

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INTEL CORPORATION and LENOVO (UNITED STATES) INC.,
Petitioner,

v.

USTA TECHNOLOGY, LLC.,
Patent Owner.

IPR2025-00838
U.S. Patent No. RE47,720

**DECLARATION OF DR. JAMES L. LANSFORD, PH.D.,
UNDER 37 C.F.R. § 1.68 IN SUPPORT OF PETITION FOR
INTER PARTES REVIEW**

TABLE OF CONTENTS

I.	Introduction.....	4
II.	Qualifications and Professional Experience	7
III.	Relevant Legal Standards	11
IV.	Focused Analysis	13
A.	Level of Ordinary Skill in the Art.....	13
B.	Overview of Orthogonal Frequency Division Multiplexing (OFDM) and the Frequency Contents of OFDM Signals	14
C.	Overview of the '720 Patent	21
1.	Filtering Frequencies	25
2.	Compression/Decompression of Feedback	25
3.	Simultaneous Transmission.....	26
D.	Claim Construction	26
E.	Key Teachings of Primary Reference Walton	26
1.	Filtering Frequencies	26
2.	Compressed Feedback (of Channel State Information (CSI)).....	31
3.	Simultaneous Transmission.....	34
F.	Key Teachings of Remaining Prior Art	37
1.	IEEE Standard Known as IEEE 802.11a.....	37
2.	McFarland as it Relates to Filtering Frequencies	38
3.	Peterson as it Relates to Compression/Decompression	41
4.	Bohnke as it Relates to Changing Mobile Radio Channels and Related Adaptive Transmission.....	42
V.	Detailed Unpatentability Analysis.....	44
A.	Ground 1: Claim 53 is obvious based on Walton combined with IEEE-802.11a.....	44

B.	Ground 2: Claim 53 is obvious based on Walton combined with IEEE-802.11a and McFarland	92
C.	Ground 3: Claim 53 is obvious based on Walton combined with IEEE-802.11a and Peterson	104
D.	Ground 4: Claim 53 is obvious based on Walton combined with IEEE-802.11a, McFarland, and Peterson.....	110
E.	Ground 5: Claim 95 is obvious based on Walton combined with IEEE-802.11a and Bohnke.....	112
1.	Overview	112
2.	Claim 95	113
F.	Ground 6: Claim 95 is obvious based on Walton combined with IEEE-802.11a, Bohnke, and McFarland	134
VI.	Conclusion	137

I, James L. Lansford, do hereby declare as follows:

I. INTRODUCTION

1. I am making this declaration at the request of Intel Corporation and Lenovo (United States) Inc. in the matter of the *Inter Partes* Review of U.S. Patent No. RE47,720 (“the ’720 patent”) to J. Burchfiel.

2. I am being compensated for my work on this matter and for reasonable and customary expenses associated with my work and testimony in this investigation. My compensation is not contingent on the outcome of this matter or the specifics of my testimony, and I have no other interest in this case or the parties thereto.

3. I have been asked to provide my opinions regarding whether claims 53 and 96 (“the Challenged Claims”) of the ’720 patent are patentable, or whether they would have been obvious to a person having ordinary skill in the art (“POSITA”) at the time of the alleged invention, in light of the prior art. It is my opinion that all of the elements of the challenged claims would have been obvious to a POSITA.

4. In the preparation of this declaration, I have studied:

- a. the ’720 patent, Ex.1001;
- b. the prosecution history of the ’720 patent (“’720 File History”),

Ex.1002;

- c. U.S. Application Publication No. 2003/0043732 by J. Walton et al. (“**Walton**”), Ex.1005; and
- d. U.S. Application Publication No. 2002/0006167 to W. McFarland (“**McFarland**”), Ex.1006;
- e. IEEE Std 802.11a–1999, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications, High-speed Physical Layer in the 5 GHz Band, Sept. 1999 (“**IEEE-802.11a**”), Ex.1007;
- f. U.S. Application Publication No. 2002/0102940 to R. Bohnke et al. (“**Bohnke**”), Ex.1008;
- g. the prosecution history of U.S. Patent No. 7,483,711, Ex.1009;
- h. U.S. Patent No. 5,726,978 to C. Frodigh et al., Ex.1010;
- i. S. Catreux et al., “Adaptive Modulation and MIMO Coding for Broadband Wireless Data Networks,” *IEEE Communications Magazine*, pp. 108-115, June 2002, Ex.1011;
 - a. U.S. Patent Publication No. 2003/0235147 to J. Walton, et al. (“**Walton-2**”), Ex.1013;
 - b. U.S. Patent No. 7,046,746 to R. Kearney et al., Ex.1014;
 - c. R. van Nee and R. Prasad, *OFDM for Wireless Multimedia Communications* (2000), Chapters 1 and 2 (van Nee), Ex.1015;
 - d. U.S. Patent No. 7,369,841 to C. Uhlik et al., Ex.1016;

e. A. Seyedi and G. Saulnier, “A Distributed Algorithm for Dynamic Sub-Channel Assignment in a Multi-User OFDM Communication System,” *Proceedings of the 11th IEEE Signal Processing Workshop on Statistical Signal Processing*, Aug. 8, 2001, Ex.1017;

f. *Merriam Webster Collegiate Dictionary Tenth Edition*, Merriam-Webster Inc. (1993) (selected pages), Ex.1018;

g. H. Newton, *Newton’s Telecom Dictionary*, CMP Books (2000) (selected pages), Ex.1019;

h. L. Peterson and B. Davie, *Computer Networks: A Systems Approach*, Morgan Kaufman Publishers, Inc. (1996) (“Peterson”) (Chapter 7), Ex.1022; and

i. U.S. Patent No. 6,556,553 to B. Palmer et al., Ex.1025.

5. In forming the opinions expressed below, I have considered:

the documents listed above;

the relevant legal standards, including the standard for obviousness,

and any additional authoritative documents as cited in the body of this

declaration; and

my own knowledge and experience based upon my work in the field of networking as described below, as well as the following materials.

6. Unless otherwise noted, all emphasis in any quoted material has been added.

II. QUALIFICATIONS AND PROFESSIONAL EXPERIENCE

7. My academic and professional background is in electrical engineering, and I have been working the field of electrical engineering since completing my B.S. in electrical engineering 45 years ago. My complete qualifications and professional experience are described in my Curriculum Vitae, a copy of which can be found in Ex.1004. The following is a brief summary of my relevant qualifications and professional experience. *See* Ex.1004.

8. I received a B.S. in electrical engineering from Auburn University in 1980, an M.S. in electrical engineering from the Georgia Institute of Technology in 1982, and a Ph.D. in electrical engineering from Oklahoma State University in 1988.

9. Among other roles prior to 1994, I was an assistant professor of electrical engineering from 1990-1994, where I performed research on digital receiver technology. From 1994-1996, I was the Chief Technical Officer and Founder of Momentum Microsystems, where I directed RF design and system analysis, and I was the system architect for a low-cost radio frequency network product. From 1996-2000, I was a Senior Staff Engineer and Wireless Systems Architect at Intel Corporation.

10. I was employed as Chief Technical Officer and Vice President of Business Development by Mobilian Corporation in Hillsboro, Oregon from

February 2000 to November 2003. During my tenure at Mobilian, I was responsible for, among other things, strategy and tactics with respect to standard-setting bodies, including the IEEE, the Bluetooth special interest group, the European Telecommunication Standards Institute's Broadband Radio Access Network group (ETSI/BRAN), the Software Defined Radio forum, and the Wi-Fi Alliance (formerly known as WECA). While I was at Mobilian, I regularly attended meetings of the IEEE 802.11 and 802.15 Working Groups and was an active contributor, having posted and presented several documents to both the 802.11 and 802.15 Working Groups. I was also the founder and initial chair of the IEEE 802.19 Coexistence Working Group. As a result, I was a member of the leadership team for all of IEEE 802 standards activities. In the time period of February 2000 to November 2003, there were presentations in IEEE 802.11 on OFDM and MIMO technologies that are relevant to this matter, e.g., as demonstrated by "HDR 802.11a solution using MIMO-OFDM."¹ which was presented in May 2002.

11. I was employed as Chief Technology Officer of Alereon, Inc. in Austin, Texas from November 2003 to February 2010. During my tenure at

¹ <https://mentor.ieee.org/802.11/dcn/02/11-02-0294-00-0wng-hdr-802-11a-solution-using-mimo-ofdm.ppt>

Alereon, I was responsible for, among other things, defining and executing on the company's standards and regulatory strategy. During that time, I was also the co-chair of the IEEE 802.15.3a Task Group, chair of the WiMedia Technical Steering Committee, co-chair of the WiMedia 60GHz Study Group, chair of the WiMedia Mobile Applications Study Group, Vice-Chair of the WiMedia Video Study Group, and a member of various other related boards and working groups.

12. I was employed by CSR plc ("CSR") from February 2010 to September 2015. After Qualcomm Incorporated ("Qualcomm") acquired CSR in September 2015, I continued working for Qualcomm through May of 2023. While I was at CSR, among other work, I was the head of CSR's Wi-Fi Alliance and IEEE 802.11 Standards teams. During that period, I participated in the 802.11 Wireless Next Generation Standing Committee, in addition to being an active participant, contributor, and voting member of the IEEE 802.11 Working Group. After transitioning to Qualcomm, I became a director of technical standards, where I continued as an active member of the 802.11 Working Group and also became chair of the IEEE 802.11 Wireless Next Generation Standing Committee, among other work.

13. Since 2010 I have also been a lecturer at the University of Colorado, Boulder, in the department of Computer Science. I have taught the Wireless Local Area Networks class in the graduate school since 2011, which is exclusively

focused on IEEE 802.11 technology. I have also taught classes on digital communications and signal processing at other universities, as noted in my CV; since OFDM technology was widely adopted in both cellular and Wi-Fi standards by 2002, I am personally aware that OFDM was taught in many undergraduate communication theory classes in the early 2000's.

14. Since 2023, I have worked for FaraFir consulting, where I work as a consultant, advising startup companies, research laboratories, and patent litigation firms on 802.11/15 and Wi-Fi technologies, and actively participate in 802.11, SAE International and 3GPP standards activities.

15. I am an inventor or co-inventor of 14 U.S. patents, and I am the author or co-author of numerous publications on various aspects of wireless communication technology. I am a Life Senior member of IEEE in the Communications, Computer, Intelligent Transportation, and Vehicular Technology Societies.

16. Based on my experience and education, I consider myself to be an expert at least in the fields of wireless networking and communications. As of the earliest priority date of the '720 patent (October 24, 2002), I was at least a person of ordinary skill in the art of the '720 patent, and I had personal knowledge of the technologies involved in the '720 patent.

III. RELEVANT LEGAL STANDARDS

17. I am not an attorney. In preparing and expressing my opinions and considering the subject matter of the '720 patent, I am relying on certain basic legal principles that counsel explained to me. These principles are discussed below.

18. I understand that prior art to the '720 patent includes patents and printed publications in the relevant art that predate the priority date of the alleged invention recited in the '720 patent.

19. I have been informed that a claim preamble may or may not limit the claim scope. For the purposes of this *Inter Partes* Review, I have been informed by counsel to include the preamble in the analysis for obviousness in order to follow a conservative approach.

20. I have been informed that a claimed invention is unpatentable under 35 U.S.C. § 103 if the differences between the 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 having ordinary skill in the art to which the subject matter pertains. I have also been informed by counsel that the obviousness analysis takes into account factual inquiries including the level of ordinary skill in the art, the scope and content of the prior art, and the differences between the prior art and the claimed subject matter.

21. I have been informed that a threshold inquiry as to whether a

reference can be considered in the obvious analysis is whether the reference is analogous art to the claimed invention. A reference is analogous art to the claimed invention if: (1) the reference is from the same field of endeavor as the claimed invention (even if it addresses a different problem); or (2) the 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).

22. I have been informed that the field of endeavor can be determined by reference to explanations of the invention's subject matter in the patent application, including the embodiments, function, and structure of the claimed invention. I have also been informed that the field of endeavor is not limited to the specific point of novelty, the narrowest possible conception of the field, or the particular focus within a given field.

23. I have been informed by counsel that the Supreme Court has recognized several rationales for combining references or modifying a reference to show obviousness of claimed subject matter. Some of these rationales include the following: (a) combining prior art elements according to known methods to yield predictable results; (b) simple substitution of one known element for another to obtain predictable results; (c) use of a known technique to improve a similar device (method, or product) in the same way; (d) applying a known technique to a known device (method, or product) ready for improvement to yield predictable results; (e)

choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; and (f) some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

24. Also, I have been informed and understand that obviousness does not require physical combination or bodily incorporation but rather consideration of what the combined teachings of prior art references would have suggested to a POSITA at the time of the alleged invention.

IV. FOCUSED ANALYSIS

A. Level of Ordinary Skill in the Art

25. I understand there are multiple factors relevant to determining the level of ordinary skill in the pertinent art, including (1) the levels of education and experience of persons working in the field at the time of the invention; (2) the sophistication of the technology; (3) the types of problems encountered in the field; and (4) the prior art solutions to those problems.

26. It is my understanding that the earliest possible priority date for the '720 patent is October 24, 2002. I am familiar with the wireless communications art pertinent to the '720 Patent. I am also aware of the state of the art at the time of the alleged priority date. Based on the technologies disclosed in the '720 patent, a

person of ordinary skill in the art (“POSITA”) in the field of the ’720 patent, as of the earliest possible priority date of October 24, 2002, would include someone who had a bachelor’s degree in electrical engineering, computer engineering, or equivalent training, and at least four years of professional experience relating to wireless communication technology. Moreover, lack of professional experience can be remedied by additional education, and vice versa. I believe that I possessed and exceeded such experience and knowledge before and at the priority date and that I am qualified to opine on the ’720 Patent.

27. For purposes of this Declaration, in general, and unless otherwise noted, my statements and opinions, such as those regarding my experience and the understanding of a POSITA generally (and specifically related to the references I consulted herein), reflect the knowledge that existed in the field as of the earliest alleged priority date of the ’720 patent (i.e., October 24, 2002). Unless otherwise stated, when I provide my understanding and analysis below, it is consistent with the level of a POSITA as of the alleged priority date of the ’720 patent.

B. Overview of Orthogonal Frequency Division Multiplexing (OFDM) and the Frequency Contents of OFDM Signals

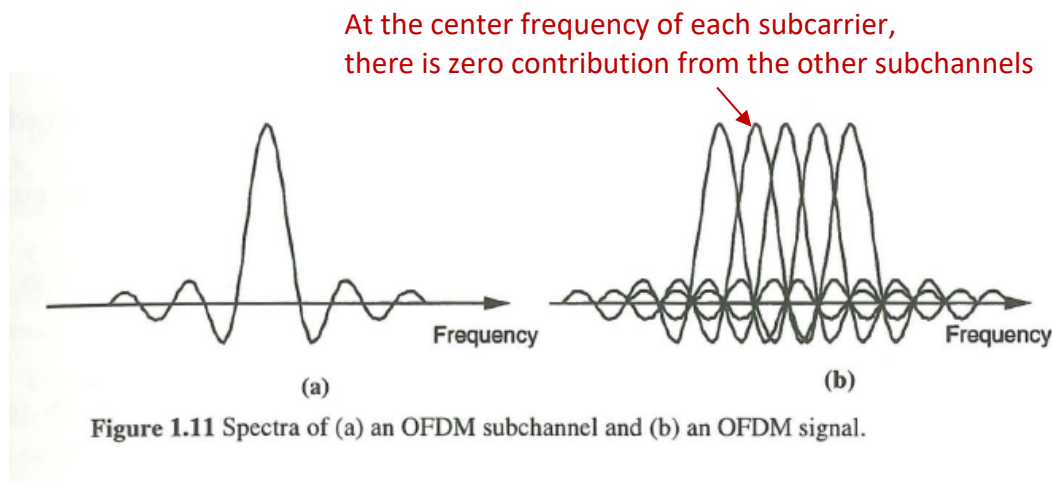
28. In a wireless communications network, a first node such as a smart phone or a laptop computer and a second node such as a base station or access point can communicate with each other using radio communication. Example wireless communications networks include a cellular network and a wireless local

area network (LAN). A family of wireless standards known as IEEE 802.11 applies to wireless LANs (WLANs). The '720 patent identifies a particular standard, IEEE 802.11a, which utilizes a modulation technique called OFDM, or orthogonal frequency division multiplexing. '720 patent, 19:42-46; 10:60-62.

29. The '720 patent assumes that a POSITA is familiar with OFDM modulation and the manipulation of the frequency contents of OFDM modulated signals to remove power from certain frequencies. For example, the '720 patent states that “[i]n preferred embodiments, orthogonal frequency division, multiplexing (OFDM) waveforms with 25 KHz channels that support transmit and receive narrow band excision may be used to eliminate interference with legacy systems.” '720 patent, 10:60-64. To better understand transmit and receive “excision” of frequencies using OFDM, some additional background is provided below.

30. Before the '720 Patent, OFDM was a well-known digital modulation scheme for wireless communication networks, dating back to the mid-1960s. *See* Ex.1015, 20-24 (“History of OFDM”) (explaining that “the ideas proposed from the mid-1960s were to use parallel data and FDM [frequency division multiplexing] with overlapping subchannels,” *id.*, 21). In OFDM, the subchannels are orthogonal in the sense that there is no crosstalk among subchannels because they align precisely next to each other in frequency, yielding a high spectral

efficiency. *Id.* For example, as illustrated in Figure 1.11 of van Nee (below), “at the center frequency of each subcarrier, there is no crosstalks from other channels.” van Nee, 22. As noted previously, OFDM technology was widely adopted in both cellular and Wi-Fi standards by 2002, and OFDM technology was taught in many undergraduate communication theory classes in the early 2000’s.



van Nee, Figure 1.11

31. In wireless communications networks that utilize OFDM, a bit stream in a first node is modulated onto multiple frequencies or subcarriers and transmitted to a second node where the process is reversed. For example, a number of subcarriers may be used in parallel (simultaneously) to communicate information, which is also sometimes referred to in the technical literature as multitone or multicarrier modulation. As such, OFDM is a type of multicarrier modulation using multiple “orthogonal” subcarriers. *See, e.g.,* Walton, [0026] (“An OFDM system effectively partitions the operating frequency band into a number of

(N_F) frequency subchannels (i.e., frequency bins or subbands).”).

32. An inverse Fast Fourier Transform (abbreviated in the art as iFFT or IFFT) operation is typically used to convert data on a representative set of subcarriers into a time-domain OFDM waveform for transmission over a wireless link. McFarland, for example, explains the modulation process:

A functional block diagram of a typical OFDM transmitter is shown in FIG. 1. Here, an incoming stream 10 of N symbols $d_0, d_1 \dots d_{N-1}$ is mapped by a serial-to-parallel converter 20 over N parallel lines 30, each line corresponding to a particular subcarrier within the overall OFDM channel. An Inverse Fast Fourier Transform (iFFT) processor 40 accepts these as frequency domain components and generates a set 50 of time domain subcarriers corresponding thereto. Each set of time domain subcarriers is considered a symbol.

McFarland, [0007]; *see also* Walton [0167] (“IFFT 440 converts each received modulation symbol vector into its time-domain representation (which is referred to as an OFDM symbol) using IFFT.”). Each of the incoming N symbols, labeled as $d_0, d_1 \dots d_{N-1}$ in McFarland, represents binary information, in the form of amplitude and phase information, transmitted over a corresponding frequency (i.e., carrier or subcarrier). The inputs to the IFFT are referred to as being in the “frequency domain” because each input represents the amplitude and phase of an individual subcarrier. The digital information is mapped to a set of complex values in the frequency domain, labeled as $d_0, d_1 \dots d_{N-1}$ in McFarland, and the IFFT

converts them into corresponding time domain values.

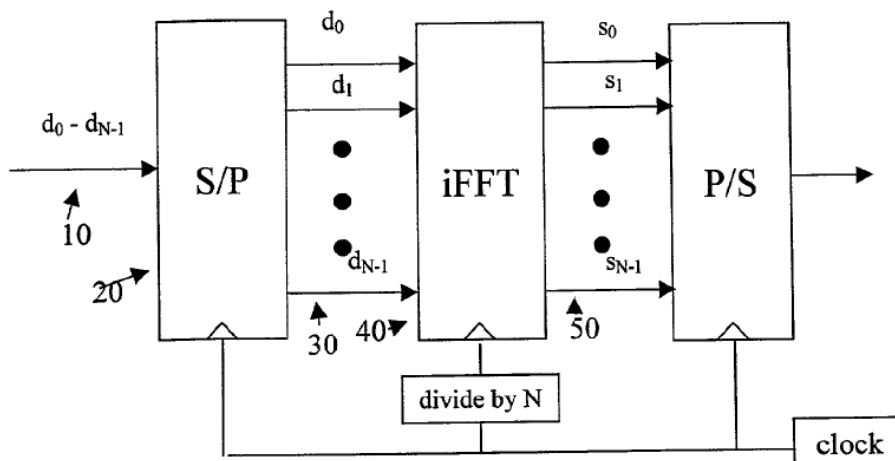


FIG. 1

McFarland, Figure 1

33. Figure 3 “shows a plot of the transmitted frequency spectrum from an OFDM system,” McFarland, [0009], and is reproduced below.

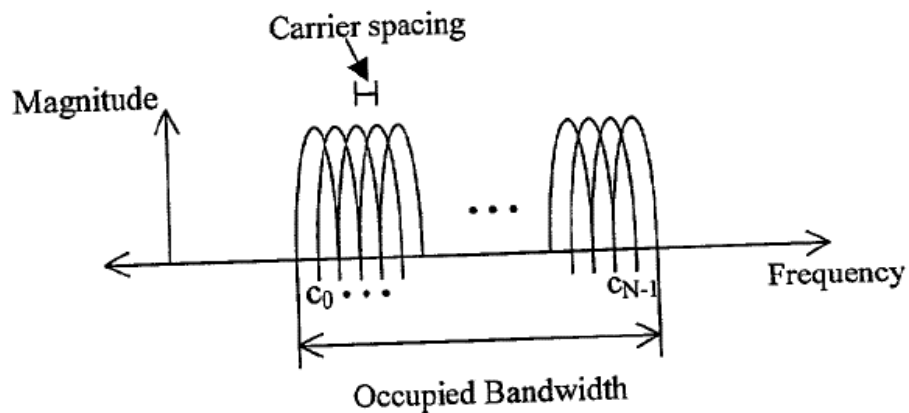


FIG. 3

McFarland, Figure 3

Each of the carriers illustrated in Figure 3 – c_0 through c_{N-1} – carries a corresponding set of bits d_0 through d_{N-1} which collectively are called a symbol.

34. OFDM modulation makes it straightforward to manipulate the frequency contents of the transmitted signal – such as by setting inputs to the IFFT, each representing different carriers – to zero or a desired frequency response. In other words, frequency contents of a signal can be changed by manipulating inputs to an IFFT.

35. McFarland, for example, describes the way an IFFT can be used for “changing the number of carriers in active use” in an OFDM system, McFarland, [0038]:

FIG. 8 shows an approach in which a single iFFT processor can be used without modification to generate a different number of carriers. The iFFT is designed to be sufficiently large enough to handle the maximum number of carriers that might ever be required. **In any given situation, a subset of the carriers can be used by simply inputting zero magnitude signals on the carriers that are not to be used.**

McFarland, [0039]. In other words, McFarland explains that “carriers that are not to be used” are indicated “by simply inputting zero magnitude signals” for the IFFT on those carriers. This technique is commonly used in OFDM to create guard bands or suppress subbands.

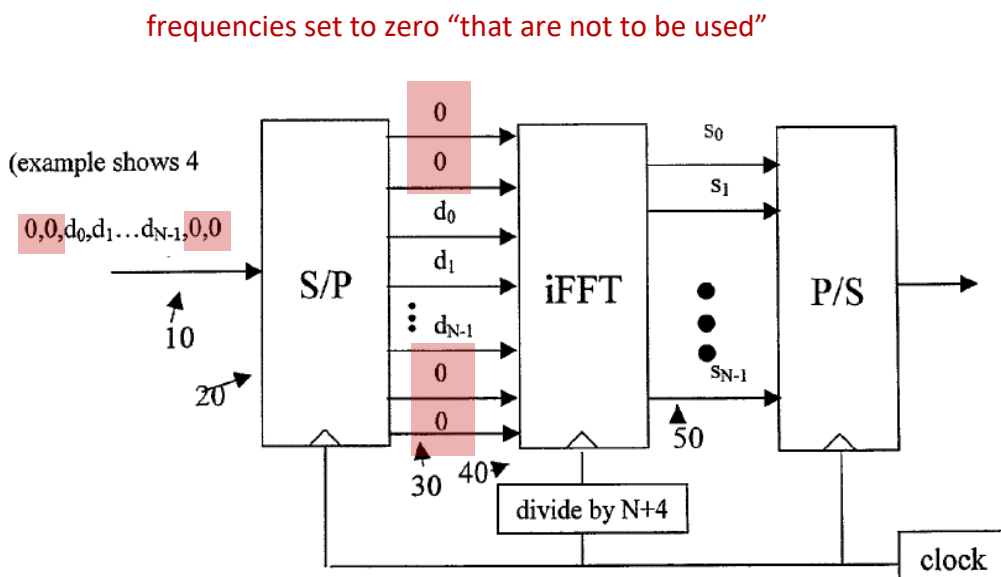


FIG. 8

McFarland, Figure 8 (annotated)

As another example, IEEE-802.11a also describes setting various inputs to the IFFT to zero (Null) that are not used. *See* IEEE-802.11a, Section 17.3.2.5 and Figure 109 (various inputs to IFFT set to “Null”).

36. The '720 patent likewise illustrates setting frequencies to zero via the use of “transmit excision” in the context of OFDM, as shown in Figure 13 (labeled as “XMT excision”). *See* '720 patent, 19:18-34.

