perahia originates (see, for example, ¶ 166 above, Ex. 1008 at pp. 34-35, Ex. 1013 at ¶¶ 9-11).



199. More specifically, Perahia explains that "The *non-HT duplicate format* is designed to be *receivable by legacy (and HT) devices in both the primary and secondary channels simultaneously*" because "In essence a *packet is transmitted in legacy OFDM format in the upper and lower halves of the 40MHz channel simultaneously*" wherein "the *Data field*" is "transmitted in legacy *format similar to* the L-SIG" described "by *Eq. (5.1)*", or hence with the same spectrum shown in Figure 5.5 above (emphasis added, see, for example, Ex. 1006 at p. 114).

200. For example, Perahia notes for this "*non-HT duplicate format*" that "*Neighboring legacy APs and clients may be present in the primary or secondary channels* of the 40 MHz channel" and "A common way to *reserve the medium for transmission* is to send an RTS/CTS"

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so "it is desirable to *make the reservation on both the primary and secondary channels simultaneously*" (emphasis added, see, for example, Ex. 1006 at p. 114).

201. Perahia further explains that "The equation for the *waveform of the Data field* is given" by Eq. (5.11) "where N_{SYM} is the *number of OFDM symbols*", "$(D_{k,n} + p_{n+1}P_k)$ are the *data and pilots*", "$\Delta_F = 312.5$ kHz (40 MHz/128)", and "$T_{SYM} = 4\ \mu s$ *symbol time*", which is mathematically similar to Eq. 20-61 of IEEE 802.11n D2.0 as described above (emphasis added, see, for example, Ex. 1006 at p. 114, Eq. (5.11) as reproduced below, ¶ 104 above).

$$r_{\text{LEG-DUP}}^{(i_{\text{TX}})}(t) = \frac{1}{\sqrt{104}} \sum_{n=0}^{N_{\text{SYM}}-1} \left[\sum_{k=-26}^{26} \left(D_{k,n} + p_{n+1}P_k\right) \exp\left(\text{j}2\pi\,(k-32)\,\Delta_{\text{F}} \times \left(t - n \cdot T_{\text{SYM}} - T_{\text{GI}} - T_{\text{CS}}^{i_{\text{TX}}}\right)\right) + \text{j} \sum_{k=-26}^{26} \left(D_{k,n} + p_{n+1}P_k\right) \times \exp\left(\text{j}2\pi\,(k+32)\,\Delta_{\text{F}} \left(t - n \cdot T_{\text{SYM}} - T_{\text{GI}} - T_{\text{CS}}^{i_{\text{TX}}}\right)\right) \right] \quad (5.11)$$

202. Additionally, Perahia teaches that "Typically, a *40 MHz device* is designed with the *same output power* to maintain the *same cost as a 20 MHz device*" and thus "To compensate for the reduced range in 40 MHz relative to 20 MHz, a *special HT duplicate format*, MCS 32, was *created in 40 MHz*" wherein "the *signal is duplicated on the upper and lower channel* during the *Data field*" (emphasis added, see, for example, Ex. 1006 at p. 111).

203. Moreover, Perahia explains for this "*special HT duplicate format*, MCS 32" that "*Combining the subcarriers in the upper and lower channel at the receiver* improves the required SNR of the HT duplicate format resulting in a *comparable maximum range for the lowest data rates of 20 MHz and 40 MHz*" (emphasis added, see, for example, Ex. 1006 at p. 111).

204. Accordingly, Perahia notes for this "*special HT duplicate format*, MCS 32" that "The *subcarrier design for the Data field matches that of legacy 802.11a 6 Mbps rate*" but

"*replicates the subcarriers in the lower and upper* half of the channel thus maintaining the 6 Mbps data rate for MCS 32" (emphasis added, see, for example, Ex. 1006 at p. 112).

205. Perahia explains that "*Forty MHz operation in the 5 GHz bands* is accomplished by utilizing *two adjacent 20 MHz channels*" wherein "One of the 20 MHz channels is designated the *primary channel* and the other the *secondary channel*" and "The *permissible channel options* for various regulatory domains" are "summarized in Figure 10.1" (emphasis added, see, for example, Ex. 1006 at p. 244, Figure 10.1 as reproduced below).

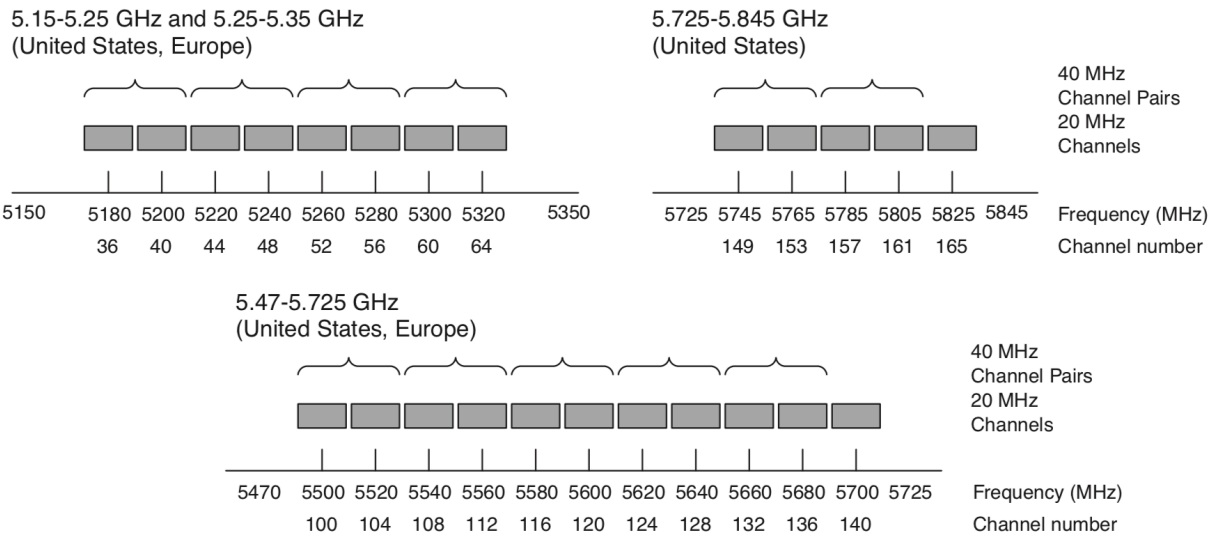


Figure 10.1 20 MHz channel pairings for 40 MHz operation in the 5 GHz bands.

206. Perahia further explains that IEEE 802.11-2007 (by its incorporation of the IEEE 802.11h amendment per ¶ 122 above) "introduced a *mechanism for moving a BSS to a different channel*" using "A *Channel Switch Announcement* element and a Channel Switch Announcement frame" that "were defined along with a *procedure for performing the channel switch*" (emphasis added, see, for example, Ex. 1006 at p. 253) as I have already noted herein (see, for example, ¶ 136 above).

207. Perahia notes that in 2007, "another task group working on the 802.11y amendment" created "a new *Extended Channel Switch Announcement* element and Extended Channel Switch Announcement frame" that would "handle the *channel pairing used to create 40 MHz channels*" (emphasis added, see, for example, Ex. 1006 at pp. 253-254).

208. Consequently, Perahia explains that "An AP that *detects significant traffic from neighboring BSSs on the secondary channel*, or *significant traffic on the primary channel* for that matter, could *move the BSS to a channel pair with less traffic*" wherein this "*decision to switch channels is made by the AP* and the AP should *select a new channel* that is *supported by all associated stations*" such that "The *AP informs associated stations* that the BSS is moving to a new channel and/or changing operating channel width at some point in the future by including the *Extended Channel Switch Announcement element* in Beacon frames and Probe Response frames" (emphasis added, see, for example, Ex. 1006 at pp. 253-254).

209. Perahia also describes "*Phased coexistence operation* (PCO)" as a "*BSS mode* with *alternating 20 MHz and 40 MHz* phases of operation controlled by the AP" wherein one example is "using the sequences shown in Figure 10.6" (emphasis added, see, for example, Ex. 1006 at pp. 255-256, Figure 10.6 as reproduced below, ¶ 115 above).

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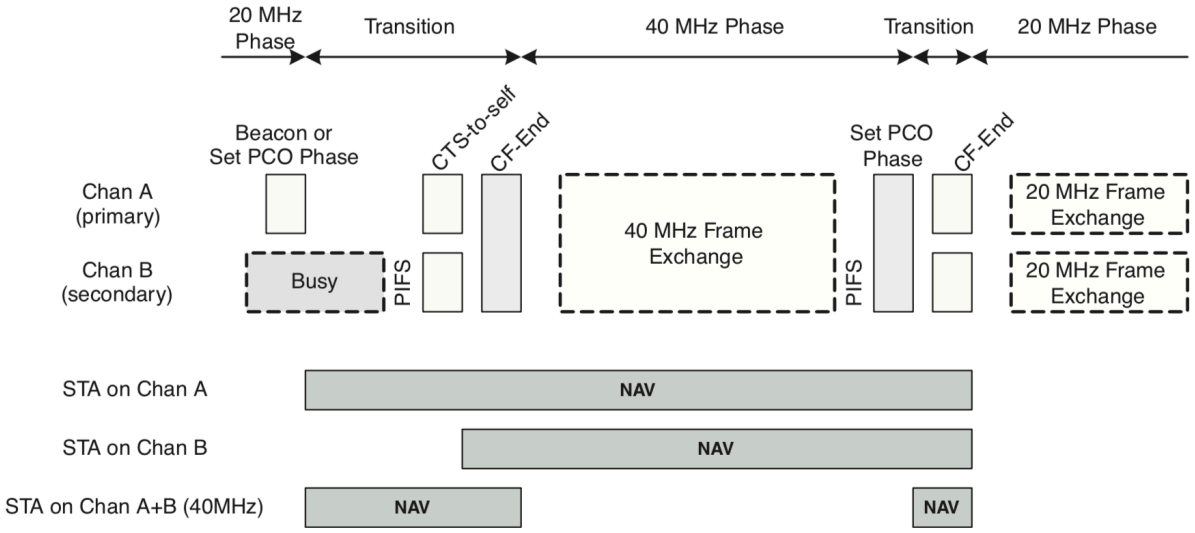


Figure 10.6 PCO 20 and 40 MHz phase transitions. Reproduced with permission from IEEE (2007a) © IEEE.

210. In reference to the example shown in Figure 10.6 above, Perahia explains that "If the secondary channel goes idle then the *AP transmits a CTS-to-self on both the primary and secondary channels using the non-HT duplicate mode*" and further that "*During the 40 MHz phase*, a 20/40 MHz PCO *station transmits* data frames using a 40 MHz HT PPDU and *control frames using a non-HT duplicate*" (emphasis added, see, for example, Ex. 1006 at pp. 255-256).

D. Shearer (Ex. 1007)

211. For example, amongst the numerous prior art references in this field, U.S. Patent Publication No. 2006/0018249 by D. Shearer and M. Webster, entitled "Packet generation systems and methods" ("Shearer") was filed on Jul. 20, 2005 and claims priority to Jul. 20, 2004 and was published on Jan. 26, 2006 (see, for example, Ex. 1007 at [10], [22], [43], [60], [76], ¶ 1). Thus, I understand that Shearer qualifies as prior art to the '802 Patent at least under 35 U.S.C. §§ 102(a), 102(b) and 102(e).

212. Shearer is "generally related to digital communications and, more particularly, is *related to a system and method for increased bandwidth digital communications*" (emphasis added, see, for example, Ex. 1007 at ¶ 2).

213. In its "**Related Art**" section, Shearer notes that "A *wireless local area network* (LAN) typically uses infrared (IR) or *radio frequency (RF) communications channels* to communicate between portable or mobile computer terminals and stationary access points or base stations" such as specified by "*IEEE Standard 802.11* ("802.11")" which "permits either IR or *RF communications* at 1 Mbps, 2 Mbps and higher data rates, a *medium access technique* similar to carrier sense multiple access/collision avoidance (CSMA/CA), a *power-save mode* for battery-operated mobile stations, *seamless roaming* in a full cellular network, *high throughput operation*, *diverse antenna systems* designed to eliminate "dead spots," and an *easy interface to existing network infrastructures*" (emphasis added, see, for example, Ex. 1007 at ¶¶ 4, 6).

214. More specifically, Shearer discloses that "The *802.11a standard* defines data rates of 6, 12, 18, 24, 36 and 54 Mbps in the *5 GHz band*" and teaches that "*Demand for higher data rates* may result in the *need for devices that can communicate with each other at the higher rates*, *yet co-exist in the same WLAN* environment or area *without significant interference* or

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interruption from each other" while preferably such "*high data rate devices*" would "be able to *communicate with the 802.11a devices*, such as at any of the *standard 802.11a rates*" (emphasis added, see, for example, Ex. 1007 at ¶ 7).

215. Additionally, Shearer teaches that "*Increasing the data rate* and allowing more effective use of bandwidth for devices operating in these bands *enables more efficient communications*" and thus "A higher data rate may *enable service providers to more effectively use their allotted spectrum*" such that "Consumers may *realize a cost savings* as well" (emphasis added, see, for example, Ex. 1007 at ¶ 8).

216. Accordingly, in its "**Detailed Description**" section, Shearer describes that "One *system embodiment* comprises a system that *receives a number of digital signals*, *multiplies the signal sample rate by the number of received signals* (e.g., an *interpolation*), *shifts the signals with respect to a center frequency*, and *accumulates the shifted signals into one signal*" (emphasis added, see, for example, Ex. 1007 at ¶ 35).

217. Therefore, in my opinion, a POSITA would understand even before considering the entire detailed disclosure of Shearer to follow that Shearer is from the same field of endeavor as the '802 Patent and that Shearer is reasonably pertinent to the problem faced by the '802 Patent (see, for example, ¶¶ 39-40 and 63 above). Accordingly, Shearer is analogous art to the '802 Patent.

218. Shearer observes that (in 2005) "A *new standard is being proposed*, referred to as *802.11n* (the "802.11n proposal"), which is a *high data rate extension of the 802.11a* standard at 5 GHz" and accordingly this "**Detailed Description**" section of Shearer is at least "*described in the context of 802.11a and an 802.11n proposal*" (emphasis added, see, for example, Ex. 1007 at ¶ 35).

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219. According to Shearer, "FIG. 2 is a *block diagram of a wireless local area network* (WLAN) system **200** operating within area **202**" wherein "*Devices* **204** and **206** are *implemented* according to at least one of several embodiments *compliant with the 802.11n proposal*, whereas *devices* **208** and **210** are *implemented according to the 802.11a standard*" but "All of the devices **204-210** *operate in the 5 GHz band*" although "*other frequency bands are contemplated*" (emphasis added, see, for example, Ex. 1007 at ¶¶ 38-39, FIG. 2 as reproduced below).

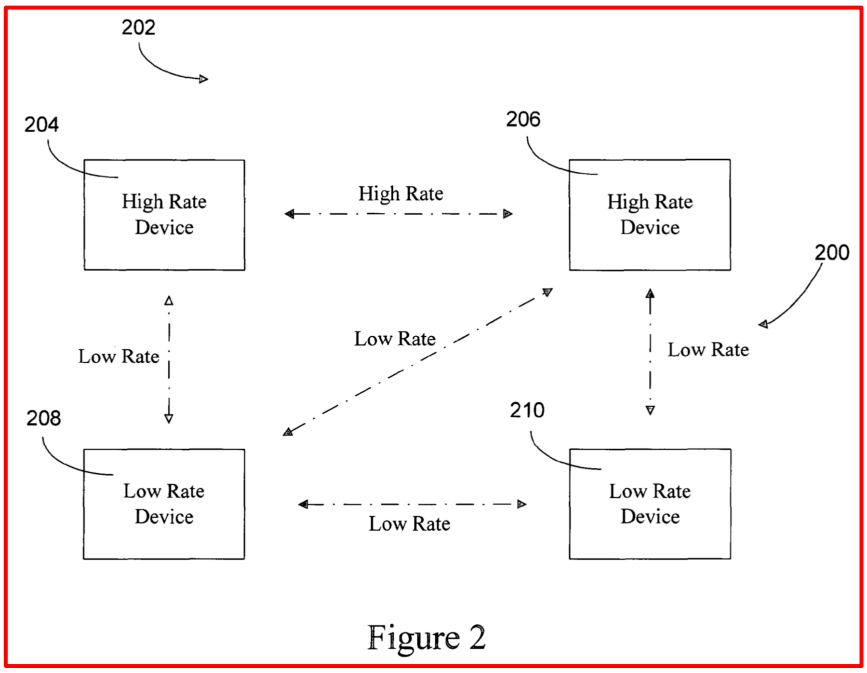


Figure 2

220. For example, Shearer describes that "Devices **208** and **210** *communicate with each other* at any of the *standard 802.11a rates*" while "The devices **204** and **206** *communicate with each other at different data rates* than devices **208** and **210**" but "devices **204-210** may *operate or coexist* in the area **202** *without significant interference* from each other" and "In *one embodiment*, *devices **204, 206*** can *communicate with* either or both of *devices **208, 210*** at any one or more of the *standard 802.11a data rates*" (emphasis added, see, for example, Ex. 1007 at ¶ 39).

221. Shearer explains that "*802.11 is directed to wireless LANs*, and in particular *specifies the MAC and the PHY layers*" which "correspond closely to the two lowest layers of a system based on the ISO Basic Reference Model of OSI, i.e., the data link layer and the *physical layer*" that "is *responsible for encoding and decoding data into signals that are transmitted across a particular medium*" (emphasis added, see, for example, Ex. 1007 at ¶¶ 36-37).

222. According to Shearer, "One embodiment of a transmitter for an 802.11 device is provided in FIG. 3" wherein "a PHY unit **300** includes an *orthogonal frequency division multiplex (OFDM) transmit kernel* **320**, a *symbol wave shaper/interpolator/shifter/summer* (accumulator, assimilator) **310**, an *IQ modulator* **312**, a *mixer* **314**, *high power amplifier (HPA)* **316**, and *antenna* **318**" (emphasis added, see, for example, Ex. 1007 at ¶ 40, FIG. 3 as reproduced below). A POSITA would understand that FIG. 3 of Shearer is substantially similar to the "*general block diagram of the transmitter … for the OFDM PHY*" shown in Figure 17-12 of IEEE 802.11-2007 (see, for example, ¶ 157 above) or in Figure 118 of IEEE 802.11a-1999 (see, for example, Ex. 1009 at § 17.3.8.1).

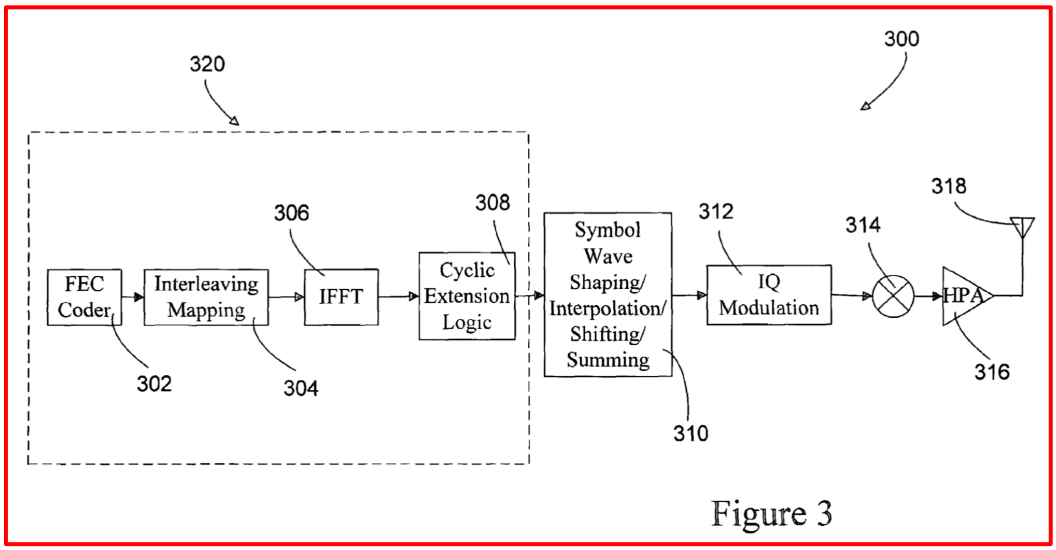


Figure 3

223. More specifically, Shearer discloses that "*OFDM transmit kernel* **320** includes an *FEC coder* **302** (for *encoding the data received from a MAC unit*), an *interleaver/mapper* **304**, an *inverse fast Fourier transform* (IFFT) unit **306**, and *cyclic extension* logic **308**" and that "*During a data transmit process*, *data and control information are received at the FEC coder* **302**" (emphasis added, see, for example, Ex. 1007 at ¶¶ 40-41).

224. Additionally, Shearer discloses that "*Symbol wave shaper/interpolator/shifter/summer* **310** comprises a *low-pass filter* to smooth the spectral edges between successive OFDM symbols" as well as "*interpolation, shifting, and summing functionality* as described below" (emphasis added, see, for example, Ex. 1007 at ¶ 41).

225. In reference to FIG. 3 shown above, Shearer discloses that "The output of *symbol wave shaper/interpolator/shifter/summer* **310** is *sent to modulator* **312**" which "*modulates the encoded data onto carriers in OFDM symbols* in accordance with conventional OFDM modulation techniques" and then "The *output of the modulator* **312** is *sent to mixer* **314** where it is *upconverted to the desired transmit frequency*" so that "the upconverted signal is *amplified in high powered amplifier (HPA)* **316** and *sent to antenna* **318** for *transmission*" (emphasis added, see, for example, Ex. 1007 at ¶¶ 42-43).

226. Shearer observes that "In an *IEEE 802.11a/g design*, each *transmission channel* has a *bandwidth of 20 MHz*" such that "As shown in FIG. 4, in an IEEE 802.11a or IEEE 802.11g OFDM signal, a packet **400** within *each 20 MHz channel has fifty-two (52) subcarriers*" (emphasis added, see, for example, Ex. 1007 at ¶ 44, FIG. 4 as reproduced below).

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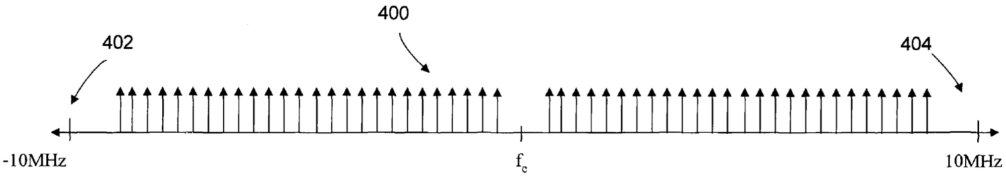


Figure 4

227. More specifically, Shearer explains that even though "*only 52 of the bins* are populated with *non-zero subcarriers*" that "there are *sixty-four (64) subcarriers bins* from −10 MHz **402** to +10 MHz **404** because a *64 point IFFT* is used" wherein "*Twenty-six* (26) active subcarriers are *spectrally less than zero* (DC), and *26 active subcarriers* are *spectrally greater than zero*" (emphasis added, see, for example, Ex. 1007 at ¶ 44).

