

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INTEL CORPORATION and LENOVO (UNITED STATES) INC.

Petitioners,

v.

USTA TECHNOLOGY, LLC.,
Patent Owner (“PO”).

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

**PETITION FOR *INTER PARTES* REVIEW
UNDER 35 U.S.C. § 312 AND 37 C.F.R. § 42.104**

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EXHIBIT LIST

Ex.1001	U.S. Patent No. RE47,720 to J. Burchfiel (“’720 patent”)
Ex.1002	Prosecution File History of U.S. Patent Application No. 15/898,404, issued as the ’720 Patent (“’720 File History”)
Ex.1003	Declaration of James Lansford, Ph.D. under 37 C.F.R. § 1.68
Ex.1004	Curriculum Vitae of James Lansford, Ph.D.
Ex.1005	U.S. Application Publication No. 2003/0043732 by J. Walton et al. (“Walton”)
Ex.1006	U.S. Application Publication No. 2002/0006167 to W. McFarland (“McFarland”)
Ex.1007	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.1008	U.S. Application Publication No. 2002/0102940 to R. Bohnke et al. (“Bohnke”)
Ex.1009	Prosecution File History of U.S. Patent Application No. 10/689,763, issued as U.S. Patent No. 7,483,711
Ex.1010	U.S. Patent No. 5,726,978 to C. Frodigh et al. (“Frodigh”)
Ex.1011	S. Catreux et al., “Adaptive Modulation and MIMO Coding for Broadband Wireless Data Networks,” <i>IEEE Communications Magazine</i> , pp. 108-115, June 2002
Ex.1012	App. No. 90/019702, <i>Ex Parte</i> Reexamination of the ’720 patent, Exhibit AA
Ex.1013	U.S. Patent Publication No. 2003/0235147 to J. Walton, et al. (“Walton-2”)
Ex.1014	U.S. Patent No. 7,046,746 to R. Kearney et al.

Ex.1015	R. Van Nee and R. Prasad, <i>OFDM for Wireless Multimedia Communications</i> (2000), Chapters 1 and 2 (“Van-Nee”)
Ex.1016	U.S. Patent No. 7,369,841 to C. Uhlik et al.
Ex.1017	A. Seyedi and G. Saulnier, “A Distributed Algorithm for Dynamic Sub-Channel Assignment in a Multi-User OFDM Communication System,” <i>Proceedings of the 11th IEEE Signal Processing Workshop on Statistical Signal Processing</i> , Aug. 8, 2001.
Ex.1018	<i>Merriam Webster Collegiate Dictionary Tenth Edition</i> , Merriam-Webster Inc. (1993) (selected pages)
Ex.1019	H. Newton, <i>Newton’s Telecom Dictionary</i> , CMP Books (2000) (selected pages)
Ex.1020	Declaration of Sylvia Hall-Ellis
Ex.1021	Declaration of David Ringle
Ex.1022	L. Peterson and B. Davie, <i>Computer Networks: A Systems Approach</i> , Morgan Kaufman Publishers, Inc. (1996) (“Peterson”) (Chapter 7)
Ex.1023	Exhibit 2 to Complaint, <i>USTA Technology, LLC v. Lenovo Group Limited et al</i> , 4-24-cv-00515, June 7, 2024
Ex.1024	Lenovo Group Limited’s Notice of Sotera Stipulations for U.S. Patent No. RE47,720, <i>USTA Technology, LLC v. Lenovo Group Limited et al</i> , 4-24-cv-00515, Dkt. 60, filed April 25, 2025
Ex.1025	U.S. Patent No. 6,556,553 to B. Palmer et al.
Ex.1026	Joint Rule 26(f) Conference Report, <i>USTA Technology, LLC v. Lenovo Group Limited et al</i> , 4-24-cv-00515, Dkt. 49, March 28, 2025

I. INTRODUCTION

Intel Corporation and Lenovo (United States) Inc. (collectively “Petitioners”) respectfully request that the Board review and cancel as unpatentable claims 53 and 95 of U.S. Patent RE47,720 (“the ’720 patent,” Ex.1001).

II. GROUNDS FOR STANDING

Petitioners certify that the ’720 patent is eligible for IPR and that Petitioners are not barred or estopped from requesting this IPR.

III. THE PETITION’S RELIANCE ON EXPERT TESTIMONY

A. Technological Background

The ’720 patent relates to wireless communications networks involving nodes that can communicate with each other using radio communication. To the extent the Board needs discussion of the relevant background technology, Dr. Lansford’s declaration describes the background technology predating the ’720 patent. This includes OFDM, or orthogonal frequency division multiplexing, which is a modulation technique dating back to the mid-1960s. *See* Ex.1003, ¶31. Dr. Lansford’s declaration also describes simultaneously transmitting different OFDM signals to different nodes on the network using multiple antennas, such as forming a multiple-input/multiple-output (MIMO) communication link. *See* Ex.1003, ¶¶28-36.

B. Focused Expert Testimony

Dr. Lansford's declaration provides focused expert testimony on the following topics: (i) the level of skill in the relevant art, Ex.1003, ¶¶25-27; (ii) claim construction, *id.*, ¶45; and (iii) key teachings of the prior art, including:

- Filtering frequencies (Ex.1003, ¶¶46-51, 63-66)
- Compression and decompression (Ex.1003, ¶¶52-56, 67)
- Simultaneous transmission (Ex.1003, ¶¶57-58); and
- Changing mobile radio channels and adaptive transmission
(Ex.1003, ¶¶68-69)

C. Detailed Expert Testimony

To the extent a more detailed analysis comparing the prior art and the claims is desired, Dr. Lansford's declaration also includes a detailed element-by-element analysis of the prior art, including reasons to combine prior art references. Ex.1003, ¶¶73-243.

IV. THE '720 PATENT

The '720 patent, including claim 53, relates to three 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

Ex.1003, ¶42.

2. Compressed feedbacks: The optimal waveform profile 1401 can be compressed at the sending node and correspondingly decompressed at the receiving node. Ex.1001, 22:16-21, 34-37; Ex.1003, ¶43.

3. Simultaneously transmitting: “[M]ultiple 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; Ex.1003, ¶¶37-44.

V. PROSECUTION HISTORY

The ’720 patent is a reissue of U.S. Patent No. 7,483,711 (“the ’711 patent”), which claims priority to U.S. Provisional App. 60/420,930. There were no prior art rejections during prosecution of the ’711 patent. Ex.1009, pp. 14, 33-37.