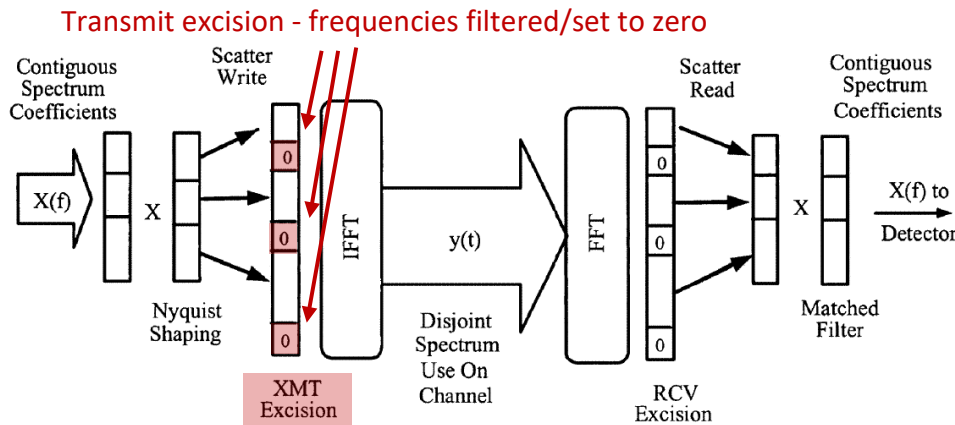


FIG. 13

'720 patent, Figure 13 (annotated)

C. Overview of the '720 Patent

37. Independent claim 53 of the '720 patent can be summarized as having three main features: (1) a first node such as an access point receiving instructions from a second node such as a laptop computer to filter a transmission signal to avoid certain frequencies, (2) receiving compressed feedback from the second node, as well as from a third node (e.g., another laptop computer), and decompressing the feedback, and (3) sending the filtered transmission signal to the second node, while simultaneously transmitting another filtered transmission signal to the third node, as annotated in claim 53 reproduced below and described thereafter. Elements are also numbered for reference as addressed in Ground #1.

[53.0] *A method for managing interference in a radio communications network, comprising the steps of:*

(1) Filtering
frequencies:

[53.1] *receiving at a first node in the radio communications network an instruction transmitted from a second node in the radio communications network to avoid using a plurality of frequencies to transmit to the second node;*

[53.2] *filtering a transmission signal to remove power from the transmission signal at each frequency in the plurality of frequencies to be avoided;*

[53.3] *transmitting the filtered transmission signal to the second node;*

(2) Compressed
and decompressed
feedback:

[53.4] *receiving a compressed first feedback from the second node that characterizes receipt of a first signal sent from the first node to the second node;*

[53.5] *receiving a compressed second feedback from a third node that characterizes receipt of a second signal sent from the first node to the third node;*

[53.6] *decompressing the compressed first feedback resulting in a decompressed first feedback; and*

[53.7] *decompressing the compressed second feedback resulting in a decompressed second feedback;*

(3) Simultaneously
transmitting:

[53.8] *wherein the filtered transmission signal is a filtered first transmission signal that is transmitted to the second node using an 802.11-based orthogonal frequency-division multiplexing (OFDM) protocol via at least one antenna of a plurality of antennas, using a first power that is based on the decompressed first feedback; and further comprising:*

[53.9] *transmitting, using the 802.11-based OFDM protocol, a filtered second transmission signal, simultaneously*

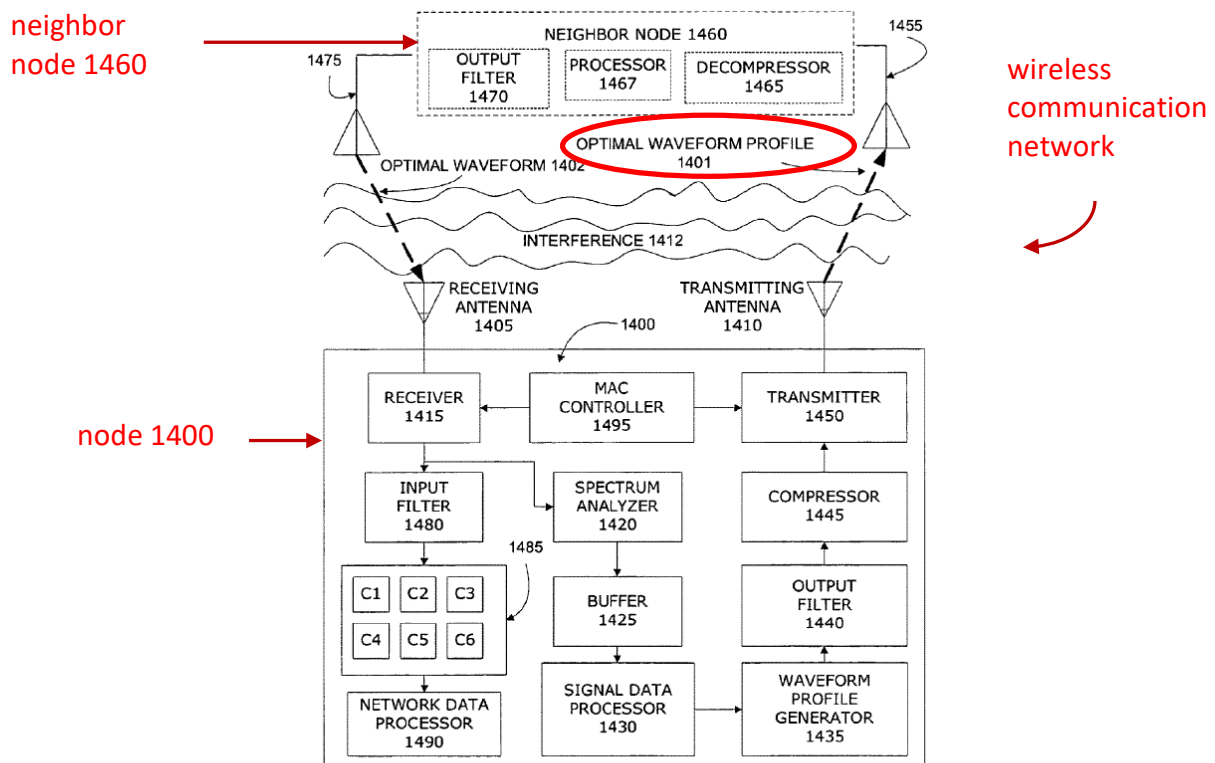
with the filtered first transmission signal, to the third node using a second power that is based on the decompressed second feedback.

38. Independent claim 95 – the other independent claim being challenged – covers some similar features but has a few notable differences. Claim 95 additionally includes “*an update of the compressed feedback is repeatedly generated, compressed, and transmitted at time periods of less than one second*” but does not recite *decompressing* any feedback.

39. Claims 53 and 95 also refer to *an 802.11-based OFDM protocol*. IEEE 802.11 refers to a well-known family of wireless network standards in the prior art. For example, van Nee, a textbook from 2000, refers to “IEEE 802.11” as one of the “three main forums for the standardization of wireless broadband communication systems.” van Nee (Ex.1015), 4. I am also aware of IEEE 802.11, including IEEE 802.11a (Ex.1007), from my experience working with IEEE 802.11 standards prior to the earliest priority date of the ’720 patent of 2002. IEEE 802.11a states on the first page that it “Published 30 December 1999,” and it was my experience at that time that this statement indeed reflects the date of publication of this technical standard. Further POSITAs were certainly well aware of IEEE 802.11a by the earliest priority date of the ’720 patent in 2002.

40. The ’720 patent assumes familiarity with IEEE 802.11 standards. The only reference to IEEE 802.11 in the “Description of Preferred Embodiments” is

41. Figure 14 of the '720 patent, reproduced and annotated below, shows a wireless or radio communication network. The figure illustrates wireless communication between “node 1400” and “neighboring node 1460.” Ex.1001, 22:2-63 (communicating waveforms 1401, 1402 between nodes 1400, 1460); *see also*, 21:40 – 23:59.



'720 patent, Figure 14 (annotated)

24

1. Filtering Frequencies

42. In Figure 14 above, an “optimal waveform profile 1401” is provided from the node 1400 to the neighboring node 1460. Ex.1001, 22:2-10 The optimal waveform profile identifies frequencies that “neighboring nodes” should avoid using in communicating with node 1400 due to those frequencies being “already populated” with other signals. *Id.*, 22:2-7. The ’720 patent further explains that “neighboring node 1460” likewise determines frequencies that “should not be used” by node 1400 in transmitting to node 1460. *Id.*, 22:8-17. Node 1400 uses a filtering process called “transmit excision to remove power from” these frequencies. *Id.*

2. Compression/Decompression of Feedback

43. The ’720 patent describes that the optimal waveform profile 1401 is part of a feedback sent from node 1400 to neighboring node 1460. As for compression, the “Description of the Preferred Embodiments” includes only one sentence in the discussion of Figure 14 as follows: “Optionally, node 1400 includes a compressor 1445, which may be implemented in hardware, software, or both, which compresses the optimal waveform profile 1401 prior to sending it to neighboring node 1460...” Ex.1001, 22:16-21. There is likewise only one sentence on decompression. *Id.*, 22:34-37 (“If the signal containing optimal waveform profile 1401 is compressed, decompressor 1465 of neighboring node 1460

decompresses the signal before passing it along to processor 1467.”).

3. Simultaneous Transmission

44. The ’720 patent states that “multiple transceivers may be used at each node to support simultaneous operation in multiple bands, simultaneous spectral analysis and communications, and other functions.” Ex.1001, 11:28-40.

D. Claim Construction

45. It is my understanding that in order to properly evaluate the ’720 patent, the terms of the claims must first be interpreted. It is my understanding that for the purposes of this *inter partes* review, the claims are to be construed under the so-called *Phillips* standard, under which claim terms are given their ordinary and customary meaning as would be understood by one of ordinary skill in the art in light of the specification and prosecution history, unless the inventor has set forth a special meaning for a term. For the purposes of my analysis below, I do not believe any claim terms require an explicit construction.

E. Key Teachings of Primary Reference Walton

1. Filtering Frequencies

a) OFDM Transmission to Mobile Terminals Using Groups of Frequency Subchannels

46. Walton generally describes the well-known use of orthogonal frequency division multiplexing (OFDM) as partitioning the “operating frequency band” into “frequency subchannels (or frequency bins), each of which is associated

with a respective subcarrier on which data may be modulated.” Walton, [0005], [0026], [0023]. Walton also describes multi-antenna techniques, including multiple-input multiple-output (MIMO) techniques, and describes different ways to form multiple transmission channels in systems that employ OFDM, MIMO, or a combination of MIMO and OFDM:

A multi-channel communication system thus supports a number of “transmission” channels, each of which may correspond to a spatial subchannel in a MIMO system, a frequency subchannel in an OFDM system, or a spatial subchannel of a frequency subchannel in a MIMO system that utilizes OFDM.

Walton, [0005], [0024], [0025] (“A MIMO system employs multiple (N_T) transmit antennas and multiple (N_R) receive antennas for data transmission.”).

47. Walton recognizes that different channels may have different transmission capacities, and recognizes that “[t]here is therefore a need in the art for techniques to effectively and efficiently process data for transmission on multiple transmission channels with different capacities to improve performance and reduce complexity.” Walton, [0008]. Walton’s teachings generally apply to any system with multiple transmission channels:

Various aspects, embodiments, and features of the invention may be applied to any multi-channel communication system in which multiple transmission channels are available for data transmission. Such multi-channel communication systems include multiple-input multiple-

output (MIMO) systems, orthogonal frequency division modulation (OFDM) systems, MIMO systems that utilize OFDM, and others.

Walton, [0023].

48. Walton describes segmenting the transmission channels into “groups, with each group including any number of transmission channels.” Walton, [0009]. “The segregation of the available transmission channels into groups permits optimization to be achieved on a per group basis (**e.g., per transmit antenna or per frequency subchannel**).” Thus, each user may be placed in its own group of channels, with different users being assigned to different groups of channels, corresponding to different transmit antennas. Walton, [0068] (“**The transmission channels associated with the assigned transmit antennas for each terminal may be placed in a group**, the selective channel transmission may be performed on each group of transmission channels, and a single coding and modulation scheme may be used for the data transmission to each terminal.”).

b) Selective Channel Transmission

49. Walton describes selective channel transmission within groups of transmission channels. *See, e.g.*, Walton, [0037]; Title (“Method and Apparatus for Processing Data for Transmission in a Multi-channel Communication System Using Selective Channel Transmission”). Further:

the available transmission channels are segregated into groups and the selective channel transmission is applied independently to each group

of channels. For example, the frequency subchannels of each transmit antenna may be grouped together, and the selective channel transmission may be applied independently for each of the transmit antennas. This segregation permits the optimization to be achieved on a per group (e.g., per transmit antenna) basis.

Walton, [0032]. In Walton, “good” transmission channels within a group are used, and “bad” transmission channels are not used. *See, e.g.*, Walton [0031] (“Using selective channel transmission, only ‘good’ transmission channels having transmission capacities (e.g., received SNRs or power gains) at or above a particular (SNR or power gain) threshold are selected for use for data transmission, and ‘bad’ transmission channels are not used.”); *see also* Walton, [0050] (describes selective channel transmission within each group of transmission channels);

Abstract.

50. Different groups of transmission channels may be assigned to different terminals/users, e.g., one transmit antenna and its associated group of transmission channels may be assigned to one terminal, and another transmit antenna and its associated group of transmission channels may be assigned to a different terminal:

The segregation of the available transmission channels into groups permits optimization to be achieved on a per group basis (e.g., per transmit antenna or per frequency subchannel). A specific coding and modulation scheme may also be used for all selected transmission

channels in each group, which can simplify the processing at both the transmitter and receiver systems. In an example application, one or more transmit antennas may be assigned to each terminal scheduled for data transmission. **The transmission channels associated with the assigned transmit antennas for each terminal may be placed in a group, the selective channel transmission may be performed on each group of transmission channels, and a single coding and modulation scheme may be used for the data transmission to each terminal.**

Walton, [0068].

c) Transmission of Only Selected “Good” Channels and not “Bad” Channels

51. Walton describes the process of forming a modulated signal for transmission as using the “**selected** frequency subchannels for a particular antenna” (i.e., selected transmission channels or frequencies) in each group of subchannels for transmitted data:

The modulation symbols from each data processor 410 are provided to a respective combiner 434 within TX channel processor 320c. If each group includes the **selected frequency subchannels** for a particular transmit antenna, then combiner 434 combines the modulation symbols for the **selected frequency subchannels** to form a modulation symbol vector for each time slot, which is then provided to a respective modulator 322. The processing by each modulator 322 to **generate a modulated signal** is described below.

Walton, [0160]; [0167]-[0168] (describing formation of “modulated signal”).

Walton further discloses that “the total available transmit power” is allocated “amongst only the selected transmission channels,” Walton, [0012]; *see also* Abstract, [0031], [0036], [0063], [0066], [0129], meaning that power is removed from the “unselected” or “bad” frequency subchannels to create the modulated signal. Walton’s “modulated signal” is an example of a transmission signal that has been filtered because only selected frequency subchannels are used while the unselected/“bad” frequency subchannels are not used, *id.*, [0010], [0031]

2. Compressed Feedback (of Channel State Information (CSI))

52. Channel state information (CSI) may be determined and used to “more fully utilize the capacity of the transmission channels.”

To more fully utilize the capacity of the transmission channels, channel state information (CSI) descriptive of the link conditions may be determined (typically at the receiver system) and provided to the transmitter system.

Walton, [0029]. The CSI may generally include “any type of information that is indicative of (1) the characteristics of the communication link, (2) the selected transmission channels...or some other information or **any combination thereof**.

Various types and forms of information may be provided as CSI, some examples of which are described below.” Walton, [0204]. Examples of the information that can be included in CSI are the “channel mask” identifying “the selected transmission channels,” *id.*, [0205], and the “SNR...for each selected

transmission channel,” *id.*, [0208]. Another example of information that would have been included in CSI is “power control information for each selected transmission channel, data stream, group or [*sic* – of] transmission channels, or any other unit of transmission.” *id.*, [0209].

53. CSI may be determined at a receiver system and fed back to the transmitter system. Walton, [0203] (“[V]arious types of CSI may be reported by a receiver system to a transmitter system.”); [0221] (CSI is “fed back.”); [0222]-[0223] (CSI is transmitted “back to transmitter system 310” as a “feedback signal.”). For the “downlink,” or data communication from a base station to a terminal, Walton, [0024], “transmitter system 310 in FIGS. 3 and 4A through 4D may represent part of a base station and receiver system 350 in FIGS. 3, 5, and 7 may represent part of a terminal.” For the “uplink,” or data transmissions from a terminal to a base station, Walton, [0024], “transmitter system 310 in FIGS. 3 and 4A through 4D may represent part of a terminal and receiver system 350 in FIGS. 3, 5, and 7 may represent part of a base station.”

54. Walton’s CSI may be compressed and also “reported periodically.”

In one embodiment, CSI is reported periodically, and differential updates are sent based on the prior transmitted CSI. In another embodiment, the CSI is sent only when there is a change (e.g., if the change exceeds a particular threshold), which may lower the effective rate of the feedback channel. As an example, the channel mask or SNRs

may be sent back (e.g., differentially) only when they change. Other compression and feedback channel error recovery techniques to reduce the amount of data to be fed back for CSI may also be used and are within the scope of the invention.

Walton, [0221].

55. CSI may be used in various ways, such as for selecting a modulation and coding scheme. Walton, [0030] (“In one technique, data for each transmission channel may be coded and modulated based on a particular coding and modulation scheme selected for that channel based on the channel's CSI.”); [0068] (“A specific coding and modulation scheme may also be used for all selected transmission channels in each group...the selective channel transmission may be performed on each group of transmission channels, and a single coding and modulation scheme may be used for the data transmission to each terminal”). The CSI may also be used to determine how transmit power is distributed over transmission channels, Walton, [0130], or to determine overall transmit power for each selected transmission channel or group of transmission channels, Walton, [0209] (“In yet another embodiment, the CSI comprises power control information for each selected transmission channel, data stream, group or transmission channels, or any other unit of transmission.”).

56. Walton teaches that its CSI that is “fed back” is compressed:

CSI is reported periodically, and differential updates are sent based on the prior transmitted CSI... Other compression and

feedback channel error recovery **techniques to reduce the amount of data to be fed back for CSI** may also be used and are within the scope of the invention.

Walton, [0221]. Thus, differential CSI updates are described as an example of “compression,” and Walton discloses that “other compression...techniques” may alternatively be used to beneficially “reduce the amount of data to be fed back for CSI.”

3. Simultaneous Transmission

57. Walton describes a system in which a base station concurrently communicates with a number of mobile terminals. Walton, [0024] (“MIMO system 100 is effectively formed for a multiple access communication system having a **base station (BS) 104 that concurrently communicates with a number of terminals (T) 106.**”). Thus, for example, the frequency subchannels for one transmit antenna may be allocated to one terminal, and the frequency subchannels for another antenna may be allocated to another terminal. Figure 4C illustrates a “MIMO transmitter... which utilizes OFDM,” Walton, [0158], where multiple data streams are individually encoded and modulated, one data stream for each antenna.

Each group may correspond to one transmit antenna and the transmission channels in each group may correspond to the frequency subchannels for the transmit antenna....As shown in FIG. 4C, the coding and modulation control may be individually provided for each group.

Walton, [0159].]. In the transmitter of Figure 4C, multiple data streams are individually encoded and modulated, one data stream for each antenna, corresponding to one “group” of OFDM transmission channels for each antenna. Walton, [0137] (referring to TX channel processor 320 of Figure 3, an embodiment of which is in Figure 4C, per [0158], “[i]f OFDM is employed, **TX channel processor 320 provides a stream of modulation symbol vectors for each antenna used for data transmission.**”); [0158] (“Each group may correspond to one transmit antenna and the transmission channels in each group may correspond to the frequency subchannels for the transmit antenna.”); *see also* [0066].

first data stream using first group of subchannels (e.g., to a first terminal)

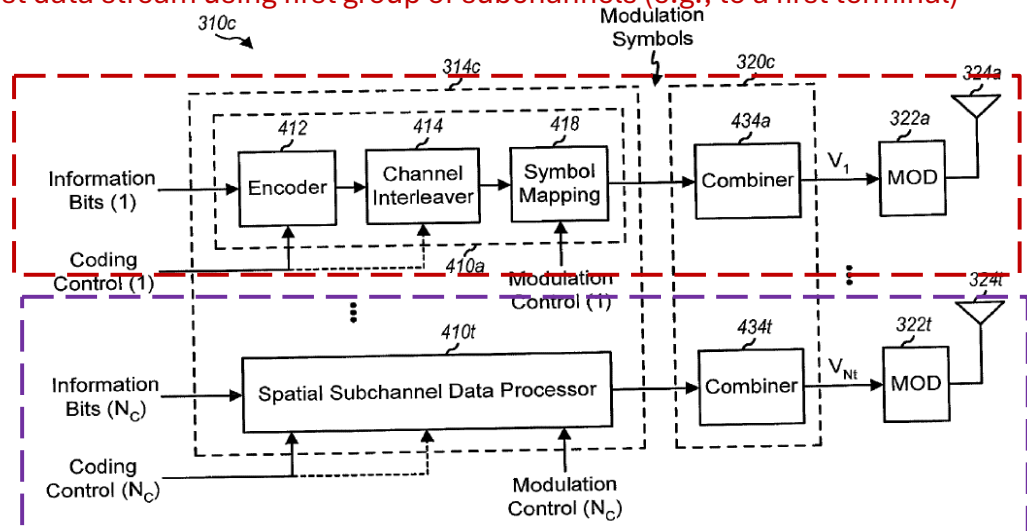


FIG. 4C

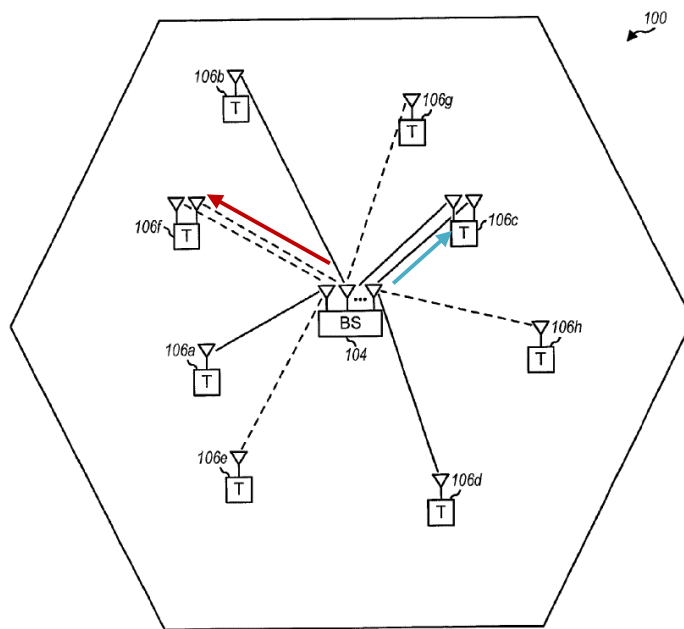
N_c th data stream using N_c th group of subchannels (e.g., to N_c th terminal)

Walton, Figure 4C

Simultaneous transmission is consistent with a reason to use a “multi-channel communication system,” such as a MIMO system, which is to “provide increased

transmission capacity.” Walton, [0023], [0005].

58. Figure 1 illustrates a base station 104 communicating concurrently with multiple terminals, such as 106c and 106f, shown below.



Walton, Figure 1 (annotated)

Summary

59. In summary, Walton describes MIMO and OFDM communication systems that divide the transmission channels (such as OFDM frequency subchannels) into groups and that perform channel selection within each group such that only “good” channels are used and “bad” channels are not used. Different terminals may be assigned different groups of transmission channels (e.g., OFDM frequency subchannels on different transmit antennas of a base station) for

concurrent communication. CSI may be determined at a receiver system, compressed, and reported back to the transmitter system periodically.

F. Key Teachings of Remaining Prior Art

1. IEEE Standard Known as IEEE 802.11a

60. Although Walton discusses OFDM extensively, Walton does not explicitly disclose the use of an OFDM protocol that is 802.11-based. However, the use of an 802.11-based OFDM protocol was well-known in view of the IEEE 802.11a standard as documented in IEEE 802.11a (1999) (Ex.1007).

61. IEEE 802.11a (1999) presents an industry standard for wireless local area networks (LANs) that uses a physical layer protocols with OFDM. *See* IEEE-802.11a (Ex.1007), i, viii (“OFDM PHY [Physical Layer] specification for the 5 GHz band”); 3, 4 (“The OFDM PHY layer consists of two protocol functions”).

62. IEEE-802.11a (which uses OFDM), discloses use of specific operating parameters, such as a 5 GHz band, Ex.1007, 3, modulation of OFDM subcarriers, such as using “binary or quadrature phase shift keying (BPSK/QPSK), 16-quadrature amplitude modulation (QAM), or 64-QAM,” *id.*, “forward error correction coding (convolutional coding with rates of 1/2, 2/3, or 3/4),” *id.*, an OFDM preamble, *id.*, 7, and certain subcarrier spacing, 9, slot times, *id.*, 27, and/or power levels, *id.*

2. McFarland as it Relates to Filtering Frequencies

63. While Walton describes identifying frequencies or channels in an OFDM signal that are to be avoided and then removing those frequencies, McFarland explains in more detail how to remove such frequencies from an OFDM signal using the same filtering process used in the '720 patent.

64. McFarland addresses OFDM transmission, McFarland, [0006], which, like Walton, uses an “Inverse Fast Fourier Transform (iFFT) processor,” *id.*, [0007]. McFarland further uses “carrier” and “subcarrier” interchangeably in the context of OFDM. McFarland, [0007] (N data symbols, each mapped to different “subcarrier”), [0009], Figure 3 (OFDM channel having N “carriers.”). Walton associates a OFDM “subcarrier” as having a related OFDM “subchannel” in one-to-one correspondence. Walton, [0005] (“**An OFDM system effectively partitions the operating frequency band into a number of frequency subchannels (or frequency bins), each of which is associated with a respective subcarrier on which data may be modulated.**”). More specifically, a subcarrier is a frequency within a frequency subchannel that carries a modulation symbol. *Id.*, [0165].