228. Accordingly, Shearer defines that "the *packet is 20 MHz wide because* that is the *span of the 64 points in the IFFT*" and observes that for "*IEEE 802.11a/g*" that "the 20 MHz (wide) packets are *spaced in channels whose center frequencies are separated by 20 MHz*" even though "the *active (populated) subcarriers span* a spectrum somewhat *less than 20 MHz wide*, *about 16.5 MHz*" (emphasis added, see, for example, Ex. 1007 at ¶ 44).

229. According to Shearer, FIG. 7 shows "three different *ways to create a 40 MHz wide packet subcarrier layout*" (emphasis added, see, for example, Ex. 1007 at ¶ 47, excerpted FIG. 7 as reproduced below).

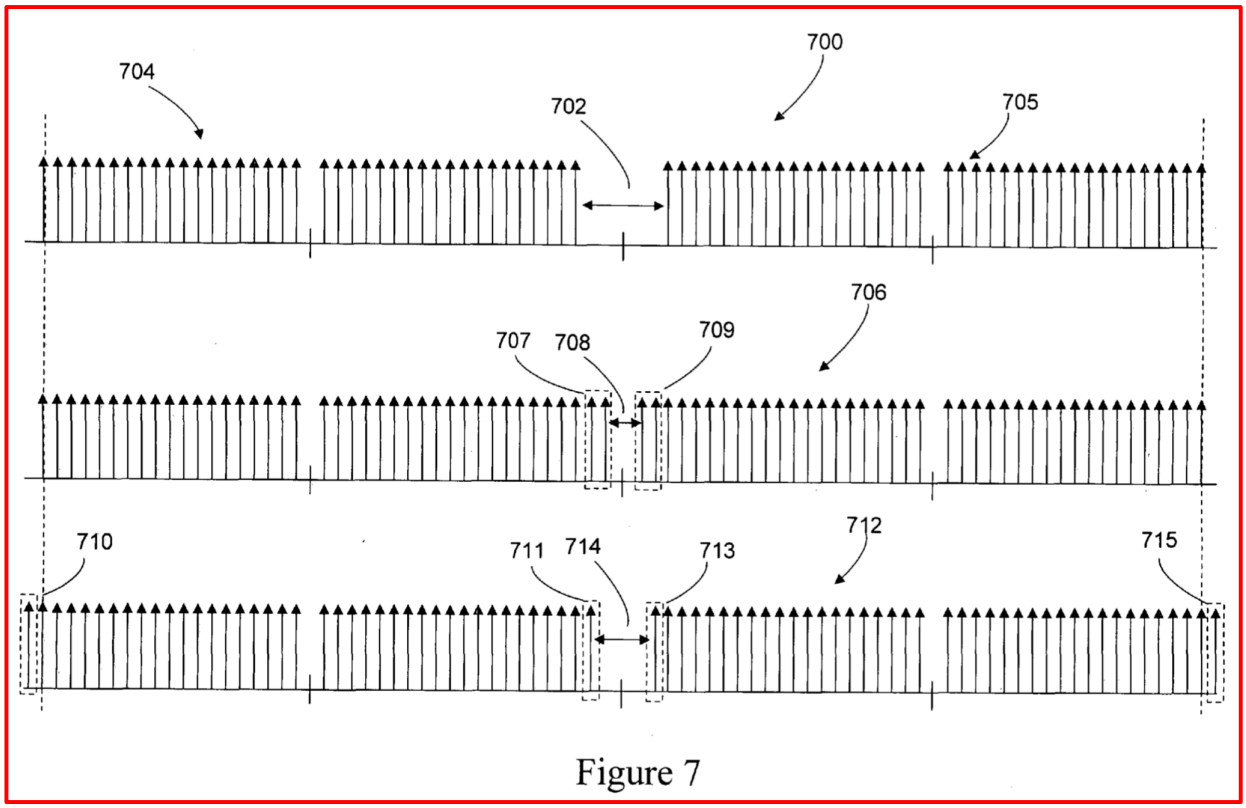


Figure 7

230. For example, Shearer explains that "Waveform **700** provides a *40 MHz packet's subcarrier structure* matching the subcarrier structure of *two 20 MHz 802.11a/g OFDM packets*" wherein the respective "*center frequencies* are *spaced by 10 MHz*" (emphasis added, see, for example, Ex. 1007 at ¶ 47).

231. Additionally, Shearer explains that "Waveform **700** has an *11 subcarrier gap* **702** between the packets" wherein "This gap **702** is introduced into the waveform *because the transmit and receive filters roll off with a finite rate*" so "Some *margin is provided* to allow a *filter to be flat across the pass band* and still *attenuate quickly in the stop band*" (emphasis added, see, for example, Ex. 1007 at ¶ 48).

232. Shearer also describes in reference to FIG. 7 shown above that "Waveform **706** *adds extra subcarriers to the gap in the middle*, on the *inner spectral edges* of the two 20 MHz

sub-packets" while "Waveform **712** *adds extra subcarriers to the outer and inner edges* of the sub-packets" (emphasis added, see, for example, Ex. 1007 at ¶ 47).

233. Shearer focuses "on a *scenario with two inputs*, increasing the *bandwidth by a factor of 2*" such that "In one embodiment of an *802.11n system*, *two 20 MHz 802.11a input signals are received at the PHY* unit **300** from FIG. 3 substantially *simultaneously*" wherein "The *two signals are processed separately*, one in a *lower 20 MHz path* and one in an *upper 20 MHz path*" (emphasis added, see, for example, Ex. 1007 at ¶ 57).

234. For example, Shearer describes a "*lower 20 MHz path* **800**" shown at FIG. 8 in which "*One of the inputs* is first *processed by the lower 20 MHz OFDM transmit kernel* **320a** which corresponds to the transmit kernel **320** from FIG. 3" followed by "an *interpolation stage* **310a**" that "corresponds to shaper/interpolator/shifter/summer **310** of FIG. 3" wherein "the *interpolation factor is 2*", and then "The output of interpolation stage **310a** is then *shifted down by 10 MHz at frequency shift stage* **310b**" which "corresponds to shaper/interpolator/shifter/summer **310** of FIG. 3" and operated "by *multiplying the sample* by $e^{j2\pi f_{shift}t}$, where f_{shift} is the *amount of desired frequency shift*" (emphasis added, see, for example, Ex. 1007 at ¶¶ 57-58, FIG. 8 as reproduced below).

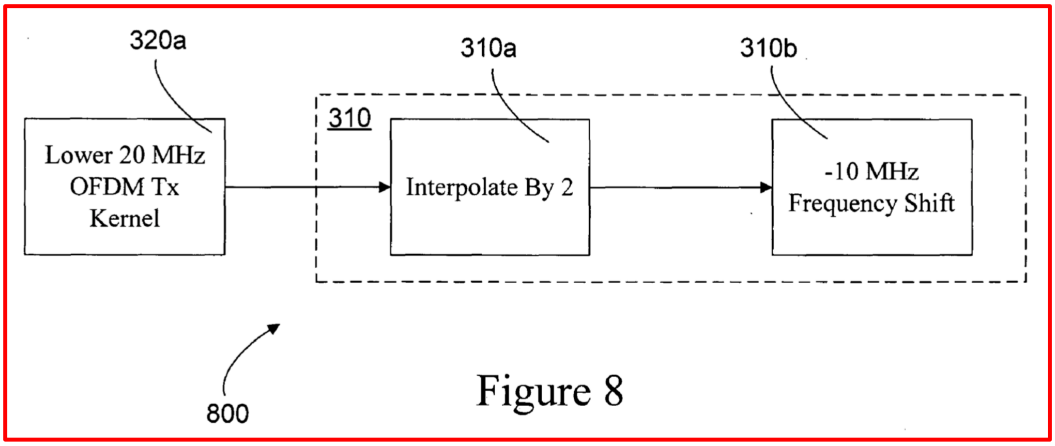


Figure 8

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235. Similarly, Shearer also describes an "*upper 20 MHz path* **1100**" shown at FIG. 11 wherein "output of interpolation stage **310c** is then *shifted up by 10 MHz at frequency shift stage* **310d**" (emphasis added, see, for example, Ex. 1007 at ¶ 60).

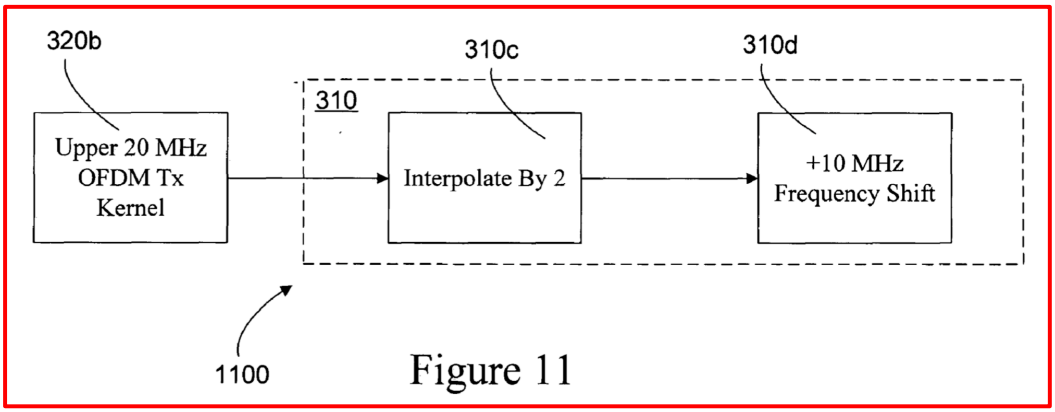


Figure 11

236. According to Shearer, "FIG. 13 presents an exemplary *embodiment with 2 signal paths*, *upper path* **1100** and *lower path* **800**, *each processing a 20 MHz 802.11a input signal* substantially *simultaneously*" (emphasis added, see, for example, Ex. 1007 at ¶ 62, FIG. 13 as reproduced below). Note that a POSITA would understand that FIG. 13 has a clear typographical error in that by comparing the depictions of the "*upper path* **1100**" of FIG. 11 and "*lower path* **800**" of FIG.8, then a POSITA would understand that the terms "-10 MHz" and "+10 MHz" in FIG. 13 are intended to be swapped with each other.

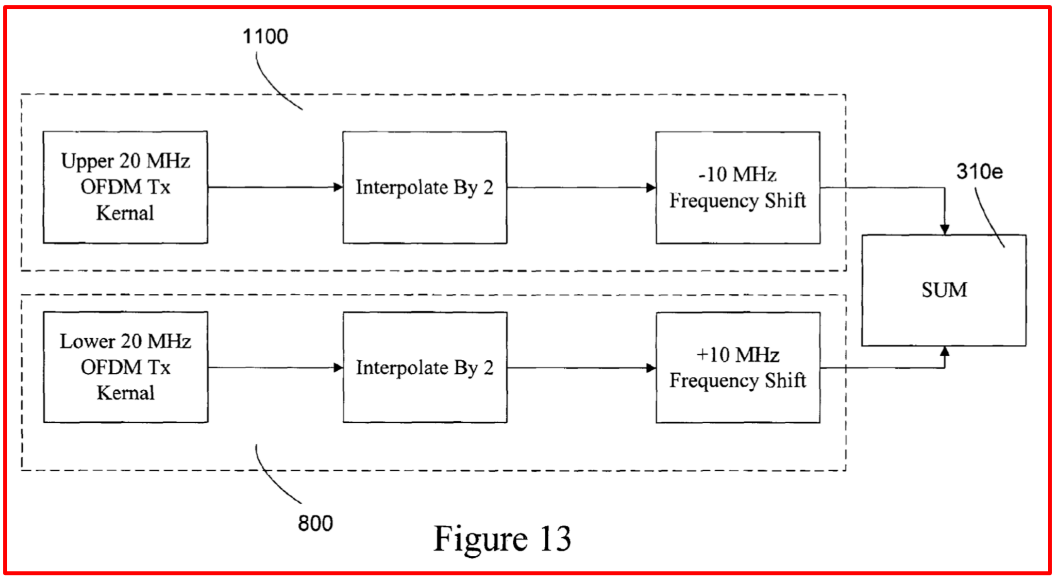


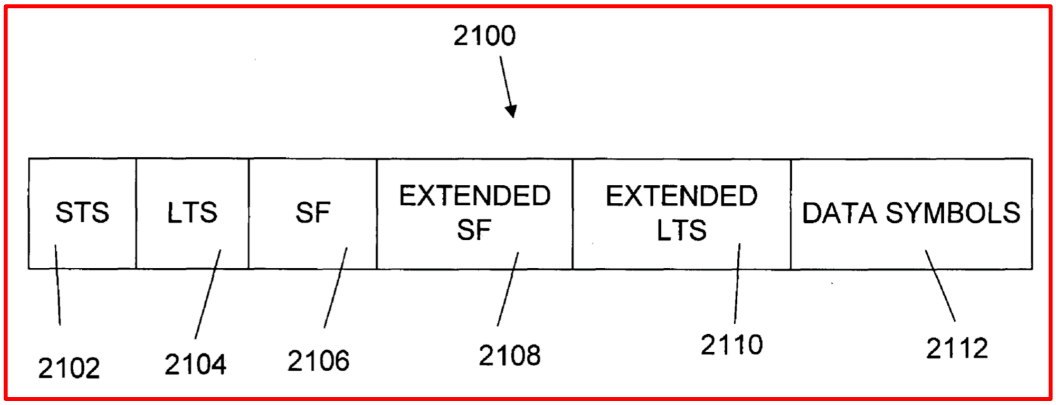
Figure 13

237. In reference to FIG. 13 shown above, Shearer teaches that "The *output of each path is aggregated in adder* **310e** to achieve, in this exemplary embodiment, a signal **1400** with a 40 MHz bandwidth and a 40 MHz sample rate" wherein "this process could be *easily adapted for other systems with different protocols*, with different frequencies, and with more input signals" (emphasis added, see, for example, Ex. 1007 at ¶ 62).

238. Shearer teaches that "*40 MHz packets* reuse the *20 MHz IEEE 802.11a/g preamble subcarrier definition*" and thus to "implement the *receiver* of a *40 MHz system*", Shearer further teaches that "*legacy sensing circuits*" each of which "includes a *correlator*" for "*detection of the LTS sequence*" are usable for such a "*40 MHz waveform*" by "breaking it down into *20 MHz halves* and *processing each half individually*" (emphasis added, see, for example, Ex. 1007 at ¶¶ 75-76).

239. Additionally, Shearer teaches that "An *exemplary embodiment* can support *two types of packets*, for example, for *both 20 MHz and 40 MHz*" as shown in FIG. 21 as "a *mixed-mode packet*, which has the *spectrally aligned legacy preamble/header* **2102**, **2104**, **2106**, the

extended header **2108**, **2110**, and *data symbols* **2112**" (emphasis added, see, for example, Ex. 1007 at ¶ 77, FIG. 21 as reproduced below).



240. More specifically, Shearer explains in reference to FIG. 21 shown above that "With mixed mode, the *legacy radio receives what looks like a legacy packet*, so it remains dormant through the following extended part" which "*allows for reception of legacy packets by legacy radios* without disruption by an extended packet" as "sometimes referred to as *spoofing a legacy radio*" (emphasis added, see, for example, Ex. 1007 at ¶ 77).

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VIII. OBVIOUSNESS OF THE '802 PATENT UNDER 35 U.S.C. § 103 DUE TO IEEE 802.11n D2.0 IN VIEW OF IEEE 802.11-2007

241. In my opinion, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 renders obvious at least Claims 1-9 of the '802 Patent for at least the reasons described herein.

242. IEEE 802.11n D2.0 is analogous art to the '802 Patent (see ¶ 89 above).

243. IEEE 802.11-2007 is analogous art to the '802 Patent (see ¶ 135 above).

244. A general overview of IEEE 802.11n D2.0 is given at ¶¶ 82-118 above.

245. A general overview of IEEE 802.11-2007 is given at ¶¶ 120-163 above.

246. My specific analyses of IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA, with respect to the challenged claims of the '802 Patent is given herein.

247. Note that for purposes of my analysis herein that I have provided subsection headings for claim elements in the form "1(a)", "1(b)", etc. for the convenience of the reader even though such headings do not exist in the actual '802 Patent claims themselves.

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‘802 Patent: Claim 1

> 1. A method of transmitting information in a wireless communication channel comprising:
>
> (a) transmitting first information across a first frequency range using a wireless transmitter, the first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency; and
>
> (b) simultaneously transmitting second information across a second frequency range using the same wireless transmitter, the second frequency range having a second center frequency greater than the first center frequency, a second highest frequency, and a second lowest frequency.

1. A method of transmitting information in a wireless communication channel comprising:

248. In my opinion, this preamble claim element expresses no limitations.

249. However, I have considered that this preamble claim element may be limiting.

250. For example, IEEE 802.11n D2.0 discloses “a high throughput (HT) *orthogonal frequency division multiplexing (OFDM) system*” that is “*applicable to operation* in either the *2.4 GHz band* or the *5 GHz bands*, or *both*” (see, for example, ¶ 86 above).

251. More specifically, IEEE 802.11n D2.0 teaches that “In the case of the *HT duplicate and Non-HT duplicate formats*, the *same data* are *transmitted over two adjacent 20 MHz channels*” such that “In this case, the *40 MHz channel is divided into 128 sub-carriers* and the *data are transmitted on carriers -58 to -6 and 6 to 58*” (see, for example, ¶ 95 above).

252. Additionally, IEEE 802.11n D2.0 also provides an “*Overview of the PPDU encoding process*” which includes to “*Up-convert the resulting complex baseband waveform*” to “*an RF signal according to the center frequency of the desired channel and transmit*” (see, for example, ¶ 118 above).

253. In my opinion, a POSITA would understand that such disclosure in IEEE 802.11n D2.0 of “***data***” that is “***transmitted***” as “***an RF signal***” using “***orthogonal frequency division multiplexing (OFDM)***” (i.e. a “**method of transmitting information**”) over “***two adjacent 20 MHz channels***” according to the “***center frequency of the desired channel***” for “***operation in either the 2.4 GHz band or the 5 GHz bands, or both***” (i.e. “**in a wireless communication**

channel") as summarized herein would at least constitute a "**method of transmitting information in a wireless communication channel**".

254. Thus, IEEE 802.11n D2.0 discloses a "**method of transmitting information in a wireless communication channel**" (for example, by transmitting data in two adjacent 20 MHz channels using at least the IEEE 802.11n HT duplicate or Non-HT duplicate formats for OFDM at 2.4 GHz or 5 GHz).

255. For example, IEEE 802.11-2007 discloses "The *scope of this standard* is to define one medium access control (MAC) and *several physical layer (PHY) specifications for wireless connectivity* for fixed, portable, and moving stations (STAs) within a local area" (see, for example, ¶ 126 above).

256. Additionally, IEEE 802.11-2007 observes that "The *PHYs used in IEEE Std 802.11* are *fundamentally different* from wired media" at least because they "Have *time-varying and asymmetric propagation properties*" (see, for example, ¶ 128 above).

257. More specifically, IEEE 802.11-2007 "specifies the PHY entity for an *orthogonal frequency division multiplexing (OFDM) system*" which "*uses 52 subcarriers that are modulated*" with "*data, pilots, or training symbols*" specifically for the "*5 GHz band*" (see, for example, ¶¶ 137 and 145 above).

258. For example, IEEE 802.11-2007 provides an "*Overview of the PPDU encoding process*" which includes to "*Up-convert the resulting "complex baseband" waveform to an RF according to the center frequency of the desired channel and transmit*" (see, for example, ¶ 141 above).

259. In my opinion, a POSITA would understand that such disclosure in IEEE 802.11-2007 of "***data***" to "***transmit***" as "***an RF***" using "***orthogonal frequency division multiplexing***

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(OFDM)" (i.e. a "**method of transmitting information**") by "***wireless connectivity***" with "***time-varying and asymmetric propagation properties***" according to the "***center frequency of the desired channel***" for the "***5 GHz band***" (i.e. "**in a wireless communication channel**") as summarized herein would at least constitute a "**method of transmitting information in a wireless communication channel**".

260. Thus, IEEE 802.11-2007 discloses a "**method of transmitting information in a wireless communication channel**" (for example, by transmitting data using OFDM at 5 GHz).

261. In my opinion, a POSITA would have combined the disclosures of IEEE 802.11n D2.0 with IEEE 802.11-2007 in a way that would perform at least the recited "**method of transmitting information in a wireless communication channel**" by using at least the IEEE 802.11n HT duplicate or Non-HT duplicate formats for OFDM in two adjacent 20 MHz channels for a 40 MHz channel bandwidth device at 2.4 GHz or 5 GHz for at least the following reasons.

262. First, a POSITA would understand that IEEE 802.11n D2.0 is an **amendment** to IEEE 802.11-2007 (see, for example, ¶¶ 85-88, 121-125 and 195 above).

263. For example, a POSITA would understand that IEEE 802.11n D2.0 is described by numerous specific references to sections of what at the time of the alleged invention of the '802 Patent was IEEE 802.11-2007 (see, for example, ¶¶ 87-88, 92, 99-100, 102-105 and 111 above).

264. More specifically, a POSITA would understand that key aspects of transmitting the IEEE 802.11n HT duplicate or Non-HT duplicate formats, such as the "*windowing function*" that affects the "*transmit spectrum mask*", the modulation values for the pilot subcarriers, and the "*maximum allowable transmit power*", are only determinable by consultation with the

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appropriate sections of IEEE 802.11-2007 (see, for example, ¶¶ 100, 103, 105, 111, 147 and 159 above).

265. Second, a POSITA would have been highly motivated to practice the 40 MHz channel bandwidth using at least the IEEE 802.11n HT duplicate or Non-HT duplicate formats for OFDM in two adjacent 20 MHz channels as described at the time of the alleged invention of the '802 Patent by the combination of IEEE 802.11n D2.0 with IEEE 802.11-2007 at least due to design incentives or other market forces.

266. For example, at the time of the alleged invention of the '802 Patent, a POSITA would understand that there was tremendous commercial interest in the development of WLAN products described by the combination of IEEE 802.11n D2.0 with IEEE 802.11-2007 (see, for example, ¶¶ 171-175 above).

267. More specifically, a POSITA would understand that there was tremendous commercial interest in the development of WLAN products described by the combination of IEEE 802.11n D2.0 with IEEE 802.11-2007 whereby the 40 MHz channel bandwidth capability is utilized for at least the "*significant increase in data rate [that] is derived from the new 40MHz channel width*" with the "*same cost as 20 MHz devices*" thereby providing the "*most cost effective way to increase data rate*" and the IEEE 802.11n HT duplicate or Non-HT duplicate formats are utilized for at least "*comparable maximum range for the lowest data rates of 20 MHz and 40 MHz*" and interoperability with "*Neighboring legacy APs and clients [that] may be present in the primary or secondary channels* of the 40 MHz channel" operating as "*legacy 802.11a/g OFDM devices*" (see, for example, ¶¶ 173-174, 178, 186, 196-197, 200, 203 and 209-210 above).