Nine years later, the patentee filed a reissue application, adding over 70 new claims including the Challenged Claims. There were no prior art rejections of claims 53 or 95. *See* Ex.1002. The Reasons for Allowance for claim 53 refers to simultaneous transmission of “802.11-based OFDM” filtered signals. Ex.1002, 26, 49. As shown herein, Walton combined with IEEE-802.11a renders obvious these elements.

VI. LEVEL OF ORDINARY SKILL IN THE ART

A person having ordinary skill in the art (POSITA) in October 2002 would have been someone knowledgeable and familiar with the wireless communications systems and networks that are pertinent to the '720 Patent, including OFDM. A POSITA would have 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 systems and networks. Lack of professional experience can be remedied by additional education, and vice versa. Ex.1003, ¶¶25-27.

VII. CLAIM CONSTRUCTION

For the purposes of this proceeding and the grounds presented herein, no claim term requires express construction. 37 C.F.R. § 42.100(b). Ex.1003, ¶45.

VIII. RELIEF REQUESTED AND THE REASONS FOR THE REQUESTED RELIEF

Petitioners ask that the Board institute an IPR trial and cancel claims 53 and 95.

IX. IDENTIFICATION OF HOW THE CLAIMS ARE UNPATENTABLE

A. Challenged claims

Claims 53 and 95 are “the Challenged Claims.”

B. Statutory grounds for challenges

Grounds	Claims	35 U.S.C. § 103 (pre-AIA)
#1	53	Walton and IEEE-802.11a
#2	53	Walton, IEEE-802.11a, and McFarland
#3	53	Walton, IEEE-802.11a, and Peterson
#4	53	Walton, IEEE-802.11a, McFarland, and Peterson
#5	95	Walton, IEEE-802.11a, and Bohnke
#6	95	Walton IEEE-802.11a, Bohnke, and McFarland

Walton (Ex.1005); McFarland (Ex.1006): and Bohnke (Ex.1008) are published U.S. patent applications, and are prior art under pre-AIA 35 U.S.C. §§ 102(a) and 102(e).

IEEE-802.11a (Ex.1007, also Exhibit A of Ex.1021) is an IEEE Standard published in 1999 and is prior art under pre-AIA 35 U.S.C. § 102(b). Ex.1021, 1-2; Ex.1007, 1; Ex.1003, ¶39.

Peterson (Ex.1022) is a book published in 1996 and is prior art under pre-AIA 35 U.S.C. § 102(b). Ex.1020, ¶¶56-63.

Additional prior art is cited as evidence of the background knowledge of a POSITA and to provide contemporaneous context to support Petitioners' assertions regarding what a POSITA would have understood.

C. Ground-1: Claim 53 is obvious over Walton and IEEE-802.11a

1. Brief Summary of the Prior Art

Walton teaches or suggests all elements of claim 53 with the following exception. While Walton refers generally to using an OFDM protocol, it does not mention using an OFDM protocol that is *802.11-based*. However, Walton combined with IEEE-802.11a renders obvious such a protocol.

2. Claim 53

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

To the extent any part of the preamble is limiting, Walton alone and combined with IEEE-802.11a renders obvious the preamble.

First, Walton describes a “multiple access communication system” in which a “base station BS 104” and “a number of terminals (T) 106” engage in communication, thus forming a *communications network*. Ex.1005, [0024], *see also* Figure 1, below. Ex.1003, ¶75.

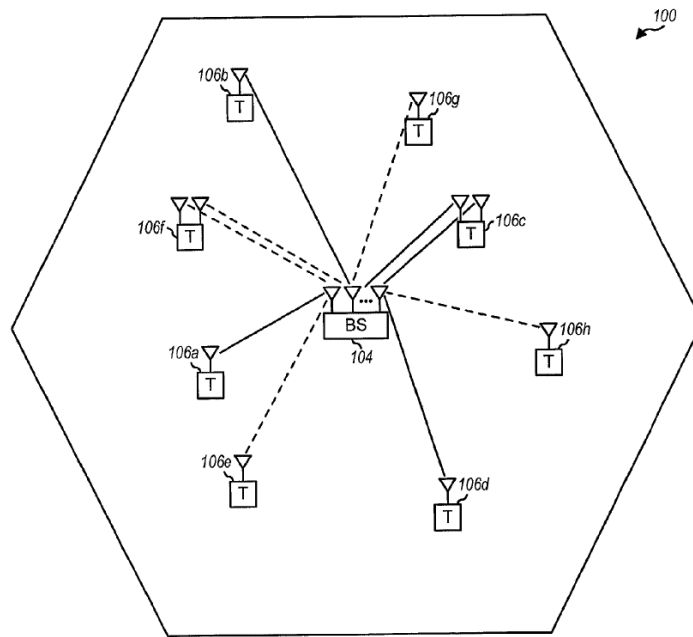


FIG. 1

Ex.1005, Figure 1

Second, Walton discloses that the devices in its communications network engage in wireless communication. For example, Walton explains that all the devices have antennas, Ex.1005, [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, and radio frequencies in the hundreds of MHz to several GHz were typical, thus rendering obvious “a radio communications network.” Ex.1003, ¶76 (citing Ex.1010, 1:15-19; Ex.1015, 15-19; Ex.1018, 963). Additionally, it would have been obvious to communicate using radio frequencies at or around 5 GHz, as was used in IEEE-802.11a, Ex.1007, 3,

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.” Ex.1003, ¶76.