65. McFarland describes “changing the number of carriers in active use,” McFarland, [0037]-[0038], by using “a single iFFT processor ... without modification,” *id.*, [0039]. Specifically, “[i]n any given situation, a subset of the

carriers can be used by simply inputting zero magnitude signals on the carriers that are not to be used.” *Id.* In other words, McFarland explains that “[i]n any given situation” (such as in Walton) “carriers that are not to be used” (such as the corresponding “bad” frequency subchannels and their associated subcarriers in Walton, Walton, [0009]-[0010]) are filtered out “by simply inputting zero magnitude signals” for the IFFT on those carriers, as illustrated in Figure 8 (annotated below). McFarland’s teaching that realizes “power savings from using a smaller number of carriers,” McFarland, [0039], confirms that power is removed from carriers that are not to be used.

subcarriers/frequencies set to zero “that are not to be used”

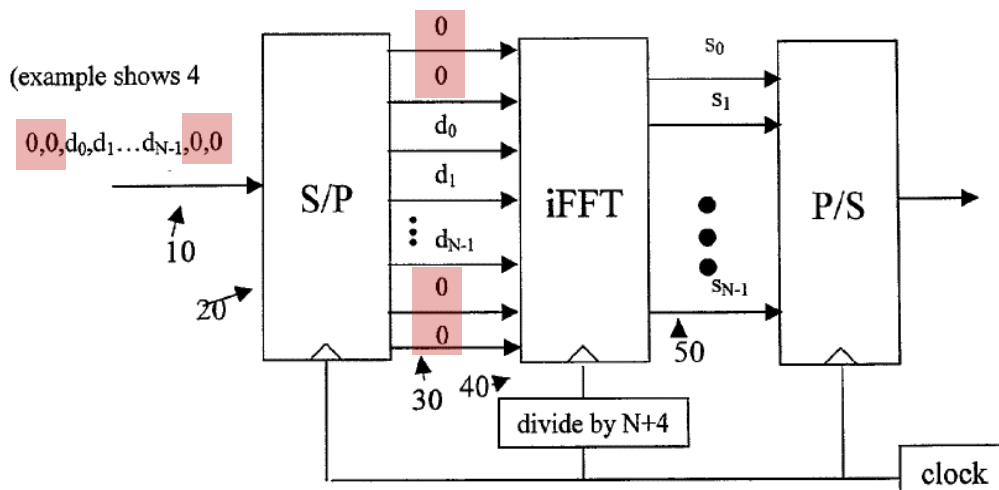


FIG. 8

McFarland, Figure 8 (annotated)

66. McFarland’s description of setting IFFT inputs to zero is an example

of “*filtering*” to “*remove power*” from a signal “*at each frequency in the plurality of frequencies to be avoided*” because McFarland’s description matches how the ’720 patent specification describes such filtering. For example, the ’720 patent recites that “output filter 1440 performs **transmit excision to remove power** from certain frequencies that neighboring node 1460 has determined should not be used...” Ex.1001, 22:8-17. Note that this is the only place in the specification where the phrase “to remove power,” as in the claim language, is used. The ’720 patent describes “transmit excision” further with regard to an inverse FFT (or IFFT):

An alternative approach is shown in FIG. 13. ... This wider band frequency vector is then inverse-FFT’ed into a time waveform for transmission across the channel. ... **The undesired frequencies have been removed from $y(t)$ by the transmit excision.**

Ex.1001, 19:18-34.

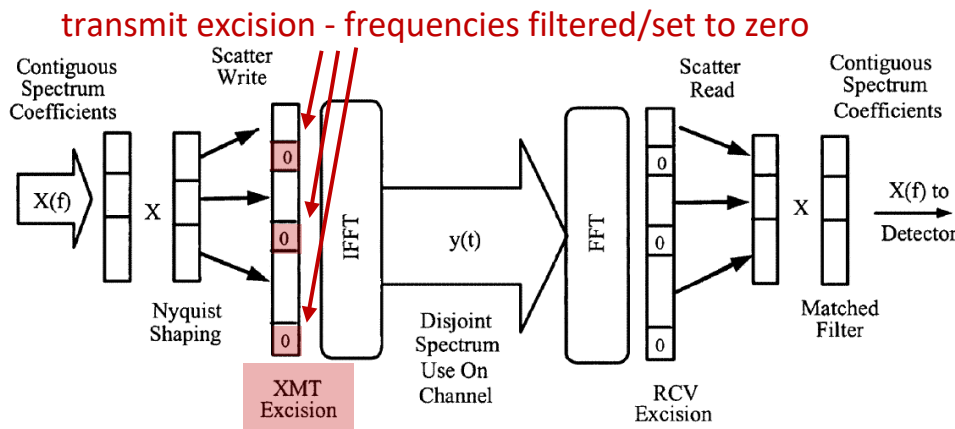


FIG. 13

'720 patent, Figure 13 (annotated)

3. Peterson at it Relates to Compression/Decompression

67. Peterson, a textbook on computer networking, explains that when data is first “*compressed* at the sender” this is followed by the data being “*decompressed* at the receiver.” Ex.1022, 357 (emphasis in original); *see also* 355. Peterson provides examples of compression/decompression techniques, Ex.1022, 357, such as “run length encoding,” *id.*, 358, “Differential Pulse Code Modulation” or “DPCM,” *id.*, 359, and “dictionary-based” methods, *id.* Walton describes “compression” of CSI, but does not explicitly use the term decompression. Peterson is evidence that a POSITA would have understood that a process complementary to compressing data (such as CSI) is decompressing the compressed data (such as compressed CSI).

4. Bohnke as it Relates to Changing Mobile Radio Channels and Related Adaptive Transmission

68. As explained above in Section IV.C (Overview of the '720 Patent), claim 95 additionally includes the following limitation that is not in claim 53: “*an update of the compressed feedback is repeatedly generated, compressed, and transmitted at time periods of less than one second.*”

69. Bohnke explains that the channel “can be considered constant for a certain time,” Bohnke, [0065], known as the “coherence time,” Bohnke, [0066]. Bohnke provides numerical examples of coherence time for “mobile radio channels.” Bohnke, [0066]. The numerical examples in the table below are for a system that uses a carrier frequency of 5 GHz.

“Channel Coherence Time Examples

Carrier Frequency: 5 GHz”

Carrier Freq [GHz] 5			Coherence Level 0.9
Speed [km/h]	Speed [m/s]	Doppler	Coherence Time [ms]
0.1	0.02777778	0.46296296	155.052
0.3	0.08333333	1.38888889	51.6839
1	0.27777778	4.62962963	15.5052
3	0.83333333	13.8888889	5.16839

Bohnke, [0068]-[0069]. As shown in the table, the coherence time for “low mobility speeds (< 3 km/hr),” *id.*, [0070]) ranges from about 15 milliseconds (ms) (or “15.5052” ms) up to 155 ms (or “155.052” ms). Thus, the coherence time, or

the time the channel remains relatively constant, is substantially less than 1 s, even in scenarios when the mobile terminals move with low speeds. Bohnke concludes that the “coherence time” “becomes rather long,” acknowledging that 15 ms in a wireless system is “long.” Bohnke, [0070]. Therefore, the “application of adaptive modulations (which relies on a ‘constant’ channel) becomes applicable,” Bohnke, [0070], meaning that a wireless system can adapt quickly enough to the current channel conditions such that a selected modulation for the channel conditions can be applied before the channel changes significantly. As would have been understood by a POSITA, Bohnke’s concepts apply to adaptive transmission applied to other transmission parameters, such as transmit power. For example, Ex.1011 spells out the basic idea as follows:

The basic idea behind LA [link adaptation] techniques is to adapt the transmission parameters to take advantage of prevailing channel conditions. **The fundamental parameters to be adapted include modulation and coding levels, but other quantities can be adjusted for the benefit of the systems such as power levels (as in power control), spreading factors, signaling bandwidth, and more....** The principle of LA is simple. It aims to exploit the variations of the wireless channel (over time, frequency, and/or space) by dynamically adjusting certain key transmission parameters to the changing environmental and interference conditions observed between the base station and the subscriber.

Ex.1011, 108-109.

V. DETAILED UNPATENTABILITY ANALYSIS

70. I have been asked to provide my opinion as to whether the Challenged Claims of the '720 patent would have been obvious in view of the prior art. The discussion below provides a detailed analysis of how the prior art references identified below teach the elements of the Challenged Claims of the '720 patent.

71. As part of my analysis, I have considered the scope and content of the prior art and any differences between the alleged invention and the prior art. I describe in detail below the scope and content of the prior art, as well as differences between the alleged invention and the prior art, on an element-by-element basis for each Challenged Claims of the '720 patent.

72. As described in detail below, the alleged invention of the Challenged Claims would have been obvious in view of the teachings of the identified prior art references as well as the knowledge of a POSITA.

A. Ground 1: Claim 53 is obvious based on Walton combined with IEEE-802.11a

[53.0] *A method for managing interference in a radio communications network, comprising the steps of:*

73. Walton, alone or in combination with IEEE-802.11a, discloses or renders obvious element [53.0].

74. First, Walton discloses a “*communications network*.”

75. Walton describes a “multiple access communication system” in which

a base station and a number of terminals engage in communication, thus forming a *network*. Walton, [0024], *see also*, Fig. 1, below of communications system 100.

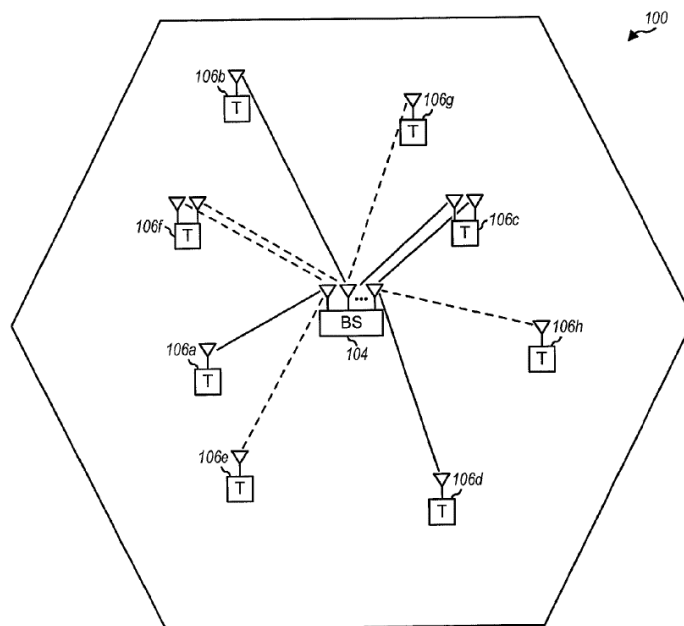


FIG. 1

Walton, Figure 1

76. Second, Walton discloses that the devices in its communications network engage in wireless communication, and it would have been obvious that such communication is via radio frequencies, rendering obvious “*radio communication*.” For example, Walton explains that all the devices have antennas, Walton, [0024], thus forming “a wireless communication system,” *id.*, [0003]. Walton does not identify any specific frequencies for its system to use, leaving that implementation detail to a POSITA. However, it would have been obvious that radio frequencies are used, which generally exist in a broad range from a few

kilohertz up to hundreds of gigahertz (GHz), *see, e.g.*, Ex.1018, 963 (definition of “radio frequency”), and radio frequencies in the hundreds of MHz to several GHz were typical examples. Ex.1015, 15-19 (describing frequencies of interest of “800 MHz to 6 GHz.”) Moreover, it is well known that wireless communication signals propagate on a radio channel. *See, e.g.*, Ex.1015, 15-19 (describing physical characteristics of the “indoor **radio channel**” and frequencies of interest of “800 MHz to 6 GHz.”), *see also*, Ex.1010, 1:15-19 (A “mobile station” communicates with “base stations” using “radio communication” via a “radio interface.”). Thus, Walton’s wireless terminals in communication with a base station, in view of background knowledge of a POSITA, renders obvious “a *radio communications network*.” However, to the extent that the use of radio frequencies was not obvious based on Walton alone, it would have been obvious to communicate using radio frequencies at or around 5 GHz, as was used in IEEE-802.11a, and it would have been obvious to combine Walton with IEEE-802.11a for the reasons presented in the analysis of element [53.8.1] *infra*, thereby also rendering obvious “a *radio communications network*.”

77. Third, as discussed in the remaining elements [53.1]-[53.9], Walton describes methods for managing OFDM subchannels based on a parameter called “SNR”, which Walton defines as: “signal-to-noise-plus-interference ratios.” Walton, [0028], [0009], [0010] (emphasis added). As discussed in the analysis of

element [53.1], for example, “bad” OFDM subchannels are avoided in Walton, e.g., those channels for which SNR is lower than a threshold, Walton, Abstract (“only ‘good’ channels in each group are selected (e.g., based on the channels’ received SNRs and an SNR threshold), “bad” channels are not used”), [0010], [0036] (“In an embodiment, transmission channels having received SNRs that fall below a particular SNR threshold are not selected for use.”). And avoiding “bad” channels is a way to manage interference. *See, e.g.*, Ex.1017, 398 (“The more important benefit of this algorithm, however, appears in a multi-user system. In this case, a *bad* channel for user *k* is not necessarily *bad* for user *l*, thus turning off such a sub-channel will reduce the interference that user *l* receives. In other words, the users try to avoid the subchannels with high level of interference. This will result in less average interference for the users, and improves the overall performance.”) (Emphasis in original).

[53.1] *receiving at a first node in the radio communications network an instruction transmitted from a second node in the radio communications network to avoid using a plurality of frequencies to transmit to the second node;*

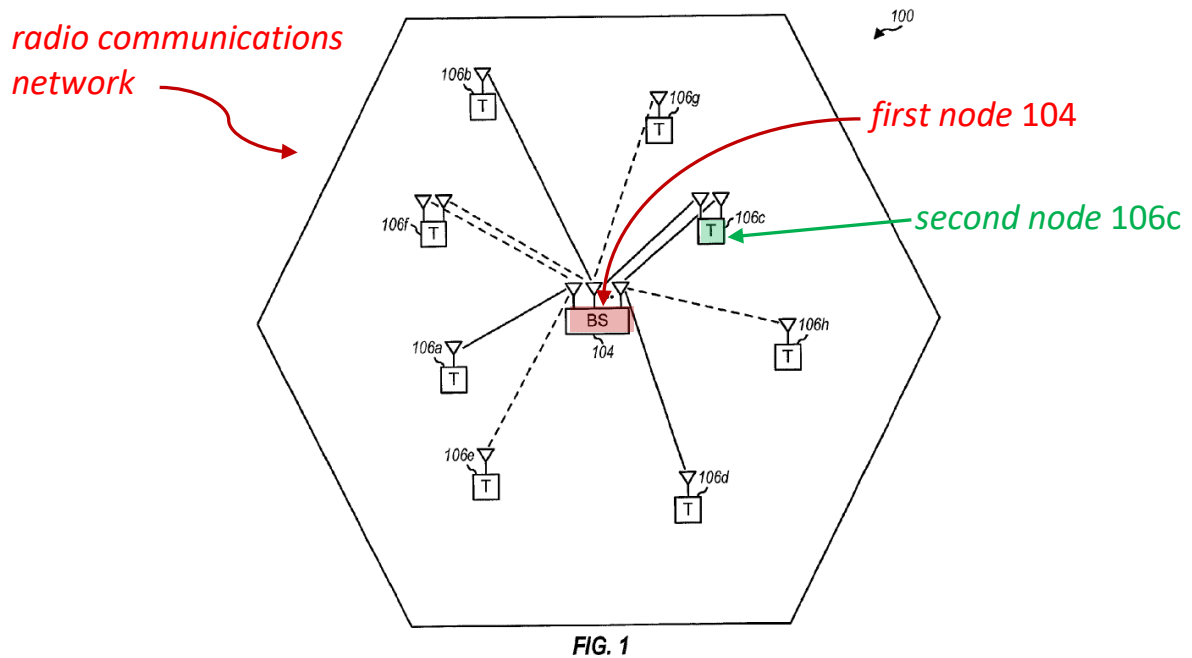
78. Walton discloses or renders obvious element [53.1].

79. Walton describes how devices in its wireless communication network use transmission signals to communicate with each other using OFDM. Walton, [0023]-[0024], [0027]. Although Walton does not use the term “node,” a POSITA would have understood that all communication devices in Walton’s network are

“nodes” as the term was commonly understood in the field and used in the ’720 patent. Regarding the ’720 patent, it refers to communication devices throughout the specification as “nodes.” *See* ’720 patent. For example, the ’720 patent describes each communication device in Figure 14 as a node. *See* ’720 patent, 21:40-23:59 (“node 1400” and “neighboring node 1460”). As another example, McFarland refers to its communication devices as “nodes.” *See, e.g.,* McFarland, Abstract (“**A multi-carrier communication system such as an OFDM or DMT system has nodes** which are allowed to dynamically change their receive and transmit symbol rates...”), [0048]. The usage of the term “node” in the ’720 patent is consistent with technical dictionaries. For example, one technical dictionary defines “node” as “a point of connection into a network. Ex.1019, 613. Likewise, a POSITA would have understood all communication devices in Walton (e.g., base stations and terminals) as example nodes, such that a base station is an example *first node* and a terminal is an example *second node*.”

80. As shown below, certain channel state information (CSI) is an example of the claimed “*instruction*,” and Walton describes CSI as being determined “at the receiver system” and “provided to the transmitter system.” Walton, [0029]; *see also* [0203], [0204]. A base station includes a “transmitter system,” and each terminal includes a “receiver system.” *Id.*, [0225]. Figure 1 of Walton, reproduced and annotated below, illustrates multiple nodes, of which base

station 104 is the claimed “*first node*” and terminal 106c is the claimed “*second node*.”



Walton, Figure 1 (annotated)

Base station 104 provides downlink transmission to terminals (such as 106c).

Ex.1005, [0024]. Base stations, such as base station 104, include a “transmitter system 310” of Figure 3, and the terminals, such as terminal 106c, include a “receiver system 350” of Figure 3 in communication to system 310. *Id.*, [0134].

The techniques described in Walton are applicable to data transmissions on the downlink from transmitter system 310 of a base station to receiver system 310 of a terminal. *Id.*, [0225]. Accordingly, Walton’s general references to a “transmitter system” are applicable to transmitter system 310 of base station 104, and general

references to a receiver system are applicable to receiver system 350 of each terminal. Figures 3, 4C, and 4D, referred to throughout my declaration, illustrate more detailed examples of a base station “transmitter system,” Walton, [0158], [0225] (“[T]ransmitter system 310 in Figures 3 and 4A through 4D may represent part of a base station...”), an example of which is base station 104 in Figure 1, *id.*, [0134].

81. As discussed in the Technology Background section above, OFDM is a digital-modulation technology that divides a frequency band into subchannels with data modulated on a subcarrier in each subchannel. Regarding the transmission channels used between two nodes, Walton provides the following summary:

Transmission channels available for use are segregated into one or more groups, with each group including any number of channels. With selective channel transmission, only “good” channels in each group are selected (e.g., based on the channels received SNRs and an SNR threshold), **“bad” channels are not used, and the total available transmit power for the group is (e.g., uniformly) distributed across only the good channels.**

Walton, Abstract.

82. Regarding the transmission channels used between two nodes, Walton describes the use of “selective channel transmission” in which “only ‘good’ channels in each group are selected (e.g., based on the channels received SNRs and

an SNR threshold), **‘bad’ channels are not used, and the total available transmit power for the group is (e.g., uniformly) distributed across only the good channels.**” Walton, Abstract. Walton’s techniques apply to many types of transmission channels, *id.*, [0023] (“[F]eatures of the invention may be applied to any multi-channel communication system in which multiple transmission channels are available for data transmission.”), but the focus in this Petition is in MIMO communication that uses OFDM, such that the transmission channels of interest are OFDM frequency subchannels corresponding to each antenna, *id.*, [0009] (“For a MIMO system that utilizes OFDM, ...each group [of transmission channels] may correspond to, for example, a respective transmit antenna, and the transmission channels in each group may be the **frequency subchannels** for the corresponding transmit antenna.”), [0005], [0027], [0066].

83. As discussed in detail below, , the list of good transmission channels (frequency subchannels) and bad channels is included in a channel state information (CSI) frame that includes a “channel mask” transmitted from the terminal 106c to the base station 104 which provides “*an instruction transmitted from a second node in the radio communications network to avoid using a plurality of frequencies to transmit.*”

84. **First**, as mentioned above, an OFDM transmission signal includes multiple transmission channels or frequency subchannels (*frequencies*). Walton

describes segregating the OFDM subchannels into “groups, with each group including any number of transmission channels.” Walton, [0009]. “The segregation of the available transmission channels into groups permits optimization to be achieved on a per group basis (e.g., per transmit antenna ...).” Walton, [0068]. For example, Walton describes placing the OFDM frequency subchannels for each transmit antenna into its own group, with “selective channel transmission” applied to each group:

In another aspect, **the available transmission channels are segregated into groups and the selective channel transmission is applied independently to each group of channels.** For example, **the frequency subchannels of each transmit antenna may be grouped together, and the selective channel transmission may be applied independently for each of the transmit antennas.** This segregation permits the optimization to be achieved on a per group (e.g., per transmit antenna) basis.

Walton, [0032], where “frequency subchannels” refers to OFDM frequency subchannels, *id.*, [0026] (“An **OFDM system** effectively partitions the operating frequency band into a number of (N_F) **frequency subchannels** (i.e., frequency bins or subbands).”), and “selective channel transmission” refers to avoiding (not using) “bad” transmission channels, *id.*, Abstract, [0010], [0031], [0066]. Thus, the OFDM transmission channels for each transmit antenna are assigned to a respective group, and selective channel transmission is applied to each group of

subchannels (and antenna) to avoid “bad” frequency subchannels.

85. Second, an OFDM receiver feeds back information instructing which transmission channels (OFDM subchannels) to use and which transmission channels not to use, or avoid, and this information may be in the form of a “channel mask” fed back to the transmitter system/base station (*a first node*) from a receiver system/terminal (*a second node*). A “receiver system,” such as in a terminal (e.g., one of terminal 106c in Figure 1, Walton, [0134]), feeds back CSI information to a “transmitter system,” such as in a base station (e.g, base station 104). Walton, [0029], [0203] (“[V]arious types of CSI may be reported by a receiver system to a transmitter system.”), [0204], [0225] (“[T]ransmitter system...may represent part of a base station and receiver system ... may represent part of a terminal.”), [0134]. Walton’s CSI instructs which transmission channels (*frequencies*) to use and which transmission channels not to use, or avoid, and this information may be in the form of a “channel mask.”

The selective channel transmission may be implemented in various manners, and various types of CSI may be reported by a receiver system to a transmitter system. In one implementation...[t]he identity of the selected transmission channels ... comprise the CSI that is sent back to the transmitter system and used to process data for transmission.

Walton, [0203]; *see also* [0204]. Channel State Information, or “CSI”, *id.*, [0029], is a feedback message that can include the channel mask, which as discussed

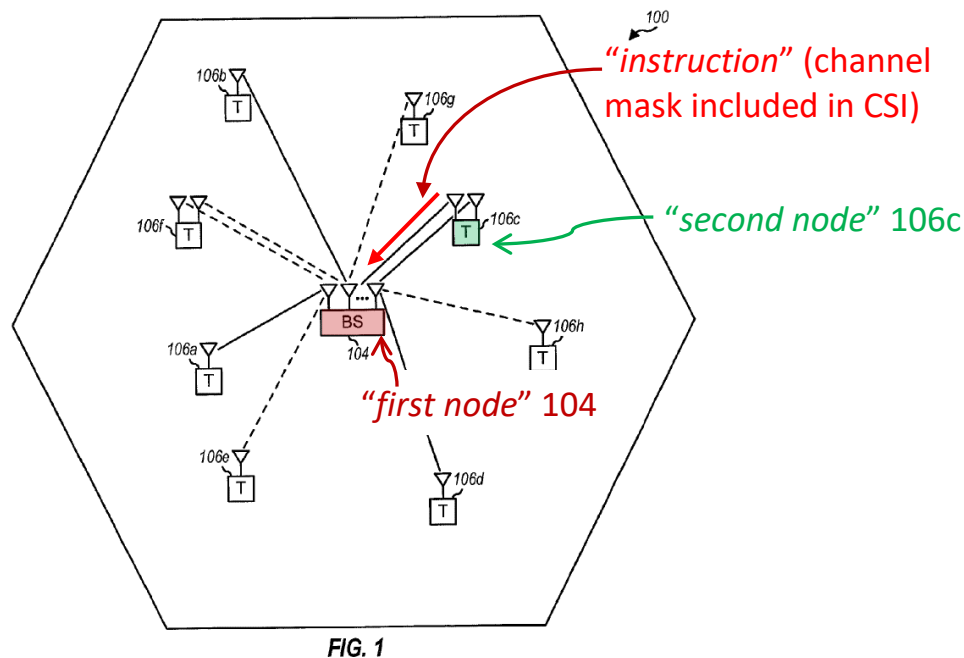
above, instructs the receiving node which transmission channels to use, and which channels it should not use (or “disabled”).²

In one embodiment, the **CSI comprises an indication of all transmission channels that have been selected for use** ... In one specific implementation, a **channel mask may be defined to include a bit for each transmission channel that may be selected for use**. Prior to a data transmission, the available transmission channels may be evaluated and selected at the receiver system. The bit for each selected transmission channel may then be enabled (e.g., set to logic high) and **the bit for each unselected transmission channel may be disabled** (e.g., set to logic low).

Walton, [0205]. The CSI is derived at a receiver system, Walton, [0211] (“The processing to derive certain types and forms of CSI (e.g., the channel mask ... and so on) based on estimates of the channel characteristics may be performed at the receiver system by a controller 362 shown in FIG. 3.”). The CSI, including the channel mask, is fed back from the receiver system (e.g., terminal) to the transmitter system (e.g., base station). Id., [0222] (Receiver system “transmit[s] the CSI back to the transmitter system 310 via a reverse channel.”), [0225]. The channel mask included in CSI is therefore *an instruction...to avoid using a*

² The CSI feedback message is further discussed with reference to claim elements [53.4]-[53.7].

Figure 1 of Walton is labeled according to Walton's teachings below.



Walton, Figure 1 (annotated)

86. Thus, Walton discloses or renders obvious *receiving at a first node in*

the radio communications network (receiving at a base station 104 in communication system 100) an instruction (channel mask of CSI) transmitted from a second node in the radio communications network (e.g., transmitted from terminal 106c) to avoid using a plurality of frequencies (to avoid using bad transmission channels/frequency subchannels) to transmit to the second node (to transmit to terminal 106c).