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268. For example, a POSITA would understand that the IEEE 802.11n HT duplicate format specifically supports this "*significant increase in data rate [that] is derived from the new 40MHz channel width*" because it mitigates the potential of reduced wireless connectivity range during operation at "*40MHz channel width*" with the "*same cost as 20 MHz devices*" since "*Combining the subcarriers in the upper and lower channel at the receiver* improves the required SNR of the HT duplicate format resulting in a *comparable maximum range for the lowest data rates of 20 MHz and 40 MHz*", thereby overcoming a potential objection to deploying the increased data rates realized by this "*40MHz channel width*" (see, for example, ¶¶ 202-203 above).

269. For example, a POSITA would understand that the IEEE 802.11n non-HT duplicate format specifically supports this "*significant increase in data rate [that] is derived from the new 40MHz channel width*" because it mitigates the potential of increased interference with 20 MHz devices during operation at "*40MHz channel width*" since "*Neighboring legacy APs and clients may be present in the primary or secondary channels* of the 40 MHz channel" and thus "it is desirable to *make the reservation on both the primary and secondary channels simultaneously*" wherein "A common way to *reserve the medium for transmission* is to send an RTS/CTS" (see, for example, ¶¶ 199-200 above).

270. Third, a POSITA would understand that transmitting the IEEE 802.11n HT duplicate or Non-HT duplicate formats of IEEE 802.11n D2.0 as described by the combination of IEEE 802.11n D2.0 with IEEE 802.11-2007 would be predictable and highly likely to succeed.

271. For example, a POSITA would understand that every aspect of IEEE 802.11n D2.0 was written as an amendment to an underlying set of existing wireless protocols that are

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specifically described by IEEE 802.11-2007 (see, for example, ¶¶ 85-88, 121-125 and 195 above).

272. More specifically, a POSITA would understand that the IEEE 802.11n HT duplicate or Non-HT duplicate formats of IEEE 802.11n D2.0 are described with precisely the center frequencies and numbers of carriers for the two adjacent 20 MHz channels as specified by IEEE 802.11n D2.0 so that such formats are interoperable with the IEEE 802.11a and IEEE 802.11g formats described in Clause 17 of IEEE 802.11-2007, thereby ensuring that the IEEE 802.11n HT duplicate or Non-HT duplicate formats of IEEE 802.11n D2.0 as described by the combination of IEEE 802.11n D2.0 with IEEE 802.11-2007 will lead to predictable and successful results (see, for example, ¶¶ 85, 87-88, 104, 113, 121-125, 195-200, 219, 226 and 229-233 above).

273. At least since both of IEEE 802.11n D2.0 and IEEE 802.11-2007 discloses the limitations of this claim element, if any, then the above described combination of IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA also discloses the limitations of this claim element, if any.

274. Therefore, in my opinion, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious the limitations of this claim element, if any.

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1(a) transmitting first information across a first frequency range using a wireless transmitter, the first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency;

275. IEEE 802.11n D2.0 defines "*high throughput duplicate format* (HT duplicate format)" as "A PPDU format of the HT PHY in which *signals in two halves of the occupied channel width contain the same information*" and IEEE 802.11n D2.0 defines "*non-HT duplicate*" as "A mode of operation of the PHY that *duplicates a 20 MHz non-HT transmission in two adjacent 20 MHz channels*, allowing a non-HT BSS on *either channel to receive the transmission*" (see, for example, ¶¶ 112-113 above).

276. IEEE 802.11n D2.0 also provides an "*Overview of the PPDU encoding process*" which includes that each one of "*groups* of N_{SD} *complex numbers*" is "*associated with one OFDM symbol* in one spatial stream" such that "In each group, the *complex numbers are indexed* 0 to $N_{SD} - 1$ *and mapped hereafter onto OFDM subcarriers*" as described in at least "*20.3.10.10.4 (Transmission in HT duplicate format)*, and *20.3.10.11 (Non-HT duplicate transmission)*" (see, for example, ¶ 116 above).

277. IEEE 802.11n D2.0 recites "an *HT duplicate format* (specified in 20.3.10.10.4) used for *MCS 32* that provides the lowest rate in a *40 MHz channel*" and "a *non-HT duplicate format* (specified in 20.3.10.11 (Non-HT duplicate transmission)) that *duplicates the 20 MHz non-HT packet in two 20 MHz halves of a 40 MHz channel*" wherein the "Non-HT PPDU format is defined in 17.3.3 and 17.3.2" (see, for example, ¶ 93 above). A POSITA would understand that such reference to "Non-HT PPDU format" as "defined in 17.3.3 and 17.3.2" is determined from consulting IEEE 802.11-2007 at §§ 17.3.2, 17.3.3 (see, for example, ¶¶ 138-149 above).

278. IEEE 802.11n D2.0 teaches that "The *transmitted signal* is described in *complex base-band signal notation*" wherein "The *actual transmitted signal* is related to the complex

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baseband signal" by Eq. (20-1) wherein "Re{·} represents the *real part of a complex variable*" and "f_c is the *center frequency of the carrier*" (see, for example, ¶¶ 96-97 above).

279. For example, IEEE 802.11n D2.0 specifically teaches that for the "*HT duplicate format*" that Eq. (20-60) "*defines the signal*" (see, for example, ¶¶ 102-103 above, annotated Eq. (20-60) shown below).

IEEE 802.11n D2.0 Eq. (20-60) describing HT Duplicate Format

$$r_{HT-DATA}^{i_{TX}}(t) = \frac{1}{\sqrt{N_{Duplicate}^{Tone}}} \sum_{n=0}^{N_{SYM}-1} w_{T_{SYM}}(t - nT_{SYM}) \cdot \sum_{k=-N_{SR}}^{N_{SR}} (D_{k,n} + p_{n+z}P_k)([Q_{k-32}]_{i_{TX},1} \exp(j2\pi(k - 32)\Delta_F(t - nT_{SYM} - T_{GI})) + j[Q_{k+32}]_{i_{TX},1} \exp(j2\pi(k + 32)\Delta_F(t - nT_{SYM} - T_{GI})))$$

Example disclosure of both a *"first highest frequency"* and a *"second highest frequency"*

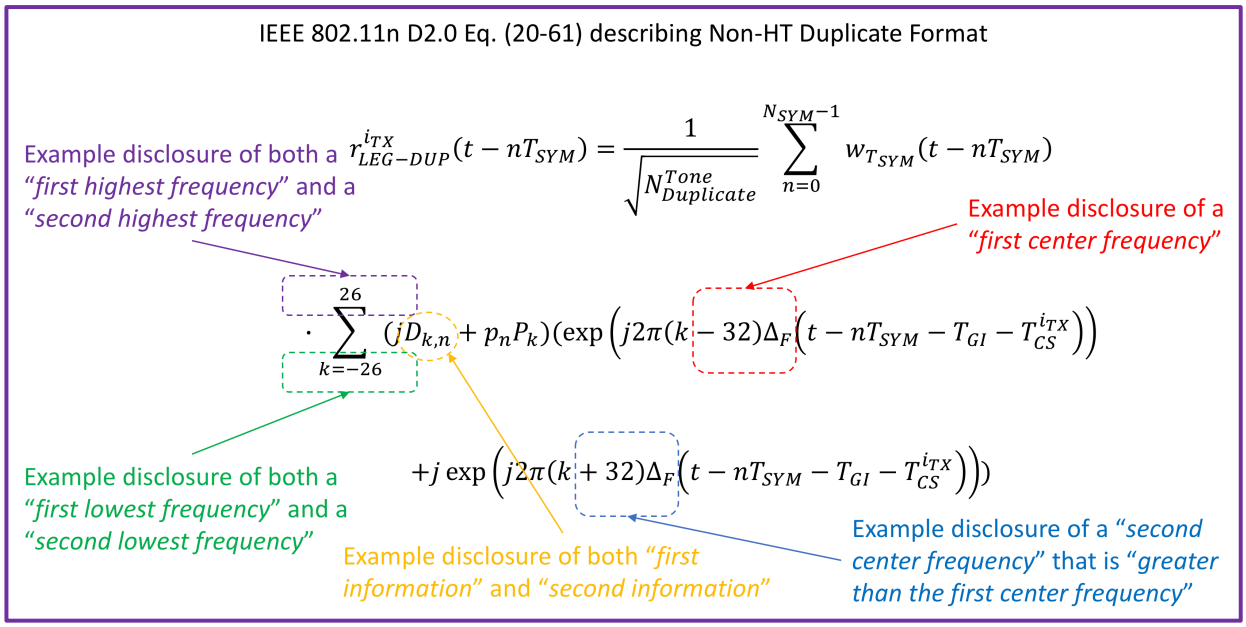
Example disclosure of a *"first center frequency"*

Example disclosure of both a *"first lowest frequency"* and a *"second lowest frequency"*

Example disclosure of both *"first information"* and *"second information"*

Example disclosure of a *"second center frequency"* that is *"greater than the first center frequency"*

280. Similarly, IEEE 802.11n D2.0 teaches that "*Non-HT duplicate transmission* is used to *transmit to Clause 17 STAs* that may be present in either the *upper or lower halves of the 40 MHz channel*" wherein "*Data transmission is defined* in Equation (20-61)" (see, for example, ¶¶ 104-105 above, annotated Eq. (20-61) shown below).



281. Note also that IEEE 802.11n D2.0 recites that "$\Delta_F = 312.5\ kHz$" (i.e. the frequency domain separation between adjacent subcarriers is $312.5\ kHz$) for Eqs. (20-60) and (20-61), "$D_{k,n}$ is defined in 20.3.9.4.3" (i.e. modulation values for data subcarriers k at symbol number n) for Eqs. (20-60) and (20-61) and "N_{SR} has the value defined for non-HT 20 MHz transmission" (i.e. 26) in Eq. (20-60) (see, for example, ¶¶ 103 and 105 above).

282. IEEE 802.11n D2.0 specifies that "*Channel center frequencies* are defined at every integral multiple of 5 MHz" for both the 2.4 GHz and the 5 GHz bands (see, for example, ¶¶ 106-107 above).

283. More specifically, IEEE 802.11n D2.0 teaches that "The *40 MHz channels are specified by two fields*: (Nprimary_ch, Secondary)" wherein "The *first field represents the channel number* of the *primary channel*, and the *second one indicates whether the secondary channel is above or below* the primary channel (1 -> above, -1 -> below)" (see, for example, ¶ 108 above).

284. Accordingly, a POSITA would understand that as illustrated by annotated Eq. (20-60) for the IEEE 802.11n D2.0 "***HT duplicate format***" in ¶ 279 above and as illustrated by annotated Eq. (20-61) for the IEEE 802.11n D2.0 "***non-HT duplicate format***" in ¶ 280 above, the "***complex number***" modulation values for each data subcarrier and symbol index, "$\boldsymbol{D_{k,n}}$", of the "***PPDU encoding process***" discloses at least "**transmitting first information**".

285. Additionally, a POSITA would understand that as illustrated by annotated Eq. (20-60) for the IEEE 802.11n D2.0 "***HT duplicate format***" in ¶ 279 above and as illustrated by annotated Eq. (20-61) for the IEEE 802.11n D2.0 "***non-HT duplicate format***" in ¶ 280 above, when the "***secondary channel is above***" the "***primary channel***" then the term "$-32\Delta_F$" discloses that a "**first center frequency**" for such a "***primary channel***" would be disclosed as "$f_{c1} = f_c - 32\Delta_f$", or thus since "$\Delta_F = 312.5\ kHz$", then this "**first center frequency**" for such a "***primary channel***" would be disclosed as "$f_{c1} = f_c - 10\ MHz$".

286. Similarly, a POSITA would understand that when the "***secondary channel is … below***" the "***primary channel***", then this "**first center frequency**" for such a "***secondary channel***" would be disclosed as "$f_{c1} = f_c - 10\ MHz$".

287. Furthermore, a POSITA would understand that as illustrated by annotated Eq. (20-60) for the IEEE 802.11n D2.0 "***HT duplicate format***" in ¶ 279 above and as illustrated by annotated Eq. (20-61) for the IEEE 802.11n D2.0 "***non-HT duplicate format***" in ¶ 280 above, the index range on the subcarriers starting at either "$N_{SR} = -26$" or "-26" discloses that a "**first lowest frequency**" below such "**first center frequency**" would be given approximately by "$f_{L1} \approx f_{c1} - 26\Delta_f$", or thus since "$\Delta_F = 312.5\ kHz$", then this "**first lowest frequency**" would be disclosed as "$f_{L1} \approx f_c - 18.125\ MHz$".

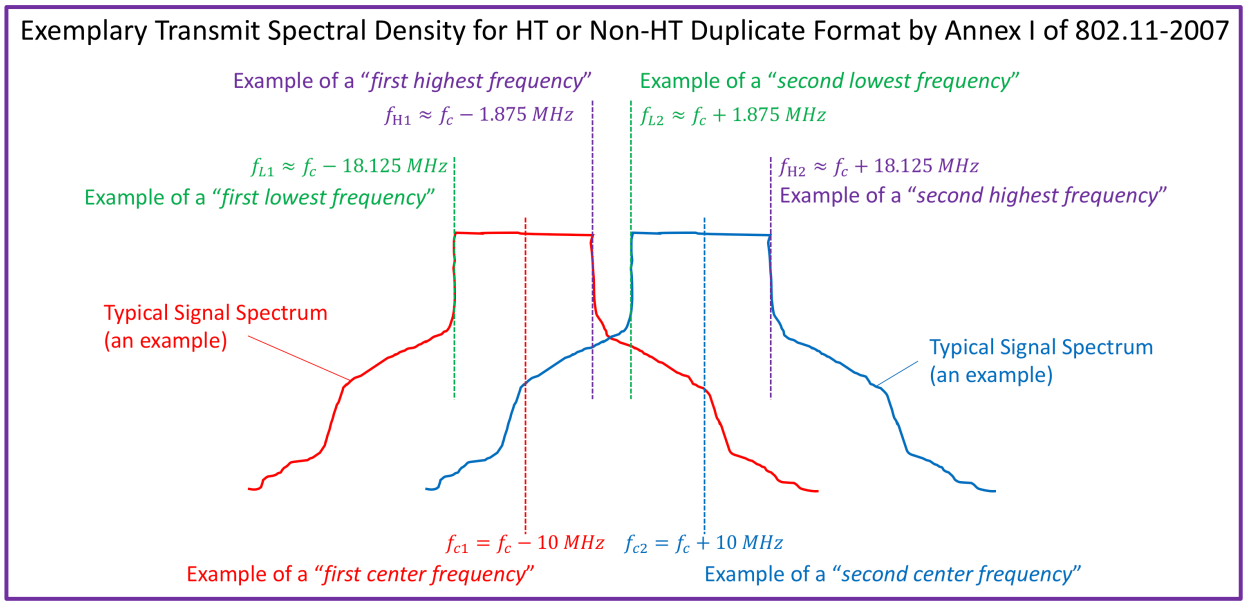
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288. Similarly, a POSITA would understand that as illustrated by annotated Eq. (20-60) for the IEEE 802.11n D2.0 "***HT duplicate format***" in ¶ 279 above and as illustrated by annotated Eq. (20-61) for the IEEE 802.11n D2.0 "***non-HT duplicate format***" in ¶ 280 above, the index range on the subcarriers ending at either "$N_{SR} = 26$" or "26" discloses that a "**first highest frequency**" above such "**first center frequency**" would be given approximately by "$f_{H1} \approx f_{c1} + 26\Delta_f$", or thus since "$\Delta_F = 312.5\ kHz$", then this "**first highest frequency**" would be disclosed as "$f_{H1} \approx f_c - 1.875\ MHz$".

289. Accordingly, a POSITA would further understand that the IEEE 802.11n D2.0 "***HT duplicate format***" and "***non-HT duplicate format***" also disclose a "**first frequency range**" that is approximately the difference between such "**first highest frequency**" and such "**first lowest frequency**", or thus "$f_{R1} \approx f_{H1} - f_{L1} \approx 16.5\ MHz$".

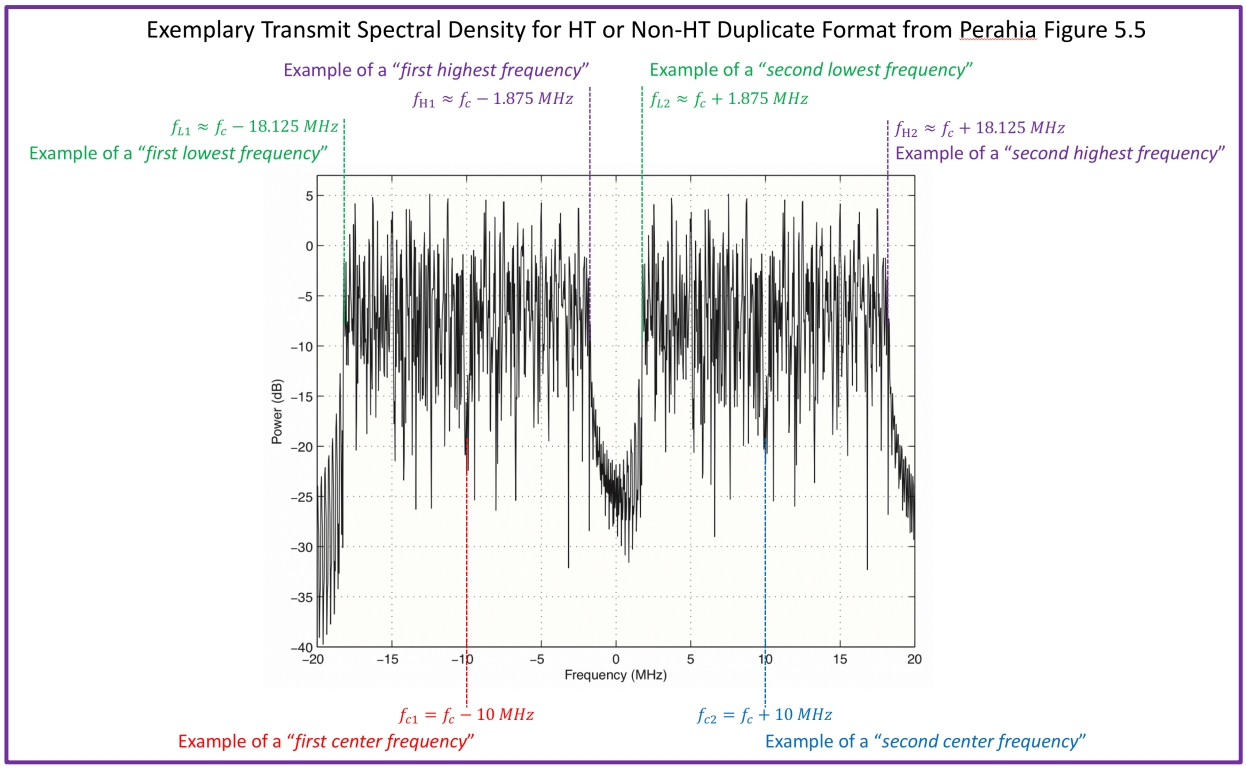
290. A POSITA would understand from the disclosures of IEEE 802.11n D2.0 that Annex I of IEEE 802.11-2007 specifies the "*Transmit spectrum mask*" including "an *example*" of a "*Typical Signal Spectrum*" that would correspond to the "*transmitted spectral density* of the transmitted signal" for such a "**first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency**" of either the IEEE 802.11n D2.0 "***HT duplicate format***" and "***non-HT duplicate format***" in either a "***primary channel***" or a "***secondary channel***" (see, for example, ¶¶ 92-93, 111 and 162-163 above, concatenated "***Typical Signal Spectrum***" for each of a "***primary channel***" and a "***secondary channel***" from Figure I.1 as annotated below).

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291. Similarly, a POSITA would have known at the time of the alleged invention of the '802 Patent that the known "***transmitted spectral density***" described for a "***Typical Signal Spectrum***" in Annex I of IEEE 802.11-2007 would disclose such a "**first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency**" of either the IEEE 802.11n D2.0 "***HT duplicate format***" and "***non-HT duplicate format***" in either a "***primary channel***" or a "***secondary channel***" as shown by Figure I.1 as annotated above (see, for example, ¶¶ 198-199 and 229-236 above).

292. For example, a POSITA would have known at the time of the alleged invention of the '802 Patent that the "***transmitted spectral density***" of either the IEEE 802.11n D2.0 "***HT duplicate format***" and "***non-HT duplicate format***" in either a "***primary channel***" or a "***secondary channel***" includes such a "**first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency**" (see, for example, ¶¶ 198-199 above, annotated Figure 5.5 as shown below).



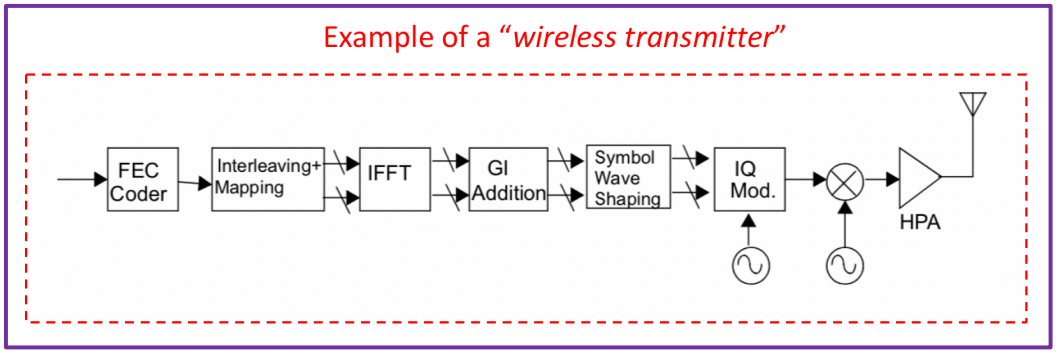
293. Moreover, a POSITA would have known from additional prior art at the time of the alleged invention of the '802 Patent that "*simultaneously*" duplicating "*two 20 MHz 802.11a input signals*" within an "*802.11n system*", as proposed by either the IEEE 802.11n D2.0 "***HT duplicate format***" and "***non-HT duplicate format***", wherein "The *two signals are processed separately*, one in a *lower 20 MHz path* and one in an *upper 20 MHz path*" would disclose at least a "***transmitted spectral density***" that comprises at least a "**first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency**" (see, for example, ¶¶ 226-236 above).

294. In my opinion, a POSITA would have known that the disclosure of "**transmitting first information across a first frequency range**" having "**a first center frequency, a first highest frequency, and a first lowest frequency**" by either of the "***HT duplicate format***" and "***non-HT duplicate format***" described by IEEE 802.11n D2.0 in view of IEEE 802.11-2007 as

summarized above would specifically be performed "**using a wireless transmitter**" for at least the following reasons.