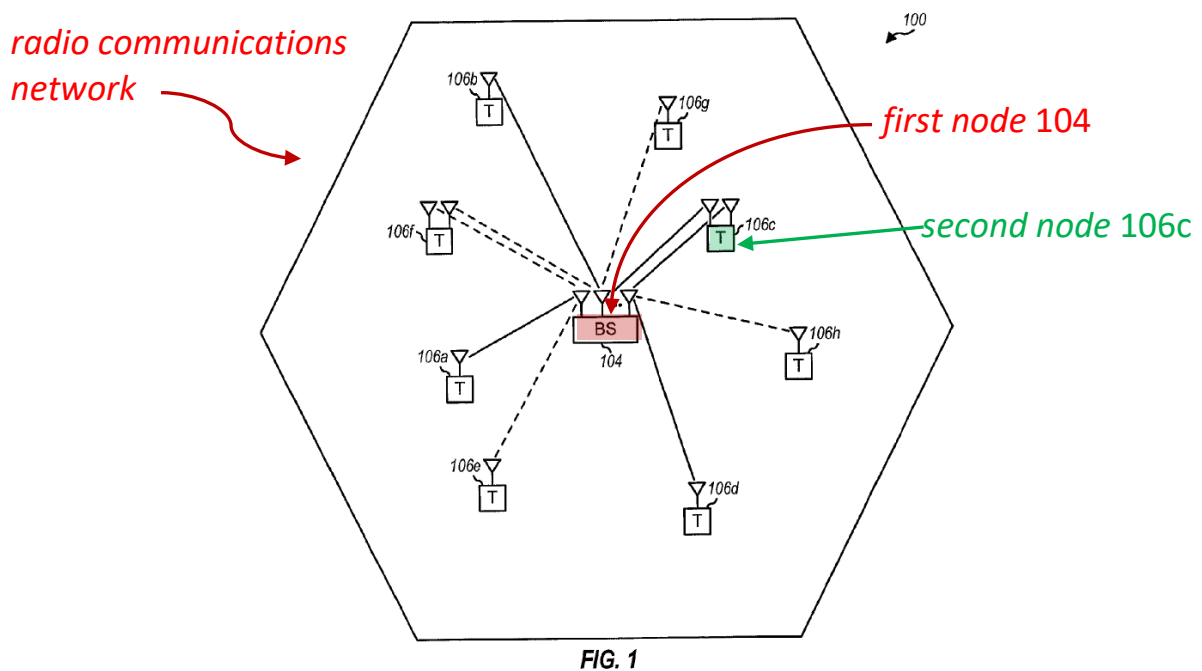
Third, as discussed in the remaining elements [53.1]-[53.9], Walton describes managing OFDM subchannels based on parameters called “signal-to-noise-plus-interference ratios,” abbreviated “SNRs.” Ex.1005, [0028], [0009], [0010]. As discussed in the analysis of element [53.1], for example, “bad” OFDM subchannels are avoided in Walton, e.g., those channels for which SNR is lower than a threshold, Ex.1005, Abstract, [0009], [0010], [0031], [0036]. Thus, the system avoids creating interference in transmission channels (OFDM subchannels) that yield low link throughput, thereby *managing interference*. Ex.1003, ¶77 (citing Ex.1017, 398).

Regardless, the preamble term “*for managing interference*” is not a limitation because it states a purpose or intended use of the claimed method, which is otherwise structurally complete. *See Catalina Mktg. Int'l, Inc. v. Coolsavings.com, Inc.*, 289 F.3d 801, 808 (Fed. Cir. 2002). Also, the term “*interference*” does not appear anywhere else in claim 53.

[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;

Walton discloses or renders obvious element [53.1].

First, Walton describes how the devices in its wireless communication network, understood as “nodes,” use transmission signals to communicate with each other using OFDM. Ex.1005, [0023]-[0024], [0026]-[0027]; Ex.1003, ¶79 (citing Ex.1001; Ex.1006, Abstract, [0048]; Ex.1019, 613). Walton’s base station is an example *first node* and a terminal (e.g., terminal 106c) is an example *second node*, as illustrated in Figure 1.



Ex.1005, Figure 1 (annotated); Ex.1003, ¶80

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 this Petition, illustrate more detailed examples of a base station “transmitter system,” Ex.1005, [0158], [0225], an example of which is base station 104 in Figure 1, *id.*, [0134]; Ex.1003, ¶80.

Second, as discussed in detail below, the list of good transmission channels (frequency subchannels) and bad channels is included in a channel state information (CSI) 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 to the second node.*” Ex.1003, ¶¶81-83.

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.**” Ex.1005, 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]; Ex.1003, ¶82.

An OFDM transmission signal includes multiple frequency subchannels (*frequencies*). “The segregation of the available transmission channels into groups permits optimization to be achieved on a per group basis (e.g., per transmit antenna ...).” Ex.1005, [0068]. For example, Walton describes placing the 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.

Ex.1005, [0032], [0066], 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).”), [0066], 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.

Ex.1003, ¶84.

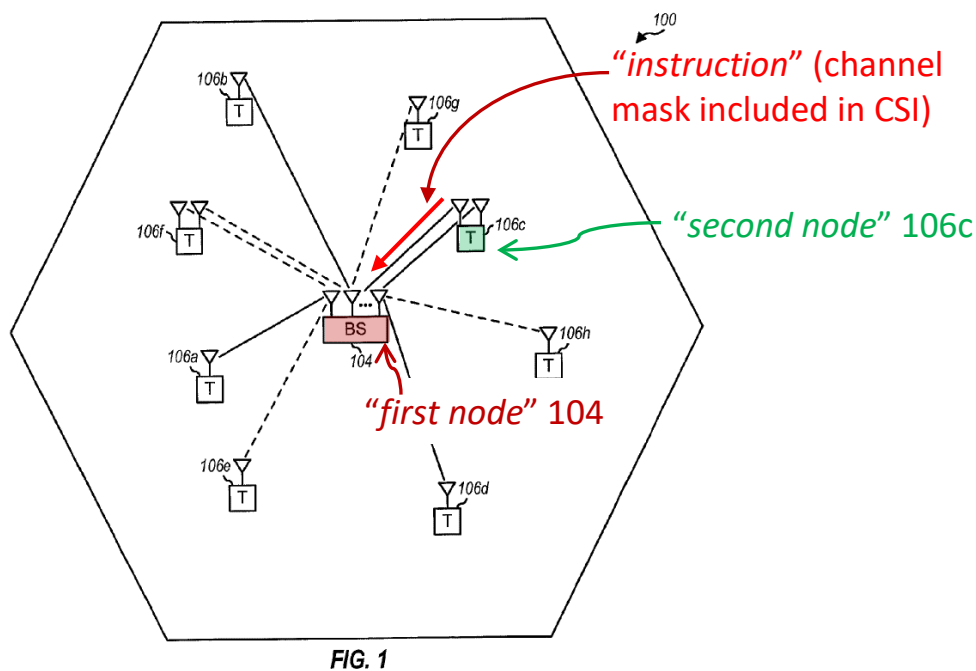
A “receiver system,” such as in a terminal, (e.g., terminal 106c in Figure 1, Ex.1005, [0134]), feeds back CSI information to a “transmitter system,” such as in a base station (e.g., base station 104), *id.*, [0029], [0203] (“[V]arious types of CSI may be reported by a receiver system to a transmitter 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.”

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).