[53.2] *filtering a transmission signal to remove power from the transmission signal at each frequency in the plurality of frequencies to be avoided;*

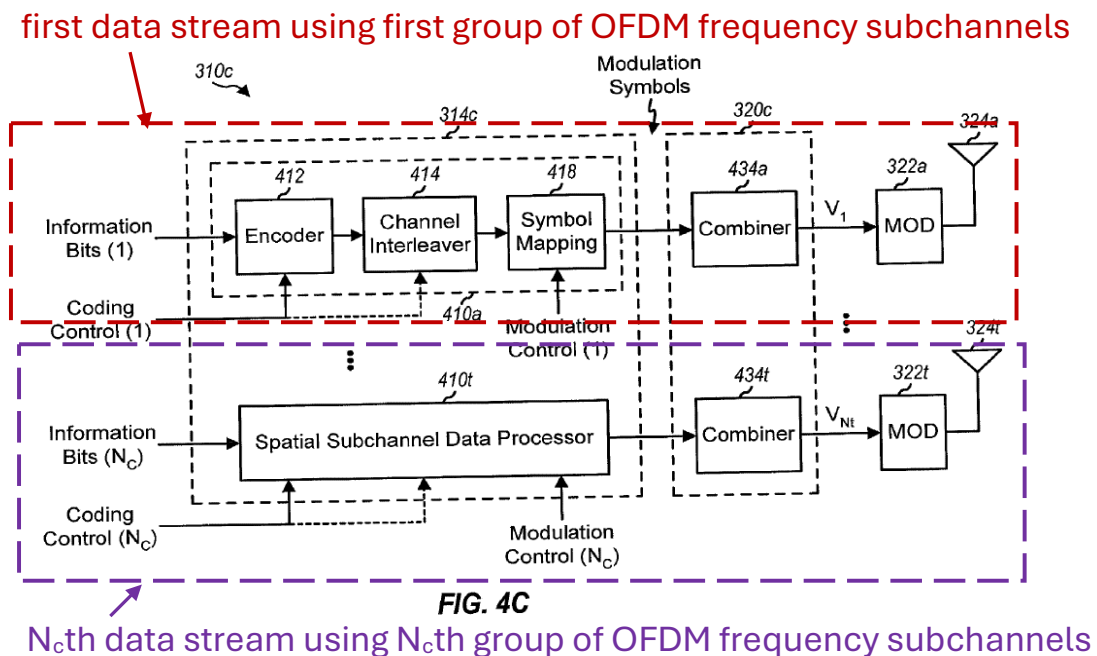
87. Walton discloses or renders obvious [53.2].

88. As discussed in the analysis of element [53.1], Walton's OFDM transmitter system receives the "channel mask" instructing which frequency subchannels to use and not to use, and, as demonstrated below, generates an OFDM signal for transmission having only "selected" frequency subchannels. Walton, [0205], [0066], [0009]-[0010].

89. Walton's "MIMO transmitter system 310c, which utilizes OFDM" in Figure 4C is an "embodiment of the transmitter portion of system 310 in Figure 3," Walton, [0158], and is therefore part of base station 104 (*first node*), *id.*, [0134]. In the transmitter of Figure 4C, multiple data streams are individually encoded and modulated, one data stream for each antenna, corresponding to one "group" of OFDM transmission channels for each antenna. Walton, [0137] (referring to TX channel processor 320 of Figure 3, an embodiment of which is in Figure 4C, per

[0158], “[i]f OFDM is employed, TX channel processor 320 provides a stream of modulation symbol vectors for each antenna used for data transmission.”);

[0158] (“Each group may correspond to one transmit antenna and the transmission channels in each group may correspond to **the frequency subchannels for the transmit antenna.**”); *see also* [0066].



Walton, Figure 4C (annotated)

90. The modulators 322 in Figure 4C employ OFDM transmission.

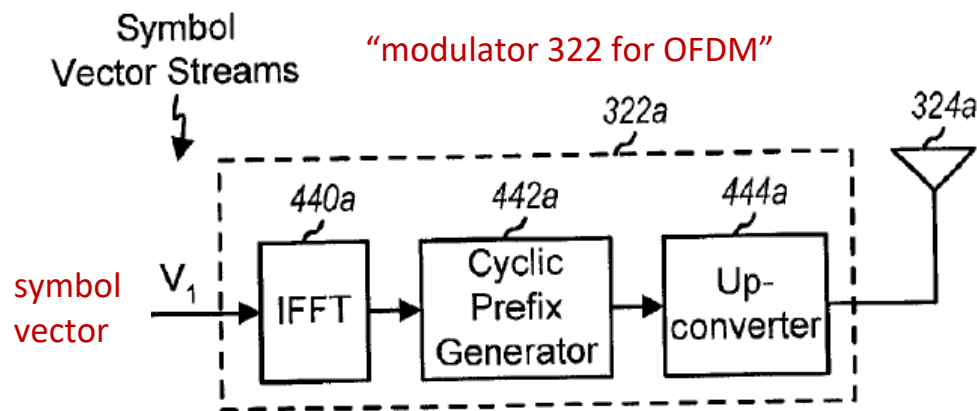
Walton, [0160] (“The processing by each modulator 322 to generate a modulated signal is described below.”); [0167] (“FIG. 4D also shows an embodiment of modulator 322 for OFDM.”). Walton’s modulator 322 for OFDM transmission includes an IFFT that operates on an input symbol vector, which is “known in the

art and not described in detail herein.”

[E]ach modulator 322 includes an inverse Fast Fourier Transform (IFFT) 440...

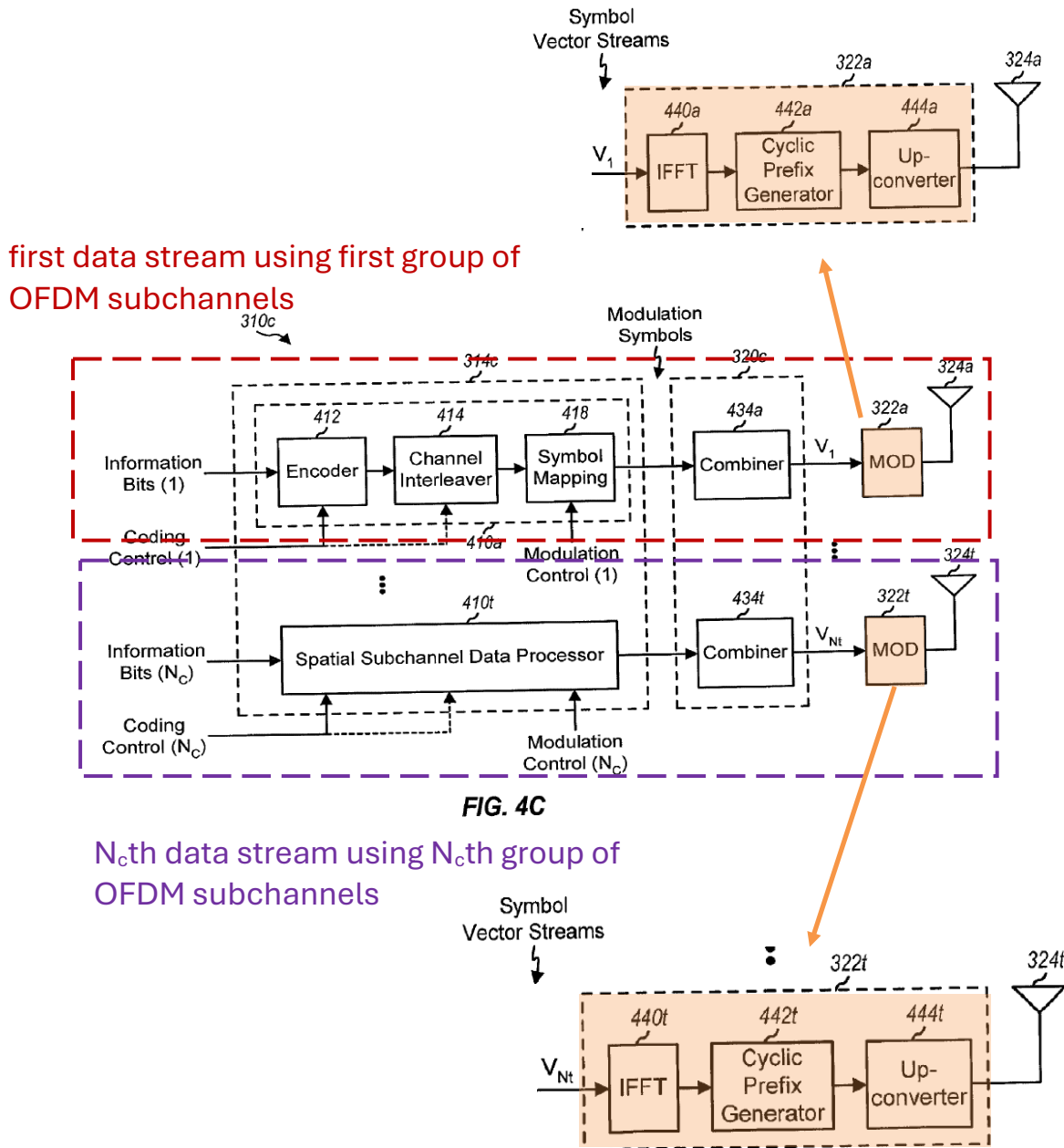
IFFT 440 converts each received modulation symbol vector into its time-domain representation (which is referred to as an OFDM symbol) using IFFT. ... The implementation of IFFT 440 and cyclic prefix generator 442 is known in the art and not described in detail herein.

Walton, [0166]-[0167].



Walton, Figure 4D (partial) (annotated)

91. The combined teachings of Figures 4C and 4D (“FIG. 4D also shows an embodiment of modulator 322 for OFDM.” Walton, [0167]) are illustrated below.



Walton, Figures 4C and 4D (partial) (annotated)

92. Walton describes the process of forming a modulated signal for transmission as using the “**selected** frequency subchannels for a particular antenna” (i.e., selected transmission channels or frequencies) in each group of

subchannels for transmitted data:

The modulation symbols from each data processor 410 are provided to a respective combiner 434 within TX channel processor 320c. If each group includes the **selected frequency subchannels** for a particular transmit antenna, then combiner 434 combines the modulation symbols for the **selected frequency subchannels** to form a modulation symbol vector for each time slot, which is then provided to a respective modulator 322. The processing by each modulator 322 to **generate a modulated signal** is described below.

Walton, [0160]; [0167]-[0168] (describing formation of “modulated signal”).

Walton further discloses that “the total available transmit power” is allocated

“amongst only the selected transmission channels,” Walton, [0012]; *see also*

Abstract, [0031], [0036], [0063], [0066], [0129], meaning that power is removed from the “unselected” or “bad” frequency subchannels (*frequencies to be avoided*)

to create the modulated signal (*a transmission signal after filtering*). Walton’s

“modulated signal” is an example of *a transmission signal* that has been filtered

because only selected frequency subchannels are used while the unselected/“bad”

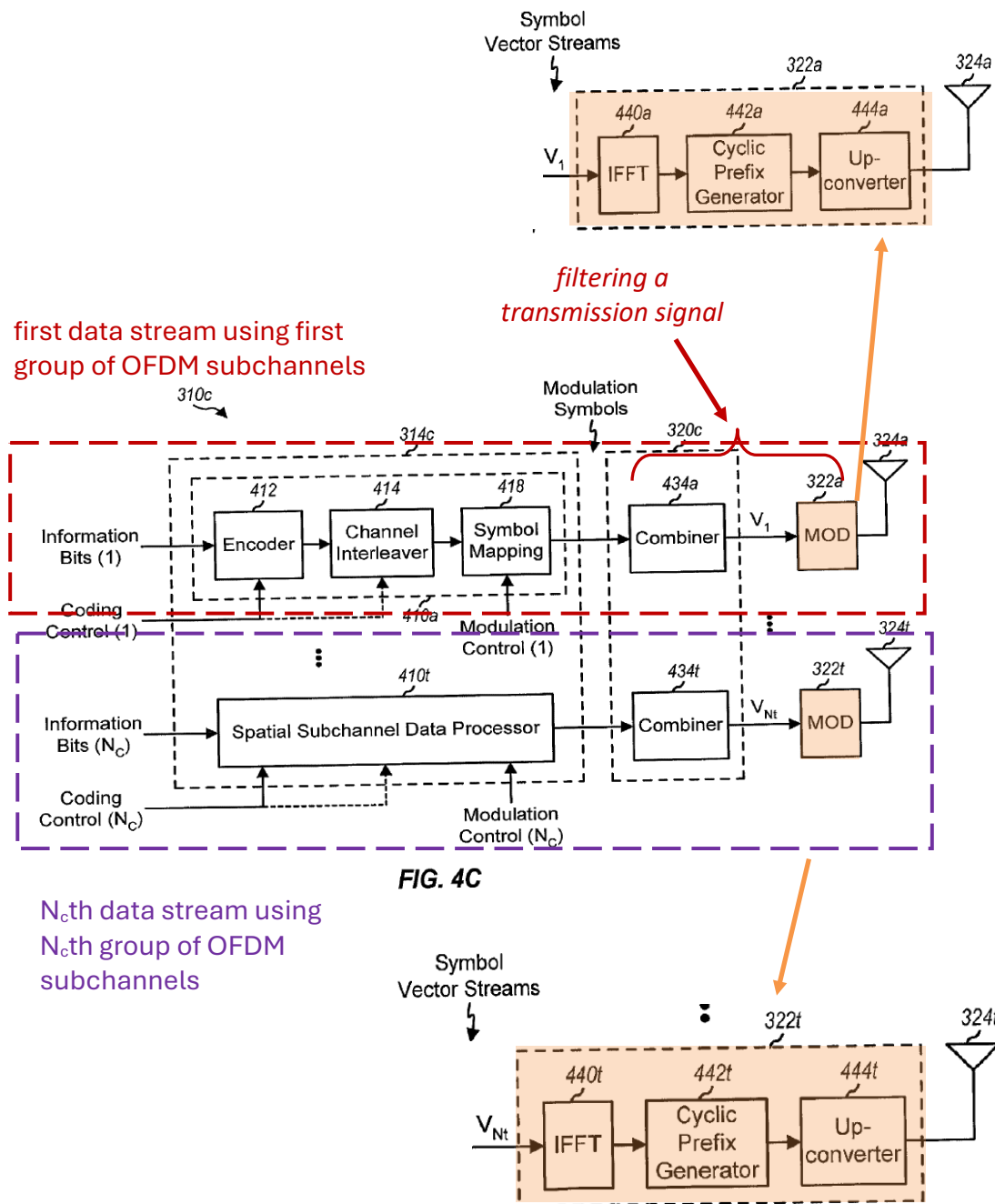
frequency subchannels (*frequencies to be avoided*) are not used, *id.*, [0010],

[0031], thereby disclosing or rendering obvious *filtering a transmission signal to*

remove power from the transmission signal at each frequency in the plurality of

frequencies to be avoided, further illustrated in combined Figures 4C and 4D

below.



Walton, Figures 4C and 4D (partial) (annotated)

93. To the extent PO argues that Walton does not disclose or render obvious element [53.2], such would have been obvious in view of McFarland as

discussed in Ground 2.

[53.3] *transmitting the filtered transmission signal to the second node;*

94. Walton discloses or renders obvious element [53.3].

As explained in the analysis of element [53.2] (of this Ground 1), *filtering a transmission signal* is indicated in a figure that combines Figures 4C and 4D. This figure is reproduced below, with the added indication that the output of modulator 322a is also an example *filtered transmission signal*. Walton discloses transmitting the modulated signal that is the output of modulator 322a. Walton, [0160], [0167]-[0168]. Thus, Walton discloses *transmitting the filtered transmission signal*.

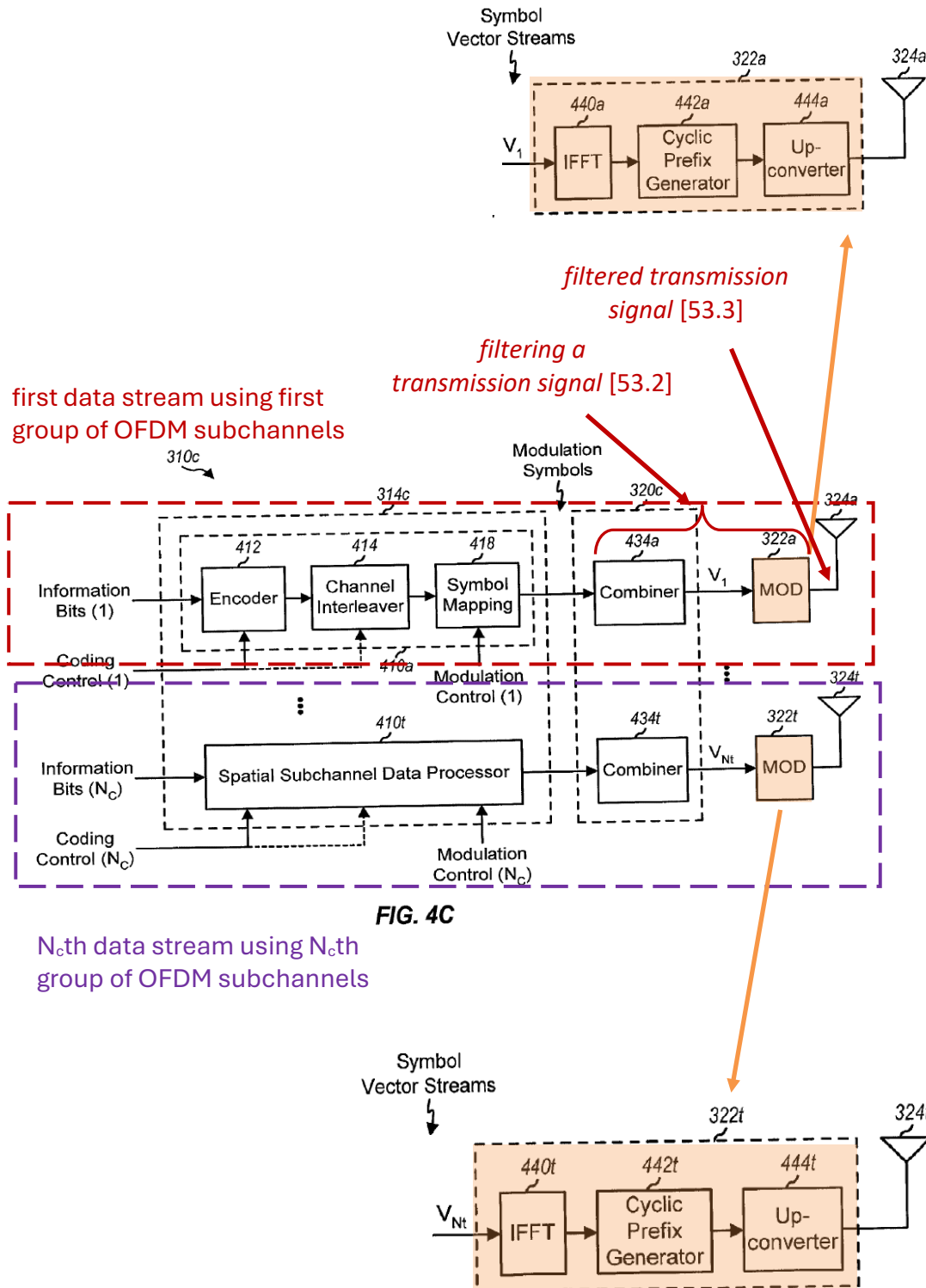
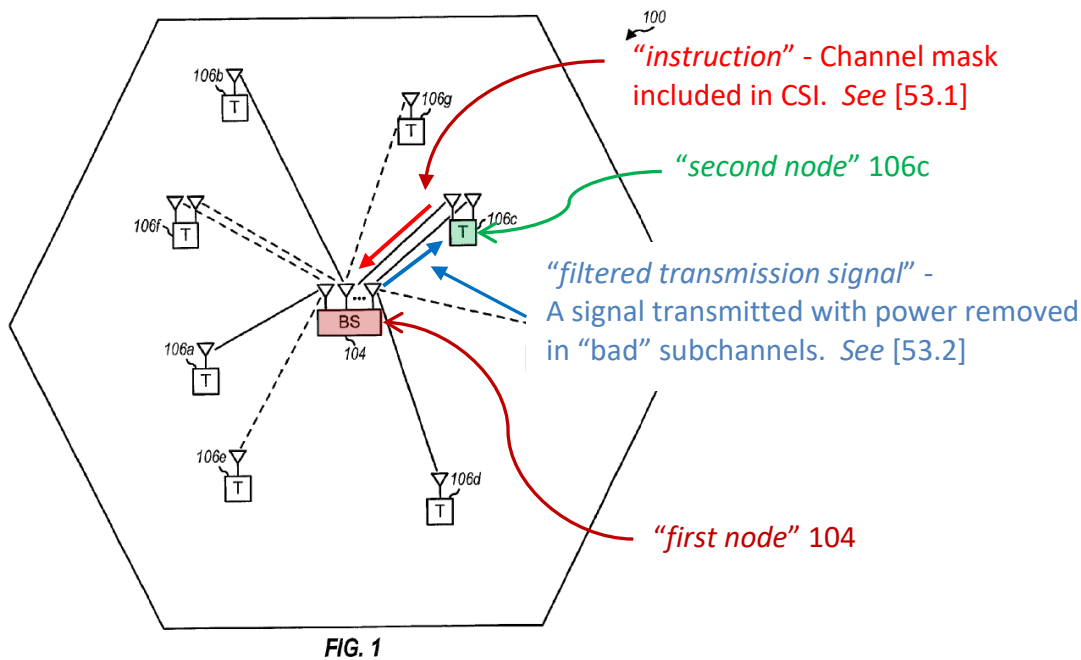


FIG. 4C

N_c th data stream using N_c th group of OFDM subchannels

Walton, Figures 4C and 4D (partial) (annotated)

95. The *filtered transmission signal* is transmitted to the node (*second node*) that transmitted the CSI (*instruction*) to indicate which frequency subchannels to use. For example, in Figure 3, the second system 350 (e.g., terminal 106c) reports the CSI to the transmitter system 310 (e.g., base station 104) via “feedback.” *Id.*, [0222]-[0223], [0134]. A controller 334 in transmitter system 310/base station 104 (*first node*) applies the “identity of the selected transmission channels” in transmissions to the second system 350/terminal 106c (*second node*). *Id.*, [0203], [0224]-[0225], [0134], [0068]. Figure 1 is illustrated below with these teachings.



Walton, Figure 1 (annotated)

96. Thus, Walton discloses or renders obvious *transmitting the filtered*

transmission signal (a base station 104 transmits a modulated signal from modulator 322) *to the second node* (to the terminal, such as terminal 106c, that sent the channel mask).

[53.4] receiving a compressed first feedback from the second node that characterizes receipt of a first signal sent from the first node to the second node;

97. Walton discloses or renders obvious element [53.4].

98. As discussed above at [53.1] and [53.3], Walton teaches that a terminal, such as terminal 106c, (*second node*) sends a CSI (*feedback*) including a “channel mask” to the base station 104 (*first node*). The CSI is generated, *compressed*, transmitted and then received as discussed in detail below.

99. **First**, CSI includes a “channel mask” (*instruction*) as explained in the analysis of element [53.1] of this Ground (Ground 1). More generally, Walton explains that the CSI that is “reported” may **“comprise any type of information that is indicative of (1) the characteristics of the communication link, (2) the selected transmission channels...or some other information or any combination thereof. Various types and forms of information may be provided as CSI, some examples of which are described below.”** Walton, [0204]. Examples of the information that can be included in CSI are the “channel mask” identifying “the selected transmission channels,” *id.*, [0205], and the “SNR...for each selected transmission channel,” *id.*, [0208]. For example, the transmitter system applies the “channel mask” as an indication of which

transmission channels to use (i.e., are selected), and the transmitter system uses the SNR for each selected transmission channel at least to determine the distribution of the “total available transmit power amongst the selected transmission channels,” such as “allocat[ion] non-uniformly, for example, based on the distribution of SNRs achieved for the transmission channels,” *id.*, [0129]-[0130].

100. An alternative example of the information that would have been included in the CSI in addition to the “channel mask” identifying “the selected transmission channels,” *id.*, [0205], is “power control information for each selected transmission channel, data stream, group or [*sic* – of] transmission channels, or any other unit of transmission.” *id.*, [0209]. “The power control information may include a single bit for each transmission unit to indicate a request for either more power or less power, or it may include multiple bits to indicate the magnitude of the change in power level requested.” Walton, [0209]. Thus, there are at least two alternative examples of information included in Walton’s CSI, besides the channel mask (*instruction* of [53.1]).

101. Second, Walton discloses compressing CSI that is “fed back,” thereby disclosing that the *feedback* is *compressed*. Walton, [0221] (“**CSI is reported periodically, and differential updates are sent based on the prior transmitted CSI... Other compression and feedback channel error recovery techniques to reduce the amount of data to be fed back for CSI may also be used and are**

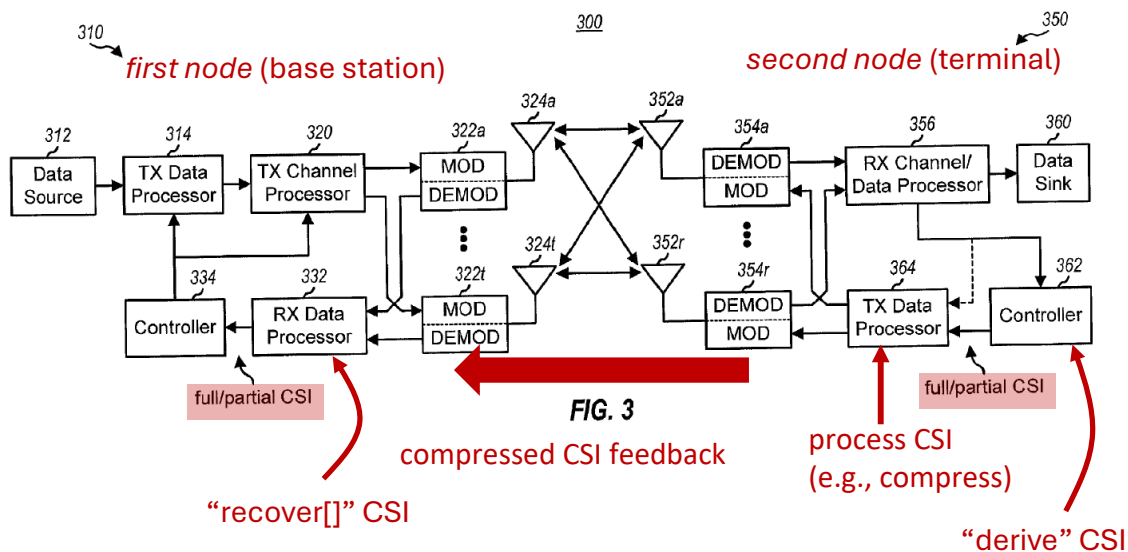
within the scope of the invention.”); see also [0222]-[0223] (describing receiving a CSI “feedback signal”); [0204]. Thus, differential CSI updates are described as an example of “compression,” and Walton discloses that “other compression...techniques” may alternatively be used to beneficially “reduce the amount of data to be fed back for CSI,” teaching that each instance of CSI *feedback is compressed*.

102. Third, the CSI is compressed at Walton’s “receiver system” (e.g., in terminal, *second node*) and transmitted to “transmitter system” (e.g., in base station) that receives the compressed CSI, thereby disclosing *receiving a compressed first feedback from the second node*.