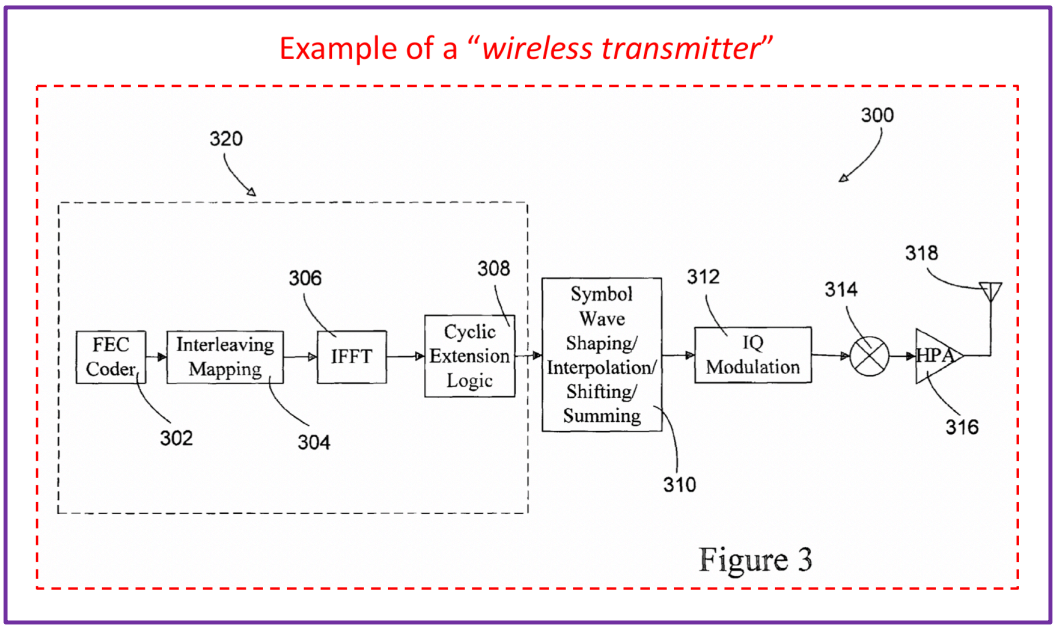
295. First, a POSITA would have known that "**transmitting**" in either of the 2.4 GHz or the 5 GHz bands for IEEE 802.11n D2.0 in view of IEEE 802.11-2007 (see, for example, ¶¶ 106-107 above) necessarily requires "**using a wireless transmitter**". Without a "**wireless transmitter**", a POSITA would have known that there is no practical way to "*Up-convert the resulting "complex baseband" waveform*" described for either of the "***HT duplicate format***" and "***non-HT duplicate format***" to "*an RF according to the center frequency of the desired channel and transmit*" as specifically taught by IEEE 802.11n D2.0 in view of IEEE 802.11-2007 (see, for example, ¶¶ 118 and 141 above).

296. Second, a POSITA would have known that IEEE 802.11n D2.0 in view of IEEE 802.11-2007 discloses a "***general block diagram of the transmitter***" (i.e. an exemplary "**wireless transmitter**") to "***transmit***" (i.e. for "**transmitting**") such "***an RF according to the center frequency of the desired channel***" (see, for example, ¶ 157 above, annotated Figure 17-12 as shown below).



297. Third, a POSITA would have known that additional prior art at the time of the alleged invention of the '802 Patent disclosed a substantially similar "***block diagram***" for a "***transmitter***" as shown by annotated Figure 17-12 shown above that is described as suitable for

"***simultaneously***" duplicating "***two 20 MHz 802.11a input signals***" within an "***802.11n system***", as proposed by either the IEEE 802.11n D2.0 "***HT duplicate format***" and "***non-HT duplicate format***", specifically "***in the 5 GHz band***" (see, for example, ¶¶ 219-225 and 229-236 above, annotated FIG. 3 as shown below).



298. Fourth, a POSITA would have known from at least contemporaneous art at the time of the alleged invention of the '802 Patent of at least another "***block diagram***" for a "***transmitter***" that is specifically described as suitable for the "***HT duplicate format***" and "***non-HT duplicate format***" when "***in the 5.47–5.725 GHz band***" (see, for example, ¶¶ 174 and 194-204 above, annotated Figure 4.8 as shown below).

Example of a "*wireless transmitter*"

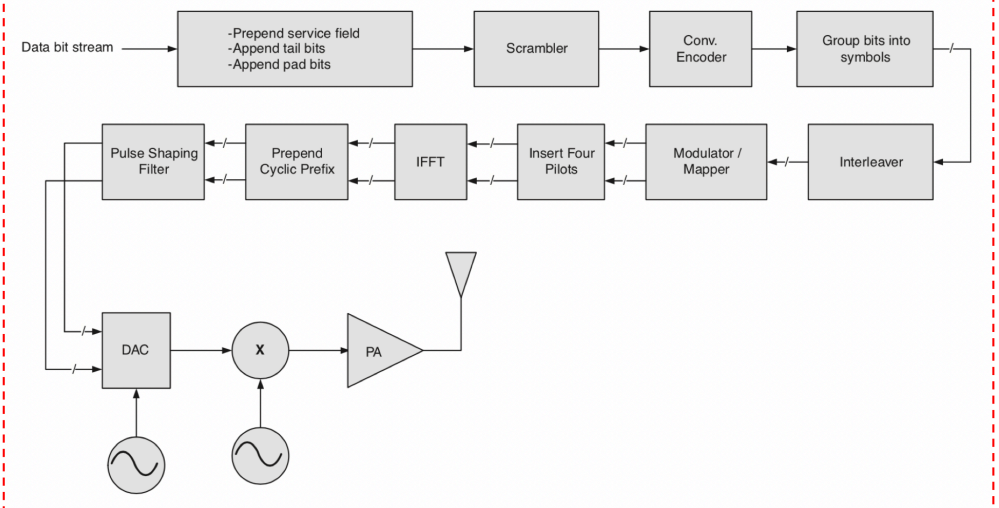


Figure 4.8 Transmitter block diagram for Data field.

299. Thus, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious "**transmitting first information across a first frequency range using a wireless transmitter**" (for example, when transmitting using a disclosed transmitter block diagram to upconvert to an RF carrier a complex baseband signal that is OFDM modulated with data mapped to complex numbers, $D_{k,n}$, and that corresponds to the lower 20 MHz of a 40 MHz HT duplicate or non-HT duplicate format transmission), with such "**first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency**" (for example, when the lower 20 MHz of a 40 MHz HT duplicate or non-HT duplicate format transmission has a lowest frequency of $f_{L1} \approx f_c - 18.125\ MHz$, a highest frequency of $f_{H1} \approx f_c - 1.875\ MHz$, and a center frequency of $f_{c1} = f_c - 10\ MHz$).

300. Therefore, in my opinion, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious the limitations of this claim element.

1(b) simultaneously transmitting second information across a second frequency range using the same wireless transmitter, the second frequency range having a second center frequency greater than the first center frequency, a second highest frequency, and a second lowest frequency.

301. A POSITA would understand that scope of the term "**second information**" for this claim element would include at least disclosure of "**second information**" and "**first information**" that are either the same "**information**" or related "**information**" derived from the same data (see, for example, ¶ 49 above and dependent Claims 7 and 8).

302. See ¶¶ 275-283 above from my analysis of claim element 1(a), which summarizes exemplary disclosures from IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and which I incorporate herein for my analysis of this claim element 1(b).

303. Additionally, I note that a POSITA would have known at the time of the alleged invention of the '802 Patent that "The *non-HT duplicate format* is designed to be *receivable by legacy (and HT) devices in both the primary and secondary channels simultaneously*" because "In essence a *packet is transmitted in legacy OFDM format in the upper and lower halves of the 40MHz channel simultaneously*" (see, for example, ¶ 199 above).

304. Moreover, a POSITA would have known that the prior art specifically teaches to "***simultaneously***" duplicate "***two 20 MHz 802.11a input signals***" within an "***802.11n system***" as proposed by either the IEEE 802.11n D2.0 "***HT duplicate format***" and "***non-HT duplicate format***" (see, for example, ¶ 297 above).

305. Accordingly, a POSITA would understand that as illustrated by annotated Eq. (20-60) for the IEEE 802.11n D2.0 "***HT duplicate format***" in ¶ 279 above and as illustrated by annotated Eq. (20-61) for the IEEE 802.11n D2.0 "***non-HT duplicate format***" in ¶ 280 above, the "***complex number***" modulation values for each data subcarrier and symbol index, "$\boldsymbol{D_{k,n}}$", of the "***PPDU encoding process***" discloses at least "**transmitting second information**", as noted

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above that such "**transmitting second information**" is performed "***simultaneously***" (i.e. "**simultaneously transmitting second information**") with the recited disclosure of "**transmitting first information**" per my analysis of claim element 1(a) herein.

306. Additionally, a POSITA would understand that as illustrated by annotated Eq. (20-60) for the IEEE 802.11n D2.0 "***HT duplicate format***" in ¶ 279 above and as illustrated by annotated Eq. (20-61) for the IEEE 802.11n D2.0 "***non-HT duplicate format***" in ¶ 280 above, when the "***secondary channel is above***" the "***primary channel***" then the term "$+32\Delta_F$" discloses that a "**second center frequency**" for such a "***secondary channel***" would be disclosed as "$f_{c2} = f_c + 32\Delta_f$", or thus since "$\Delta_F = 312.5\ kHz$", then this "**second center frequency**" for such a "***primary channel***" would be disclosed as "$f_{c2} = f_c + 10\ MHz$".

307. Similarly, a POSITA would understand that when the "***secondary channel is … below***" the "***primary channel***", then this "**second center frequency**" for such a "***primary channel***" would be disclosed as "$f_{c2} = f_c + 10\ MHz$".

308. Additionally, at least because such "**second center frequency**" of "$f_{c2} = f_c + 10\ MHz$" exceeds such "**first center frequency**" of "$f_{c1} = f_c - 10\ MHz$" by "$f_{c2} - f_{c1} = f_c + 10\ MHz - (f_c - 10\ MHz) = +20\ MHz$", then IEEE 802.11n D2.0 in view of IEEE 802.11-2007 discloses a "**second center frequency greater than the first center frequency**" as required by the limitations of this claim element 1(b).

309. Furthermore, a POSITA would understand that as illustrated by annotated Eq. (20-60) for the IEEE 802.11n D2.0 "***HT duplicate format***" in ¶ 279 above and as illustrated by annotated Eq. (20-61) for the IEEE 802.11n D2.0 "***non-HT duplicate format***" in ¶ 280 above, the index range on the subcarriers starting at either "$N_{SR} = -26$" or "-26" discloses that a "**second lowest frequency**" below such "**second center frequency**" would be given

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approximately by "$f_{L2} \approx f_{c2} - 26\Delta_f$", or thus since "$\Delta_F = 312.5\ kHz$", then this "**second lowest frequency**" would be disclosed as "$f_{L2} \approx f_c + 1.875\ MHz$".

310. Similarly, a POSITA would understand that as illustrated by annotated Eq. (20-60) for the IEEE 802.11n D2.0 "***HT duplicate format***" in ¶ 279 above and as illustrated by annotated Eq. (20-61) for the IEEE 802.11n D2.0 "***non-HT duplicate format***" in ¶ 280 above, the index range on the subcarriers ending at either "$N_{SR} = 26$" or "26" discloses that a "**second highest frequency**" above such "**second center frequency**" would be given approximately by "$f_{H2} \approx f_{c2} + 26\Delta_f$", or thus since "$\Delta_F = 312.5\ kHz$", then this "**first highest frequency**" would be disclosed as "$f_{H2} \approx f_c + 18.125\ MHz$".

311. Accordingly, a POSITA would further understand that the IEEE 802.11n D2.0 "***HT duplicate format***" and "***non-HT duplicate format***" also disclose a "**second frequency range**" that is approximately the difference between such "**second highest frequency**" and such "**second lowest frequency**", or thus "$f_{R2} \approx f_{H2} - f_{L2} \approx 16.5\ MHz$".

312. A POSITA would understand from the disclosures of IEEE 802.11n D2.0 that Annex I of IEEE 802.11-2007 specifies the "*Transmit spectrum mask*" including "an *example*" of a "*Typical Signal Spectrum*" that would correspond to the "*transmitted spectral density* of the transmitted signal" for such a "**second frequency range having a second center frequency greater than the first center frequency, a second highest frequency, and a second lowest frequency**" of either the IEEE 802.11n D2.0 "***HT duplicate format***" and "***non-HT duplicate format***" in either a "***primary channel***" or a "***secondary channel***" as I described in my analysis of claim element 1(a) at ¶ 290 above.

313. Also, a POSITA would have known at the time of the alleged invention of the '802 Patent that the "***transmitted spectral density***" of either the IEEE 802.11n D2.0 "***HT***

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duplicate format" and "***non-HT duplicate format***" in either a "***primary channel***" or a "***secondary channel***" includes such a "**second frequency range having a second center frequency greater than the first center frequency, a second highest frequency, and a second lowest frequency**" as I described in my analysis of claim element 1(a) at ¶ 292 above.

314. Moreover, a POSITA would have known from additional prior art at the time of the alleged invention of the '802 Patent that "*simultaneously*" duplicating "*two 20 MHz 802.11a input signals*" within an "*802.11n system*", as proposed by either the IEEE 802.11n D2.0 "***HT duplicate format***" and "***non-HT duplicate format***", wherein "The *two signals are processed separately*, one in a *lower 20 MHz path* and one in an *upper 20 MHz path*" would disclose at least a "***transmitted spectral density***" that comprises at least a "**second frequency range having a second center frequency greater than the first center frequency, a second highest frequency, and a second lowest frequency**" as I described in my analysis of claim element 1(a) at ¶ 293 above.

315. In my opinion, a POSITA would have known that the disclosure of "**transmitting second information across a second frequency range**" having "**a second center frequency greater than the first center frequency, a second highest frequency, and a second lowest frequency**" by either of the "***HT duplicate format***" and "***non-HT duplicate format***" described by IEEE 802.11n D2.0 in view of IEEE 802.11-2007 as summarized above would specifically be performed at least "**using a wireless transmitter**" for at least the same reasons I provided for my analysis of claim element 1(a) at ¶¶ 294-298 above.

316. Additionally, a POSITA would have known that the recited "**simultaneously transmitting second information across a second frequency range using the same wireless**

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transmitter" would also be performed by such disclosed "**wireless transmitter**" for at least the following reasons.

317. First, the "**first information**" and the "**second information**" are disclosed by either of the "***HT duplicate format***" and "***non-HT duplicate format***" described by IEEE 802.11n D2.0 in view of IEEE 802.11-2007 as being transmitted "**simultaneously**" as I noted at ¶¶ 301-305 above for this claim element 1(b). Accordingly, a POSITA would understand that transmitting "**simultaneously**" is advantageously achieved by "**using the same wireless transmitter**".

318. Second, a POSITA would understand that the "**first information**" and the "**second information**" are disclosed by either of the "***HT duplicate format***" and "***non-HT duplicate format***" as being within a single composite complex baseband signal that is generated using a complex IFFT structure analogous to that shown within the examples of a "***block diagram***" for a "***transmitter***" at ¶¶ 296-298 above.

319. More specifically, at least the exemplary prior art "***block diagram***" for a "***transmitter***" shown at ¶ 297 above specifically discloses a "**same wireless transmitter**" that transmits "**simultaneously**" both "**first information**" and "**second information**" for "***two 20 MHz 802.11a input signals***" being duplicated within an "***802.11n system***".

320. Third, a POSITA would have known from at least contemporaneous art at the time of the alleged invention of the '802 Patent that since 2004 "*40 MHz devices could be produced at almost the same cost as 20 MHz devices*" at least when "Typically, a *40 MHz device* is designed with the *same output power* to maintain the *same cost as a 20 MHz device*" (see, for example, ¶¶ 174 and 202 above).

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321. Accordingly, a POSITA would have had a high expectation of success in "**simultaneously transmitting second information across a second frequency range using the same wireless transmitter**" as used for "**transmitting first information across a first frequency range**" at least because it was well known at the time of the alleged invention of the '802 Patent that this was possible using a "***40 MHz device***" with both the "***same output power***" and the "***same cost***" as for a "***20 MHz device***" such as the depicted "***block diagram***" for a "***transmitter***" disclosed by IEEE 802.11n D2.0 in view of IEEE 802.11-2007.

322. Thus, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious "**simultaneously transmitting second information across a second frequency range using the same wireless transmitter**" (for example, when transmitting using a disclosed transmitter block diagram to upconvert to an RF carrier a complex baseband signal that is OFDM modulated with data mapped to complex numbers, $D_{k,n}$, and that corresponds to the upper 20 MHz of a 40 MHz HT duplicate or non-HT duplicate format transmission) with such "**second frequency range having a second center frequency greater than the first center frequency, a second highest frequency, and a second lowest frequency**" (for example, when the upper 20 MHz of a 40 MHz HT duplicate or non-HT duplicate format transmission has a lowest frequency of $f_{L2} \approx f_c + 1.875\ MHz$, a highest frequency of $f_{H2} \approx f_c + 18.125\ MHz$, and a center frequency of $f_{c2} = f_c + 10\ MHz$, thereby also disclosing that f_{c2} is greater than f_{c1} when $f_{c2} - f_{c1} = +20\ MHz$).

323. Therefore, in my opinion, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious the limitations of this claim element.

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‘802 Patent: Claim 2

> 2. The method of claim 1 wherein frequency difference between the first center frequency and the second center frequency is greater than the sum of one-half the first frequency range and one-half the second frequency range.

2. The method of claim 1 wherein frequency difference between the first center frequency and the second center frequency is greater than the sum of one-half the first frequency range and one-half the second frequency range.

324. In my analysis showing that IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious the limitations of “**The method of claim 1**”, I also provide analysis sufficient to show that the additional limitations of “**wherein frequency difference between the first center frequency and the second center frequency is greater than the sum of one-half the first frequency range and one-half the second frequency range**” are disclosed by IEEE 802.11n D2.0 in view of IEEE 802.11-2007.

325. For example, I noted that a POSITA would understand that either of the “***HT duplicate format***” and “***non-HT duplicate format***” described by IEEE 802.11n D2.0 in view of IEEE 802.11-2007 as summarized herein discloses at least “**the first frequency range**” of this claim element as “$f_{R1} \approx f_{H1} - f_{L1} \approx 16.5\ MHz$” and “**the second frequency range**” of this claim element as “$f_{R2} \approx f_{H2} - f_{L2} \approx 16.5\ MHz$” (see, for example, ¶¶ 287-289 and 309-311 above).

326. Accordingly, a POSITA would understand that either of the “***HT duplicate format***” and “***non-HT duplicate format***” described by IEEE 802.11n D2.0 in view of IEEE 802.11-2007 as summarized herein discloses that “**the sum of one-half the first frequency range and one-half the second frequency range**” is “$\frac{f_{R1}}{2} + \frac{f_{R2}}{2} \approx 16.5\ MHz$”.

327. For example, I noted that a POSITA would understand that either of the “***HT duplicate format***” and “***non-HT duplicate format***” described by IEEE 802.11n D2.0 in view of IEEE 802.11-2007 as summarized herein discloses at least a “**frequency difference between the**

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first center frequency and the second center frequency" of this claim element given by "$f_{c2} - f_{c1} = f_c + 10\ MHz - (f_c - 10\ MHz) = +20\ MHz$" (see, for example, ¶¶ 285-286 and 306-308 above).

328. Accordingly, a POSITA would understand that because "20 MHz" is "**greater than**" "16.5 MHz", then either of the "***HT duplicate format***" and "***non-HT duplicate format***" described by IEEE 802.11n D2.0 in view of IEEE 802.11-2007 as summarized herein discloses all of the additional limitations of this dependent claim.

329. Thus, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious "**The method of claim 1**" (for example, by my analysis for Claim 1) wherein "**frequency difference between the first center frequency and the second center frequency is greater than the sum of one-half the first frequency range and one-half the second frequency range**" (for example, by the 40 MHz HT duplicate or non-HT duplicate format transmission that has its second center frequency higher than its first center frequency by 20 MHz, which is greater than the 16.5 MHz of frequency expanse for the sum of each of its first and second frequency ranges).

330. Therefore, in my opinion, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious the limitations of this claim element.

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‘802 Patent: Claim 3

> 3. The method of claim 1 wherein the first and second information are transmitted using the same power amplifier in said wireless transmitter.

3. The method of claim 1 wherein the first and second information are transmitted using the same power amplifier in said wireless transmitter.

331. In my analysis showing that IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious the limitations of “**The method of claim 1**”, I also provide analysis showing the understanding of a POSITA with respect to the antecedent “**wireless transmitter**” of this dependent claim.

332. More specifically, I note that a POSITA would understand that IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious that “**the first and second information are transmitted**” using the “**same wireless transmitter**” (i.e. “**said wireless transmitter**” of this dependent claim) (see, for example, ¶¶ 315-321 above).

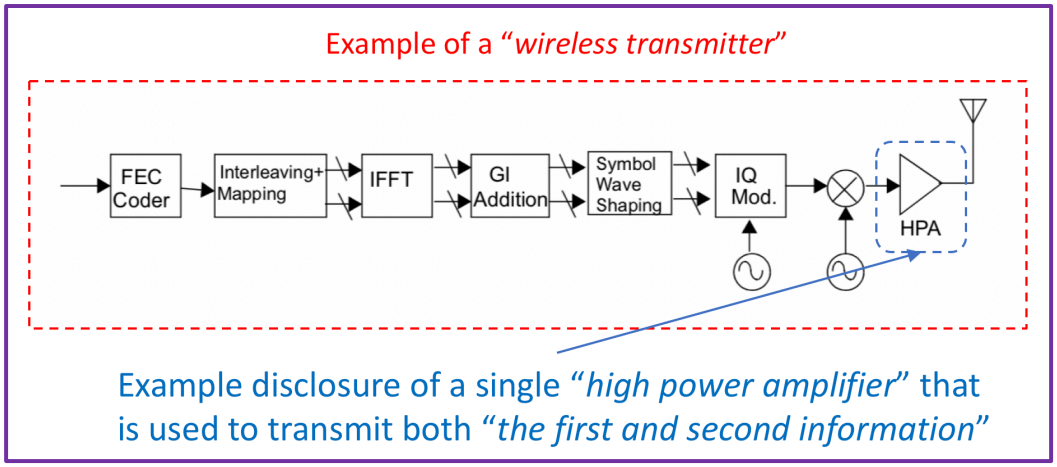
333. In my opinion, a POSITA would further understand that IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious that “**the first and second information are transmitted**” using “**the same power amplifier**” within such “**said wireless transmitter**” for at least the following reasons.

334. First, a POSITA would understand that the “***HT duplicate format***” and “***non-HT duplicate format***” described by IEEE 802.11n D2.0 in view of IEEE 802.11-2007 discloses that both “**the first and second information**” are “**transmitted**” based upon a single composite complex baseband signal that is generated using a complex IFFT structure analogous to that shown within the examples of a “***block diagram***” for a “***transmitter***” at ¶¶ 296-298 above (see, for example, ¶ 318 above).