Ex.1005, [0205]. The CSI is derived at a receiver system, Ex.1005, [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.”), such as in a terminal, *id.*, [0225], [0134]. Thus, the CSI, including the channel mask, is fed back from the receiver system (e.g., terminal, *second node*) to the transmitter system (e.g., base station) and received by the transmitter system (*receiving at a first node in the radio communications network*). *Id.*, [0222] (Receiver system “transmit[s] the CSI back to the transmitter system 310 via a reverse channel.”), [0223] (“At system 310, the transmitted feedback channel is received...”), [0224]-[0225]. And the

transmitter system abides by the channel mask by allocating transmit power amongst “only the selected transmission channels” for transmitting to the receiver system. *Id.*, [0012], Abstract, [0031], [0040], [0066]; *see also* [0068] (describes performing selective channel transmission on each group of transmission channels “for the data transmission to each terminal.”). Figure 1 of Walton is labeled according to Walton’s teachings below. Ex.1003, ¶85.



Ex.1005, Figure 1 (annotated); Ex.1003, ¶85

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 (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). Ex.1003, ¶86.

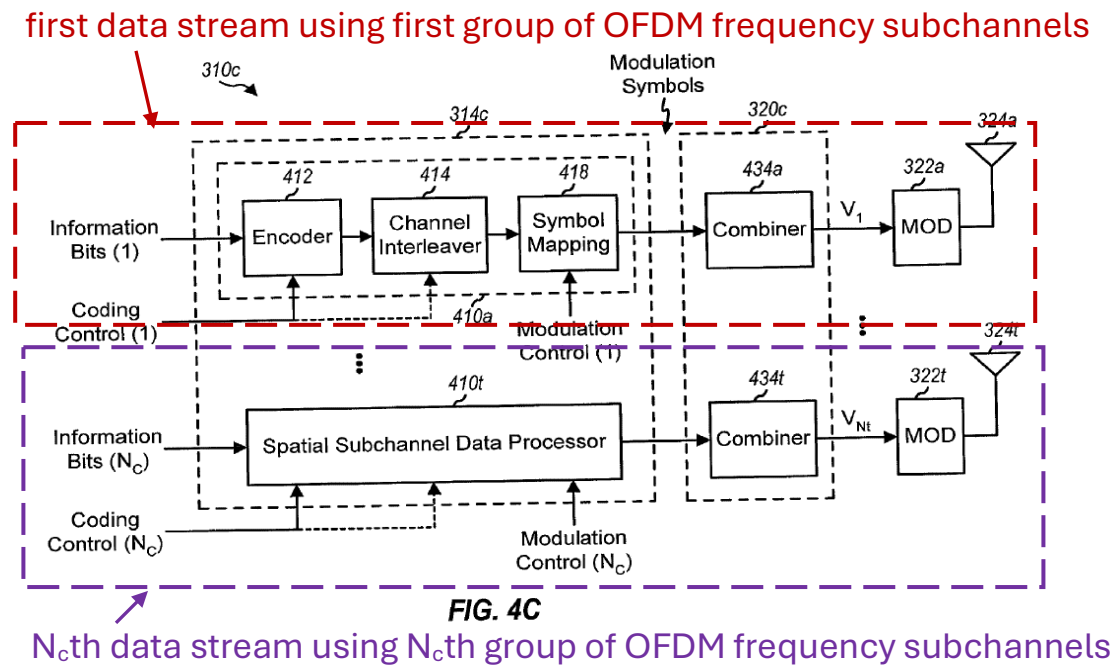
[53.2] *filtering a transmission signal to remove power from the transmission signal at each frequency in the plurality of frequencies to be avoided;*

Walton discloses or renders obvious [53.2].

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. Ex.1005, [0205], [0066], [0009]-[0010]; Ex.1003, ¶88.

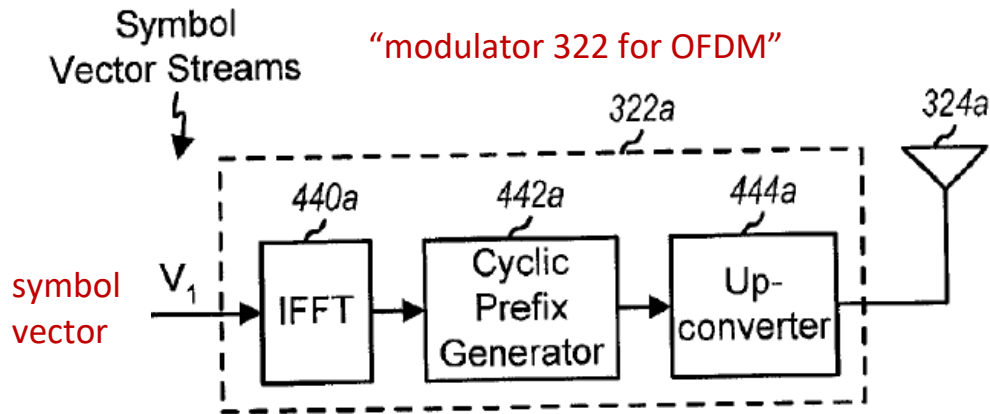
Walton’s “MIMO transmitter system 310c, which utilizes OFDM” in Figure 4C is an “embodiment of the transmitter portion of system 310 in Figure 3,” Ex.1005, [0158], and is therefore part of base station 104 (*first node*), *id.*, [0134]. In the transmitter of Figure 4C, multiple data streams are individually encoded and modulated, one data stream for each antenna, corresponding to one “group” of OFDM transmission channels for each antenna. Ex.1005, [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]; Ex.1003, ¶89.