103. Referring to Figure 3, Walton explains that “[t]he processing to derive certain types and forms of CSI (**e.g., the channel mask**, data rate indicator, differential indicator, **and so on**) based on estimates of the channel characteristics may be performed at the receiver system by a controller 362 shown in FIG. 3.” Walton, [0211]. Further, the data processor 364 “processes the CSI,” and “[m]odulators 354...transmit the CSI back to transmitter system 310.” *Id.*, [0222]. Next, “[a]t [transmitter] system 310...**RX data processor 332 performs processing complementary to that performed by TX data processor 364 [in receiver system 350] and recovers the reported CSI**.” Walton, [0223]. And, as explained throughout, a base station 104 includes an example “transmitter system

310” and a terminal 106 includes an example “receiver system 350.” *Id.*, [0225].

Thus, Walton’s disclosure of performing processing “complementary” to that of compression to recover reported CSI renders obvious that the first feedback is decompressed (e.g., by the base station), as decompressing CSI is a process “complementary” to compressing CSI to recover the CSI as it existed in the receiver system 350/terminal 106.



Walton, Figure 3 (annotated)

104. Fourth, Walton describes a signal (*first signal*) that is transmitted from a transmitter system (of base station 104, *first node*) and received by a receiver system (of terminal 106c, *second node*) to allow the terminal to derive CSI (*first feedback*) for downlink data transmissions. Walton, [0211]-[0212], [0225] (“[T]echniques described ... may be used for data transmission on the downlink,”

using transmitter system 310 of base station and receiver system 350 of terminal), [0134] (base station 104 uses system 310 and terminal 106c uses system 350); *see also* [0024]. The transmitted signal (*first signal*) includes either data and/or a pilot reference based on which the CSI is derived. Walton, [0212] (“The CSI may be derived based on the signals transmitted from the transmitter system and received at the receiver system,” in which the signals include “data” and/or “pilot data.”), [0142] (“[p]ilot data” is “data of [a] known pattern”), [0192]. An OFDM signal received by a terminal (*second node*) on the downlink from a base station (*first node*) that is used for deriving CSI is an example of a *first signal sent from the first node to the second node*.

105. Fifth, Walton describes that the CSI (*first feedback*) characterizes receipt of the transmitted signal (*first signal*). “The **CSI may be derived based on the signals ... received at the receiver system.**” *Id.*, [0212]. “For example, CSI processor 626 may estimate a noise covariance matrix based on the received pilot signals and then compute the SNR of the k-th transmission channel used for the data stream being decoded.” Walton, [0192]. CSI processor 626 of Fig. 6A is part of data processor 520x of receiver system 350x of Fig. 5, which is an embodiment of system 350 of Fig. 3 and therefore part of terminal 106c (*second node*). Walton, Figs. 3, 5, 6A, [0134], [0180], [0190].

106. Walton also describes that “[i]f all available transmission channels are

used for data transmission and the same amount of transmit power is used for each selected transmission channel, then the transmitted modulation symbols will be received at different SNRs depending on the specific channels on which the modulation symbols are transmitted.” Walton, [0039], [0049]. SNRs are therefore a characteristic of the receipt of a signal. See Walton, [0082] (“received SNRs” are “characteristics”), [0119], [0147], [0166]-[0168] (modulated symbols are transmitted as modulated signals from an antenna), [0160]. And because “power control information” is based on received SNRs (Walton, [0209]), CSI that contains SNRs or power control information derived from a first signal *characterizes receipt of the first signal*.

107. In summary, Walton discloses or renders obvious *receiving a compressed first feedback* (compressed CSI containing SNRs or power control information) *from the second node* (terminal, e.g., 106c) *that characterizes receipt of a first signal* (pilot reference/data signal is received to derive CSI) *sent from the first node* (base station 104) *to the second node*.

[53.5] *receiving a compressed second feedback from a third node that characterizes receipt of a second signal sent from the first node to the third node;*

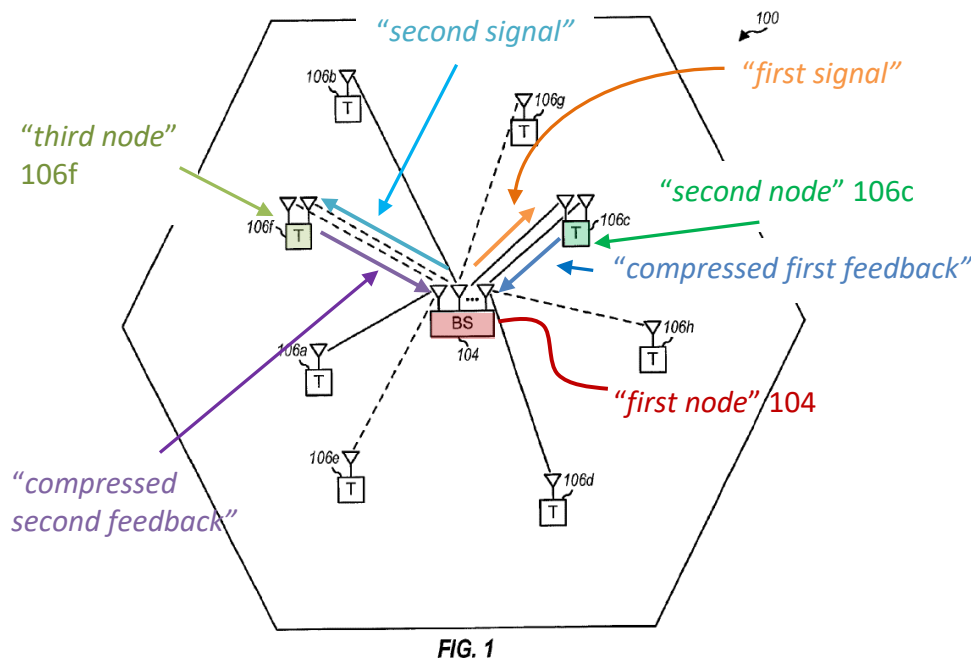
108. Walton discloses or renders obvious element [53.5].

109. Element [53.5] is similar to element [53.4], except that the *compressed feedback* in [53.5] is from a *third node* instead of a *second node*.

Walton discloses or renders obvious element [53.5] for substantially the same

reasons as [53.4], as applied to a different receiving node (terminal, *third node*).

Walton, [0024], [0134], [0225]. Walton's Figure 1 is updated below to indicate an example *third node* (any of the terminals besides 106c is an example *third node*).



Walton, Figure 1 (annotated)

110. Each terminal may have its own assigned transmit antenna(s) at the base station 104. *Id.*, [0032] (“[T]he frequency subchannels of each transmit antenna may be grouped together, and the selective channel transmission may be applied independently for each of the transmit antennas,” which applies to base station 104, *id.*, [0024]-[0025]); [0068] (“**[O]ne or more transmit antennas may be assigned to each terminal** scheduled for data transmission. The transmission channels associated with the **assigned transmit antennas for each terminal** may

be placed in a group...”); *see also* [0134], [0158]-[0160], [0180], [0188], [0225].

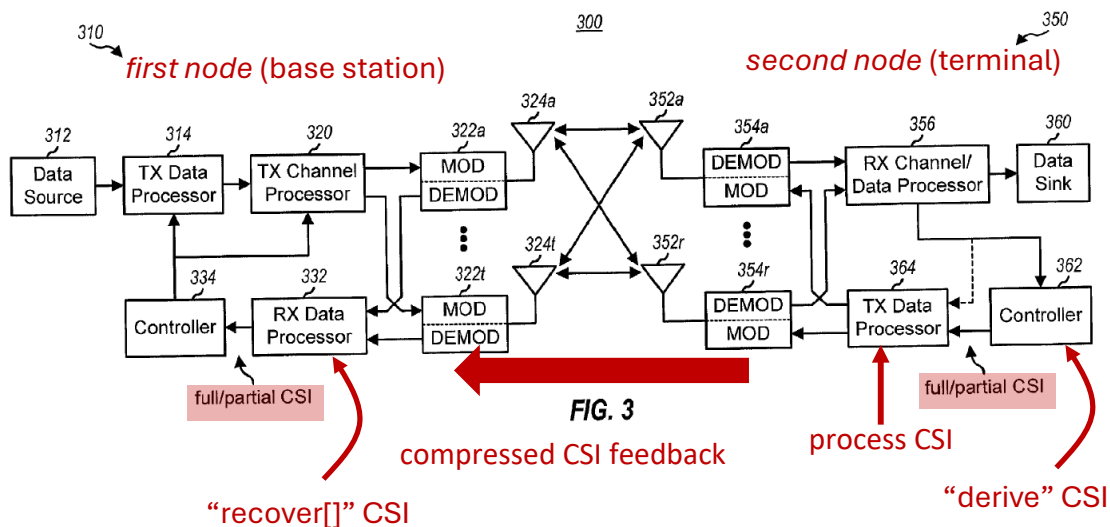
Because the base station 104 transmits on the downlink to the various terminals 106, each of the various terminals includes an example “receiver system,” such that each of the terminals generates CSI for its associated downlink. Walton, [0212] (“The CSI may be derived based on the signals transmitted from the transmitter system and received at the receiver system.”); [0225] (“The techniques described herein may be used for data transmission **on the downlink from a base station to one or more terminals**. For the downlink, **transmitter system 310** in FIGS. 3 and 4A through 4D **may represent part of a base station** and **receiver system 350** in FIGS. 3, 5, and 7 **may represent part of a terminal**.”); *see also* [0024], [0134], [0192], [0203], [0204], [0221].

111. Thus, for the same reasons as presented in the analysis of [53.4], which is in the general context of transmitter/receiver systems and therefore applicable to transmissions from base station 104 to terminal 106c as well as from base station 104 to terminal 106f (or any other terminal), Walton discloses or obvious *receiving a compressed second feedback from a third node* (terminal 106d or 106f, as examples) *that characterizes receipt of a second signal sent from the first node to the third node* (that characterizes receipt of a signal sent from the base station 104 to the terminal 106d or 106f).

[53.6] decompressing the compressed first feedback resulting in a decompressed first feedback; and

112. Walton discloses or renders obvious element [53.6].

113. As explained in the analysis of [53.4] (of this Ground 1), Walton discloses “*receiving a compressed first feedback*” in the form of compressed CSI at system 310 of base station 104 (*first node*) (Walton, [0134]), as illustrated in annotated Figure 3, reproduced from [53.4] below. *Id.*, [0221]-[0223].



Walton, Figure 3 (annotated)

114. Walton explains that transmitter “system 310...performs processing complementary to that performed by TX data processor 364 [in receiver system 350 of terminal 106c (*second node*)] and recovers the reported CSI.” Walton, [0222], [0223], [0134]. Peterson demonstrates and confirms that a POSITA would have understood that a “complementary” process of receiving compressed CSI to “recover[] the reported CSI,” Walton, [0223], is decompressing the compressed CSI to recover the CSI. Ex.1022, 357 (In cases where it is

desirable “to send more data in a timely fashion than the bandwidth of the network supports...data can first be *compressed* at the sender, then transmitted over the network, and finally *decompressed* at the receiver.”) (emphasis in original).

115. As explained in the analysis of [53.4] (of this Ground 1), CSI includes a channel mask indicating selected channels (*instruction*), and either SNRs of the selected channels, or power control information for each selected channel, and the latter two forms of CSI are, when compressed, examples of *compressed first feedback*. The various forms of CSI are not required to be sent together in the same message. For example, the channel mask or SNRs (or other type of CSI) may be sent back only when one of them changes, such that channel mask may at times remain the same but other forms of CSI may change. Walton, [0221] (“[T]he CSI is sent only when there is a change ... **As an example, the channel mask or SNRs may be sent back** (e.g., differentially) **only when they change.**”). Regardless, as claim 82 makes clear via claim differentiation, even if the channel mask (*instruction*) and either the SNRs of selected channels or power control information is included in the same message, elements [53.1] and [53.4] are rendered obvious (claim 82 recites that the “*instruction*” is received “*separately*” from “*the compressed first feedback*,” meaning in claim 53 this information can be received together or separately.)

116. Thus, Walton discloses or renders obvious *decompressing the*

compressed first feedback (decompressing the compressed CSI, which is the complementary process of compressing CSI) *resulting in a decompressed first feedback* (resulting in CSI, which is decompressed version of compressed CSI).

Further, to the extent PO argues that Walton does not disclose or render obvious element [53.6], such would have been obvious in view of Peterson as discussed in Ground 3.

[53.7] *decompressing the compressed second feedback resulting in a decompressed second feedback*;

117. Walton discloses or renders obvious element [53.7].

118. For the same reasons provided in the analysis of claim element [53.5], the same teachings of Walton described for claim element [53.6] for downlink communication from a base station (e.g., base station 104, example transmitter system, *first node*) to a first terminal (e.g., terminal 106c, example receiver system, *second node*) also apply for downlink communication from the base station to another terminal (example receiver system, *third node*). *See, e.g.*, Walton, [0212] (“The CSI may be derived based on the signals transmitted from the transmitter system and received at the receiver system.”); [0225] (“The techniques described herein may be used for data transmission **on the downlink from a base station to one or more terminals**. For the downlink, transmitter system 310 in FIGS. 3 and 4A through 4D may represent part of a base station and receiver system 350 in FIGS. 3, 5, and 7 may represent part of a terminal.”); [0024], [0134],

[0221]-[0223]. Thus, as applied to a different receiver system (*a third node*) communicating with the transmitter system (base station, *first node*), Walton renders obvious claim element [53.7] for the same reasons as claim element [53.6].

[53.8.1] wherein the filtered transmission signal is a filtered first transmission signal that is transmitted to the second node using an 802.11-based orthogonal frequency-division multiplexing (OFDM) protocol via at least one antenna of a plurality of antennas,

119. Walton combined with IEEE-802.11a renders obvious element [53.8.1].

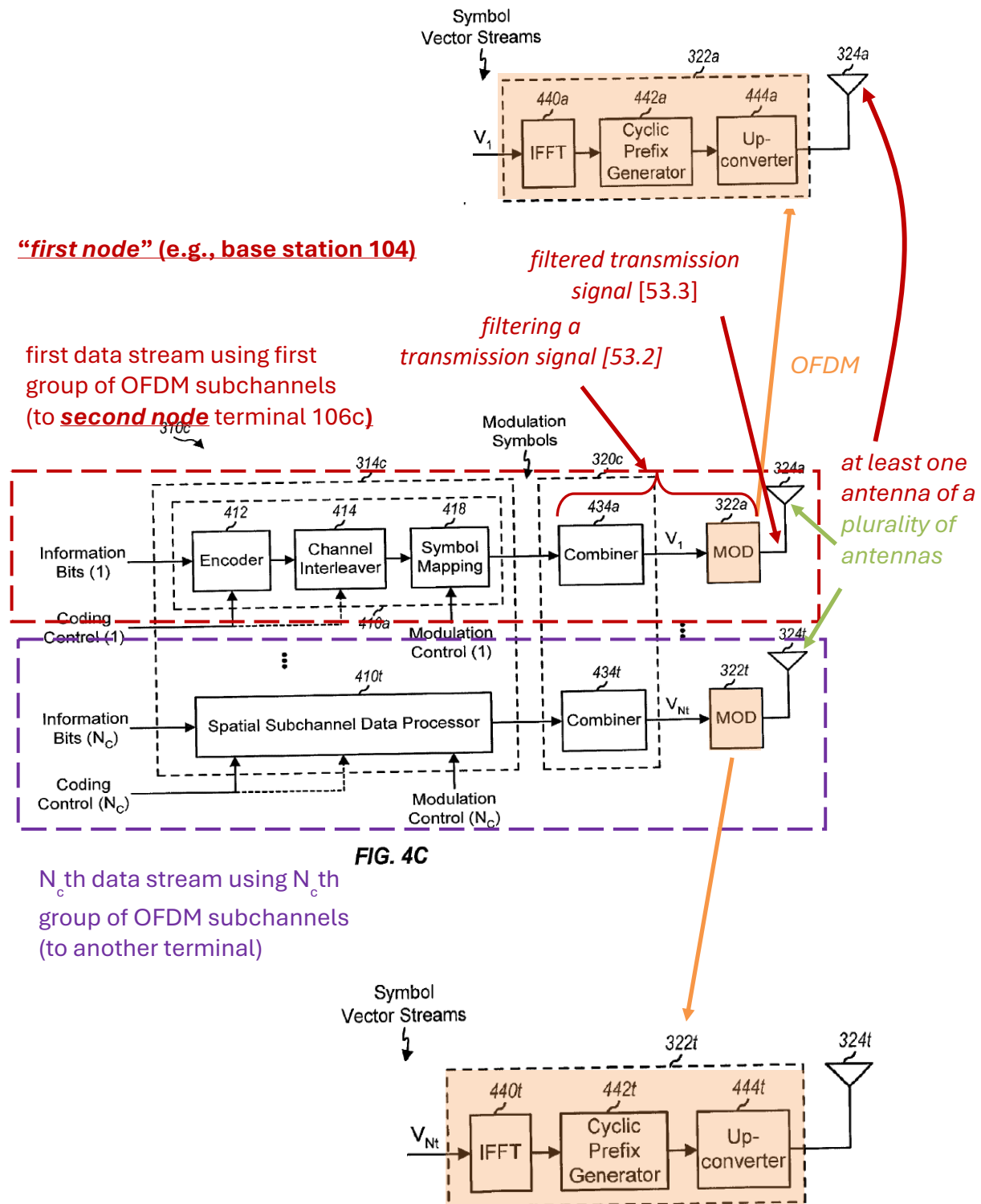
120. First, Walton discloses or renders obvious *the filtered transmission signal is a filtered first transmission signal that is transmitted to the second node* for the same reasons as presented in element [53.3] because this claim language is substantially the same as [53.3].

121. Second, Walton's transmissions are examples of *using an ... orthogonal frequency-division multiplexing (OFDM) protocol*. For example, each modulator 322 in Figure 4C employs an IFFT to generate an OFDM "modulated signal" (*filtered transmission signal*) as shown in Figure 4D. Walton, [0160], [0166]-[0167], and "OFDM" is a "communication scheme," *id.*, [0170].

122. Third, Walton's OFDM modulated signal (*filtered transmission signal*) is transmitted *via at least one antenna of a plurality of antennas* because Walton's modulated signal (*filtered transmission signal*) is "transmitted from a respective antenna 324." Walton, [0160], [0168]; *see also* Figure 1 (base station

104 having multiple antennas), [0024], Figures 3, 4C (illustrates plurality of antennas 324a-324t), and 4D, and [0137], [0158].

123. The combined teachings of Walton's Figures 1, 3, 4C, and 4D and [0005], [0024], [0134], [0137], [0158], [0159] are presented below, thus disclosing *the filtered transmission signal is a filtered first transmission signal that is transmitted to the second node (e.g., to terminal 106c in Figure 1) using an ... orthogonal frequency-division multiplexing (OFDM) protocol (OFDM signal) via at least one antenna (signal generated from respective antenna 324) of a plurality of antennas (324a-324t).*



Walton, Figures 4C and 4D (partial) (annotated)

124. Fourth, although Walton discusses OFDM throughout, it does not explicitly disclose the use of an OFDM protocol that is *802.11-based*. However, the use of an *802.11-based OFDM protocol* would have been obvious in view of IEEE-802.11a, and the well-known reasons that standardized protocols are used. IEEE-802.11a (1999) presents an industry standard for wireless local area networks (LANs) that uses a physical layer with OFDM, thus disclosing *an 802.11-based orthogonal frequency-division multiplexing (OFDM) protocol*. See IEEE-802.11a (Ex.1007), i, viii (“OFDM PHY [Physical Layer] specification for the 5 GHz band”); 3, 4 (“The OFDM PHY layer consists of two protocol functions”).

125. For example, employing elements of IEEE-802.11a (which uses OFDM), such as a 5 GHz band, Ex.1007, 3, modulation of OFDM subcarriers, such as using “binary or quadrature phase shift keying (BPSK/QPSK), 16-quadrature amplitude modulation (QAM), or 64-QAM,” *id.*, “forward error correction coding (convolutional coding with rates of 1/2, 2/3, or 3/4),” *id.*, OFDM preamble, *id.*, 7, subcarrier spacing, 9, slot time, *id.*, 27, and/or power levels, *id.*, in Walton’s communication system (which also uses OFDM, see above Figures 4C and 4D, convolutional coding using encoder 412, Walton, [0141], [0144], [0159], and PSK and QAM modulation using symbol mapping element 418, *id.*), renders obvious *an 802.11-based orthogonal frequency-division multiplexing (OFDM)*

protocol, in view of the motivation to combine Walton and IEEE-802.11a presented below.

126. Note that the ‘720 patent does not identify any particular aspect of an *IEEE 802.11-based OFDM protocol*, as compared to OFDM modulation in general (which includes IFFT, channel, and FFT, as discussed above), other than the fact that the IEEE 802.11 standard has “commercialized” OFDM modulation. *See* Ex.1001, 19:42-45 (“The core structure (IFFT, channel, FFT) corresponds to OFDM modulation recently commercialized in IEEE 802.11a and 802.11g wireless LANs.”).

Motivation to Combine Walton and IEEE-802.11a

127. It would have been obvious to apply IEEE 802.11 protocols, such as those OFDM protocols described in IEEE-802.11a, in Walton’s network (e.g., Figure 1) to create a wireless local area network (LAN) without changing Walton’s network architecture, and a POSITA would have recognized benefits of doing so. The benefits of using a standardized protocol, such as IEEE 802.11 protocols, were well-known – including guarantees of interoperability of products from different vendors, worldwide reach, and economies of scale, yielding lower costs, general familiarity with the technology, and existing circuitry/components for implementing it. *See, e.g.*, Ex.1015, 4 (“IEEE 802.11” is one of “three main forums for the standardization of wireless broadband communication systems.”); Ex.1015,

5 (An “industry alliance...has been established to promote the high rate IEEE 802.11 technology and to certify interoperability of products from different vendors...The OFDM standard was developed jointly with ETSI BRAN and MMAC, making OFDM effectively a worldwide standard for the 5-GHz band.”).

128. Combining Walton and IEEE-802.11a merely amounts to the use of a known technique (use of IEEE-802.11a’s OFDM protocol in a 5 GHz band) to improve a similar system (Walton’s Figure 1 system, implemented using Figures 3, 4C, and 4D) in the same way (e.g., having improved interoperability of produces from different vendors and economies of scale). Combining Walton and IEEE-802.11a is also nothing more than combining prior art elements according to known methods (such as adopting an IEEE-802.11a 5 GHz band, modulation of OFDM subcarriers, forward error correction coding, OFDM preamble, subcarrier spacing, slot time, and/or power levels in Walton’s OFDM system and transmissions) to yield the predictable and beneficial result of an OFDM communication system that includes standardized elements of IEEE802.11a, improving interoperability of products from different vendors, and making it more likely to achieve worldwide reach and economies of scale.

129. A POSITA would have had a reasonable expectation of success of incorporating teachings of IEEE-802.11a into Walton because other similar OFDM communication systems were likewise known to incorporate similar elements from

802.11, and Walton's communication system is in the form of a network architecture that employs IEEE 802.11 protocols. For example, Walton employs the same communication architecture as wireless local area networks that employ IEEE 802.11a protocols. For example, compare Walton, Figure 1 and Ex.1013 (Walton-2), Figure 1. Walton-2's access point (AP) 104 in Figure 1 is the same as Walton's base station 104 because Walton-2 uses "access point" and "base station" synonymously, Ex.1013, [0031], consistent with other prior art, *see* Ex.1014 4:1-5 ("...base station, i.e., an access point connected to the Internet..."). And the communication system of Walton-2 is a "MIMO OFDM system that has some of the characteristics **defined by the IEEE Standard 802.11a.**" Ex.1013, [0084]. As another example, Bohnke describes incorporating link adaptation that either applies a modulation to a subcarrier or assigns the subcarrier as an "empty" subcarrier that means no modulation is applied at all (as in Walton), Bohnke (Ex.1008), [0082], in a "wireless, multicarrier" system, such as "IEEE802.11a...with minimum changes required in current standards," *id.*, [0074]. And Walton's base station 104 (or access point) represents wireless infrastructure that exists in IEEE 802.11 networks, such as those that employ the 802.11a standard. *See, e.g.*, Ex.1014, 4:1-27 (an "IEEE-802.11" network "uses an access point for allocating the transmit time for all stations."); Ex.1016, 3:42-57 ("A **wireless access point 110, or simply, access point 110 is a wireless base-station**

that collects packets from and distributes packets to user terminals in its wireless coverage area... **The access point 110 can be an IEEE 802.11 base station,** capable of communicating with user terminals via the radio frequency link 107 using a wireless protocol such as IEEE 802.11. While FIG. 1 illustrates a single UT and **a single access point or wireless radio base station...**”).

130. Finally, Walton and IEEE-802.11a are analogous art to the ’720 patent. The field of endeavor of the ’720 patent is management of the frequencies used by wireless communication systems, sometimes referred to as spectrum management. For example, the ’720 patent states that “[t]he present invention relates generally to radio frequency spectrum management systems...” ’720 patent, 1:18-20. Walton is in the same field of endeavor as the ’720 patent because Walton in the field of management of frequencies used by wireless communications systems. *See, e.g.*, Walton, [0003] (“The present invention relates generally to data communication, and more specifically to techniques for processing data for transmission in **a wireless communication system using selective channel transmission** and defined (e.g., uniform) transmit power allocation.”); [0009]-[0010] (Only “good” transmission channels, e.g., “frequency subchannels,” are selected for use.); [0024], [0031], [0066], [0068], Figures 1, 3, 4C, 4D.

131. IEEE-802.11a is also in the same field of endeavor as the ’720 patent because Walton relates to management of frequencies used by wireless

communications systems. *See, e.g.*, IEEE-802.11a, i (Title: “Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications: High-speed Physical Layer in the 5 GHz Band”; “Changes and additions to IEEE Std. 802.11-1999 are provided to support the new high rate physical layer (PHY) for operation in the 5 GHz band.”); iii (“This standard is part of a family of standards for local and metropolitan area networks... This family of standards deals with the Physical and Data Link layers as defined by the International Organization for Standardization (ISO) Open Systems Interconnection (OSI) Basic Reference Model (ISO/IEC 7498-1:1994).”); 3 (“17. OFDM PHY specification for the 5 GHz band”). In other words, IEEE-802.11a is a standard providing high-speed operation in the 5 GHz radio frequency band for a wireless local area network using OFDM, and such high-speed operation yields efficient management of frequencies. And as shown in this discussion of [53.8.1], IEEE-802.11a is also reasonably pertinent to the problem of providing an “*802.11-based OFDM protocol*” as recited in claims 53 and 95 of the ’720 patent.