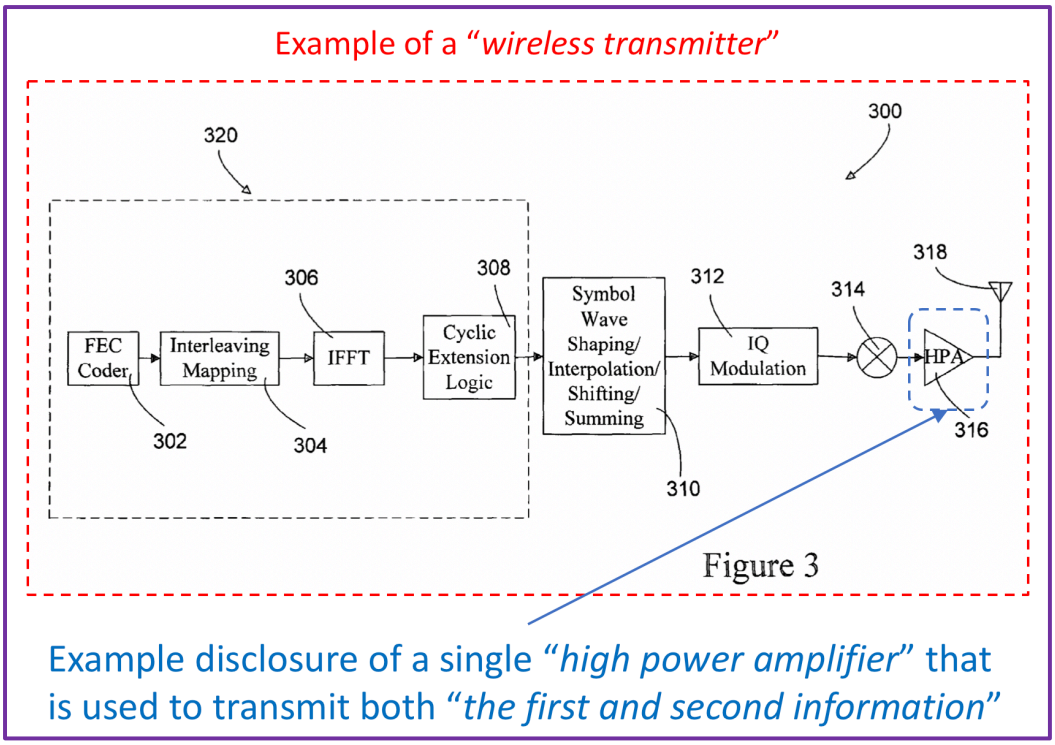
335. Second, the example of a “***block diagram***” for a “***transmitter***” as disclosed specifically by IEEE 802.11n D2.0 in view of IEEE 802.11-2007 (see, for example, ¶ 296 above)

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informs a POSITA that the composite complex baseband signal that a POSITA would understand to correspond with the "***HT duplicate format***" and "***non-HT duplicate format***" of IEEE 802.11n D2.0 would be upconverted and them amplified by one "***HPA***" (or "***high power amplifier***") as shown in annotated Figure 17-12 below (i.e. "**the first and second information are transmitted**" using "**the same power amplifier**" within such "**said wireless transmitter**").



336. Third, the example of a "***block diagram***" for a "***transmitter***" as disclosed by additional prior art at the time of the alleged invention of the '802 Patent (see, for example, ¶ 297 above) also informs a POSITA that the composite complex baseband signal that a POSITA would understand to correspond with the "***HT duplicate format***" and "***non-HT duplicate format***" of IEEE 802.11n D2.0 would be upconverted and them amplified by one "***HPA***" (or "***high power amplifier***") as shown in annotated FIG. 3 below (i.e. "**the first and second information are transmitted**" using "**the same power amplifier**" within such "**said wireless transmitter**").



337. Fourth, the example of a "***block diagram***" for a "***transmitter***" as disclosed by at least contemporaneous art at the time of the alleged invention of the '802 Patent (see, for example, ¶ 298 above) also informs a POSITA that the composite complex baseband signal that a POSITA would understand to correspond with the "***HT duplicate format***" and "***non-HT duplicate format***" of IEEE 802.11n D2.0 would be "*converted to analog* with a DAC, which is then *followed by an up-converter to RF* and a *power amplifier*" (or "***PA***") (see, for example, ¶ 194 above) as shown in annotated Figure 4.8 below (i.e. "**the first and second information are transmitted**" using "**the same power amplifier**" within such "**said wireless transmitter**").

Example of a "*wireless transmitter*"

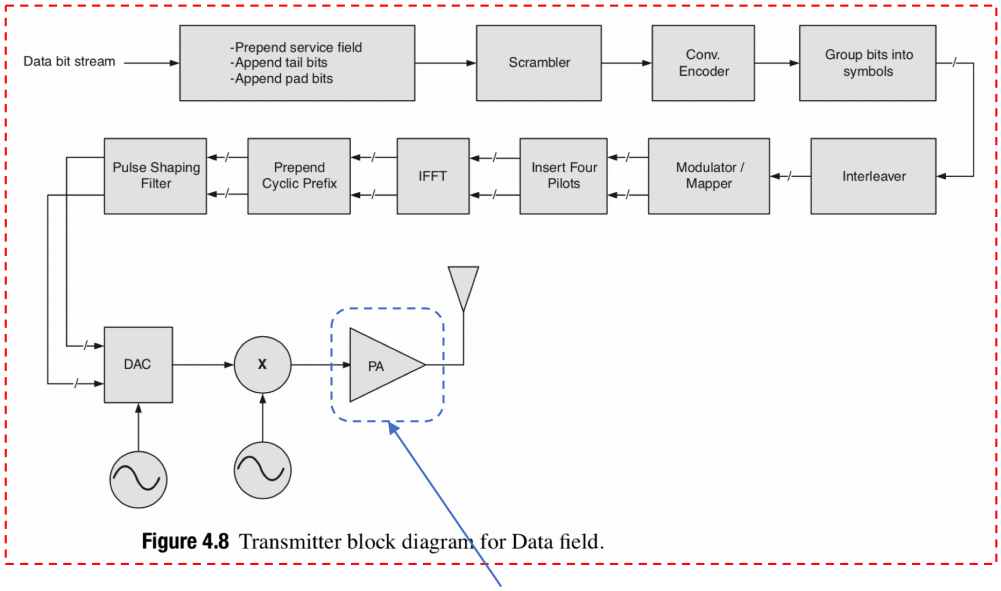


Figure 4.8 Transmitter block diagram for Data field.

Example disclosure of a single "*power amplifier*" that is used to transmit both "*the first and second information*"

338. Fifth, a POSITA would have known from at least contemporaneous art at the time of the alleged invention of the '802 Patent that since 2004 "*40 MHz devices could be produced at almost the same cost as 20 MHz devices*" at least when "Typically, a *40 MHz device* is designed with the *same output power* to maintain the *same cost as a 20 MHz device*" (see, for example, ¶¶ 174 and 202 above), thereby further informing a POSITA of both the desirability of and the high expectation of success for using "**the same power amplifier**" within such "**said wireless transmitter**" with which "**the first and second information are transmitted**".

339. Thus, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious "**The method of claim 1**" (for example, by my analysis for Claim 1) wherein "**the first and second information are transmitted using the same power amplifier in said wireless transmitter**" (for example, when the 40 MHz HT duplicate or non-HT duplicate format signals are transmitted by a single high power amplifier within an exemplary block diagram of a transmitter).

340. Therefore, in my opinion, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious the limitations of this claim element.

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‘802 Patent: Claim 4

> 4. The method of claim 3 wherein the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency.

4. The method of claim 3 wherein the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency.

341. My analysis herein shows that IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious the limitations of “**The method of claim 3**”.

342. Additionally, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious the limitation “**wherein the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency**” of this dependent claim for at least the following reasons.

343. First, a POSITA would understand that using “**the same power amplifier**” within a “**wireless transmitter**” with which “**the first and second information are transmitted**” for the “***HT duplicate format***” and “***non-HT duplicate format***” of IEEE 802.11n D2.0 means that the RF signals being amplified by the “**same power amplifier**” (i.e. the “***HPA***” or “***PA***”) in the exemplary “***block diagrams***” for a “***transmitter***” (see, for example, ¶¶ 335-337 above) includes at least the frequency expanse spanning “**the difference between the first lowest frequency and the second highest frequency**”, which by my analysis for Claim 1 herein is given by “$f_{H2} - f_{L1} \approx (f_c + 18.125\ MHz) - (f_c - 18.125\ MHz) \approx 36.25 MHz$” (see, for example, ¶¶ 287 and 310 above).

344. Accordingly, it would have been obvious to a POSITA to select the “***HPA***” or “***PA***” with a “**bandwidth**” that is “**greater than the difference between the first lowest frequency and the second highest frequency**” so that such RF signals are not unacceptably distorted in the frequency domain.

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345. Second, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 discloses specific requirements for the "**wireless transmitter**" with which "**the first and second information are transmitted**" for the "***HT duplicate format***" and "***non-HT duplicate format***" that inform a POSITA of this need to use a "**power amplifier**" with a "**bandwidth**" that is "**greater than the difference between the first lowest frequency and the second highest frequency**".

346. For example, IEEE 802.11n D2.0 requires for "*Spectral flatness*" that "In *HT duplicate* format and *non-HT duplicate* format the *average energy of the constellations* in *each of the spectral lines* -42 to -33, -31 to -6, +6 to +31, and +33 to +42 *shall deviate no more than* ± 2 dB from their average energy" while "The *average energy of the constellations* in *each of the spectral lines* -43 to -58 and +43 to +58 *shall deviate no more than* +2/-4 dB from the average energy of spectral lines -42 to -33, -31 to -6, +6 to +31, and +33 to +42" (see, for example, ¶ 110 above).

347. In contrast, IEEE 802.11-2007 also recites for "*Transmitter spectral flatness*" that "The *average energy of the constellations in each of the spectral lines* –16.. –1 and +1.. +16 will *deviate no more than ± 2 dB* from their average energy" while "The *average energy of the constellations in each of the spectral lines* –26.. –17 and +17.. +26 will *deviate no more than +2/–4 dB* from the average energy of spectral lines –16.. –1 and +1.. +16" (see, for example, ¶ 160 above).

348. Accordingly, it would have been obvious to a POSITA to select the "***HPA***" or "***PA***" with a "**bandwidth**" that is "**greater than the difference between the first lowest frequency and the second highest frequency**" for the 40 MHz wide "***HT duplicate format***" and "***non-HT duplicate format***" of IEEE 802.11n D2.0 at least because if a "***HPA***" or "***PA***" with a "**bandwidth**" appropriate only to meet the minimum requirements for the 20 MHz format of

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IEEE 802.11-2007 were used, then at least the "***average energy of the constellations***" in approximately half "***of the spectral lines***" would not meet the minimum requirements for the 40 MHz wide "***HT duplicate format***" and "***non-HT duplicate format***" of IEEE 802.11n D2.0.

349. Third, a POSITA would understand that at the time of the alleged invention of the '802 Patent that it was known to use an "***HPA***" or "***PA***" with a "**bandwidth**" that is "**greater than the difference between the first lowest frequency and the second highest frequency**" for the 40 MHz wide "***HT duplicate format***" and "***non-HT duplicate format***" of IEEE 802.11n D2.0 as disclosed in the art (see, for example, ¶¶ 194-195, 222-225 and 229-234 above), thereby further informing a POSITA of both the desirability of and the high expectation of success for using an "***HPA***" or "***PA***" with a "**bandwidth**" that is "**greater than the difference between the first lowest frequency and the second highest frequency**".

350. Thus, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious "**The method of claim 3**" (for example, by my analysis for Claim 3) wherein "**the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency**" (for example, when the 40 MHz HT duplicate or non-HT duplicate format signals are transmitted by a single high power amplifier with a bandwidth of at least approximately 40 MHz within an exemplary block diagram of a transmitter).

351. Therefore, in my opinion, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious the limitations of this claim element.

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'802 Patent: Claim 5

> 5. The method of claim 1 further comprising concurrently changing the first center frequency to a third center frequency and the second center frequency to a fourth center frequency, wherein the fourth center frequency is greater than the third center frequency, and wherein the first center frequency changes by at least the first frequency range and the second center frequency changes by at least the second frequency range, and wherein the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency for the changed first and second center frequencies.

5. The method of claim 1 further comprising concurrently changing the first center frequency to a third center frequency and the second center frequency to a fourth center frequency, wherein the fourth center frequency is greater than the third center frequency, and wherein the first center frequency changes by at least the first frequency range and the second center frequency changes by at least the second frequency range, and wherein the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency for the changed first and second center frequencies.

352. My analysis herein shows that IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious the limitations of "**The method of claim 1**".

353. Additionally, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious the additional limitations of "**concurrently changing the first center frequency to a third center frequency and the second center frequency to a fourth center frequency**" of this dependent claim for at least the following reasons.

354. First, IEEE 802.11n D2.0 specifies that "*Channel center frequencies* are defined at every integral multiple of 5 MHz above 5 GHz" wherein "The *relationship between center frequency and channel number* is given by" Equation (20-88) where "$n_{ch} = 0, 1, \ldots, 200$" and "Channel starting frequency" is "defined as 5 GHz" for operation in the USA (see, for example, ¶ 107 above, Eq. (20-88) as reproduced below).

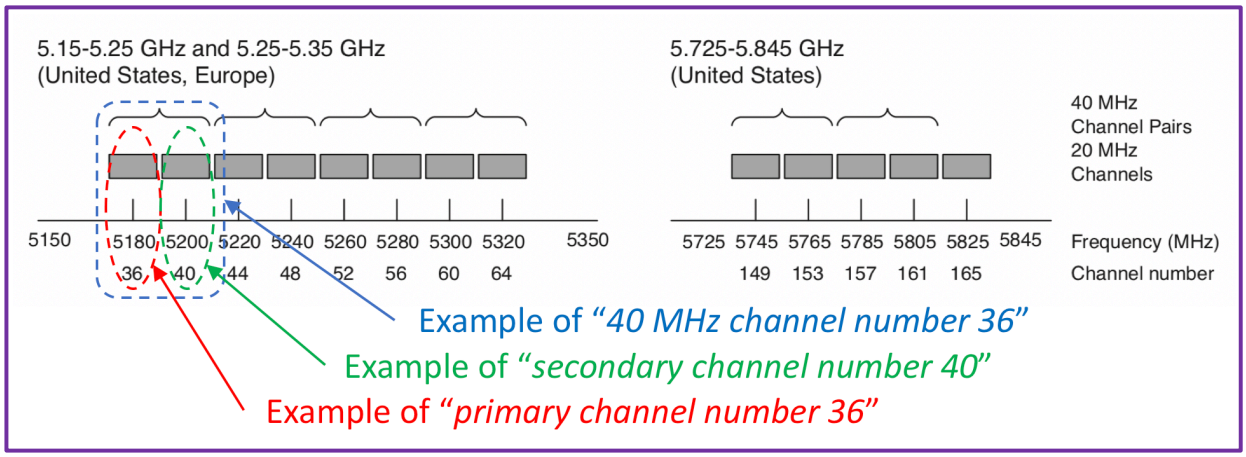
$$\text{Channel center frequency} = \text{Channel starting frequency} + 5 \times n_{ch}(\text{MHz})$$

355. Additionally, IEEE 802.11n D2.0 teaches that "The *40 MHz channels are specified by two fields*: (Nprimary_ch, Secondary)" wherein "The *first field represents the channel number* of the *primary channel*, and the *second one indicates whether the secondary*

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channel is above or below the primary channel (1 -> above, -1 -> below)" and thus "The secondary channel number shall be Nprimary_ch + Secondary*4" (see, for example, ¶ 108 above).

356. For example, IEEE 802.11n D2.0 recites that "a *40 MHz channel* consisting of *40 MHz channel number 36* and Secondary 1 *specifies the primary channel is 36 and the secondary channel is 40*" (see, for example, ¶ 109 above) and a POSITA would understand that this specific example from IEEE 802.11n D2.0 is understood by the following annotated figure from at least contemporaneous art (see, for example, ¶ 205 above) at the time of the alleged invention of the '802 Patent:



357. Second, IEEE 802.11n D2.0 recites that "The *maximum allowable transmit power* by regulatory domain is *defined in Annex I*" wherein this Annex I of IEEE 802.11-2007 specifies "*Transmit power level* by regulatory domain" in Table I.4 which lists at least the "*Frequency Band*" of 5150-5350 MHz shown in the annotated figure above (see, for example, ¶¶ 111 and 161 above).

358. Third, IEEE 802.11-2007 discloses that "The *Channel Switch Announcement* element is used by an AP in a BSS or a STA in an IBSS to advertise *when it is changing to a new channel and the channel number of the new channel*" wherein "Figure 10-6 depicts the

management *process for a channel switch using a Channel Switch Announcement frame*" (see, for example, ¶ 136 above).

359. Fourth, additional art at the time of the alleged invention of the '802 Patent explains that IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA further informs that such a "***process for a channel switch using a Channel Switch Announcement frame***" is applicable specifically for "***40 MHz channels***" within the "***Frequency Band***" of 5150-5350 MHz.

360. For example, at the time of the alleged invention of the '802 Patent "a *mechanism for moving a BSS to a different channel*" and "a *procedure for performing the channel switch*" was known to a POSITA that would "handle the *channel pairing used to create 40 MHz channels*" using IEEE 802.11 protocols (see, for example, ¶¶ 206-207 above).

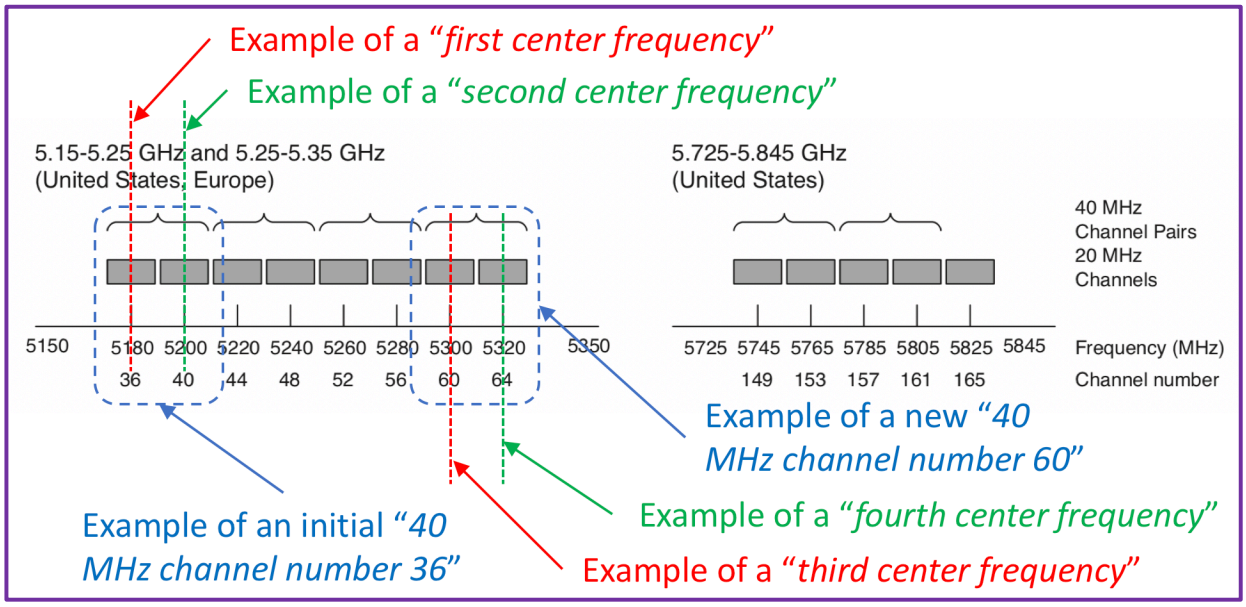
361. Fifth, a POSITA would have been highly motivated to apply the disclosures of IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA specifically to "***a channel switch***" for "***40 MHz channels***" within at least the "***Frequency Band***" of 5150-5350 MHz because a POSITA would have known from at least contemporaneous art at the time of the alleged invention of the '802 Patent that when an access point (or "AP") "*detects significant traffic from neighboring BSSs on the secondary channel*, or *significant traffic on the primary channel*" then such AP can "*move the BSS to a channel pair with less traffic*" wherein this "*decision to switch channels is made by the AP* and the AP should *select a new channel* that is *supported by all associated stations*" (see, for example, ¶ 208 above), thereby advantageously avoiding such interfering "***traffic***".

362. Sixth, a POSITA would have had an expectation of success in performing such "***a channel switch***" for "***40 MHz channels***" within at least the "***Frequency Band***" of 5150-5350

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MHz because a POSITA would have known that the "***process for a channel switch***" is described by interoperable wireless protocols including IEEE 802.11n D2.0 and IEEE 802.11-2007 (see, for example, ¶¶ 107-109, 158, 161 and 205-208 above).

363. Accordingly, a POSITA would have understood that "***a channel switch***" described by IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA for "***40 MHz channels***" within the "***Frequency Band***" of 5150-5350 MHz would include at least "**concurrently changing**" (i.e. "***switch[ing]***") both the "**first center frequency**" (e.g. the initial "***primary channel***" such as "***36***") and "**second center frequency**" (e.g. the initial "***secondary channel***" such as "***40***") to a respective "**third center frequency**" (e.g. a new "***primary channel***" such as "***60***") and "**fourth center frequency**" (e.g. a new "***secondary channel***" such as "***64***") for the 40 MHz wide "***HT duplicate format***" and "***non-HT duplicate format***" of IEEE 802.11n D2.0 as shown by the following annotated figure from at least contemporaneous art (see, for example, ¶ 205 above) at the time of the alleged invention of the '802 Patent:



364. Thus, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious at least the recited additional limitation of "**concurrently changing the**

first center frequency to a third center frequency and the second center frequency to a fourth center frequency".

365. Additionally, for the example described herein where an AP can "***move the BSS to a channel pair with less traffic***" such as the depicted "***channel switch***" from an initial "***40 MHz channel number 36***" to an exemplary new "***40 MHz channel number 60***" at ¶ 363 above, then a POSITA would understand that the new "***secondary channel***" (i.e. the "**fourth center frequency**") has channel number 64 (or 5320 MHz) which is higher (i.e. "**greater than**") the new "***primary channel***" (i.e. the "**third center frequency**") has channel number 60 (or 5300 MHz). Note that a POSITA would further understand that after a "***channel switch***" that such "**fourth center frequency**" would also be higher than such "**third center frequency**" for any valid "***40 MHz channel number***" within at least the "***Frequency Band***" of 5150-5350 MHz with "***Secondary 1***" as applied to 40 MHz wide "***HT duplicate format***" and "***non-HT duplicate format***" of IEEE 802.11n D2.0.