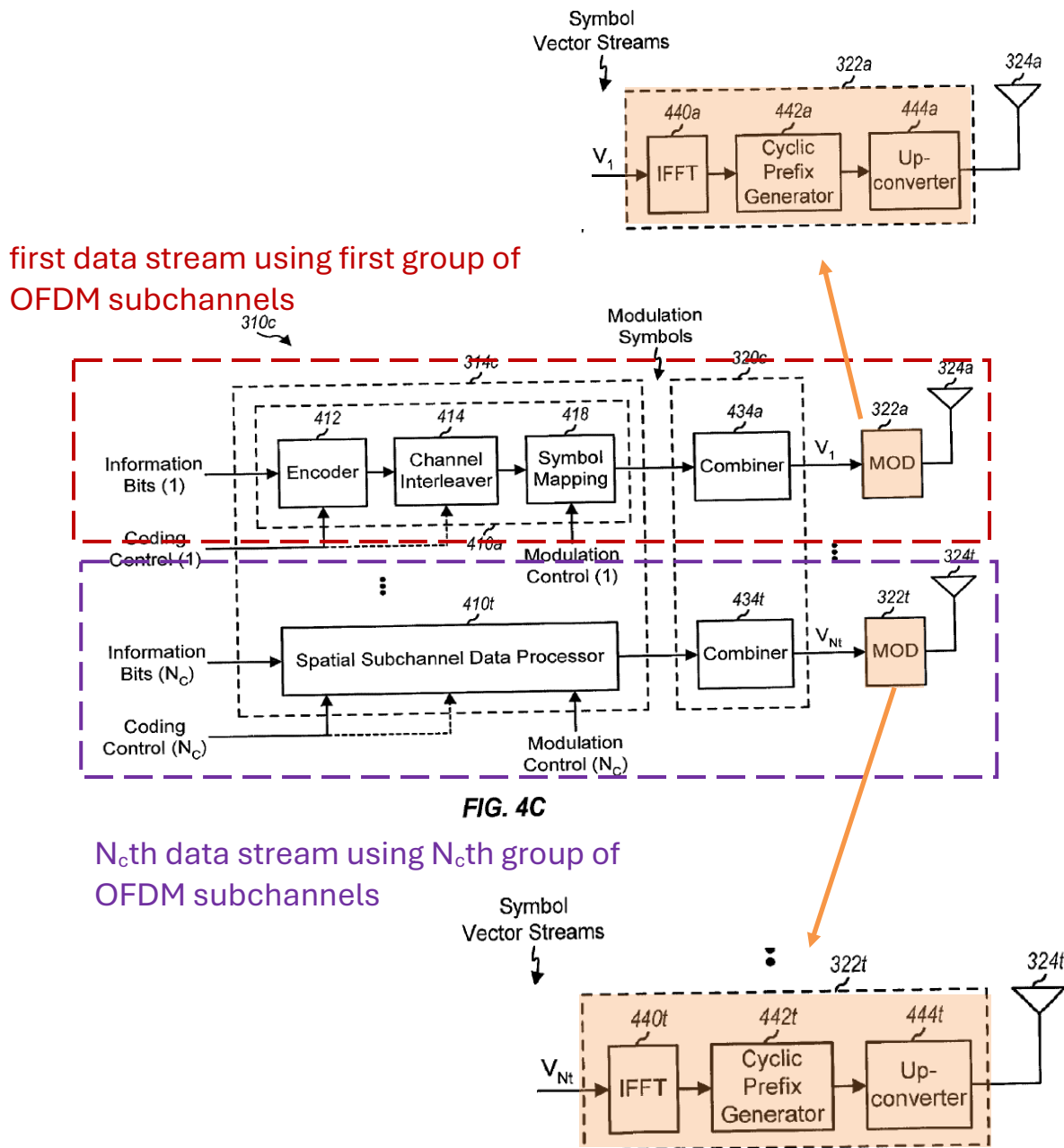
Ex.1005, Figure 4C (annotated); Ex.1003, ¶89

The modulators 322 in Figure 4C employ OFDM transmission. Ex.1005, [0160] (“The processing by each modulator 322 to generate a modulated signal is described below.”); [0166] (“FIG. 4D also shows an embodiment of modulator 322 for OFDM.”). Walton’s modulator 322 for OFDM transmission utilizes an inverse Fast Fourier Transform (IFFT) that converts an input symbol vector, and IFFTs are “known in the art and not described in detail herein.” Ex.1005, [0166]-[0167].



Ex.1005, Figure 4D (partial) (annotated); Ex.1003, ¶90

The combined teachings of Figures 4C and 4D are illustrated below.



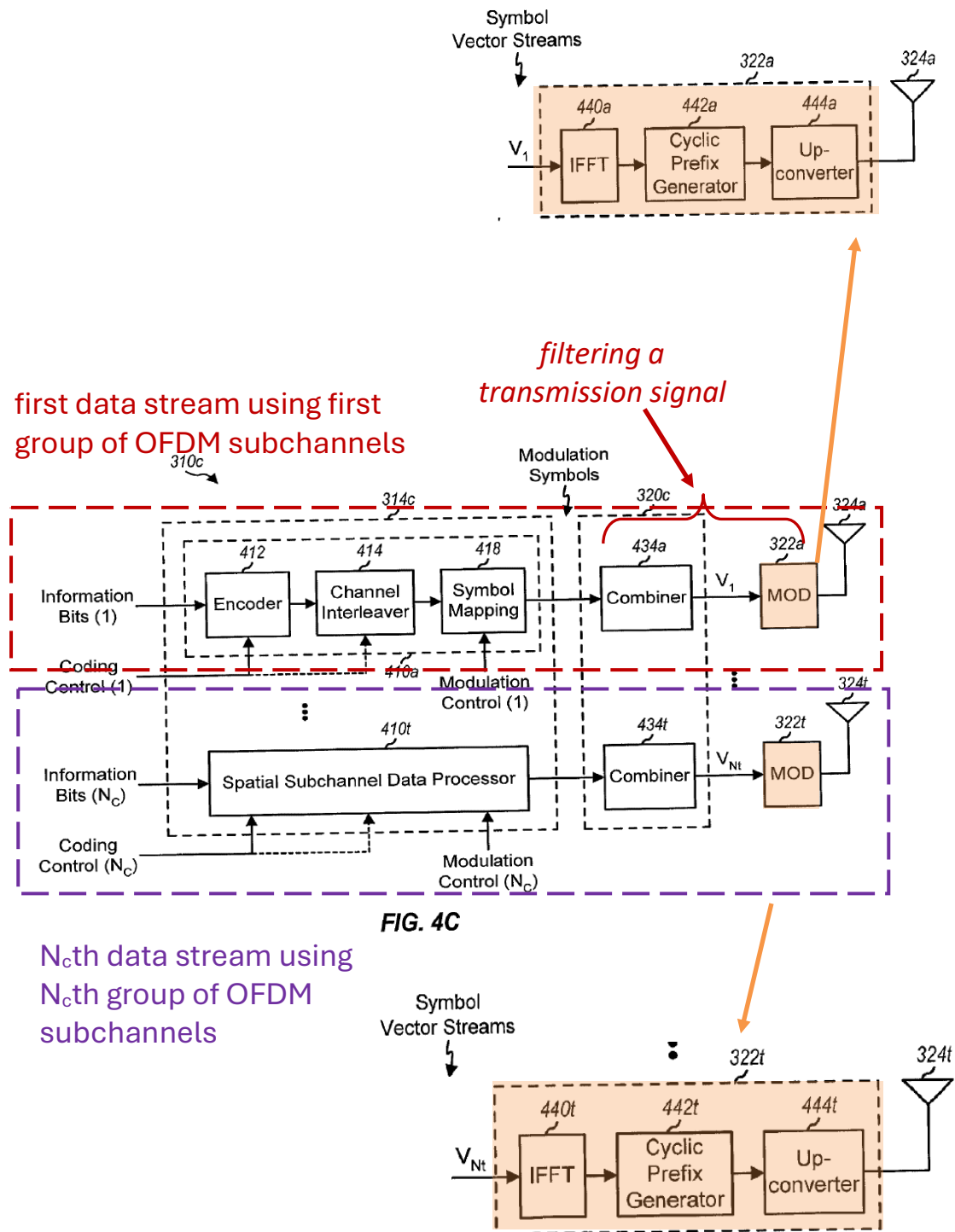
Ex.1005, Figures 4C and 4D (partial) (annotated); Ex.1003, ¶91