[53.8.2] using a first power that is based on the decompressed first feedback;

132. Walton discloses or renders obvious element [53.8.2].

133. First, Walton explains that the “**total available transmit power for each group** [of transmission channels] is [] **distributed amongst the good transmission channels** in accordance with a defined allocation scheme,” Walton,

[0010], [0031], thus teaching that the power distribution is applicable to the group of transmission channels for the *filtered transmission signal* of [53.2], [53.3], and [53.8.1] transmitted to the *second node, id.*, [0158] and Figure 4C.

134. Second, the claimed “*a first power*” is disclosed or rendered obvious in multiple ways.

As explained in the analysis of element [53.4] (of this Ground 1), the CSI includes the “channel mask” identifying “the selected transmission channels,” *id.*, [0205] (*instruction* of [53.1]), and the “SNR...for each selected transmission channel,” *id.*, [0208], which is compressed and fed back from a terminal (*compressed first feedback from the second node*). The SNR for each selected transmission channel is used to determine the distribution of the “total available transmit power amongst the selected transmission channels,” Walton, [0129], such as power “**allocat[ed] non-uniformly, for example, based on the distribution of SNRs achieved** for the transmission channels,” *id.*, [0130], Abstract, [0009]-[0010], [0031].. Any of the power values of any of the selected transmission channels (OFDM subchannels) is an example *first power that is based on the decompressed first feedback* (SNRs of the selected subchannels, per the analysis of [53.4] and [53.6]). *Id.* The base station (e.g., base station 104) receives the compressed CSI in this case, per the analysis of [53.4], and the base station necessarily distributes transmit power over the selected transmission channels

based on the decompressed CSI ([53.6]) since the base station is doing the transmitting (*using a first power that is based on the decompressed first feedback*), thereby disclosing or rendering obvious element [53.8.2].

135. Walton also discloses or renders obvious element [53.8.2] in multiple ways using “power control information.” Walton, [0209]. More specifically, as explained in the analysis of element [53.4] (of this Ground 1), an alternative example of the information that would have been included in the CSI in addition to the “channel mask” identifying “the selected transmission channels,” *id.*, [0205], is “power control information for each selected transmission channel, data stream, group or [*sic* – of] transmission channels, or any other unit of transmission.” *id.*, [0209]. “The power control information may include a single bit for each transmission unit to indicate a request for either more power or less power, or it may include multiple bits to indicate the magnitude of the change in power level requested.” Walton, [0209]. The claimed “*first power*” is disclosed or rendered obvious in at least three ways from “power control information”:

- (1) a first power for a selected transmission channel is based on the single bit (request) or the multiple bit (change in magnitude) for the selected transmission channel;
- (2) a first (overall) power for the group of selected transmission channels is based on a single bit (request) or multiple bits (change in magnitude) for a

selected transmission channel (i.e., a change of power for one channel will result in a change to the overall power);

(3) a first (overall) power for the group of selected transmission channels is based on a single bit (request) or multiple bits (change in magnitude) for a “group [of] transmission channels.” Note that Walton at [0209] refers to single-bit or multiple-bit power control information for “each transmission unit” which can be a “group [of] transmission channels.”

136. Thus, in addition to allocating a given transmit power over the selected channels, Walton discloses changing transmit power per transmission channel or group of transmission channels based on decompressed CSI feedback, thereby disclosing or rendering obvious *using a first power* (overall transmit power) *that is based on the decompressed first feedback* (decompressed CSI feedback).

[53.9] *transmitting, using the 802.11-based OFDM protocol, a filtered second transmission signal, simultaneously with the filtered first transmission signal, to the third node using a second power that is based on the decompressed second feedback.*

137. Walton combined with IEEE-802.11a renders obvious element [53.9].

138. Element [53.9] is similar to elements [53.3], [53.8.1], and [53.8.2], except that [53.9] involves communication with a different node (*third node*) and communication is *simultaneous[ly]* with the *filtered first transmission signal*.

Elements [53.3], [53.8.1], and [53.8.2] are presented together with [53.9] to

highlight the similarities, with similar wording indicated using similar colors.

Underlined portions highlight material differences between the elements.

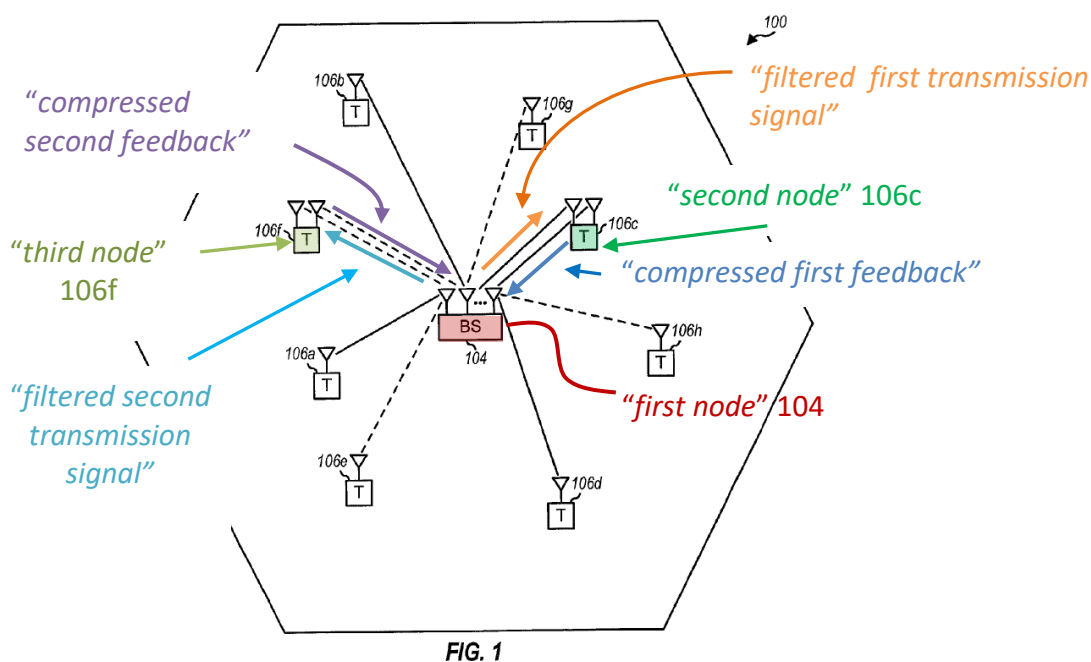
<p>[53.3] <i>transmitting the filtered transmission signal to the second node; [53.8.1] wherein the filtered transmission signal is a filtered first transmission signal that is transmitted to the second node using an 802.11-based orthogonal frequency-division multiplexing (OFDM) protocol via at least one antenna of a plurality of antennas, [53.8.2] using a first power that is based on the decompressed first feedback;</i></p>	<p>[53.9] <i>transmitting, using the 802.11-based OFDM protocol, a filtered second transmission signal, simultaneously with the filtered first transmission signal, to the third node using a second power that is based on the decompressed second feedback.</i></p>
--	---

139. First, the application of Walton-802.11a for downlink data transmission from base station 104 (*first node*) to terminal 106c (*second node*), as discussed for [53.1]-[53.4], [53.6], and [53.8.1]-[53.8.2], is likewise applicable for downlink data transmission from base station 104 (*first node*) to terminal 106f (or any other terminal), for the same reasons stated for [53.5] and [53.7]. *See* Walton, [0024], [0134], [0225]. Accordingly, Walton-802.11a likewise renders obvious *transmitting, using the 802.11-based OFDM protocol, a filtered second transmission signal ... to the third node using a second power that is based on the decompressed second feedback*. A POSITA would have understood that the teachings of Walton apply to the *n*th data stream in Figure 4C, just as they do for

the 1st data stream. *See, e.g.*, Walton, [0160] (The modulation symbols from each data processor 410 are provided to a **respective** combiner 434 within TX channel processor 320c. If each group includes the **selected frequency subchannels for a particular transmit antenna**, then combiner 434 combines the modulation symbols for the **selected frequency subchannels** to form a modulation symbol vector for each time slot, which is then provided to a **respective modulator 322.**”). Walton describes the “selected frequency subchannels” on a per-antenna basis, which is consistent with teachings that different transmit antennas may be assigned to different terminals. Walton, [0066], [0068]. And transmit power is allocated to those selected frequency subchannels on a per-antenna (per-terminal) basis. *See, e.g.*, Walton, [0066] (“**The total transmit power available for each transmit antenna** is then allocated in a defined manner (e.g., uniformly) to the **selected frequency subchannels for the transmit antenna.**”).

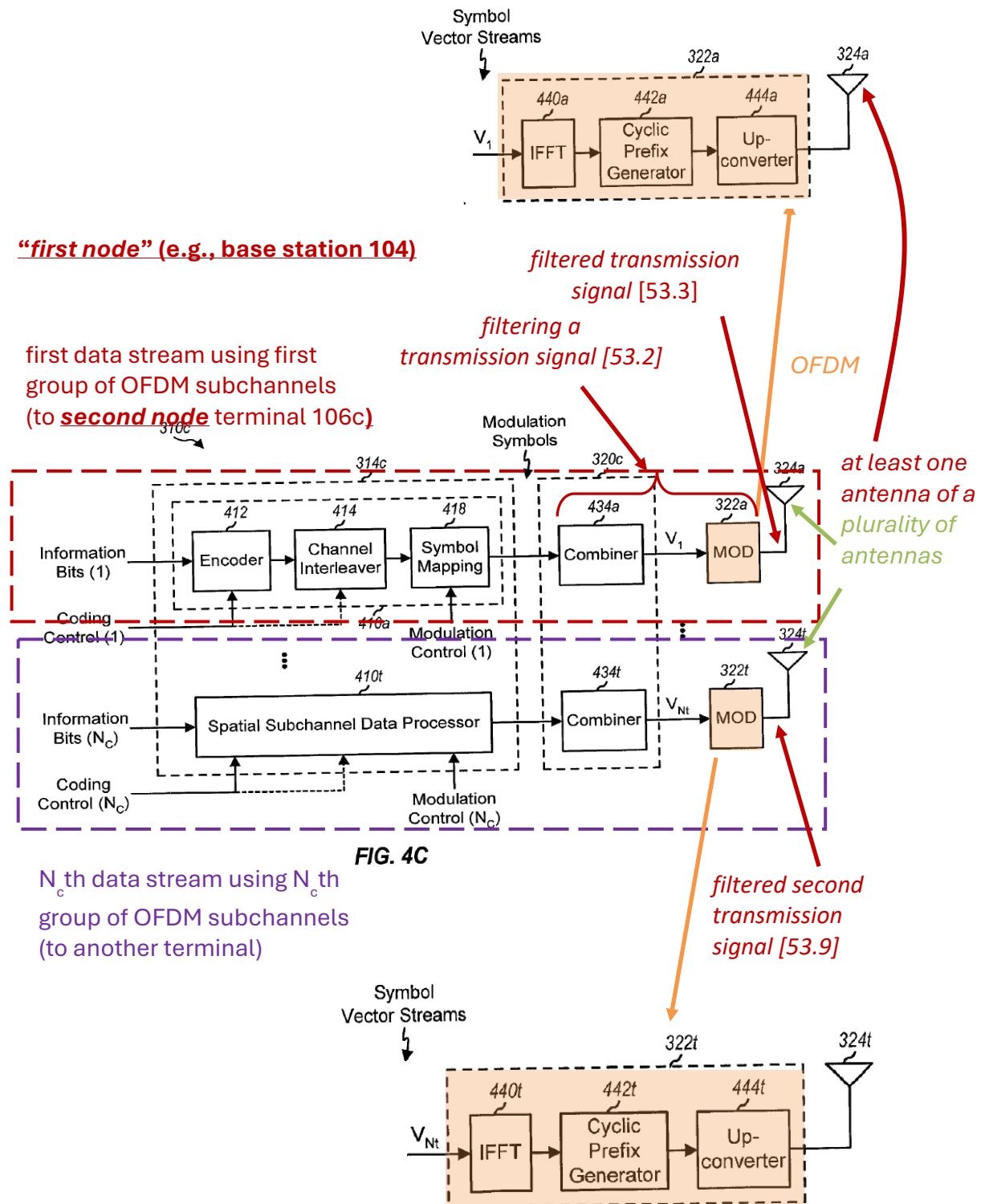
140. Second and with regard to “simultaneously,” Walton discloses simultaneous (concurrent) transmission of OFDM signals to different terminals. Walton, [0024] (“MIMO system 100 is effectively formed for a multiple access communication system having a **base station (BS) 104 that concurrently communicates with a number of terminals (T) 106.**”); [0025]; [0027] (“MIMO system utilizing OFDM.”). For example, the base station 104 (*first node*) would simultaneously transmit the *filtered first transmission signal* to terminal 106c

(*second node*) using one antenna 324a and transmit the *filtered second transmission signal* to terminal 106f (*third node*) using a different antenna 324t, as examples, as shown in Figure 1, reproduced below. Ex.1005, [0137], [0158], [0160], [0168].



Walton, Figure 1 (annotated)

141. The combined teachings of Figures 4C and 4D from elements [53.1]-[53.3], [53.8.1], and [53.8.2] are reproduced below with labels added for element [53.9].



Walton, Figures 4C and 4D (partial) (annotated)

B. Ground 2: Claim 53 is obvious based on Walton combined with IEEE-802.11a and McFarland

[53.0] *A method for managing interference in a radio communications network, comprising the steps of:*

142. Walton combined with IEEE-802.11a discloses or renders obvious element [53.0]. See Ground 1, analysis of [53.0].

[53.1] *receiving at a first node in the radio communications network an instruction transmitted from a second node in the radio communications network to avoid using a plurality of frequencies to transmit to the second node;*

143. Walton discloses or renders obvious element [53.1]. See Ground 1, analysis of [53.1].

[53.2] *filtering a transmission signal to remove power from the transmission signal at each frequency in the plurality of frequencies to be avoided;*

144. Walton combined with McFarland renders obvious [53.2].

145. To the extent that Patent Owner argues that Walton does not disclose or render obvious element [53.2], such would have been obvious in view of McFarland.

146. As shown below, McFarland provides implementation detail explaining that certain frequencies to be avoided are set to zero prior to the IFFT (*filtering*), so that frequencies in an OFDM signal “are not to be used.” McFarland, [0039] (“a subset” of frequencies can used “by simply inputting zero magnitude signals” on the frequencies “that are not to be used”).

147. McFarland addresses OFDM transmission, McFarland, [0006], which,

like Walton, uses an “Inverse Fast Fourier Transform (iFFT) processor,” *id.*, [0007]. McFarland further uses “carrier” and “subcarrier” interchangeably in the context of OFDM. McFarland, [0007] (N data symbols, each mapped to different “subcarrier”), [0009], Figure 3 (OFDM channel having N “carriers.”). Walton associates a OFDM “subcarrier” as having a related OFDM “subchannel” in one-to-one correspondence. Walton, [0005] (“**An OFDM system effectively partitions the operating frequency band into a number of frequency subchannels (or frequency bins), each of which is associated with a respective subcarrier on which data may be modulated.**”). More specifically, a subcarrier is a frequency within a frequency subchannel that carries a modulation symbol. *Id.*, [0165].

148. McFarland describes “changing the number of carriers in active use,” McFarland, [0037]-[0038], by using “a single iFFT processor ... without modification,” *id.*, [0039]. Specifically, “[i]n any given situation, **a subset of the carriers can be used** by simply inputting zero magnitude signals **on the carriers that are not to be used.**” *Id.* In other words, McFarland explains that “[i]n any given situation” (such as in Walton) “carriers that are not to be used” (such as the corresponding “bad” frequency subchannels and their associated subcarriers in Walton, Walton, [0009]-[0010]) are filtered out “by simply inputting zero magnitude signals” for the IFFT on those carriers, as illustrated in Figure 8

(annotated below). McFarland's teaching that realizes "power savings from using a smaller number of carriers," McFarland, [0039], confirms that power is removed from carriers that are not to be used (*"remov[ing] power from the transmission signal from each frequency in the plurality of frequencies to be avoided"*).

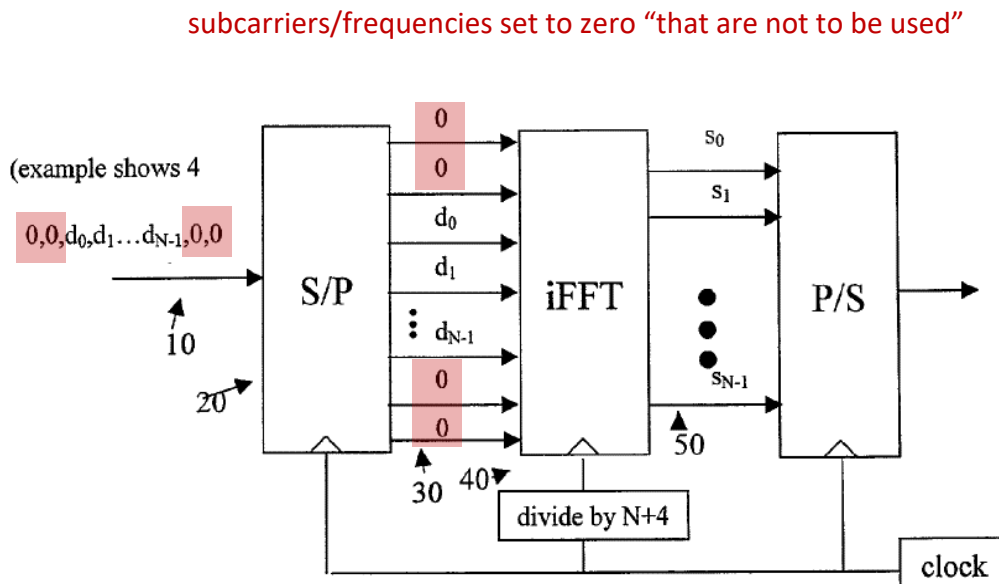


FIG. 8

McFarland, Figure 8 (annotated)

149. Walton explains that the "combiner 434 combines the modulation symbols for the selected frequency subchannels to form a modulation symbol vector for each time slot, which is then provided to a respective modulator 322." Walton, [0160]. "Filtering a transmission signal" is indicated in a figure below that combines Figures 4C and 4D of Walton, in view of the teachings of McFarland.

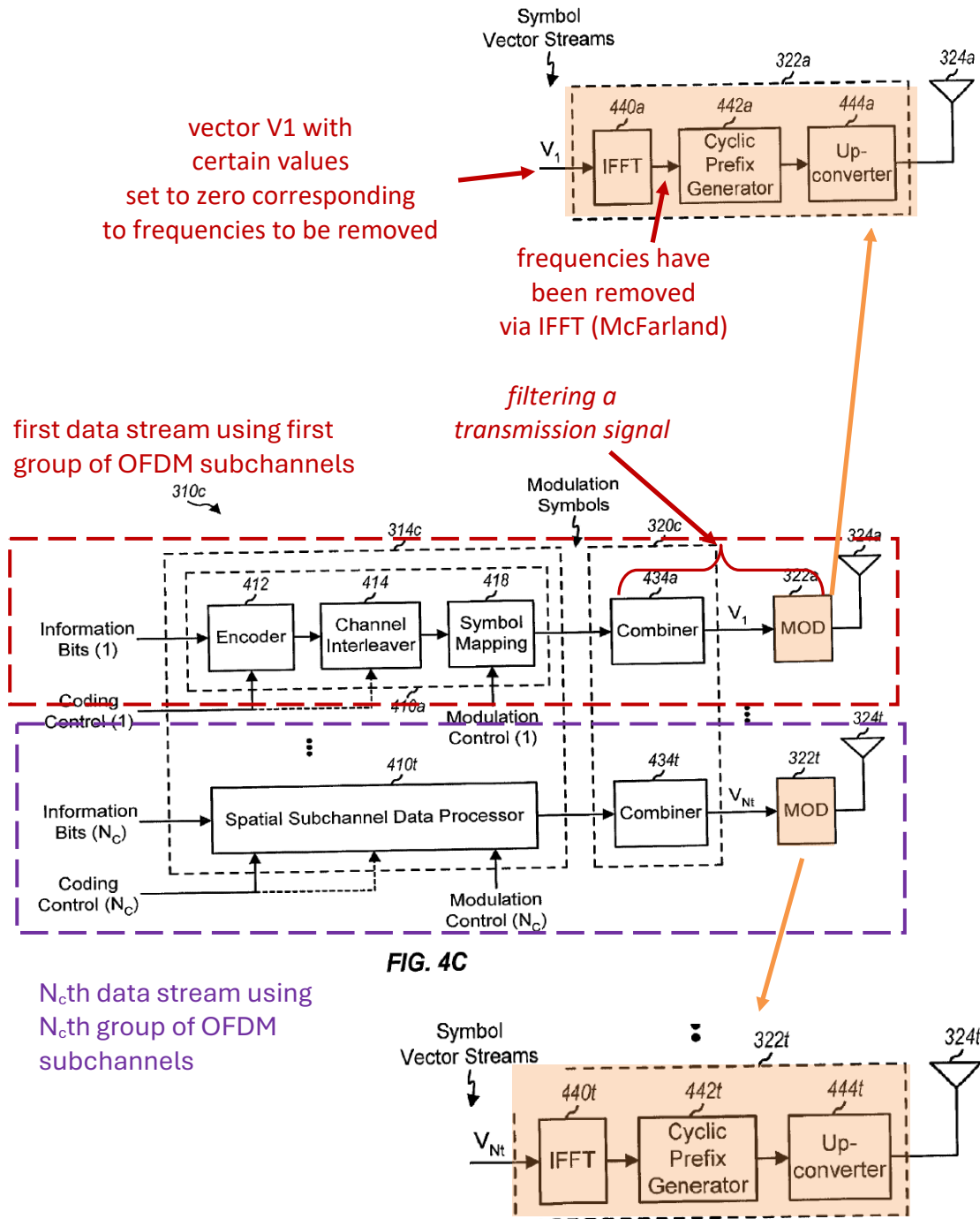


FIG. 4C

Walton, Figures 4C and 4D (partial) (annotated)

150. McFarland's description of setting IFFT inputs to zero is an example

of “*filtering*” to “*remove power*” from a signal “*at each frequency in the plurality of frequencies to be avoided*” because McFarland’s description matches how the ’720 patent specification describes such filtering. For example, the ’720 patent recites that “output filter 1440 performs **transmit excision to remove power** from certain frequencies that neighboring node 1460 has determined should not be used...” Ex.1001, 22:8-17. Note that this is the only place in the specification where the phrase “to remove power,” as in the claim language, is used. The ’720 patent describes “transmit excision” further with regard to an inverse FFT (or IFFT):

An alternative approach is shown in FIG. 13. ... This wider band frequency vector is then inverse-FFT’ed into a time waveform for transmission across the channel. ... **The undesired frequencies have been removed from $y(t)$ by the transmit excision.**

Ex.1001, 19:18-34.

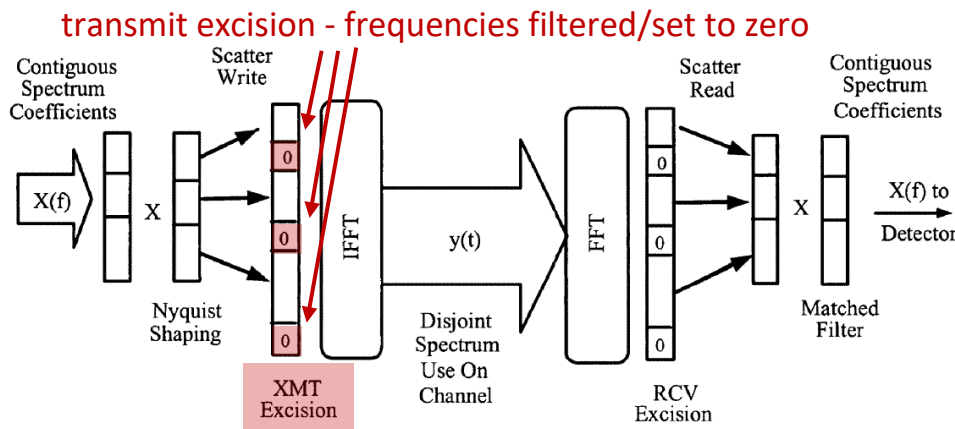


FIG. 13

'720 patent, Figure 13 (annotated)

Also, note that claim 94 of the '720 patent, confirms that transmit excision is a form of filtering, reciting "*the filtering utilizes transmit excision.*"

151. In summary, Walton discloses an OFDM modulator (with IFFT) that uses only "selected" OFDM frequency subchannels from a group of frequency subchannels and not using (avoiding) "bad" frequency subchannels (*the plurality of frequencies to be avoided*), and McFarland discloses filtering out frequency subchannels that "are not to be used" by setting the corresponding elements of an IFFT input to zero, thereby further rendering obvious *filtering a transmission signal to remove power from the transmission signal at each frequency in the plurality of frequencies to be avoided*, in view of the motivation to combine Walton and McFarland, below.

Reasons to Combine Walton and McFarland

152. It would have been obvious to a POSITA to combine Walton and McFarland to provide the obvious, predictable, and beneficial result of implementing Walton's IFFT in accordance with McFarland's teachings in order to generate an OFDM signal in which certain unselected OFDM frequency subchannels are not used. Indeed, McFarland expressly teaches that a "single iFFT processor can be used ... to generate a different [variable] number of carriers" with **"the advantage** of requiring little change to the overall circuitry and no change at all to the iFFT processor" while also providing, albeit minimal, "power savings from using a smaller number of carriers." McFarland, [0037]-[0039]. Accordingly, a POSITA would have been motivated to implement Walton's IFFT in accordance with these teachings to generate a signal that uses only selected frequency subchannels for each antenna, as taught by Walton, Walton, [0065], [0066], [0068], [0158]-[0160], to realize the benefit of the ease in doing so "with little [circuitry] change" and "no change" to the IFFT in Walton. Additionally, a POSITA would have been motivated to do so for the benefit of the "power savings" that would result as taught by McFarland.

153. A POSITA also would have been motivated to make this combination because Walton expressly relies on what is "known in the art" for implementation of its IFFT in generating OFDM signals and even expressly indicates that such

implementation is “not described herein.” Walton, [0166]-[0167]. Therefore, Walton is lacking in “known” implementation detail regarding how to generate its OFDM signals, providing motivation to a POSITA to look for other references to understand how to implement Walton’s teachings. McFarland is such a reference that provides implementation detail for Walton, explaining that “carriers” (frequencies) can be set to zero prior to the IFFT, so that certain subchannels in an OFDM signal “are not to be used.” McFarland, [0039], [0006], [0007], [0009].