366. Thus, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA also renders obvious at least the recited additional limitation of "**wherein the fourth center frequency is greater than the third center frequency**".

367. Moreover, for the example described herein where an AP can "***move the BSS to a channel pair with less traffic***" such as the depicted "***channel switch***" from an initial "***40 MHz channel number 36***" to an exemplary new "***40 MHz channel number 60***" at ¶ 363 above, then a POSITA would understand that the exemplary initial "***primary channel 36***" (i.e. the "**first center frequency**") is "***switch[ed]***" (i.e. "**changes**") by 120 MHz to the exemplary new "***primary channel 60***", and always at least by 40 MHz for any non-overlapping new one of the "***40 MHz channels***", which is always larger than the "**first frequency range**" (i.e. "**by at least**

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the first frequency range" of approximately 16.5 MHz as described in my analysis for Claim 1 (see, for example, ¶¶ 287-289 above).

368. Similarly, for the example described herein where an AP can "***move the BSS to a channel pair with less traffic***" such as the depicted "***channel switch***" from an initial "***40 MHz channel number 36***" to an exemplary new "***40 MHz channel number 60***" at ¶ 363 above, then a POSITA would understand that the exemplary initial "***secondary channel 40***" (i.e. the "**second center frequency**") is "***switch[ed]***" (i.e. "**changes**") by 120 MHz to the exemplary new "***secondary channel 64***", and always at least by 40 MHz for any non-overlapping new one of the "***40 MHz channels***", which is always larger than the "**second frequency range**" (i.e. "**by at least the second frequency range**" of approximately 16.5 MHz as described in my analysis for Claim 1 (see, for example, ¶¶ 309-311 above).

369. Thus, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA further renders obvious at least the recited additional limitation of "**wherein the first center frequency changes by at least the first frequency range and the second center frequency changes by at least the second frequency range**".

370. Finally, a POSITA would understand that for the 40 MHz wide "***HT duplicate format***" and "***non-HT duplicate format***" of IEEE 802.11n D2.0 that "**the difference between the first lowest frequency and the second highest frequency**" is always $36.25\ MHz$ (see, for example, ¶ 343 above) independent of which new one of the "***40 MHz channels***" that corresponds to "**the changed first and second center frequencies**" (see, for example, ¶ 363 above).

371. Accordingly, my Claim 3 analysis also shows that IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious at least the recited

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additional limitation of "**wherein the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency for the changed first and second center frequencies**".

372. To the extent that Patent Owner (or its expert(s)) alleges that the meaning of the claim term "**difference between the first lowest frequency and the second highest frequency for the changed first and second center frequencies**" must encompass effectively the entire RF band (e.g. approximately 200 MHz for the 5150-5350 MHz band), then it is still my opinion that IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious at least the recited additional limitation of "**wherein the bandwidth of said power amplifier is greater than**" such entire RF band at least because multiple exemplars of a "**power amplifier**" with a "**bandwidth**" that "**is greater than**" such entire RF band were commonly known at the time of the alleged invention of the '802 Patent.

373. For example, when I was Chief Technology Officer of Proxim (see, for example, ¶ 13 above), we introduced the world's first WLAN products based upon both IEEE 802.11a at 5 GHz and the use of 40 MHz wide channels over the 5150-5350 MHz band with a single power amplifier that had a bandwidth exceeding that of the 5150-5350 MHz band in 2001. A POSITA would have known that such products with 40 MHz wide channels over the 5150-5350 MHz band with a single power amplifier that had a bandwidth exceeding that of the 5150-5350 MHz band were subsequently introduced by multiple companies (see, for example, ¶¶ 174 and 195 above) prior to the time of the alleged invention of the '802 Patent.

374. However, I do not believe that a POSITA would understand the plain and ordinary meaning of the claim term "**difference between the first lowest frequency and the second highest frequency for the changed first and second center frequencies**" to recite such

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an entire RF band limitation at least because no such disclaimer appears in the intrinsic record and the words of the claim itself restrict the "**difference between the first lowest frequency and the second highest frequency**" to that of only the instant "**changed first and second center frequencies**" as opposed to all possible "**first and second center frequencies**" that the recited "**method of transmitting**" might be "**changed**" to.

375. Thus, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious "**The method of claim 1**" (for example, by my analysis for Claim 1) further comprising "**concurrently changing the first center frequency to a third center frequency and the second center frequency to a fourth center frequency**" (for example, when the 40 MHz HT duplicate or non-HT duplicate format signals are transmitted initially at 40 MHz channel 36 and then subsequently switched to a new 40 MHz channel 60), wherein "**the fourth center frequency is greater than the third center frequency**" (for example, when 40 MHz HT duplicate or non-HT duplicate format signals are transmitted at new 40 MHz channel 60), and wherein "**the first center frequency changes by at least the first frequency range and the second center frequency changes by at least the second frequency range**" (for example, when 40 MHz HT duplicate or non-HT duplicate format signals are transmitted at new 40 MHz channel 60 then the first center frequency and second center frequency each change by 120 MHz, and always by at least 40 MHz, which is greater than the 16.5 MHz first and second frequency ranges), and wherein "**the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency for the changed first and second center frequencies**" (for example, when the 40 MHz HT duplicate or non-HT duplicate format signals are transmitted by a single high power amplifier with a

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bandwidth of at least approximately 40 MHz, or alternatively covering at least the 5150-5350 MHz band, within an exemplary block diagram of a transmitter).

376. Therefore, in my opinion, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious the limitations of this claim element.

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‘802 Patent: Claim 6

> 6. The method of claim 1 wherein the first information corresponds to a first wireless protocol and the second information corresponds to a second wireless protocol.

6. The method of claim 1 wherein the first information corresponds to a first wireless protocol and the second information corresponds to a second wireless protocol.

377. My analysis herein shows that IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious the limitations of “**The method of claim 1**”.

378. Additionally, my analysis for Claim 1 herein shows that the antecedent “**first information**” (i.e. complex number modulation values, $D_{k,n}$, for data subcarriers k at symbol number n) within either of the “***HT duplicate format***” and “***non-HT duplicate format***” of IEEE 802.11n D2.0 is applied to the ensemble OFDM symbol by multiplication of $D_{k,n}$ for each respective data subcarrier k with each respective complex baseband rotator term in the forms $\exp\left(j2\pi(k-32)\Delta_F(t-nT_{SYM}-T_{GI})\right)$ or $\exp\left(j2\pi(k-32)\Delta_F\left(t-nT_{SYM}-T_{GI}-T_{CS}^{i_{TX}}\right)\right)$ (i.e. “**corresponds to a first wireless protocol**”) (see, for example, ¶¶ 196-201 and 279-281 above).

379. Similarly, my analysis for Claim 1 herein shows that the antecedent “**second information**” (i.e. complex number modulation values, $D_{k,n}$, for data subcarriers k at symbol number n) within either of the “***HT duplicate format***” and “***non-HT duplicate format***” of IEEE 802.11n D2.0 is applied to the ensemble OFDM symbol by multiplication of $D_{k,n}$ for each respective data subcarrier k with each respective complex baseband rotator term in the forms $j\exp\left(j2\pi(k+32)\Delta_F(t-nT_{SYM}-T_{GI})\right)$ or $j\exp\left(j2\pi(k+32)\Delta_F\left(t-nT_{SYM}-T_{GI}-T_{CS}^{i_{TX}}\right)\right)$ (i.e. “**corresponds to a second wireless protocol**”) (see, for example, ¶¶ 196-201 and 279-281 above).

380. Thus, a POSITA would understand that for either of the “***HT duplicate format***” and “***non-HT duplicate format***” of IEEE 802.11n D2.0 that application of such “**first wireless**

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protocol" causes transmission of an ensemble OFDM symbol with a "**first center frequency**" at $f_{c1} = f_c - 10\ MHz$ and with a complex amplitude for each respective data subcarrier k given by the corresponding $D_{k,n}$.

381. However, a POSITA would further understand that for either of the "***HT duplicate format***" and "***non-HT duplicate format***" of IEEE 802.11n D2.0 that application of such "**second wireless protocol**" causes transmission of an ensemble OFDM symbol with a "**second center frequency**" at $f_{c2} = f_c + 10\ MHz$ and with a complex amplitude for each respective data subcarrier k given by the combination of the corresponding $D_{k,n}$ and an additional 90° rotation of each subcarrier as indicated by the additional "j" in the amplitude value for each respective complex baseband rotator term.

382. Accordingly, a POSITA would understand that such a "**second wireless protocol**" is different from such a "**first wireless protocol**".

383. Alternatively, a POSITA would understand that at least for the "***non-HT duplicate format***" of IEEE 802.11n D2.0 that the ensemble OFDM modulation disclosed for the antecedent "**first information**" (i.e. complex number modulation values, $D_{k,n}$, for data subcarriers k at symbol number n) over the antecedent "**first frequency range**" is identical to that disclosed by Clause 17 of IEEE 802.11-2007 or IEEE 802.11a-1999 (i.e. the "**first wireless protocol**", as also re-used for the "IEEE 802.11g-2003 protocol", which the '802 Patent specifically cites as an example of a "**wireless protocol**" per ¶ 63 above) when applied to the same frequency channel (i.e. the "***lower 20 MHz portions of 40 MHz signal***") for a single transmit chain (see, for example, ¶¶ 92, 94, 101, 104, 137-140, 150-156, 197 and 201 above).

384. However, a POSITA would further understand that the ensemble OFDM modulation disclosed for the antecedent "**second information**" over the antecedent "**second**

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frequency range" differs even when applied to the same frequency channel (i.e. the "***upper 20 MHz portions of 40 MHz signal***") for a single transmit chain at least because the "***upper channel (higher frequency) is rotated by +90º relative to the lower channel***" as specifically defined by IEEE 802.11n D2.0 (i.e. the "**second wireless protocol**") in contrast to that disclosed by Clause 17 of IEEE 802.11-2007 or IEEE 802.11a-1999 (i.e. the "**first wireless protocol**") (see, for example, ¶¶ 92, 94, 101, 104, 137-140, 150-156, 197 and 201 above).

385. In my opinion, a POSITA would understand that IEEE 802.11n D2.0 (i.e. the "**second wireless protocol**") is different than Clause 17 of IEEE 802.11-2007 or IEEE 802.11a-1999 (i.e. the "**first wireless protocol**").

386. Thus, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious "**The method of claim 1**" (for example, by my analysis for Claim 1) wherein "**the first information corresponds to a first wireless protocol and the second information corresponds to a second wireless protocol**" (for example, when the 40 MHz HT duplicate or non-HT duplicate format signals are transmitted with complex amplitudes given by $D_{k,n}$ for a first frequency range centered at $f_{c1} = f_c - 10\ MHz$ such as according to the IEEE 802.11a protocol disclosed in IEEE 802.11-2007 and with complex amplitudes given by $jD_{k,n}$ for a second frequency range centered at $f_{c2} = f_c + 10\ MHz$ according to the IEEE 802.11n D2.0 protocol).

387. Therefore, in my opinion, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious the limitations of this claim element.

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‘802 Patent: Claim 7

> 7. The method of claim 1 wherein the first information and the second information are the same data transmitted across two different frequencies.

7. The method of claim 1 wherein the first information and the second information are the same data transmitted across two different frequencies.

388. My analysis herein shows that IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious the limitations of “**The method of claim 1**”.

389. Additionally, my analysis for Claim 1 herein shows that the antecedent “**first information**” and “**second information**” (i.e. complex number modulation values, $D_{k,n}$, for data subcarriers k at symbol number n) within either of the “***HT duplicate format***” and “***non-HT duplicate format***” of IEEE 802.11n D2.0 are simultaneously complex rotated by the terms $\exp\left(j2\pi(k-32)\Delta_F(t-nT_{SYM}-T_{GI})\right)$ or $\exp\left(j2\pi(k-32)\Delta_F\left(t-nT_{SYM}-T_{GI}-T_{CS}^{i_{TX}}\right)\right)$ and $j\exp\left(j2\pi(k+32)\Delta_F(t-nT_{SYM}-T_{GI})\right)$ or $j\exp\left(j2\pi(k+32)\Delta_F\left(t-nT_{SYM}-T_{GI}-T_{CS}^{i_{TX}}\right)\right)$ (i.e. “**are the same data transmitted across two different frequencies**”) wherein a POSITA would understand that such “**two different frequencies**” are defined by the difference between “$-32\Delta_F$” and “$+32\Delta_F$”, or thus by “$64\Delta_F$”, which for “$\Delta_F = 312.5\ kHz$” is $20\ MHz$ (see, for example, ¶¶ 196-201, 279-281 and 302-305 above).

390. Accordingly, a POSITA would understand that for either of the “***HT duplicate format***” and “***non-HT duplicate format***” of IEEE 802.11n D2.0 that application of such complex number modulation values, $D_{k,n}$, to both a first frequency range centered at $f_{c1} = f_c - 10\ MHz$ and a second frequency range centered at $f_{c2} = f_c + 10\ MHz$ discloses that “**the first information and the second information are the same data**” and furthermore that when simultaneously mapped to respective subcarriers that are separated by $64\Delta_F$ or $20\ MHz$ then such “**same data**” is “**transmitted across two different frequencies**”.

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391. Thus, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious "**The method of claim 1**" (for example, by my analysis for Claim 1) wherein "**the first information and the second information are the same data transmitted across two different frequencies**" (for example, when the 40 MHz HT duplicate or non-HT duplicate format signals are transmitted with complex amplitudes derived from the same $D_{k,n}$ for both a first frequency range centered at $f_{c1} = f_c - 10\ MHz$ and a second frequency range centered at $f_{c2} = f_c + 10\ MHz$).

392. Therefore, in my opinion, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious the limitations of this claim element.

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‘802 Patent: Claim 8

> 8. The method of claim 1 wherein the first information and the second information are from the same data stream.

8. The method of claim 1 wherein the first information and the second information are from the same data stream.

393. My analysis herein shows that IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious the limitations of “**The method of claim 1**”.

394. My analysis herein shows that IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious the additional limitations of dependent Claim 7 which recites at least that “**the first information and the second information are the same data**”.

395. Accordingly, a POSITA would understand that when “**the first information and the second information are the same data**” then this also discloses and/or renders obvious the additional limitations of this dependent Claim 8 that “**the first information and the second information are from the same data stream**”.

396. Thus, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious “**The method of claim 1**” (for example, by my analysis for Claim 1) wherein “**the first information and the second information are from the same data stream**” (for example, when the 40 MHz HT duplicate or non-HT duplicate format signals are transmitted with complex amplitudes derived from the same $D_{k,n}$ for both a first frequency range centered at $f_{c1} = f_c - 10\ MHz$ and a second frequency range centered at $f_{c2} = f_c + 10\ MHz$).

397. Therefore, in my opinion, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious the limitations of this claim element.

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‘802 Patent: Claim 9

> 9. The method of claim 1 wherein first information and second information comprise a plurality of OFDM symbols, wherein a first symbol is transmitted during a first time slot across the first frequency range and a second symbol is transmitted during the first time slot across the second frequency range, and wherein a third symbol is transmitted during a second time slot across the first frequency range and a fourth symbol is transmitted during the second time slot across a second frequency range.

9. The method of claim 1 wherein first information and second information comprise a plurality of OFDM symbols, wherein a first symbol is transmitted during a first time slot across the first frequency range and a second symbol is transmitted during the first time slot across the second frequency range, and wherein a third symbol is transmitted during a second time slot across the first frequency range and a fourth symbol is transmitted during the second time slot across a second frequency range.

398. My analysis herein shows that IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious the limitations of “**The method of claim 1**”.

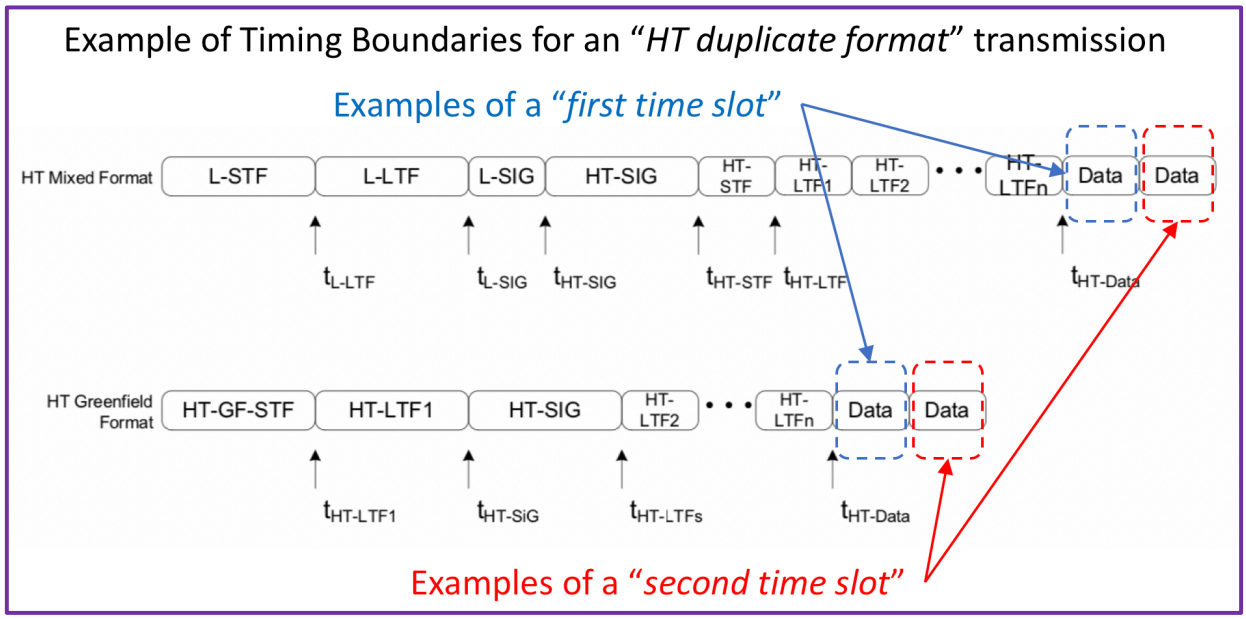
399. Additionally, my analysis for Claim 1 herein shows that the antecedent “**first information**” and “**second information**” (i.e. complex number modulation values, $D_{k,n}$, for data subcarriers k at symbol number n) within either of the “***HT duplicate format***” and “***non-HT duplicate format***” of IEEE 802.11n D2.0 are simultaneously composed into a “**first frequency range**” ensemble OFDM symbol summed across the data subcarriers k and centered at $f_{c1} = f_c - 10\ MHz$ and into a “**second frequency range**” ensemble OFDM symbol summed across the data subcarriers k and centered at $f_{c2} = f_c + 10\ MHz$ (see, for example, ¶¶ 196-201, 279-281 and 302-305 above).

400. Moreover, a POSITA would understand that for either of the “***HT duplicate format***” with MCS of 32 and “***non-HT duplicate format***” at its usual lowest modulation and coding scheme used for management or control frames of IEEE 802.11n D2.0, then the number of data bits per ensemble OFDM symbol is 24 (or 8 for the first Data field OFDM symbol which includes the Service field) but the Data frame size in bits is generally greater than 24 and thus

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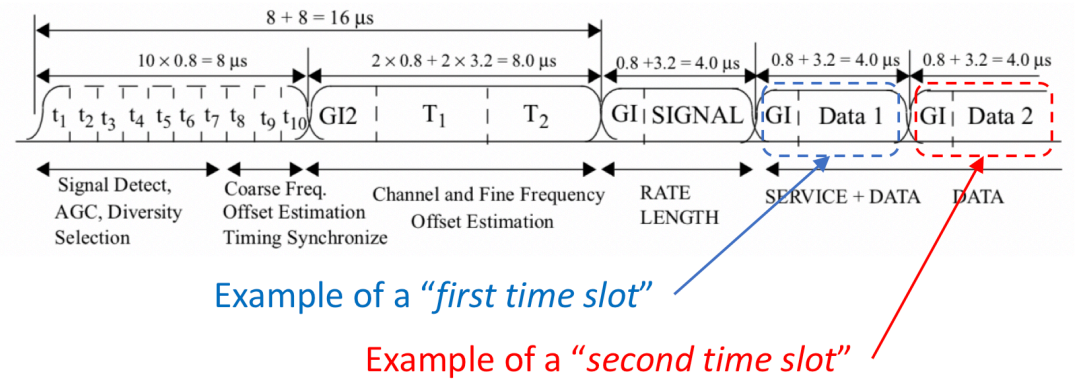
generally $N_{SYM} \geq 2$ (i.e. "**first information and second information comprise a plurality of OFDM symbols**") (see, for example, ¶¶ 102-105, 149, 152, 156 and 201 above).

401. For example, for the "***HT duplicate format***" with MCS of 32, a POSITA would understand that IEEE 802.11n D2.0 teaches that multiple ensemble OFDM symbols are transmitted in the time domain, each corresponding to a symbol time, T_{SYM} (of typically 4 μs), as shown in annotated Figure n65 below (see, for example, ¶ 98 above).



402. For example, for the "***non-HT duplicate format***", a POSITA would understand that IEEE 802.11n D2.0 in view of IEEE 802.11-2007 teaches that multiple ensemble OFDM symbols are transmitted in the time domain, each corresponding to a symbol time, T_{SYM} (of 4 μs), as shown in annotated Figure 17-4 below (see, for example, ¶¶ 119 and 149 above).

Example of Timing Boundaries for an "*non-HT duplicate format*" transmission



403. In my opinion, a POSITA would understand that for IEEE 802.11n D2.0 in view of IEEE 802.11-2007 that each OFDM symbol time of typically $T_{SYM} = 4\ \mu s$ would correspond to a "**time slot**" during which such OFDM symbol "**is transmitted**".

404. Accordingly, a POSITA would also understand, as I have summarized for Claim 1 herein, that for the examples of a "**first time slot**" shown at ¶¶ 401-402 above for either the "***HT duplicate format***" or "***non-HT duplicate format***" of IEEE 802.11n D2.0 in view of IEEE 802.11-2007 that both "**a first symbol is transmitted … across the first frequency range**" (i.e. by the ensemble OFDM symbol composed over a "**first frequency range**" shifted by "$-32\Delta_F$" and centered at $f_{c1} = f_c - 10\ MHz$ such as for the symbol index $n = 0$ in ¶¶ 279-280 above) and "**a second symbol is transmitted … across the second frequency range**" (i.e. by the ensemble OFDM symbol composed over a "**second frequency range**" shifted by "$+32\Delta_F$" and centered at $f_{c2} = f_c + 10\ MHz$ such as for the symbol index $n = 0$ in ¶¶ 279-280 above) are disclosed as being "**transmitted during the first time slot**" (i.e. for the $T_{SYM} = 4\ \mu s$ when $n = 0$).