Walton describes the process of generating a modulated signal for transmission as using the “**selected** frequency subchannels for a particular transmit antenna” (selected *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.

Ex.1005, [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,” Ex.1005, [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, *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*. Ex.1003, ¶92.



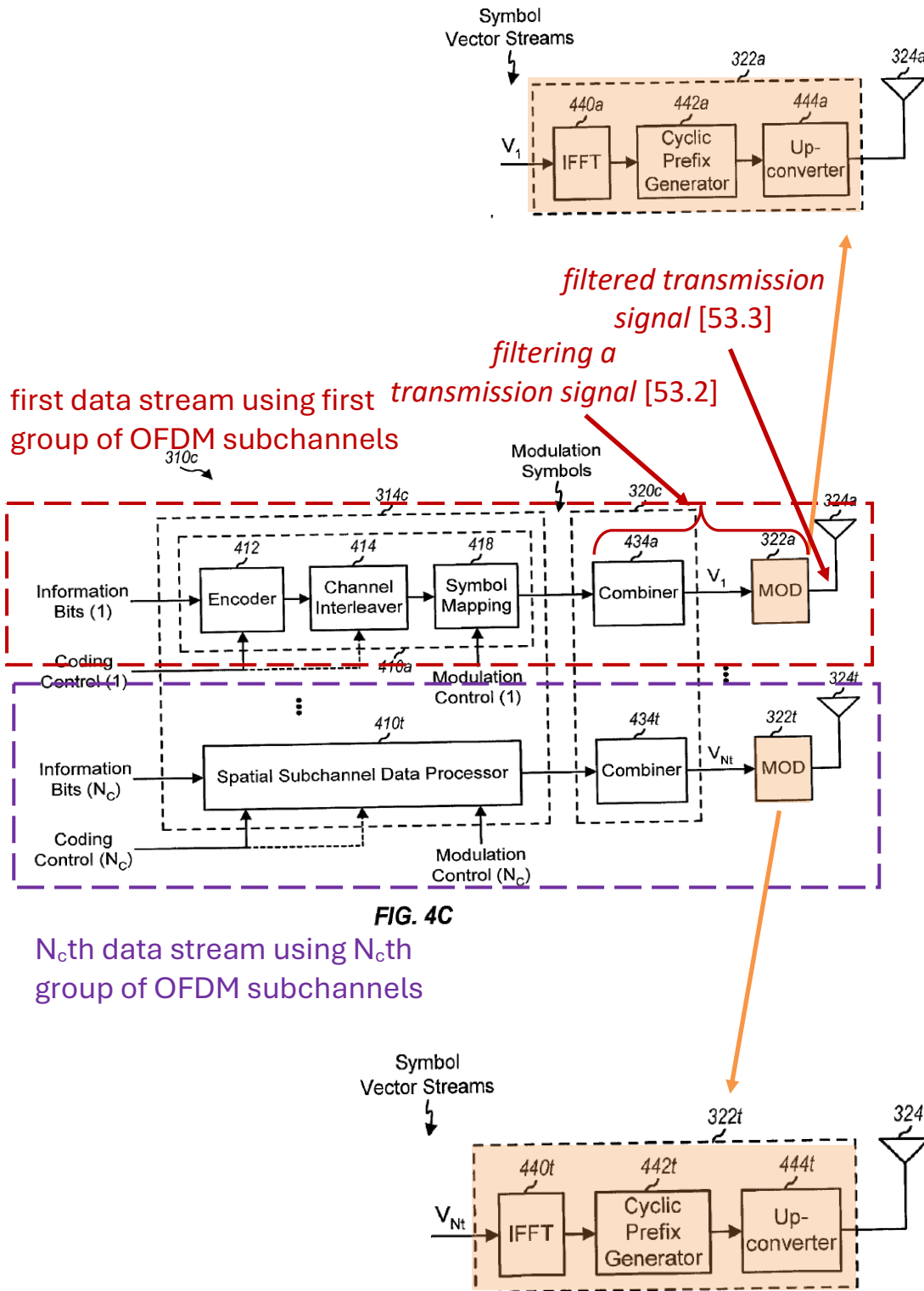
Ex.1005, Figures 4C and 4D (partial) (annotated); Ex.1003, ¶92

To the extent PO argues that Walton does not disclose or render obvious element [53.2], such would have been obvious in further view of McFarland as discussed in Ground-2. Ex.1003, ¶93.