154. Walton combined with McFarland represents use of known technique (McFarland’s IFFT technique in Figure 8 to remove “carriers that are not be used,” McFarland, [0037]-[0039]) to improve similar devices (Walton’s OFDM transmitter system/base station of Figure 4C with OFDM modulator 322 illustrated in Figure 4D, Walton, [0158]-[0160], [0166]-[0167], [0134]) in the same way (ease of implementation with little circuitry change and no IFFT change and power savings).

155. A POSITA would have had a reasonable expectation of success of implementing McFarland’s teachings regarding OFDM transmission using an IFFT in Walton’s OFDM modulator (that also uses an IFFT) because McFarland’s teachings are compatible for implementation in Walton. *See, e.g.*, Walton, [0158]-[0160] (“modulator 322” of Figure 4C described with respect to Figure 4D); [0166]-[0167] (OFDM modulator 322 using IFFT); McFarland, [0039] (setting

IFFT inputs to zero for carriers/subchannels not used); [0006]-[0007] (OFDM employs IFFT). Indeed, Walton expressly allows for what's "known in the art" for implementation of its IFFT, Walton, [0167], and McFarland's Fig. 8 IFFT implementation, which was known in the art, would have required only little circuitry change and no change to the IFFT, McFarland, [0039]. McFarland is also evidence that a POSITA knew how to implement its teachings in a similar system as Walton, and McFarland's IFFT teachings would be used merely for the same intended purpose when combined with Walton's OFDM modulator, which uses an IFFT.

156. When McFarland's teachings are applied to Walton's OFDM transmitter system/base station, a POSITA would have "simply input[] zero magnitude signals on the carriers that are not to be used," McFarland, [0039], in accordance with the received channel mask (*instruction*) described for element [53.1]. The process of filtering out certain identified "bad" frequency subchannels (per Walton) by setting these subchannels to zero (per McFarland), which would have been implemented in Walton's "combiner 434," for example, thereby removes power from those subchannels and implements *filtering a transmission signal to remove power from the transmission signal at each frequency in the plurality of frequencies to be avoided*.

157. Finally, McFarland is analogous art to the '720 patent. The field of

endeavor of the '720 patent is management of the frequencies used by wireless communication systems, sometimes referred to as spectrum management. For example, the '720 patent states that “[t]he present invention relates generally to radio frequency spectrum management systems...” ’720 patent, 1:18-20.

McFarland is in the same field of endeavor as the '720 patent because McFarland relates to management of frequencies used by wireless communications systems.

For example, McFarland focuses on multi-carrier communications, such as OFDM communications, in which “an object of the present invention is to provide a multi-carrier system in which the number of carriers, the symbol rate, and thereby the overall occupied bandwidth can be varied.” McFarland, [0015]. As a further example, McFarland describes the way an IFFT can be used for “changing the number of carriers in active use” in an OFDM system, McFarland, [0038], where “carriers” in McFarland is used in the same sense as “subchannels” in Walton.

McFarland, [0039] (“**In any given situation, a subset of the carriers can be used by simply inputting zero magnitude signals on the carriers that are not to be used.** This has the advantage of requiring little change to the overall circuitry and no change at all to the iFFT processor.”). In other words, McFarland explains that “carriers that are not to be used” are indicated “by simply inputting zero magnitude signals” for the IFFT on those carriers. And as shown in the discussion of this limitation [53.2], McFarland is also reasonably pertinent to the problem of

“filtering a transmission signal to remove power” as recited in claims 53 and 95.

Summary

158. Walton discloses an OFDM modulator (with IFFT) that uses only “selected” OFDM frequency subchannels from a group of frequency subchannels and not using (avoiding) “bad” frequency subchannels (*the plurality of frequencies to be avoided*), *see, e.g.*, Walton, [0009]-[0010], [0031], [0158]-[0160], [0166]-[0167], and McFarland discloses filtering out frequency subchannels that “are not to be used” by setting the corresponding inputs of an IFFT to zero, *see, e.g.*, McFarland, [0037]-[0039], thereby further rendering obvious *filtering a transmission signal to remove power from the transmission signal at each frequency in the plurality of frequencies to be avoided*.

[53.3] *transmitting the filtered transmission signal to the second node;*

159. Walton discloses or renders obvious element [53.3]. See Ground 1, analysis of [53.3].

[53.4] *receiving a compressed first feedback from the second node that characterizes receipt of a first signal sent from the first node to the second node;*

160. Walton discloses or renders obvious element [53.4]. See Ground 1, analysis of [53.4].

[53.5] *receiving a compressed second feedback from a third node that characterizes receipt of a second signal sent from the first node to the third node;*

161. Walton discloses or renders obvious element [53.5]. See Ground 1,

analysis of [53.5].

[53.6] *decompressing the compressed first feedback resulting in a decompressed first feedback; and*

162. Walton discloses or renders obvious element [53.6]. See Ground 1, analysis of [53.6].

[53.7] *decompressing the compressed second feedback resulting in a decompressed second feedback;*

163. Walton discloses or renders obvious element [53.7]. See Ground 1, analysis of [53.7].

[53.8.1] *wherein the filtered transmission signal is a filtered first transmission signal that is transmitted to the second node using an 802.11-based orthogonal frequency-division multiplexing (OFDM) protocol via at least one antenna of a plurality of antennas,*

164. Walton discloses or renders obvious element [53.8.1]. See Ground 1, analysis of [53.8.1].

[53.8.2] *using a first power that is based on the decompressed first feedback;*

165. Walton discloses or renders obvious element [53.8.2]. See Ground 1, analysis of [53.8.2].

[53.9] *and further comprising: transmitting, using the 802.11-based OFDM protocol, a filtered second transmission signal, simultaneously with the filtered first transmission signal, to the third node using a second power that is based on the decompressed second feedback.*

166. Walton combined with IEEE-802.11a renders obvious element [53.9]. See Ground 1, analysis of [53.9].

C. Ground 3: Claim 53 is obvious based on Walton combined with IEEE-802.11a and Peterson

[53.0] *A method for managing interference in a radio communications network, comprising the steps of:*

167. Walton combined with IEEE-802.11a discloses or renders obvious element [53.0]. See Ground 1, analysis of element [53.0].

[53.1] *receiving at a first node in the radio communications network an instruction transmitted from a second node in the radio communications network to avoid using a plurality of frequencies to transmit to the second node;*

168. Walton discloses or renders obvious element [53.1]. See Ground 1, analysis of element [53.1].

[53.2] *filtering a transmission signal to remove power from the transmission signal at each frequency in the plurality of frequencies to be avoided;*

169. Walton discloses or renders obvious element [53.2]. See Ground 2, analysis of [53.2]. See Ground 1, analysis of element [53.2].

[53.3] *transmitting the filtered transmission signal to the second node;*

170. Walton discloses or renders obvious element [53.3]. See Ground 1, analysis of element [53.3].

[53.4] *receiving a compressed first feedback from the second node that characterizes receipt of a first signal sent from the first node to the second node;*

171. Walton discloses or renders obvious element [53.4]. See Ground 1, analysis of element [53.4].

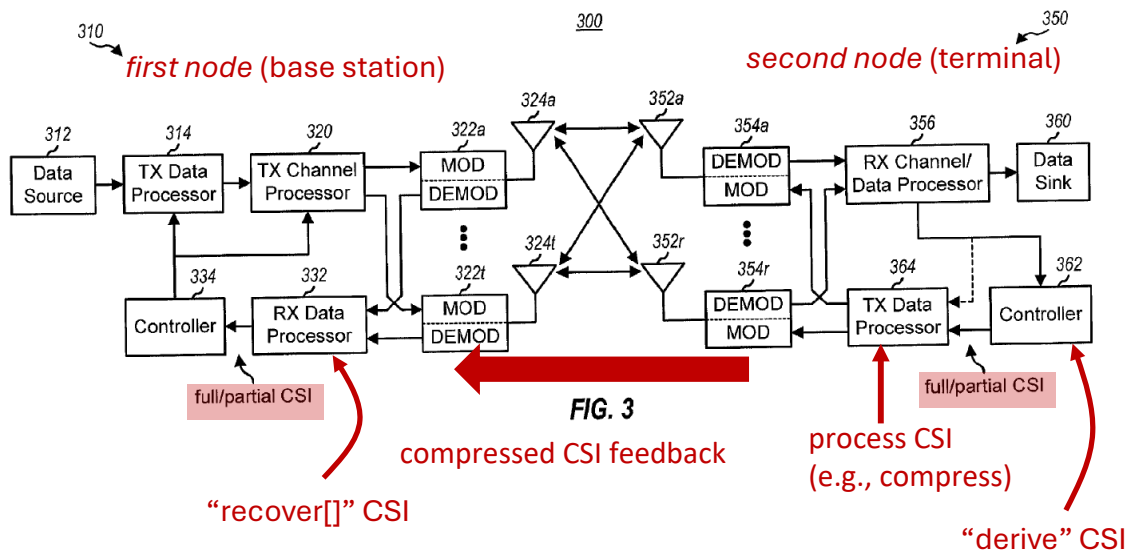
[53.5] *receiving a compressed second feedback from a third node that characterizes receipt of a second signal sent from the first node to the third node;*

172. Walton discloses or renders obvious element [53.5]. See Ground 1, analysis of element [53.5].

[53.6] *decompressing the compressed first feedback resulting in a decompressed first feedback; and*

173. Walton combined with Peterson renders obvious element [53.6].

174. Continuing with the analysis above in Ground 1 for elements [53.4] and [53.6], Walton discloses “*receiving a compressed first feedback*” in the form of compressed CSI at system 310 of base station 104 (*first node*) (Walton, [0134]), as illustrated in annotated Figure 3, reproduced from [53.4] below. *Id.*, [0221]-[0223].



Walton, Figure 3 (annotated)

175. Walton describes its “differential updates” of CSI as compression, acknowledging that “differential updates” are one form of compression but that “[o]ther compression...techniques...may also be used,” Walton, [0221], providing explicit motivation to use another compression technique. Peterson describes three exemplary compression techniques, Ex.1022, 358-360, any of which may be used to implement Walton’s “compression” of CSI. For example, “run length” encoding is an example form of compression described in Peterson (at 358) (and “run length encoding” is contemplated for encoding/compressing the channel mask, for example, Walton, [0205]). Peterson’s run length encoding applied to compress CSI at a terminal, with decompression of the CSI at the base station, renders obvious *decompressing the compressed first feedback* (performing

a complementary process to compressing CSI using run-length encoding to recover the CSI in a base station) *resulting in a decompressed first feedback* (resulting in decompression of the compressed CSI feedback), in view of the motivation to combine Walton and Peterson, presented below.

Motivation to Combine Walton and Peterson

176. Walton describes sending CSI “differentially” or using “other compression” techniques. Walton, [0221], and Walton describes a receiver of a transmitter system 130 “performing processing complementary” to that of a transmitter of a receiver system 350, *id.*, [0222]-[0223]. To the extent Walton does not expressly describe decompression of the received compressed CSI, it would have been obvious to a POSITA to have looked to a reference such as Peterson to understand how to recover the compressed CSI that was received. Peterson explains that when data is first “*compressed* at the sender” this is followed by the data being “*decompressed* at the receiver.” Ex.1022, 357 (emphasis in original); *see also* 355.

177. In addition to describing differential compression, Walton says that “other compression” techniques may be used, Walton, [0221], which expressly teaches a POSITA to consider other types of compression techniques for implementation, examples of which are presented in Peterson. Peterson provides examples of compression/decompression techniques, Ex.1022, 357, such as “run

length encoding,” *id.*, 358, “Differential Pulse Code Modulation” or “DPCM,” *id.*, 359, and “dictionary-based” methods, *id.* Indeed, Walton already teaches to use run-length encoding for CSI. Walton, [0205]

178. Combining Walton and Peterson represents simple substitution of Peterson’s compression (e.g., run length encoding) for Walton’s compression (e.g., sending differential updates) in accordance with Walton’s express teachings to use “other compression” techniques to obtain the predictable result of compressing CSI using a Peterson compression technique and decompression of the compressed CSI. Combining Walton and Peterson also represents combining prior art elements according to known methods (Walton’s performing “processing complementary” to compression of CSI, using Peterson’s specific compression applied to Walton’s teaching to use “other compression” of CSI, and using Peterson’s decompression applied to the compressed CSI) to yield the predictable and beneficial result of decompression to recover compressed CSI. A POSITA would have had a reasonable expectation of success of implementing decompression of compressed CSI in Walton’s system because Peterson is evidence that a POSITA knew how to implement various compression/decompression techniques between devices communicating in a network, see, e.g., Ex.1022, Title (“Computer Networks”), 357 (describing data “transmitted over a network”), similar to Walton’s, and the combination would merely use those techniques for their intended purpose.

179. Finally, Peterson is analogous art to the '720 patent. Peterson is at least reasonably pertinent to a problem addressed by the '720 patent of using spectrum efficiently. '720 patent, 1:54-62 (Explaining that there are “unanswered questions about how to build and configure networks and devices” that use “the available spectrum more efficiently.”). Peterson’s compression and decompression were well-known ways to “transmit [] data using as little network bandwidth as possible,” Peterson, 346; *see also* 357 (“It is sometimes the case” that “more data” needs to be sent “in a timely fashion than the bandwidth of the network supports.”), which provides for efficient use of available network bandwidth.

[53.7] *decompressing the compressed second feedback resulting in a decompressed second feedback;*

180. Walton combined with Peterson renders obvious element [53.7].

181. Peterson supplements Walton in the same way as described in claim element [53.6] as applied to the teachings of Walton presented in the analysis of [53.7] in Ground 1, thereby demonstrating that Walton combined with Peterson also renders obvious [53.7].

[53.8.1] *wherein the filtered transmission signal is a filtered first transmission signal that is transmitted to the second node using an 802.11-based orthogonal frequency-division multiplexing (OFDM) protocol via at least one antenna of a plurality of antennas,*

182. Walton discloses or renders obvious element [53.8.1]. See Ground 1, analysis of element [53.8.1].

[53.8.2] *using a first power that is based on the decompressed first feedback;*

183. Walton discloses or renders obvious element [53.8.2]. See Ground 1, analysis of element [53.8.2].

[53.9] *and further comprising: transmitting, using the 802.11-based OFDM protocol, a filtered second transmission signal, simultaneously with the filtered first transmission signal, to the third node using a second power that is based on the decompressed second feedback.*

184. Walton combined with IEEE-802.11a discloses or renders obvious element [53.9]. See Ground 1, analysis of element [53.9].

D. Ground 4: Claim 53 is obvious based on Walton combined with IEEE-802.11a, McFarland, and Peterson

[53.0] *A method for managing interference in a radio communications network, comprising the steps of:*

185. Walton combined with IEEE-802.11a discloses or renders obvious element [53.0]. See Ground 1, analysis of [53.0].

[53.1] *receiving at a first node in the radio communications network an instruction transmitted from a second node in the radio communications network to avoid using a plurality of frequencies to transmit to the second node;*

186. Walton discloses or renders obvious element [53.1]. See Ground 1, analysis of [53.1].

[53.2] *filtering a transmission signal to remove power from the transmission signal at each frequency in the plurality of frequencies to be avoided;*

187. Walton combined with McFarland renders obvious element [53.2]. See Ground 2, analysis of [53.2].

[53.3] *transmitting the filtered transmission signal to the second node;*

188. Walton discloses or renders obvious element [53.3]. See Ground 1, analysis of [53.3].

[53.4] *receiving a compressed first feedback from the second node that characterizes receipt of a first signal sent from the first node to the second node;*

189. Walton discloses or renders obvious element [53.4]. See Ground 1, analysis of [53.4].

[53.5] *receiving a compressed second feedback from a third node that characterizes receipt of a second signal sent from the first node to the third node;*

190. Walton discloses or renders obvious element [53.5]. See Ground 1, analysis of [53.5].

[53.6] *decompressing the compressed first feedback resulting in a decompressed first feedback; and*

191. Walton combined with Peterson renders obvious element [53.6]. See Ground 3, analysis of [53.6].

[53.7] *decompressing the compressed second feedback resulting in a decompressed second feedback;*

192. Walton combined with Peterson renders obvious element [53.7]. See Ground 3, analysis of [53.7].

[53.8.1] *wherein the filtered transmission signal is a filtered first transmission signal that is transmitted to the second node using an 802.11-based orthogonal frequency-division multiplexing (OFDM) protocol via at least one antenna of a plurality of antennas,*

193. Walton discloses or renders obvious element [53.8.1]. See Ground 1,

analysis of [53.8.1].

[53.8.2] *using a first power that is based on the decompressed first feedback;*

194. Walton discloses or renders obvious element [53.8.2]. See Ground 1, analysis of [53.8.2].

[53.9] *and further comprising: transmitting, using the 802.11-based OFDM protocol, a filtered second transmission signal, simultaneously with the filtered first transmission signal, to the third node using a second power that is based on the decompressed second feedback.*

195. Walton combined with IEEE-802.11a discloses or renders obvious element [53.9]. See Ground 1, analysis of [53.9].

E. Ground 5: Claim 95 is obvious based on Walton combined with IEEE-802.11a and Bohnke

1. Overview

196. As discussed above in Ground 1, element [53.4], Walton discloses or renders obvious providing compressed CSI information (*feedback*) from a terminal 106c (*second node*) to the base station 104 (*first node*). Walton further teaches that “updates” of this CSI information should be “reported periodically.” Walton, [0221]. Bohnke explains that a mobile radio channel remains relatively constant for a period of much less than one second, during which time “adaptive” transmission can be applied, with the channel calculated “at regular time intervals” of less than one second. Bohnke (Ex.1008), [0065]-[0072], [0142].

2. Claim 95

[95.0] *A method for managing interference in a radio communications network, comprising the steps of:*

[95.1] *receiving at a first node in the radio communications network an instruction transmitted from a second node in the radio communications network to avoid using a plurality of frequencies to transmit to the second node;*

[95.2] *filtering a transmission signal to remove power from the transmission signal at each frequency in the plurality of frequencies to be avoided;*

[95.3] *transmitting the filtered transmission signal to the second node;*

197. Elements [95.0]-[95.3] are verbatim identical to elements [53.0]-[53.3], respectively. Therefore, the prior art renders obvious elements [95.0]-[95.3] for the same reasons as in Ground 1, [53.0]-[53.3].

[95.4] *separately from the receipt of the instruction, receiving a particular signal at the first node that is transmitted from the second node;*

198. Walton discloses or renders obvious element [95.4].

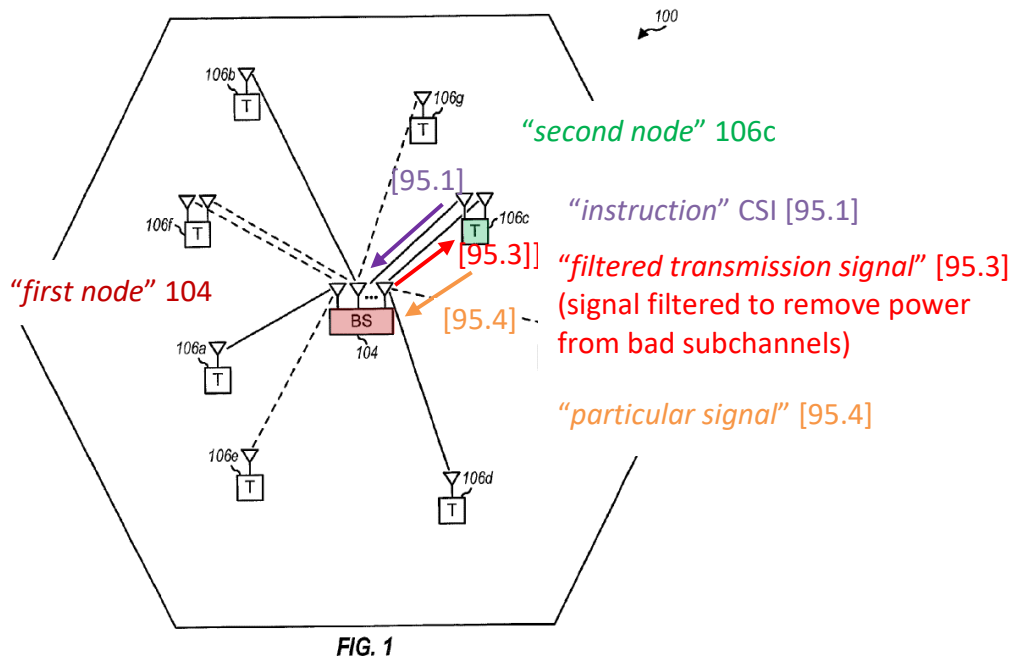
199. Walton's teachings that disclose or render obvious [95.1]-[95.3] (corresponding to [53.1]-[53.3]) relate to data transmission on the downlink from a transmitter system of base station 104 (*first node*) to a receiver system of terminal 106c (*second node*). Walton, [0225], [0024], [0134]; *see* [53.1]-[53.3]. The channel mask (*instruction*) is determined at a receiver system of terminal 106c, reported as part of CSI to transmitter system of base station 104, and "used to process data for transmission." Walton, [0203]-[0205], [0225]; *see also* [0029], [0134]. Walton's teachings that disclose or render obvious elements [95.4]-[95.7.2], as described below, relate to data transmission on the uplink from a

transmitter system of terminal 106c (*second node*) to a receiver system of base station 104 (*first node*). Walton, [0225], [0024]; *see also* [0134].

200. Walton describes a signal (*particular signal*) that is transmitted from a transmitter system (of terminal 106c, *second node*) and received by a receiver system (of base station 104, *first node*) to allow the base station to derive CSI for the uplink. Walton, [0211]-[0212], [0225] (“[T]echniques described ... may also be used for data transmission on the uplink,” using transmitter system 310 of a terminal and receiver system 350 of a base station), [0024], [0029], [0134]. The transmitted signal (*particular signal*) includes either data or a pilot reference/pilot data based on which the CSI is derived. Walton, [0212], [0142] (“[p]ilot data” is “data of [a] known pattern”), [0192].

201. Because base station 104 (*first node*) receives CSI including a channel mask (*instruction*) to be applied to a downlink data transmission and receives a signal (*particular signal*) to provide CSI to be applied to an uplink data transmission, Walton is at least suggestive that the transmitting terminal does not necessarily transmit (and the base station does not necessarily receive) a channel mask together with a pilot reference/data at the same time, rendering obvious that the *instruction* and the *particular signal* are received separately. Additionally, Walton describes that base station is involved in multiple downlink and uplink data transmissions (Walton, [0024]) so an *instruction* received for a downlink data

transmission initiated at a given point in time (e.g., early) would necessarily be received separately from any *particular signal* for an uplink data transmission initiated at another given point in time (e.g., later).



Walton, Figure 1 (annotated)

202. Thus, Walton discloses or renders obvious *separately from the receipt of the instruction* (separately from an earlier or later channel mask received at the base station to be applied to a downlink data transmission), *receiving a particular signal at the first node* (receiving a signal having data/pilot data at the base station) *that is transmitted from the second node* (transmitted from a terminal 106c).

[95.5] *generating a feedback based on a received power and one or more frequencies via which the particular signal is received;*

203. Walton discloses or renders obvious element [95.5].

204. First, Walton discloses or renders obvious *generating a feedback* at the base station 104. As explained in the analysis of element [53.4] (of Ground 1), there are at least two examples of information that would have been included in Walton's CSI feedback – (1) the “SNR...for each selected transmission channel,” Walton, [0208]; or (2) “power control information for each selected transmission channel, data stream, group or [*sic* – of] transmission channels, or any other unit of transmission.” *id.*, [0209], [0204]. Walton describes a “feedback channel” for transmitting CSI, and “recover[ing] reported CSI” from the “feedback signal” (*feedback*). *Id.*, [0221]-[0223]. Furthermore, for the uplink, the CSI is generated and fed back from a receiver system that is part of a base station (such as base station 104) to a transmitter system that is part of the terminal (such as terminal 106c). Walton, [0211]-[0212] (CSI is “derived” at the “receiver system”); [0204] (“The CSI [] is reported by the receiver system to the transmitter system.”); [0225] (“[F]or the uplink, transmitter system 310 in FIGS. 3 and 4A through 4D may represent part of a terminal and receiver system 350 in FIGS. 3, 5, and 7 may represent part of a base station.”); *see also* [0024], [0029], [0134].

205. Second, the CSI feedback is based on a received power and the frequencies via which a signal having pilot reference/data is received (*based on a received power and one or more frequencies via which the particular signal is*

received). Walton discloses CSI as including “the SNR ... estimated for each selected transmission channel ...,” Walton, [0208] (and recall that OFDM frequency subchannels are example transmission channels, *see* [53.1] and Walton, [0066]). Walton’s pilot data (*particular signal*) is used to estimate CSI. *Id.*, [0212] (“[T]he CSI is derived based on a pilot reference included in the transmitted signals.”).

206. For example, the “the SNR of the k-th transmission channel” may be computed “based on the received pilot signals.” Walton, [0192]. The received pilot signals “may be transmitted “in a subset or **all of the selected transmission channels**,” as an example. *Id.*, [0142].³ The SNR of a transmission channel accounts for *received power* because estimated signal energy or power is directly related to power of the received signal. Walton, [0006] (“SNR” is “signal-to-noise-plus-interference ratio[.]”); [0209] (“A request for **more transmit power** would indicate that **the received SNR** for the associated transmission channel(s) **has degraded**, and a **request for less transmit power** would indicate that the **received SNR** for the associated transmission channel(s) **has improved**.”); [0069]-[0071] (“Received SNR...for transmission channel k in group j” is proportional to

³ The description in [0142] applies to all that follows in Walton, such as [0192], as expressly stated in [0142]: “**The pilot data may be used at the receiver to perform channel estimation and demodulation, as described below**.”

“received power for transmission channel k in group j”). Furthermore, because the SNR for each selected transmission channel (OFDM frequency subchannel) is computed and included in CSI (Walton, [0208]), or the power control information included in CSI is determined as a measure of the SNRs for each selected transmission channel (*id.*, [0209]), and pilot data is transmitted only on each selected transmission channel, the CSI feedback is generated *based on one or more frequencies via which the particular signal is received* (pilot data is received only on the selected OFDM frequency subchannels, so CSI feedback is necessarily based only on these frequencies).