405. Similarly, a POSITA would also understand, as I have summarized for Claim 1 herein, that for the examples of a "**second time slot**" shown at ¶¶ 401-402 above for either the

"***HT duplicate format***" or "***non-HT duplicate format***" of IEEE 802.11n D2.0 in view of IEEE 802.11-2007 that both "**a third symbol is transmitted … across the first frequency range**" (i.e. by the ensemble OFDM symbol composed over a "**first frequency range**" shifted by "$-32\Delta_F$" and centered at $f_{c1} = f_c - 10\ MHz$ such as for the symbol index $n = 1$ in ¶¶ 279-280 above) and "**a fourth symbol is transmitted … across the second frequency range**" (i.e. by the ensemble OFDM symbol composed over a "**second frequency range**" shifted by "$+32\Delta_F$" and centered at $f_{c2} = f_c + 10\ MHz$ such as for the symbol index $n = 1$ in ¶¶ 279-280 above) are disclosed as being "**transmitted during the second time slot**" (i.e. for the $T_{SYM} = 4\ \mu s$ when $n = 1$).

406. Thus, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious "**The method of claim 1**" (for example, by my analysis for Claim 1) wherein "**first information and second information comprise a plurality of OFDM symbols**" (for example, when the 40 MHz HT duplicate or non-HT duplicate format signals are transmitted with a Data field with $N_{SYM} \geq 2$), wherein "**a first symbol is transmitted during a first time slot across the first frequency range and a second symbol is transmitted during the first time slot across the second frequency range**" (for example, by the 40 MHz HT duplicate or non-HT duplicate format signals when the OFDM symbol composed over a first frequency range centered at $f_{c1} = f_c - 10\ MHz$ and corresponding to symbol index $n = 0$ and the OFDM symbol composed over a second frequency range centered at $f_{c2} = f_c + 10\ MHz$ and corresponding to symbol index $n = 0$ are both transmitted simultaneously during a first 4 μs period of time), and wherein "**a third symbol is transmitted during a second time slot across the first frequency range and a fourth symbol is transmitted during the second time slot across a second frequency range**" (for example, by the 40 MHz HT duplicate or non-HT

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duplicate format signals when the OFDM symbol composed over a first frequency range centered at $f_{c1} = f_c - 10\ MHz$ and corresponding to symbol index $n = 1$ and the OFDM symbol composed over a second frequency range centered at $f_{c2} = f_c + 10\ MHz$ and corresponding to symbol index $n = 1$ are both transmitted simultaneously during a second 4 μs period of time).

407. Therefore, in my opinion, IEEE 802.11n D2.0 in view of IEEE 802.11-2007 and the knowledge of a POSITA renders obvious the limitations of this claim element.

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IX. OBVIOUSNESS OF THE '802 PATENT UNDER 35 U.S.C. § 103 DUE TO SHEARER

408. In my opinion, Shearer and the knowledge of a POSITA renders obvious at least Claims 1-4 and 9 of the '802 Patent for at least the reasons described herein.

409. Shearer is analogous art to the '802 Patent (see ¶ 217 above).

410. A general overview of Shearer is given at ¶¶ 211-240 above.

411. My specific analyses of Shearer and the knowledge of a POSITA, with respect to the challenged claims of the '802 Patent is given herein.

412. Note that for purposes of my analysis herein that I have provided subsection headings for claim elements in the form "1(a)", "1(b)", etc. for the convenience of the reader even though such headings do not exist in the actual '802 Patent claims themselves.

‘802 Patent: Claim 1

> 1. A method of transmitting information in a wireless communication channel comprising:
>
> (a) transmitting first information across a first frequency range using a wireless transmitter, the first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency; and
>
> (b) simultaneously transmitting second information across a second frequency range using the same wireless transmitter, the second frequency range having a second center frequency greater than the first center frequency, a second highest frequency, and a second lowest frequency.

1. A method of transmitting information in a wireless communication channel comprising:

413. In my opinion, this preamble claim element expresses no limitations.

414. However, I have considered that this preamble claim element may be limiting.

415. For example, Shearer discloses “a *transmitter* for an 802.11 device” to “*operate in the 5 GHz band*” wherein “a PHY unit **300** includes an *orthogonal frequency division multiplex (OFDM) transmit kernel* **320**, a *symbol wave shaper/interpolator/shifter/summer* (accumulator, assimilator) **310**, an *IQ modulator* **312**, a *mixer* **314**, *high power amplifier (HPA)* **316**, and *antenna* **318**” (see, for example, ¶¶ 219 and 222 above).

416. More specifically, Shearer teaches “a *40 MHz packet's subcarrier structure* matching the subcarrier structure of *two 20 MHz 802.11a/g OFDM packets*” thereby “increasing the *bandwidth by a factor of 2*” when “*two 20 MHz 802.11a input signals are received at the PHY* unit **300** from FIG. 3 substantially *simultaneously*” wherein “The *two signals are processed separately*, one in a *lower 20 MHz path* and one in an *upper 20 MHz path*” (see, for example, ¶¶ 230 and 233 above).

417. In my opinion, a POSITA would understand that such disclosure in Shearer of “***input signals***” to a “***transmitter***” using “***802.11a/g OFDM***” (i.e. a “**method of transmitting information**”) with a “***lower 20 MHz path***” and an “***upper 20 MHz path***” to “***operate in the 5 GHz band***” (i.e. “**in a wireless communication channel**”) as summarized herein would at least constitute a “**method of transmitting information in a wireless communication channel**”.

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418. Thus, Shearer discloses a "**method of transmitting information in a wireless communication channel**" (for example, by transmitting data in two adjacent 20 MHz channels at 5 GHz using at least the IEEE 802.11a/g formats in each of an upper path and a lower path).

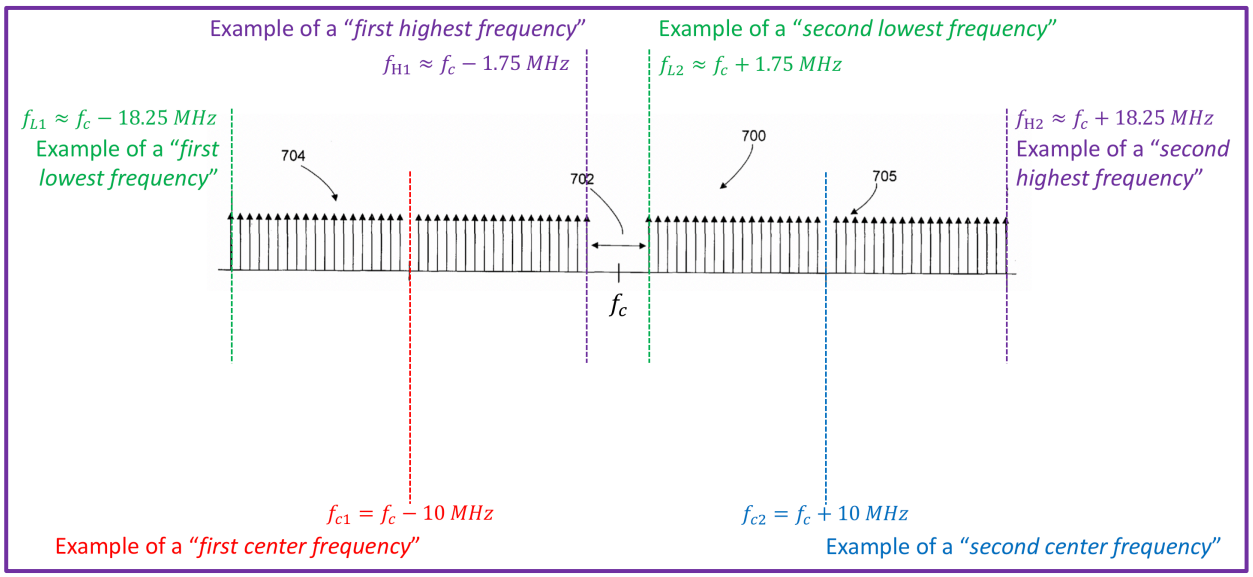
419. Therefore, in my opinion, Shearer and the knowledge of a POSITA renders obvious the limitations of this claim element, if any.

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1(a) transmitting first information across a first frequency range using a wireless transmitter, the first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency;

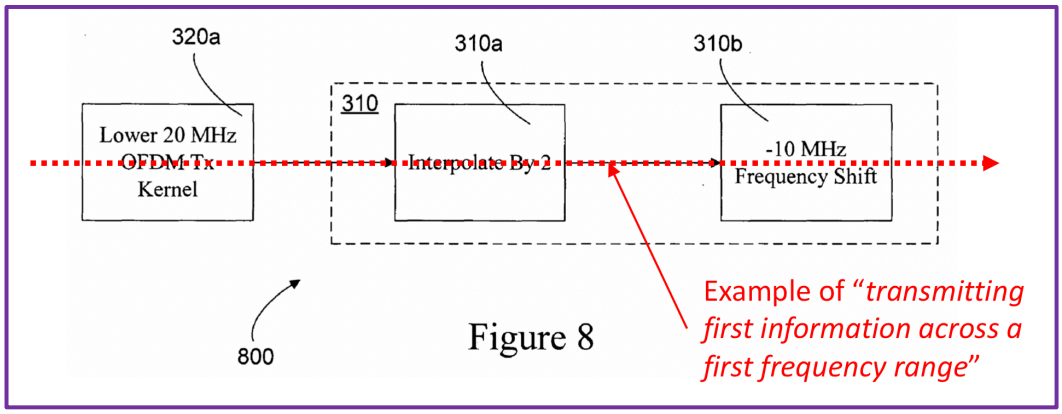
420. Shearer describes that for "an IEEE 802.11a or IEEE 802.11g OFDM signal, a packet **400** within *each 20 MHz channel has fifty-two (52) subcarriers*" but "the *packet is 20 MHz wide because* that is the *span of the 64 points in the IFFT*" even though "the *active (populated) subcarriers span* a spectrum somewhat *less than 20 MHz wide*, *about 16.5 MHz*" wherein "*Twenty-six* (26) active subcarriers are *spectrally less than zero* (DC), and *26 active subcarriers* are *spectrally greater than zero*" (see, for example, ¶¶ 226-228 above).

421. Shearer teaches that "Waveform **700** provides a *40 MHz packet's subcarrier structure* matching the subcarrier structure of *two 20 MHz 802.11a/g OFDM packets*" wherein the respective "*center frequencies* are *spaced by 10 MHz*" and there is an *11 subcarrier gap* **702** between the packets" (see, for example, ¶¶ 230-231 above, annotated FIG. 7 shown below).



422. Shearer further teaches that "*two 20 MHz 802.11a input signals are received at the PHY*" such that "The *two signals are processed separately*, one in a *lower 20 MHz path* and one in an *upper 20 MHz path*" that "corresponds to shaper/interpolator/shifter/summer **310** of

FIG. 3" wherein for this "*lower 20 MHz path* **800**" then "*One of the inputs* is first *processed by the lower 20 MHz OFDM transmit kernel* **320a**" followed by "an *interpolation stage* **310a**" wherein "the *interpolation factor is 2*", and then "The output of interpolation stage **310a** is then *shifted down by 10 MHz at frequency shift stage* **310b**" by "*multiplying the sample* by $e^{j2\pi f_{shift}t}$, where f_{shift} is the *amount of desired frequency shift*" (see, for example, ¶¶ 233-234 above, annotated FIG. 8 shown below).



423. Accordingly, a POSITA would understand that for the "***transmitter***" of Shearer that the first "***802.11a input signal***" being "***processed separately***" in the "***lower 20 MHz path***" discloses at least "**transmitting first information across a first frequency range**".

424. Additionally, a POSITA would understand that as illustrated by annotated FIG. 7 and FIG. 8 of Shearer that the "***lower 20 MHz path***" has a "***center frequency***" that is "***shifted down by 10 MHz***" (i.e. a "**first center frequency**" shown as "$f_{c1} = f_c - 10\ MHz$") and its "***active (populated) subcarriers span a spectrum***" of "***about 16.5 MHz***" (i.e. a "**first frequency range**") with "***26 active subcarriers***" that are "***spectrally greater than zero***" (i.e. a "**first highest frequency**" shown as "$f_{H1} \approx f_c - 1.75\ MHz$") and with "***Twenty-six (26) active subcarriers***" that are "***spectrally less than zero***" (i.e. a "**first lowest frequency**" shown as "$f_{L1} \approx f_c - 18.25\ MHz$").

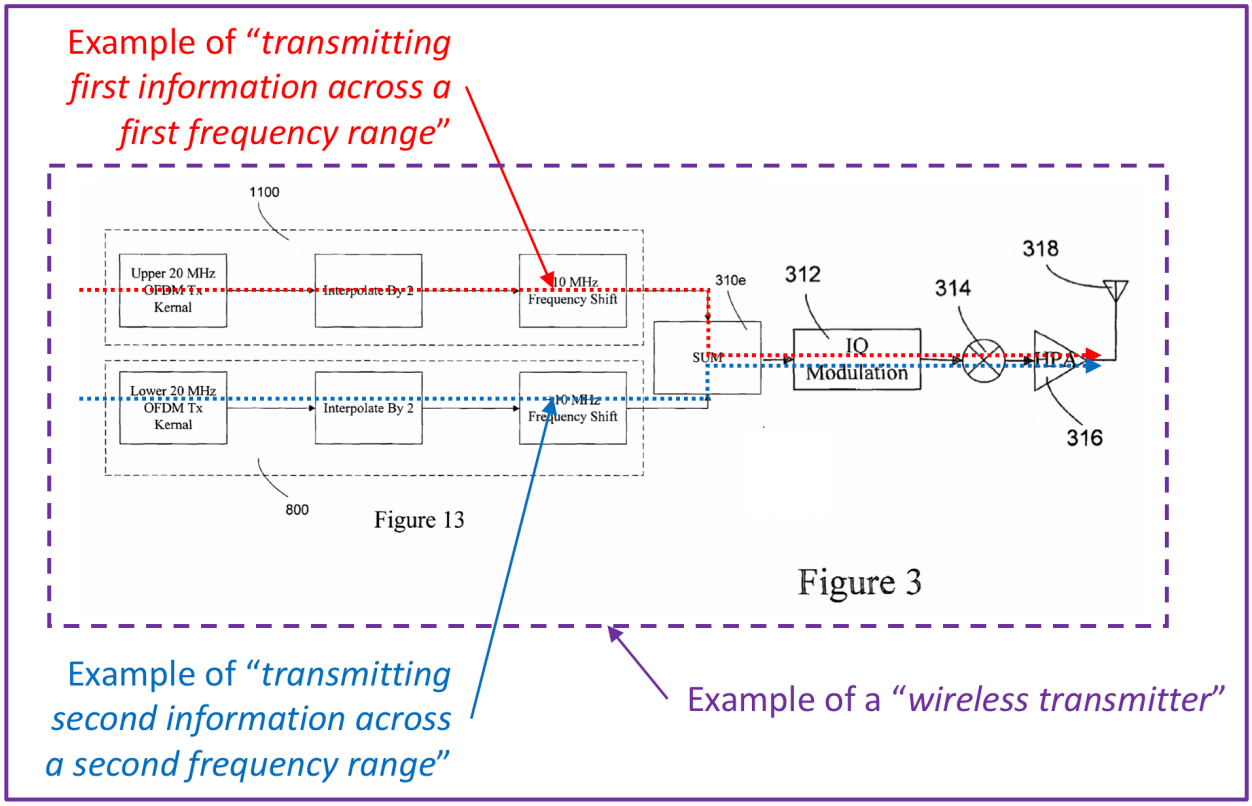
425. Shearer discloses "a *transmitter* for an 802.11 device" to "*operate in the 5 GHz band*" wherein "a PHY unit **300** includes an *orthogonal frequency division multiplex (OFDM) transmit kernel* **320**, a *symbol wave shaper/interpolator/shifter/summer* (accumulator, assimilator) **310**, an *IQ modulator* **312**, a *mixer* **314**, *high power amplifier (HPA)* **316**, and *antenna* **318**" (see, for example, ¶¶ 219 and 222 above).

426. More specifically, Shearer teaches that "*two 20 MHz 802.11a input signals are received at the PHY* unit **300** from FIG. 3 substantially *simultaneously*" wherein "FIG. 13 presents an exemplary *embodiment with 2 signal paths*, *upper path* **1100** and *lower path* **800**, *each processing a 20 MHz 802.11a input signal* substantially *simultaneously*" (see, for example, ¶¶ 233 and 236 above).

427. Additionally, Shearer teaches in reference to FIG. 3 that "The output of *symbol wave shaper/interpolator/shifter/summer* **310** is *sent to modulator* **312**" and that subsequently "The *output of the modulator* **312** is *sent to mixer* **314** where it is *upconverted to the desired transmit frequency*" so that "the upconverted signal is *amplified in high powered amplifier (HPA)* **316** and *sent to antenna* **318** for *transmission*" (see, for example, ¶ 225 above).

428. Accordingly, a POSITA would understand that Shearer discloses "***simultaneously***" transmitting "***two 20 MHz 802.11a input signals***" as a "***40 MHz packet's subcarrier structure matching the subcarrier structure of two 20 MHz 802.11a/g OFDM packets***" that are "***upconverted***" for operation "***in the 5 GHz band***" using a "***transmitter***" wherein such "***two signals are processed separately, one in a lower 20 MHz path and one in an upper 20 MHz path***" (see, for example, ¶¶ 219-225 and 229-236 above, annotated combination of FIG. 3 and FIG. 13 shown below).

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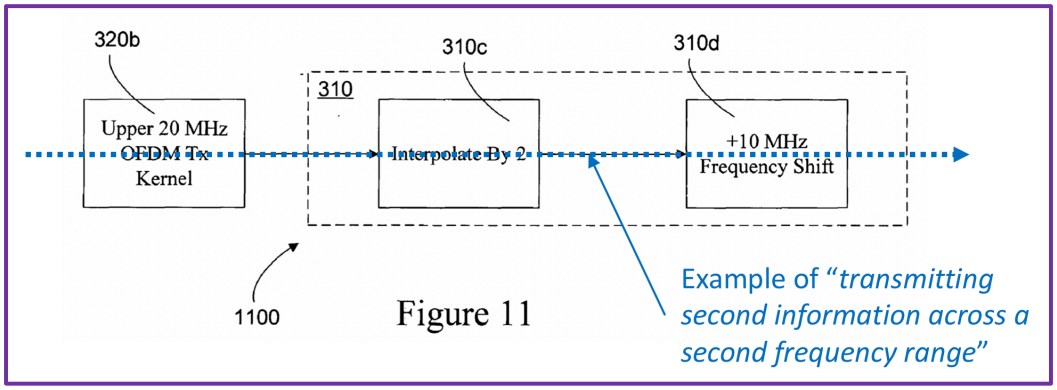
429. Thus, Shearer and the knowledge of a POSITA renders obvious "**transmitting first information across a first frequency range using a wireless transmitter**" (for example, when transmitting using a disclosed transmitter block diagram with a lower 20 MHz path that corresponds to a first 802.11a input signal that is upconverted to operate at 5 GHz), with such "**first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency**" (for example, when the waveform for the lower 20 MHz path has a lowest frequency of $f_{L1} \approx f_c - 18.25\ MHz$, a highest frequency of $f_{H1} \approx f_c - 1.75\ MHz$, and a center frequency of $f_{c1} = f_c - 10\ MHz$).

430. Therefore, in my opinion, Shearer and the knowledge of a POSITA renders obvious the limitations of this claim element.

1(b) simultaneously transmitting second information across a second frequency range using the same wireless transmitter, the second frequency range having a second center frequency greater than the first center frequency, a second highest frequency, and a second lowest frequency.

431. See ¶¶ 420-428 above from my analysis of claim element 1(a), which summarizes exemplary disclosures of Shearer and the knowledge of a POSITA and which I incorporate herein for my analysis of this claim element 1(b).

432. For example, Shearer also describes an "*upper 20 MHz path* **1100**" shown at FIG. 11 wherein "output of interpolation stage **310c** is then *shifted up by 10 MHz at frequency shift stage* **310d**" that is analogous to my description of the "***lower 20 MHz path***" for my analysis of claim element 1(a) (see, for example, ¶¶ 233-235 above, annotated FIG. 11 shown below).



433. Accordingly, a POSITA would understand that for the "***transmitter***" of Shearer that the second "***802.11a input signal***" being "***processed separately***" in the "***upper 20 MHz path***" discloses at least "**transmitting second information across a second frequency range**", and as noted above that such "**transmitting second information**" is performed "***simultaneously***" (i.e. "**simultaneously transmitting second information**") with the recited disclosure of "**transmitting first information**" per my analysis of claim element 1(a) herein.

434. Additionally, a POSITA would understand that as illustrated by annotated FIG. 7 and FIG. 11 of Shearer that the "***upper 20 MHz path***" has a "***center frequency***" that is "***shifted***

up by 10 MHz" (i.e. a "**second center frequency**" shown as "$f_{c2} = f_c + 10\ MHz$") and its "***active (populated) subcarriers span a spectrum***" of "***about 16.5 MHz***" (i.e. a "**second frequency range**") with "***26 active subcarriers***" that are "***spectrally greater than zero***" (i.e. a "**second highest frequency**" shown as "$f_{H2} \approx f_c + 18.25\ MHz$") and with "***Twenty-six (26) active subcarriers***" that are "***spectrally less than zero***" (i.e. a "**second lowest frequency**" shown as "$f_{L2} \approx f_c + 1.75\ MHz$").

435. Furthermore, a POSITA would understand that such "***center frequency***" that is "***shifted up by 10 MHz***" (i.e. a "**second center frequency**" shown as "$f_{c2} = f_c + 10\ MHz$") for the "***upper 20 MHz path***" is necessarily also "**greater than**" such "***center frequency***" that is "***shifted down by 10 MHz***" (i.e. a "**first center frequency**" shown as "$f_{c1} = f_c - 10\ MHz$") for the "***lower 20 MHz path***" of Shearer.

436. In my opinion, a POSITA would have known that the disclosure of "**transmitting second information across a second frequency range**" having "**a second center frequency greater than the first center frequency, a second highest frequency, and a second lowest frequency**" as described by Shearer as summarized above would specifically be performed at least "**using the same wireless transmitter**" as I showed for my analysis of claim element 1(a) at ¶¶ 425-428 above.

437. Thus, Shearer and the knowledge of a POSITA renders obvious "**simultaneously transmitting second information across a second frequency range using the same wireless transmitter**" (for example, when simultaneously transmitting using a disclosed transmitter block diagram with an upper 20 MHz path that corresponds to a second 802.11a input signal that is upconverted to operate at 5 GHz as well as the lower 20 MHz path that corresponds to the first 802.11a input signal), with such "**second frequency range having a second center frequency**

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greater than the first center frequency, a second highest frequency, and a second lowest frequency" (for example, when the waveform for the upper 20 MHz path has a lowest frequency of $f_{L2} \approx f_c + 1.75\ MHz$, a highest frequency of $f_{H2} \approx f_c + 18.25\ MHz$, and a center frequency of $f_{c2} = f_c + 10\ MHz$, such second center frequency necessarily higher than the disclosed first center frequency by $20\ MHz$).

438. Therefore, in my opinion, Shearer and the knowledge of a POSITA renders obvious the limitations of this claim element.