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

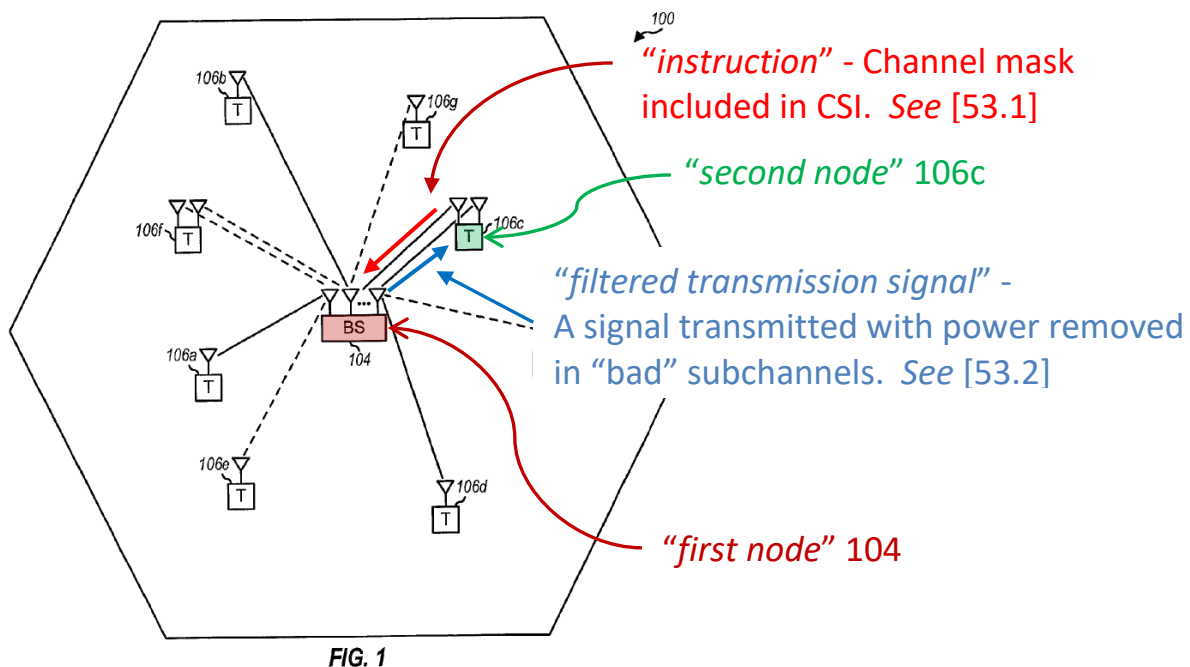
Walton discloses or renders obvious element [53.3].

As explained in the analysis of element [53.2], *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 an example *filtered transmission signal*. Walton discloses transmitting the modulated signal that is the output of modulator 322a. Ex.1005, [0160], [0167]-[0168]. Thus, Walton discloses *transmitting the filtered transmission signal*. Ex.1003, ¶94.



Ex.1005, Figures 4C and 4D (partial) (annotated); Ex.1003, ¶94

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], [0134], [0068]. Figure 1 is illustrated below with these teachings. Ex.1003, ¶¶95-96.



Ex.1005, Figure 1 (annotated); Ex.1003, ¶95

[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;*

Walton discloses or renders obvious element [53.4].

As discussed above at [53.1] and [53.3], Walton teaches that a terminal, such as terminal 106c, (*second node*) sends 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. Ex.1003, ¶98.

First, CSI includes a “channel mask” (*instruction*) as explained in the analysis of element [53.1]. 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.”** Ex.1005, [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]; Ex.1003, ¶99.

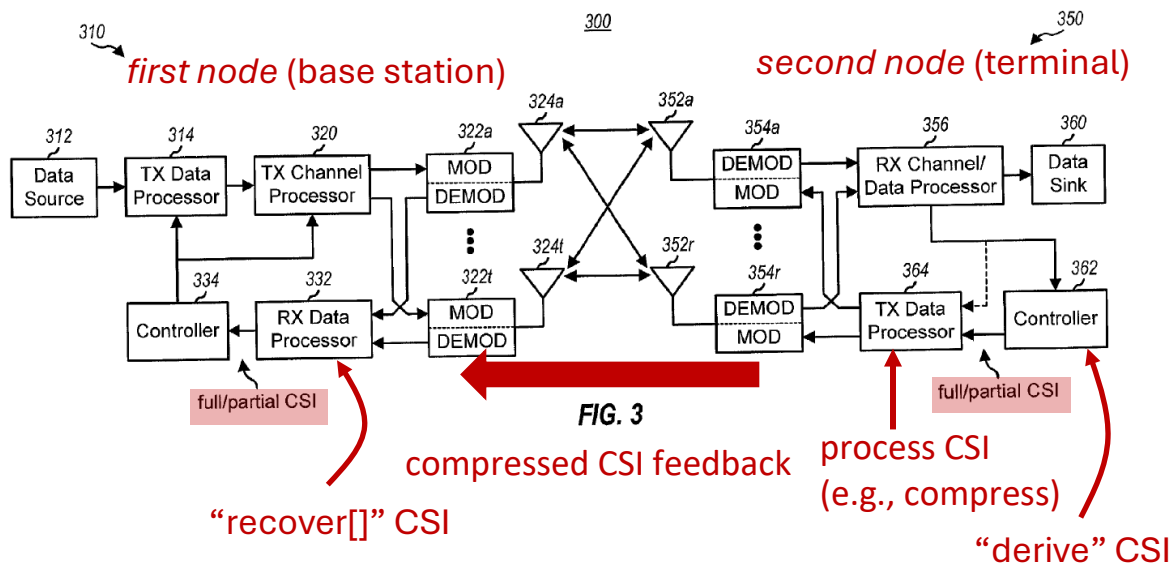
An alternative example of the information that would have been included in the CSI in addition to the “channel mask” identifying “the selected transmission channels,” Ex.1005, [0205], is “power control information for each selected transmission channel, data stream, group or [*sic* – of] transmission 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.” Ex.1005, [0209]. Thus, there are at least two alternative examples of information included in Walton’s CSI, besides the channel mask (*instruction* of [53.1]). Ex.1003, ¶100.

Second, Walton discloses compressing CSI that is “fed back,” thereby disclosing that the *feedback* is *compressed*. Ex.1005, [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*. Ex.1003, ¶101.

Third, the CSI is compressed at Walton’s “receiver system” (e.g., in terminal 106c, *second node*) and transmitted to “transmitter system” (e.g., in base station 104) that receives the compressed CSI, thereby disclosing *receiving a compressed first feedback from the second node*. Ex.1003, ¶102.

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**) ... may be performed at the receiver system by a controller 362 shown in FIG. 3.” Ex.1005, [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**.” Ex.1005, [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], [0134]; Ex.1003, ¶103.



Ex.1005, Figure 3 (annotated); Ex.1003, ¶103

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. Ex.1005, [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. Ex.1005, [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*. Ex.1003, ¶104.

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.**” Ex.1005, [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.” *Id.*, [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*). Ex.1005, Figs. 3, 5, 6A, [0134], [0180], [0190]; Ex.1003, ¶105.