207. Therefore, Walton discloses or renders obvious *generating a based on a received power and one or more frequencies via which the particular signal is received* (CSI feedback is generated from a pilot reference/data and includes SNRs of selected transmission channels, or power control information reflective of SNRs of selected channels; and CSI is based on the power of the pilot reference/data and based on receiving the pilot reference/data in only the selected OFDM frequency subchannels).

[95.6] *compressing the feedback; and*

208. In view of a goal to reduce the amount of feedback, Walton discloses CSI being “fed back” “periodically” using “differential updates,” and Walton discloses that “other compression... techniques” besides differential updates can

be used:

The CSI may be reported from the receiver system to the transmitter using various CSI transmission schemes. For example, **the CSI may be sent in full, differentially, or a combination thereof. In one embodiment, CSI is reported periodically, and differential updates are sent based on the prior transmitted CSI. ... Other compression and feedback channel error recovery techniques to reduce the amount of data to be fed back for CSI may also be used and are within the scope of the invention.**

Walton, [0221], *see also* [0222]-[0223], Ground 1, elements [53.4]-[53.5], thereby disclosing or rendering obvious *compressing the feedback* (compressing the CSI that is “fed back”).

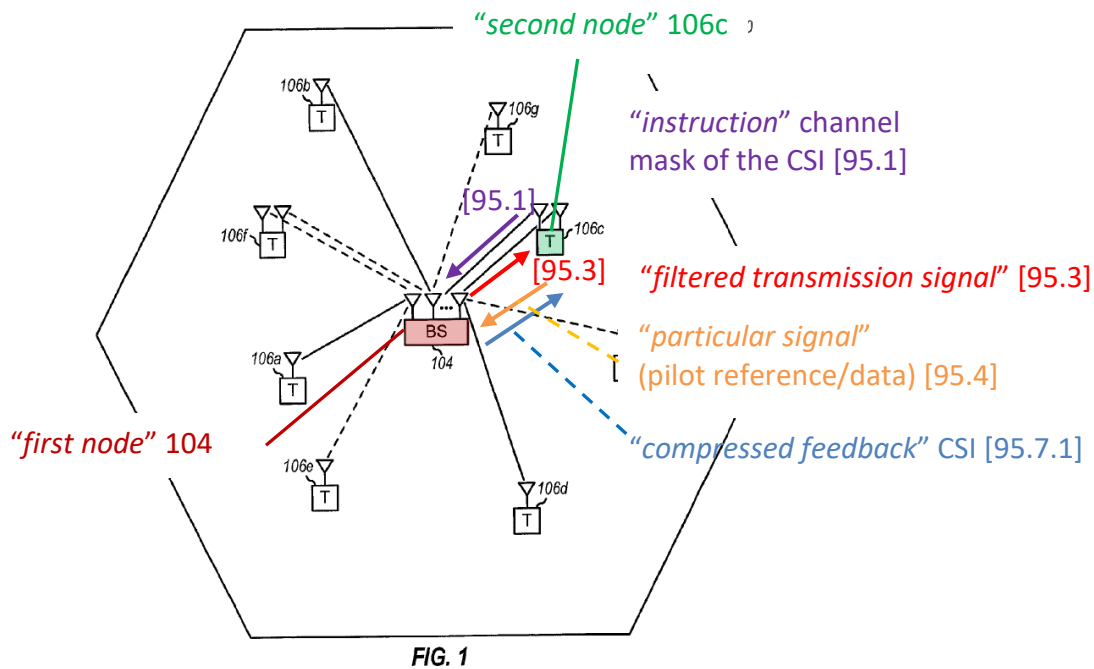
[95.7.1] *transmitting the compressed feedback from the first node to the second node, [95.7.2] for use by the second node in determining a transmit power with which the second node transmits to the first node via at least one antenna of a plurality of antennas, [95.7.3] while simultaneously transmitting to one or more other nodes;*

209. Walton discloses or renders obvious [95.7.1], [95.7.2], and [95.7.3].

210. First, Walton discloses or renders obvious element [95.7.1].

211. As explained in the analysis of elements [95.5] and [95.6] (of this Ground), CSI to be applied to the uplink is compressed and fed back from a receiver system of base station 104 (*first node*) to a transmitter system of terminal 106c (*second node*). Walton, [0024], [0029], [0204], [0221] (CSI reported from receiver system to transmitter), [0222], [0223] (modulators 354 in receiver system

350 transmit to transmitter system 310), [0225]; *see also* [0134]. Thus, Walton discloses or renders obvious *transmitting the compressed feedback* (compressed CSI) *from the first node* (base station 104) *to the second node* (e.g., terminal 106c in Figure 1, which is a transmitter system for an uplink).



Walton, Figure 1 (annotated)

212. Second, Walton discloses or renders obvious element [95.7.2].

213. As explained in [53.4] (Ground 1), [53.8.2] (Ground 1), and [95.5] (this Ground), the CSI that is fed back (*feedback*), and that is also *compressed* as explained in [95.6], includes the “SNR...for each selected transmission channel,” *id.*, [0208], or “power control information for each selected transmission channel, data stream, group or [*sic* – of] transmission channels, or any other unit of

transmission.” *id.*, [0209]. Walton discloses or renders obvious that the terminal, such as terminal 106c (*second node*) (or, more specifically, the transmitter system in the terminal) performs *determining a transmit power with which the second node transmits to the first node* (base station 104) in multiple different ways.

Walton, [0024], [0029] (CSI reported to transmitter system, and transmitter system then processes “data such that the transmitted information bit rate matches the transmission capacity of the channel.”); [0134]; [0225]. Walton’s SNR for each selected transmission channel (in CSI) is used to determine the distribution of the “total available transmit power amongst the selected transmission channels,”

Walton, [0129], such as power “**allocat[ed] non-uniformly, for example, based on the distribution of SNRs achieved** for the transmission channels,” *id.*, [0130], Abstract, [0009]-[0010], [0031]. Any of the power values determined for any of the selected transmission channels is an example of “*a transmit power*.” Moreover, as explained in [53.8.2], the claimed “*transmit power*” is determined based on the CSI feedback in three additional ways from “power control information,” Walton, [0209]:

- (1) a transmit power for a selected transmission channel is based on a single bit (request) or multiple bits (change in magnitude) for the selected transmission channel;
- (2) a transmit power (overall) for the group of selected transmission

channels is based on a single bit (request) or multiple bits (change in magnitude) for a selected transmission channel (i.e., a change of power for one channel will result in a change to the overall power);

(3) a transmit power (overall) for the group of selected transmission channels is based on a single bit (request) or multiple bits (change in magnitude) for a “group [of] transmission channels.” Note that Walton at [0209] refers to single-bit or multiple-bit power control information for “each transmission unit” which can be a “group [of] transmission channels.”

214. Thus, Walton discloses or renders obvious that the compressed CSI (*compressed feedback*) is *for use by the second node* (for use by the transmitter system in terminal 106c) *in determining a transmit power* (in determining a power allocated to each channel, or alternatively overall transmission power allocated to a group of channels).

215. A controller 334 in transmitter system 310 of the terminal (*second node*) applies the “identity of the selected transmission channels” (received in CSI) in transmissions to the receiver system 350 of the base station (*first node*). *Id.*, [0203], [0224]-[0225], [0134], [0068]. Therefore, it would have at least been obvious that the determined transmit power is for transmitting from the same terminal to the base station on an uplink (*second node transmits to the first node*) that transmitted the CSI. Walton, [0009]-[0010], [0031] (“The total available

transmit power is then allocated amongst the good transmission channels in a defined manner.”); [0024] (“[T]he uplink...refers to transmissions from the terminals to the base station.”).

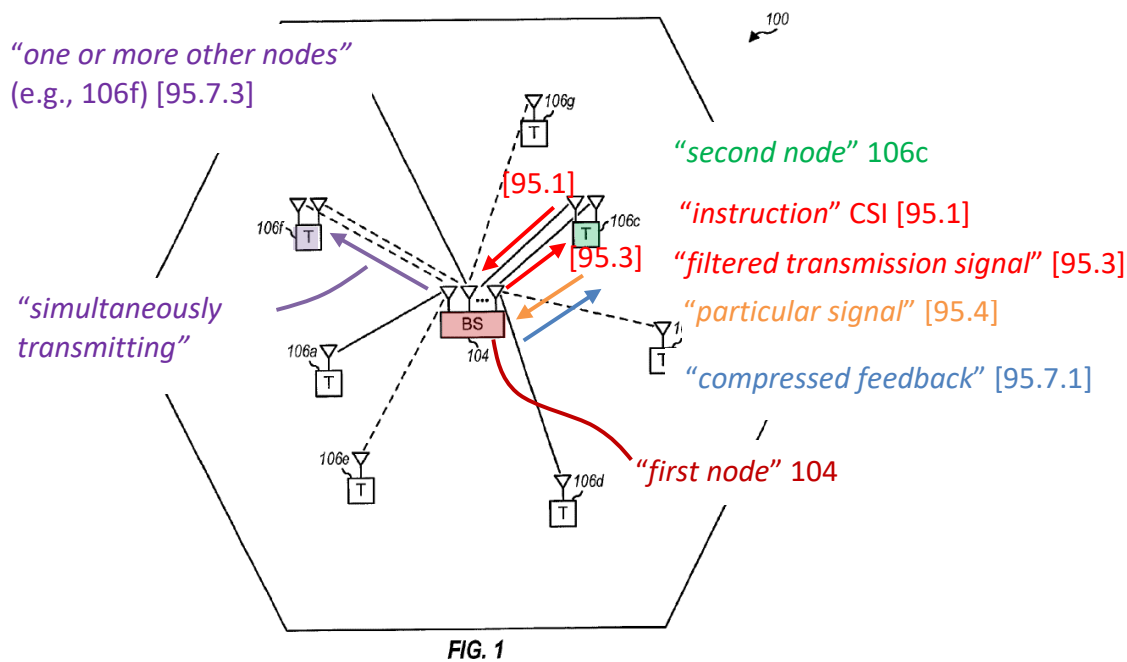
216. Furthermore, the transmitter system 310 of the terminal includes multiple antennas 324a-324t for transmitting its signals to the base station 104 on the uplink, Walton, [0225] (“[F]or the uplink, transmitter system 310 in FIGS. 3 and 4A through 4D may represent part of a terminal.”); [0137] (“[I]f OFDM is employed, TX channel processor 320 [in transmitter system 310] provides a stream of modulation symbol vectors **for each antenna used for data transmission.**”); Figure 3 (transmitter system 310 has transmit antennas 324a-324t); *see also* [0134]. Therefore, Walton discloses or renders obvious that *the second node transmits to the first node* (terminal transmits to the base station) *via at least one antenna of a plurality of antennas* (via at least one antenna of antennas 324a-324t).

217. Third, Walton discloses or renders obvious element [95.7.3].

218. The base station includes both a transmitter system 310 and a receiver system 350, Walton, [0225], wherein the transmitter system 310 transmits data from a data source 312, *id.*, [0134]-[0135], and the receiver system 350 transmits CSI (per [95.7.1]). There are multiple (N_T) antennas “associated with a single transmitter system,” and multiple (N_R) antennas “associated with a single receiver system.” *Id.*, [0025]; *see also* [0134], Figure 3, [0225]. Thus, the transmitter

system 310 of base station 104 has N_T antennas and the receiver system 350 has N_R antennas. Walton provides express motivation, or is at least suggestive, that the transmitter system 310 and receiver system 350 simultaneously transmit to different terminals. *Id.*, [0024]-[0025] (“[B]ase station 104 [] concurrently communicates with a number of terminals (T) 106.”). It would have been obvious that Walton’s CSI feedback (*compressed feedback*) is transmitted from base station 104 to terminal 106c (*second node*) via receiver system 350 (per the analysis of [95.7.1]) at the same time the transmitter system 310 is transmitting data to other terminals, yielding a benefit that data transmission from transmitter system 310 to some terminals continues uninterrupted (does not pause) while CSI is transmitted to a different terminal. The benefit is consistent with a reason to use a “multi-channel communication system” such as a MIMO system, which is to “provide increased transmission capacity.” Walton, [0023], [0005]. And there would have been a reasonable expectation of success because transmitter system 310 and receiver system 350 are separate and use separate antennas. *Id.*, [0225], Figure 3.

219. For example, the base station 104 may transmit CSI to terminal 106c using the antennas of its receiver system 350 at the same time as transmitting data to terminal 106f using transmitter system 310, as illustrated below.



Walton, Figure 1 (annotated)

[95.8] wherein the filtered transmission signal is transmitted to the second node using an 802.11-based orthogonal frequency-division multiplexing (OFDM) protocol;

220. Element [95.8] is compared with element [53.8.1] below, demonstrating that element [95.8] is broader than [53.8.1]. The non-underlined portions of [53.8.1] are substantially the same as element [95.8].

[95.8] the filtered transmission signal is transmitted to the second node using an 802.11-based orthogonal frequency-division multiplexing (OFDM) protocol

[53.8.1] the filtered transmission signal is a filtered first transmission signal that is transmitted to the second node using an 802.11-based orthogonal frequency-division multiplexing (OFDM) protocol via at least one antenna of a plurality of antennas

Therefore, Walton combined with IEEE-802.11a renders obvious [95.8] for the same reasons as [53.8.1] (of Ground 1).

[95.9] wherein an update of the compressed feedback is repeatedly generated, compressed, and transmitted at time periods of less than one second; so that the transmit power is repeatedly updated based thereupon at time periods of less than one second.

221. Walton combined with Bohnke renders obvious element [95.9].

222. First, Walton discloses or renders obvious *an update of the compressed feedback is repeatedly generated, compressed, and transmitted.*

223. Updates of CSI are generated and compressed *repeatedly* since CSI is “reported periodically” and “differential updates” or “other compression...techniques” may be applied the CSI. Walton, [0221], [0210]-[0212] (CSI is derived). The CSI is also *transmitted. Id.*, [0222] (“Modulators 354 ... **transmit the CSI ...**”); [0225]. For these reasons, Walton discloses or renders obvious *an update of the compressed feedback is repeatedly generated, compressed, and transmitted.*

224. Second, Walton discloses or renders obvious generating updates of the *compressed feedback ... so that the transmit power is repeatedly updated based thereupon.*

225. As explained in the analysis of element [95.7.2] (of this Ground), Walton discloses both distributing power over subchannels according to SNR on the various subchannels (one form of CSI feedback), setting overall transmit power

on the basis of power control information (another form of CSI feedback), or setting transmit power for each selected transmission channel (another form of CSI feedback), thereby disclosing or rendering obvious that the compressed CSI (*compressed feedback*) is for use by the second node in determining a transmit power with which the second node transmits to the first node via at least one antenna of a plurality of antennas.

226. Walton also discloses that the transmission channels “typically experience different link conditions” that “vary with time” and achieve different SNRs. Walton, [0028], [0006]. Because the compressed CSI is based on SNRs (as explained for [53.4] (of Ground 1), [95.5], [95.7.2]), Walton, [0204], [0208], [0209], [0221], and is reported “periodically,” Walton, [0221], and because the transmit power is determined based on the compressed CSI and therefore on SNRs (as explained for [95.7.2]), Walton, [0036], [0130], Walton discloses or is at least suggestive that the transmit power is “*repeatedly updated based thereupon.*” Additionally, it would have been obvious to have the transmit power updated in this manner to account for the time-varying channel conditions and ensure that transmit power matches current channel conditions, consistent with Walton’s desire to match transmission capacities of channels as they change. Walton, [0028]-[0029]. There would have been a reasonable expectation of success because Walton already teaches that compressed CSI based on SNRs is

periodically updated and that transmit power is determined based on the SNRs achieved for transmission channels. Walton, [0130], [0036].

227. Third, Walton combined with Bohnke renders obvious that the time periods for updating the *compressed feedback* and the *transmit power* are *less than one second*.

228. Walton discloses that CSI is “reported periodically,” Walton, [0221], but does not provide numeric values of the time periods between CSI reports. Therefore, a POSITA would have been motivated to look to other references to specify the period of reporting in Walton. Bohnke is one such reference with teachings that are compatible with Walton.

229. Walton’s terminals either (i) were understood to be mobile; or (ii) it would have been obvious that Walton’s terminals were mobile for the following reasons. Walton’s terminals were understood to be mobile based on Walton’s teachings regarding “link conditions [that] typically vary with time,” Walton, [0028], because other references, such as Bohnke at [0065], confirm that understanding.

230. Alternatively, it would have been obvious for a POSITA to use mobile terminals because Walton suggests doing so with teachings regarding time-varying channel conditions, and there are benefits to using mobile devices. For example, Walton explains that “the link conditions typically vary with time,” Walton,

[0028], [0006], which is at least suggestive that Walton's terminals are mobile.

See, e.g., Ex.1013, [0010] (“Moreover, **the characteristics of the communication channels between the access point and the terminals ... may further vary over time, especially for mobile terminals.**”). Furthermore, in network architectures

the same as in Walton a “mobile station” is described as another term for

“terminal.” Ex.1013, [0031] (also compare Ex.1013, Figure 1 to Walton, Figure 1).

In sum, it would have been obvious and beneficial for Walton's terminals to be mobile terminals, yielding all the benefits of mobility, *see, e.g.*, Ex.1025, 1:15-2:6

(Mobile communication provides “freedom of movement” while communicating

providing “seamless” communication, offering “increased flexibility.”). There

would have also been a reasonable expectation of success in implementing

Walton's network using mobile terminals because a POSITA knew how to

implement the same network architecture as Walton using mobile terminals.

Ex.1013, [0031].

231. For mobile wireless communication channels, such as those that occur in Walton's system when its terminals are mobile, the “coherence time” is the period of time that a channel remains relatively constant, or does “not change significantly,” making coherence time a key parameter. *See, e.g.*, Ex.1015, 19 (“The coherence time is the duration over which the channel characteristics do not change significantly.”). Bohnke explains that the channel “can be considered

constant for a certain time,” Bohnke, [0065], known as the “coherence time,” Bohnke, [0066], and the base station of Walton and Walton’s generic network architecture represents wireless infrastructure applicable in wireless local area network (LAN) scenarios (see analysis of element [95.8]).

232. A POSITA would have been motivated to use Bohnke’s teachings to implement repeated updates to CSI and to transmit power at time periods of less than one second in the Walton-IEEE-802.11a combination (that uses mobile terminals) because (1) Walton generally teaches periodic updates are made to CSI without reciting specific time intervals, so a POSITA would have looked to Bohnke for those details; and (2) Bohnke expressly teaches the desirability to achieve “a coherence level of >0.9 ” to realize “reliable channel estimation” using its recited coherence periods, which are directly applicable to a network like that of the Walton-IEEE-802.11a combination (as explained for [53.8.1] and [95.8] in Ground 1) that implements IEEE 802.11a at a 5GHz carrier frequency, per Bohnke, [0066]-[0069], [0074].

233. Bohnke provides numerical examples of coherence time for “mobile radio channels.” Bohnke, [0066]. The numerical examples in the table below are for a system that uses a carrier frequency of 5 GHz, which is used in the Walton-IEEE-802.11a system, per the analysis of [53.8.1] and [95.8].

“Channel Coherence Time Examples

Carrier Frequency: 5 GHz”

Carrier Freq [GHz] 5			Coherence Level 0.9
Speed [km/h]	Speed [m/s]	Doppler	Coherence Time [ms]
0.1	0.02777778	0.46296296	155.052
0.3	0.08333333	1.38888889	51.6839
1	0.27777778	4.62962963	15.5052
3	0.83333333	13.8888889	5.16839

Bohnke, [0068]-[0069]. As shown in the table, the coherence time for low mobility speeds (< 3 km/hr, [0070]) ranges from about 15 milliseconds (ms) (or “15.5052” ms) up to 155 ms (or “155.052” ms). Thus, the coherence time, or the time the channel remains relatively constant, is substantially less than 1 s, even in scenarios when the mobile terminals move with low speeds. Bohnke concludes that the “coherence time” “becomes rather long,” acknowledging that 15 ms in a wireless system is “long.” Bohnke, [0070]. Therefore, the “application of adaptive modulations (which relies on a ‘constant’ channel) becomes applicable,” Bohnke, [0070], meaning that the wireless system can adapt quickly enough to the channel such that a selected modulation can be applied before the channel changes significantly.

234. For these reasons it would have been obvious for Walton’s time period used for periodic CSI reporting to be less than 1 second, and to update the transmit power accordingly at the rate dictated by when updates in CSI are received. *See, e.g.*, Ex.1011, 108, 109 (“The basic idea behind LA [link adaptation]

techniques is to adapt the transmission parameters to take advantage of prevailing channel conditions. The fundamental parameters to be adapted include modulation and coding levels, but other quantities can be adjusted for the benefit of the systems such as power levels (as in power control), spreading factors, signaling bandwidth, and more.... The principle of LA is simple. It aims to exploit the variations of the wireless channel (over time, frequency, and/or space) by dynamically adjusting certain key transmission parameters to the changing environmental and interference conditions observed between the base station and the subscriber.”), 111 (“[I]t is important for the update rate of LA [link adaptation] to be less than the coherence time,” and LA is based on “CSI,” such as “SNR.”); *see also* Bohnke, [0070]-[0074]. Thus, Walton combined with Bohnke renders obvious that the time periods for updating Walton’s *compressed feedback* (compressed CSI) and *transmit power* based thereupon (see [95.7.2]) are (substantially) *less than one second* (e.g., 155 ms).

235. And a POSITA would have had a reasonable expectation of success of being able to adapt to updated channel conditions in time periods less than 1 s, such as 15 ms, because Bohnke is evidence that a POSITA knew how to do so in a system similar to the Walton-802.11a network with mobile devices. *See, e.g.,* Bohnke, [0074] (“The invention comprises an adaptive loading calculation scheme and signalling scheme usable **for wireless, multicarrier transmission, such as**

f.e. ETSI BRAN Hiperlan/2 (**and similar standards like IEEE802.11a**, ARIB MMAC WATM), with minimum changes required in the current standards.”); [0066] (Discussing “mobile radio channels”); [0140] (Exemplary system has an “access point” and a “mobile terminal.”).

236. Finally, Bohnke is analogous art to the ’720 patent. The field of endeavor of the ’720 patent is management of the frequencies used by wireless communication systems, sometimes referred to as spectrum management. For example, the ’720 patent states that “[t]he present invention relates generally to radio frequency spectrum management systems...” ’720 patent, 1:18-20. Bohnke is in the same field of endeavor as the ’720 patent because Bohnke in the field of management of frequencies used by wireless communications systems. For example, Bohnke “relates...to a data train for wireless multicarrier transmission having subcarriers which are adaptively modulated as well as to a wireless multicarrier transmission device.” Bohnke, [0001]. According to Bohnke, “[t]he goal of adaptive modulation in multi-carrier systems such as f.e. OFDM is to assign an optimum modulation scheme (e.g. by changing the constellation set) **for each of the sub-carriers such that the maximum performance can be achieved.**” Bohnke, [0002]. Bohnke manages frequencies (subcarriers) in an OFDM signal by maximizing performance on each subcarrier via adaptive modulation and transmission power, including not using some subcarriers. *See,*

e.g., Bohnke, [0044], (“**The transmission power of subcarriers** having a higher modulation scheme **can be enhanced to compensate for subcarriers which are not modulated at all** (due to the adaptation of the modulation scheme).”); [0050] (“According to a still further aspect of the present invention a data train for a **wireless multicarrier transmission having subcarriers which are adaptively modulated is proposed.**”). And as explained above in this element [95.9], Bohnke is also reasonably pertinent to the problem of how often to adapt transmit power, as reflected in claim 95, which recites “*the transmit power is repeatedly updated based thereupon at time periods of less than one second.*”

F. Ground 6: Claim 95 is obvious based on Walton combined with IEEE-802.11a, Bohnke, and McFarland

[95.0] *A method for managing interference in a radio communications network, comprising the steps of:*

[95.1] *receiving at a first node in the radio communications network an instruction transmitted from a second node in the radio communications network to avoid using a plurality of frequencies to transmit to the second node;*

[95.2] *filtering a transmission signal to remove power from the transmission signal at each frequency in the plurality of frequencies to be avoided;*

[95.3] *transmitting the filtered transmission signal to the second node;*

237. Elements [95.0]-[95.3] are verbatim identical to elements

[53.0]-[53.3], respectively. Therefore, Walton combined with McFarland renders obvious elements [95.0]-[95.3] for the same reasons as in Ground 2, [53.0]-[53.3].

[95.4] *separately from the receipt of the instruction, receiving a particular signal at the first node that is transmitted from the second node;*

238. Walton discloses or renders obvious claim element [95.4] for the same reasons as in Ground 5, analysis of [95.4].

[95.5] *generating a feedback based on a received power and one or more frequencies via which the particular signal is received;*

239. Walton discloses or renders obvious claim element [95.5] for the same reasons as in Ground 5, analysis of [95.5].

[95.6] *compressing the feedback; and*

240. Walton discloses or renders obvious claim element [95.6] for the same reasons as in Ground 5, analysis of [95.6].

[95.7.1] *transmitting the compressed feedback from the first node to the second node, [95.7.2] for use by the second node in determining a transmit power with which the second node transmits to the first node via at least one antenna of a plurality of antennas, [95.7.3] while simultaneously transmitting to one or more other nodes;*

241. Walton discloses or renders obvious elements [95.7.1], [95.7.2], and [95.7.3] for the same reasons as in Ground 5, analysis of [95.7.1], [95.7.2], and [95.7.3].

[95.8] *wherein the filtered transmission signal is transmitted to the second node using an 802.11-based orthogonal frequency-division multiplexing (OFDM) protocol;*

242. Walton combined with IEEE-802.11a renders obvious element [95.8] or the same reasons as in Ground 5, analysis of [95.8].

[95.9] *wherein an update of the compressed feedback is repeatedly generated, compressed, and transmitted at time periods of less than one second; so that the transmit power is repeatedly updated based thereupon at time periods of less*

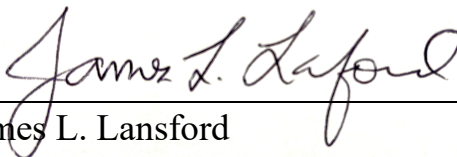
than one second.

243. Walton combined with Bohnke renders obvious element [95.9] or the same reasons as in Ground 5, analysis of [95.9].

VI. CONCLUSION

244. This declaration and my opinions herein are made to the best of my knowledge and understanding, and based on the material available to me, at the time of signing this declaration. I declare that all statements made herein on my own knowledge are true and that all statements made on information and belief are believed to be true, and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 or Title 18 of the United States Code.

Date: 29 April 2025



James L. Lansford