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‘802 Patent: Claim 2

> 2. The method of claim 1 wherein frequency difference between the first center frequency and the second center frequency is greater than the sum of one-half the first frequency range and one-half the second frequency range.

2. The method of claim 1 wherein frequency difference between the first center frequency and the second center frequency is greater than the sum of one-half the first frequency range and one-half the second frequency range.

439. In my analysis showing that Shearer and the knowledge of a POSITA renders obvious the limitations of “**The method of claim 1**”, I also provide analysis sufficient to show that the additional limitations of “**wherein frequency difference between the first center frequency and the second center frequency is greater than the sum of one-half the first frequency range and one-half the second frequency range**” are disclosed by Shearer.

440. For example, I noted that a POSITA would understand that the “***40 MHz packet's subcarrier structure matching the subcarrier structure of two 20 MHz 802.11a/g OFDM packets***” as summarized herein for Shearer discloses at least “**the first frequency range**” of this claim element as “$f_{R1} \approx f_{H1} - f_{L1} \approx 16.5\ MHz$” and “**the second frequency range**” of this claim element as “$f_{R2} \approx f_{H2} - f_{L2} \approx 16.5\ MHz$” (see, for example, ¶¶ 424 and 434 above).

441. Accordingly, a POSITA would understand that the “***40 MHz packet's subcarrier structure matching the subcarrier structure of two 20 MHz 802.11a/g OFDM packets***” as summarized herein for Shearer discloses that “**the sum of one-half the first frequency range and one-half the second frequency range**” is “$\frac{f_{R1}}{2} + \frac{f_{R2}}{2} \approx 16.5\ MHz$”.

442. For example, I noted that a POSITA would understand that the “***40 MHz packet's subcarrier structure matching the subcarrier structure of two 20 MHz 802.11a/g OFDM packets***” as summarized herein for Shearer discloses at least a “**frequency difference between the first center frequency and the second center frequency**” of this claim element given by

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"$f_{c2} - f_{c1} = f_c + 10\ MHz - (f_c - 10\ MHz) = +20\ MHz$" (see, for example, ¶¶ 424 and 434 above).

443. Accordingly, a POSITA would understand that because "20 MHz" is "**greater than**" "16.5 MHz", then the "***40 MHz packet's subcarrier structure matching the subcarrier structure of two 20 MHz 802.11a/g OFDM packets***" as summarized herein for Shearer discloses all of the additional limitations of this dependent claim.

444. Thus, Shearer and the knowledge of a POSITA renders obvious "**The method of claim 1**" (for example, by my analysis for Claim 1) wherein "**frequency difference between the first center frequency and the second center frequency is greater than the sum of one-half the first frequency range and one-half the second frequency range**" (for example, by the 40 MHz subcarrier structure that has its second center frequency higher than its first center frequency by 20 MHz, which is greater than the 16.5 MHz of frequency expanse for the sum of each of its first and second frequency ranges).

445. Therefore, in my opinion, Shearer and the knowledge of a POSITA renders obvious the limitations of this claim element.

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‘802 Patent: Claim 3

> 3. The method of claim 1 wherein the first and second information are transmitted using the same power amplifier in said wireless transmitter.

3. The method of claim 1 wherein the first and second information are transmitted using the same power amplifier in said wireless transmitter.

446. In my analysis showing that Shearer and the knowledge of a POSITA renders obvious the limitations of "**The method of claim 1**", I also provide analysis showing the understanding of a POSITA with respect to the antecedent "**wireless transmitter**" of this dependent claim.

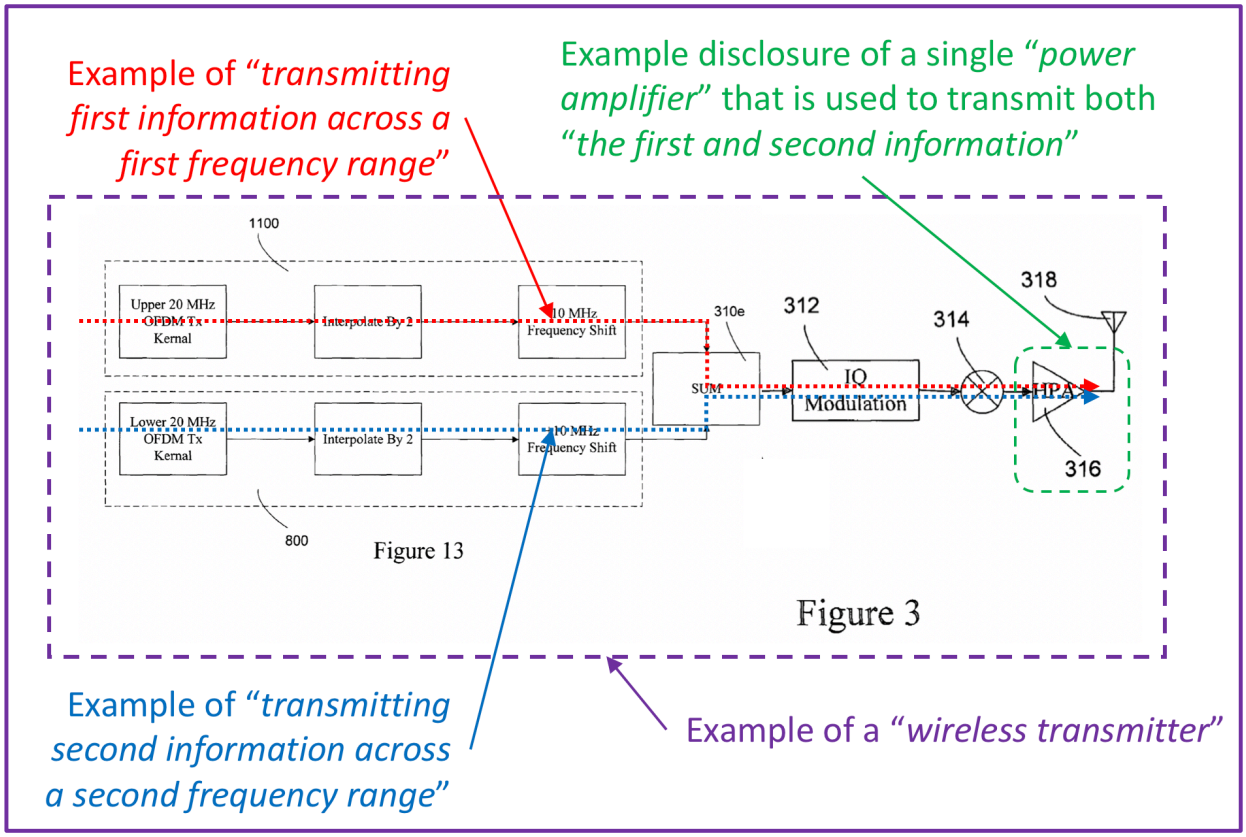
447. More specifically, I note that a POSITA would understand that Shearer and the knowledge of a POSITA renders obvious that "**the first and second information are transmitted**" using the "**same wireless transmitter**" (i.e. "**said wireless transmitter**" of this dependent claim) (see, for example, ¶¶ 432-436 above).

448. Shearer teaches in reference to FIG. 3 that "The output of *symbol wave shaper/interpolator/shifter/summer* **310** is *sent to modulator* **312**" and that subsequently "The *output of the modulator* **312** is *sent to mixer* **314** where it is *upconverted to the desired transmit frequency*" so that "the upconverted signal is *amplified in high powered amplifier (HPA)* **316** and *sent to antenna* **318** for *transmission*" (see, for example, ¶ 225 above).

449. Accordingly, a POSITA would understand that Shearer discloses "***simultaneously***" transmitting "***two 20 MHz 802.11a input signals***" as a "***40 MHz packet's subcarrier structure matching the subcarrier structure of two 20 MHz 802.11a/g OFDM packets***" that are "***upconverted***" for operation "***in the 5 GHz band***" using a "***transmitter***" wherein such "***two signals are processed separately, one in a lower 20 MHz path and one in an upper 20 MHz path***" and both such "***signals***" are subsequently "***amplified in high powered***

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amplifier (HPA)* 316 and *sent to antenna* 318 for *transmission" (see, for example, ¶¶ 219-225 and 229-236 above, annotated combination of FIG. 3 and FIG. 13 shown below).



450. Thus, Shearer and the knowledge of a POSITA renders obvious "**The method of claim 1**" (for example, by my analysis for Claim 1) wherein "**the first and second information are transmitted using the same power amplifier in said wireless transmitter**" (for example, when the 40 MHz subcarrier structure comprising both an upper 20 MHz path and a lower 20 MHz path is transmitted by a single high power amplifier within an exemplary block diagram of a transmitter).

451. Therefore, in my opinion, Shearer and the knowledge of a POSITA renders obvious the limitations of this claim element.

‘802 Patent: Claim 4

> 4. The method of claim 3 wherein the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency.

4. The method of claim 3 wherein the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency.

452. My analysis herein shows that Shearer and the knowledge of a POSITA renders obvious the limitations of “**The method of claim 3**”.

453. Although Shearer does not explicitly disclose a “**bandwidth**” for the disclosed “**same power amplifier in said wireless transmitter**” by which the disclosed “**first and second information are transmitted**”, I believe that Shearer and the knowledge of a POSITA renders obvious the limitation “**wherein the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency**” of this dependent claim for at least the following reasons.

454. First, a POSITA would understand that using “**the same power amplifier**” within a “**wireless transmitter**” when “***simultaneously***” transmitting “***two 20 MHz 802.11a input signals***” as a “***40 MHz packet's subcarrier structure matching the subcarrier structure of two 20 MHz 802.11a/g OFDM packets***” per Shearer means that the RF signals being amplified by the “**same power amplifier**” (i.e. the “***high powered amplifier (HPA)* 316**” noted at ¶ 449 above) includes at least the frequency expanse spanning “**the difference between the first lowest frequency and the second highest frequency**”, which by my analysis for Claim 1 herein is given by “$f_{H2} - f_{L1} \approx (f_c + 18.25\ MHz) - (f_c - 18.25\ MHz) \approx 36.5 MHz$” (see, for example, ¶¶ 424 and 434 above).

455. Accordingly, it would have been obvious to a POSITA to select the “***high powered amplifier (HPA)* 316**” of Shearer with a “**bandwidth**” that is “**greater than the**

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difference between the first lowest frequency and the second highest frequency" so that such RF signals are not unacceptably distorted in the frequency domain.

456. Second, Shearer discloses specific requirements for the "**wireless transmitter**" with which "**the first and second information are transmitted**" for the "***40 MHz packet's subcarrier structure matching the subcarrier structure of two 20 MHz 802.11a/g OFDM packets***" that inform a POSITA of this need to use a "**power amplifier**" with a "**bandwidth**" that is "**greater than the difference between the first lowest frequency and the second highest frequency**".

457. For example, Shearer teaches that "*40 MHz packets* reuse the *20 MHz IEEE 802.11a/g preamble subcarrier definition*" and thus to "implement the *receiver* of a *40 MHz system*", Shearer further teaches that "*legacy sensing circuits*" each of which "includes a *correlator*" for "*detection of the LTS sequence*" are usable for such a "*40 MHz waveform*" by "breaking it down into *20 MHz halves* and *processing each half individually*" such that "the *legacy radio receives what looks like a legacy packet*" which is "sometimes referred to as *spoofing a legacy radio*" (see, for example, ¶¶ 238-240 above).

458. Accordingly, it would have been obvious to a POSITA to select the "***high powered amplifier (HPA)* 316**" of Shearer with a "**bandwidth**" that is "**greater than the difference between the first lowest frequency and the second highest frequency**" for the "***40 MHz packet's subcarrier structure matching the subcarrier structure of two 20 MHz 802.11a/g OFDM packets***" at least because if lesser "**bandwidth**" were used, then the resultant "***20 MHz halves***" that the "***legacy radio receives***" would not be "***what looks like a legacy packet***" as Shearer teaches.

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459. Third, a POSITA would understand that at the time of the alleged invention of the '802 Patent that it was obvious to try the "***high powered amplifier (HPA)* 316**" of Shearer with a "**bandwidth**" that is "**greater than the difference between the first lowest frequency and the second highest frequency**" for the "***40 MHz packet's subcarrier structure matching the subcarrier structure of two 20 MHz 802.11a/g OFDM packets***" at least because there are only effectively two options – i.e. "**greater than the difference**" or "***not* greater than the difference**".

460. At least since a POSITA would understand that choosing the "***high powered amplifier (HPA)* 316**" of Shearer with a "**bandwidth**" that is "**greater than the difference between the first lowest frequency and the second highest frequency**" is predictably compatible with the disclosed goal of Shearer for "***spoofing a legacy radio***", then this also informs a POSITA of both the desirability of and the high expectation of success for choosing the "***high powered amplifier (HPA)* 316**" of Shearer with a "**bandwidth**" that is "**greater than the difference between the first lowest frequency and the second highest frequency**".

461. Thus, Shearer and the knowledge of a POSITA renders obvious "**The method of claim 3**" (for example, by my analysis for Claim 3) wherein "**the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency**" (for example, when the 40 MHz subcarrier structure comprising both an upper 20 MHz path and a lower 20 MHz path is transmitted by a single high power amplifier with a bandwidth of at least approximately 40 MHz within an exemplary block diagram of a transmitter).

462. Therefore, in my opinion, Shearer and the knowledge of a POSITA renders obvious the limitations of this claim element.

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‘802 Patent: Claim 9

> 9. The method of claim 1 wherein first information and second information comprise a plurality of OFDM symbols, wherein a first symbol is transmitted during a first time slot across the first frequency range and a second symbol is transmitted during the first time slot across the second frequency range, and wherein a third symbol is transmitted during a second time slot across the first frequency range and a fourth symbol is transmitted during the second time slot across a second frequency range.

9. The method of claim 1 wherein first information and second information comprise a plurality of OFDM symbols, wherein a first symbol is transmitted during a first time slot across the first frequency range and a second symbol is transmitted during the first time slot across the second frequency range, and wherein a third symbol is transmitted during a second time slot across the first frequency range and a fourth symbol is transmitted during the second time slot across a second frequency range.

463. My analysis herein shows that Shearer and the knowledge of a POSITA renders obvious the limitations of “**The method of claim 1**”.

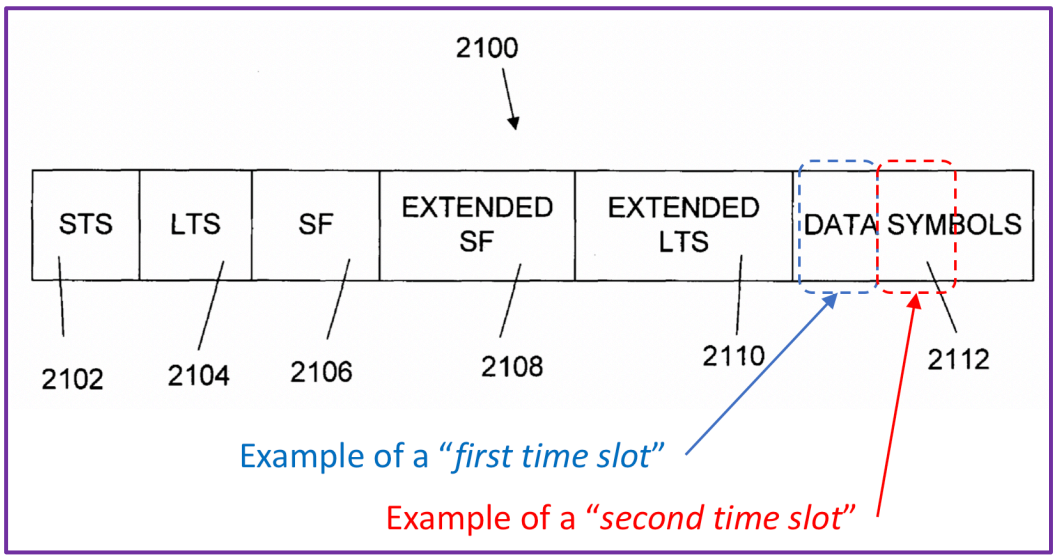
464. Additionally, my analysis for Claim 1 herein shows that the antecedent “**first information**” and “**second information**” (i.e. respective first and second ones of “***two 20 MHz 802.11a input signals***”) within the “***40 MHz packet's subcarrier structure matching the subcarrier structure of two 20 MHz 802.11a/g OFDM packets***” are simultaneously composed into a “**first frequency range**” ensemble OFDM symbol summed across the first group of “***fifty-two (52) subcarriers***” and centered at $f_{c1} = f_c - 10\ MHz$ and into a “**second frequency range**” ensemble OFDM symbol summed across the second group of “***fifty-two (52) subcarriers***” and centered at $f_{c2} = f_c + 10\ MHz$ (see, for example, ¶¶ 420-428 and 431-436 above).

465. Shearer discloses as an example of the “***40 MHz packet's subcarrier structure matching the subcarrier structure of two 20 MHz 802.11a/g OFDM packets***” a “*mixed-mode packet*, which has the *spectrally aligned* *legacy preamble/header* **2102**, **2104**, **2106**, the *extended header* **2108**, **2110**, and *data symbols* **2112**” (see, for example, ¶ 239 above).

466. Moreover, a POSITA would understand that even for the shortest data payload control frames of “***20 MHz 802.11a/g OFDM packets***”, then the number of such “***data symbols***”

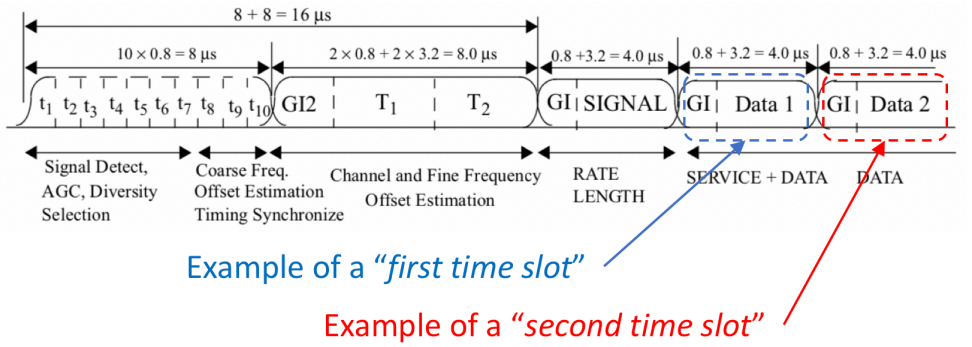
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would necessarily be greater than two as shown below for annotated FIG. 21 of Shearer (see, for example, ¶ 239 above).



467. For example, a POSITA would understand that these "***20 MHz 802.11a/g OFDM packets***" disclosed in Shearer necessarily have multiple ensemble OFDM symbols that are transmitted in the time domain, each corresponding to a symbol time, T_{SYM} (of 4 μs), as shown in annotated Figure 110 below of IEEE 802.11a-1999 (see, for example, Ex. 1009 at § 17.3.3).

Example of Timing Boundaries for transmission of "*20 MHz 802.11a/g OFDM packets*"



468. In my opinion, a POSITA would understand that for these "***20 MHz 802.11a/g OFDM packets***" disclosed in Shearer that each OFDM symbol time of typically $T_{SYM} = 4\ \mu s$ would correspond to a "**time slot**" during which such OFDM symbol "**is transmitted**".

469. Accordingly, a POSITA would also understand, as I have summarized for Claim 1 herein, that for the examples of a "**first time slot**" shown above in view of Shearer that both "**a first symbol is transmitted … across the first frequency range**" (i.e. by the ensemble OFDM symbol composed over a "**first frequency range**" shifted by "$-10\ MHz$" and centered at $f_{c1} = f_c - 10\ MHz$) and "**a second symbol is transmitted … across the second frequency range**" (i.e. by the ensemble OFDM symbol composed over a "**second frequency range**" shifted by "$+10\ MHz$" and centered at $f_{c2} = f_c + 10\ MHz$) are disclosed as being "**transmitted during the first time slot**" (i.e. for the first of the disclosed "***data symbols***").

470. Similarly, a POSITA would also understand, as I have summarized for Claim 1 herein, that for the examples of a "**second time slot**" shown above in view of Shearer that both "**a third symbol is transmitted … across the first frequency range**" (i.e. by the ensemble OFDM symbol composed over a "**first frequency range**" shifted by "$-10\ MHz$" and centered at $f_{c1} = f_c - 10\ MHz$) and "**a fourth symbol is transmitted … across the second frequency range**" (i.e. by the ensemble OFDM symbol composed over a "**second frequency range**" shifted by "$+10\ MHz$" and centered at $f_{c2} = f_c + 10\ MHz$) are disclosed as being "**transmitted during the second time slot**" (i.e. for the second of the disclosed "***data symbols***").

471. Thus, Shearer and the knowledge of a POSITA renders obvious "**The method of claim 1**" (for example, by my analysis for Claim 1) wherein "**first information and second information comprise a plurality of OFDM symbols**" (for example, the 40 MHz subcarrier structure comprising both an upper 20 MHz path and a lower 20 MHz path each path comprising a 20 MHz 802.11a/g OFDM packet), wherein "**a first symbol is transmitted during a first time slot across the first frequency range and a second symbol is transmitted during the first time slot across the second frequency range**" (for example, by the 40 MHz subcarrier

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structure comprising both an upper 20 MHz path and a lower 20 MHz path when the OFDM symbol composed over a first frequency range centered at $f_{c1} = f_c - 10\ MHz$ and corresponding to a first data symbol index in time and the OFDM symbol composed over a second frequency range centered at $f_{c2} = f_c + 10\ MHz$ and also corresponding to this first data symbol index in time are both transmitted simultaneously during a first data symbol time period), and wherein "**a third symbol is transmitted during a second time slot across the first frequency range and a fourth symbol is transmitted during the second time slot across a second frequency range**" (for example, by the 40 MHz subcarrier structure comprising both an upper 20 MHz path and a lower 20 MHz path when the OFDM symbol composed over a first frequency range centered at $f_{c1} = f_c - 10\ MHz$ and corresponding to a second data symbol index in time and the OFDM symbol composed over a second frequency range centered at $f_{c2} = f_c + 10\ MHz$ and also corresponding to this second data symbol index in time are both transmitted simultaneously during a second data symbol time period).

472. Therefore, in my opinion, Shearer and the knowledge of a POSITA renders obvious the limitations of this claim element.

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X. CONCLUSION

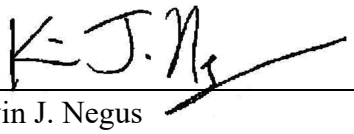
473. In my opinion, the claims of the '802 Patent are invalid for at least the reasons stated above.

474. I reserve the right to supplement my opinions in the future to respond to any arguments raised by Patent Owner or its experts and to take into account new information that becomes available to me.

475. I declare under penalty of perjury that all statements made herein are of my own knowledge and are true and correct and were made with the knowledge that willful false statements are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Respectfully submitted,

Date: March 16, 2024



Kevin J. Negus

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