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.” Ex.1005, [0039], [0049]. SNRs are therefore a characteristic of the receipt of a signal. *See id.*, [0082] (“received SNRs” are “characteristics”), [0119], [0147], [0166]-[0168] (modulated symbols

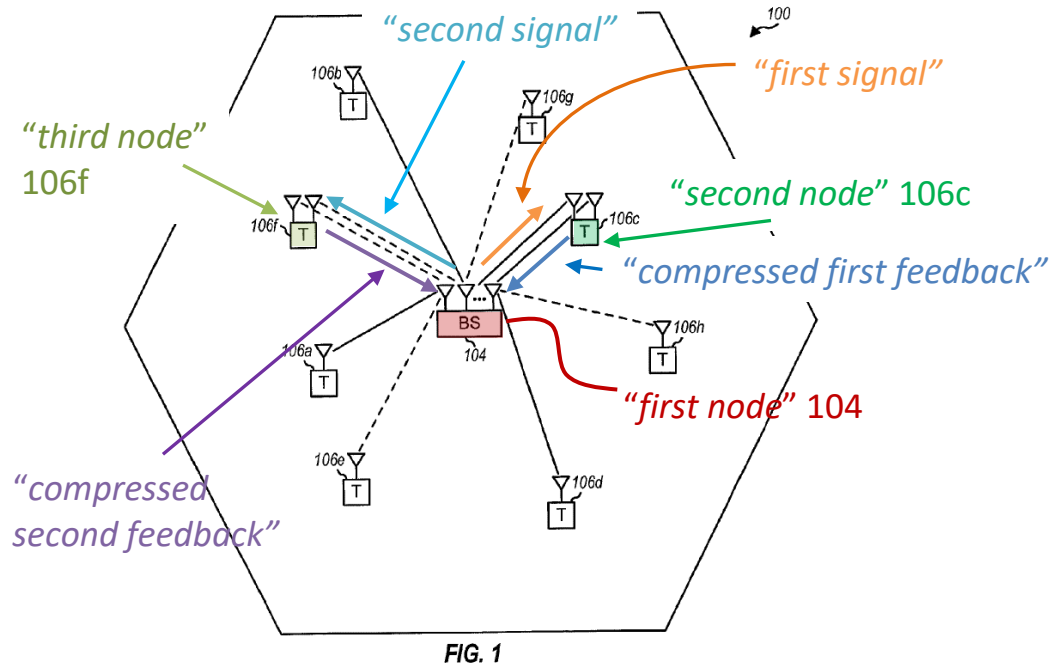
are transmitted as modulated signals from an antenna), [0160]. And because “power control information” is based on received SNRs (Ex.1005, [0209]), CSI that contains SNRs or power control information derived from a first signal *characterizes receipt of the first signal*. Ex.1003, ¶106.

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*. Ex.1003, ¶107.

[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;*

Walton discloses or renders obvious element [53.5].

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*). Ex.1005, [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*).



Ex.1005, Figure 1 (annotated); Ex.1003, ¶109

In detail, each terminal may have its own assigned transmit antenna(s) at the base station 104. Ex.1005, [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. Ex.1005, [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]. Ex.1003, ¶110.

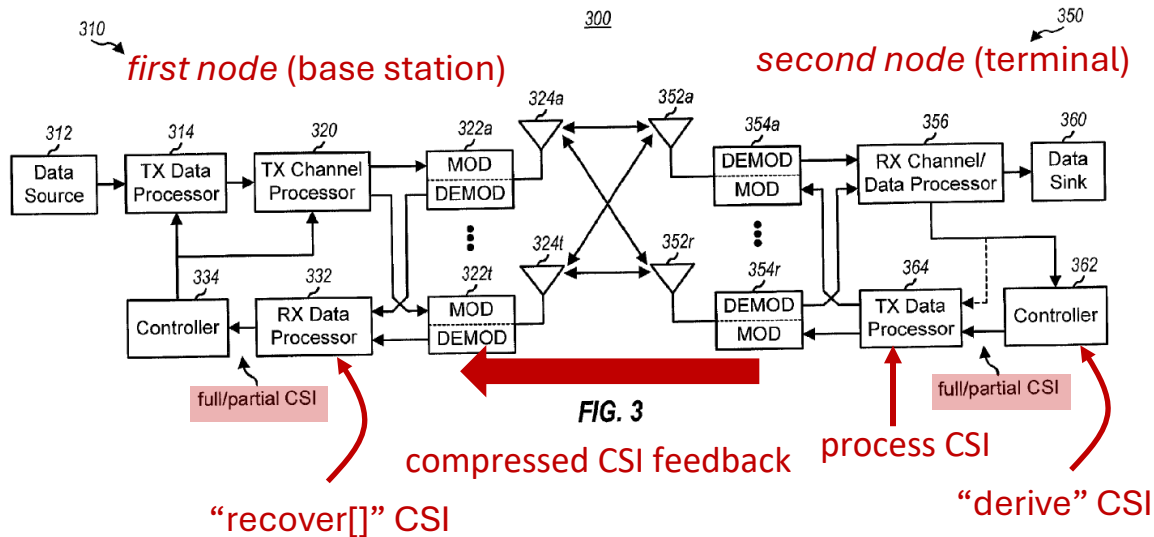
Thus, for the same reasons as presented in the analysis of [53.4], which is in the general context of transmitter/receiver systems and therefore applicable to transmissions from base station 104 to terminal 106c as well as from base station 104 to terminal 106f (or any other terminal), Walton discloses or obvious claim element [53.5]. Ex.1003, ¶111.

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

Walton discloses or renders obvious element [53.6].

First, as explained in the analysis of [53.4], Walton discloses “*receiving a compressed first feedback*” in the form of compressed CSI at system 310 of base station 104 (*first node*) (Ex.1005, [0134]), as illustrated in annotated Figure 3,

reproduced from [53.4] below. *Id.*, [0221]-[0223].



Ex.1005, Figure 3 (annotated); Ex.1003, ¶113

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.”

Ex.1005, [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,” Ex.1005, [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). *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1372-74 (Fed. Cir. 2019) (a primary reference renders obvious a limitation where a supporting reference is used to explain the primary reference). Ex.1003, ¶114.

As explained in the analysis of [53.4], 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. Ex.1005, [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.) Ex.1003, ¶¶115-116.

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;*

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 104 (*first node*) to a first terminal 106c (*second node*) also apply for downlink communication from the base station to another terminal (e.g., 106f) (*third node*). See, e.g., Ex.1005, [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 terminal (*third node*) communicating with the base station 104 (*first node*), Walton renders obvious claim element [53.7] for the same reasons as claim element [53.6]. Ex.1003, ¶118.

[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,*

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

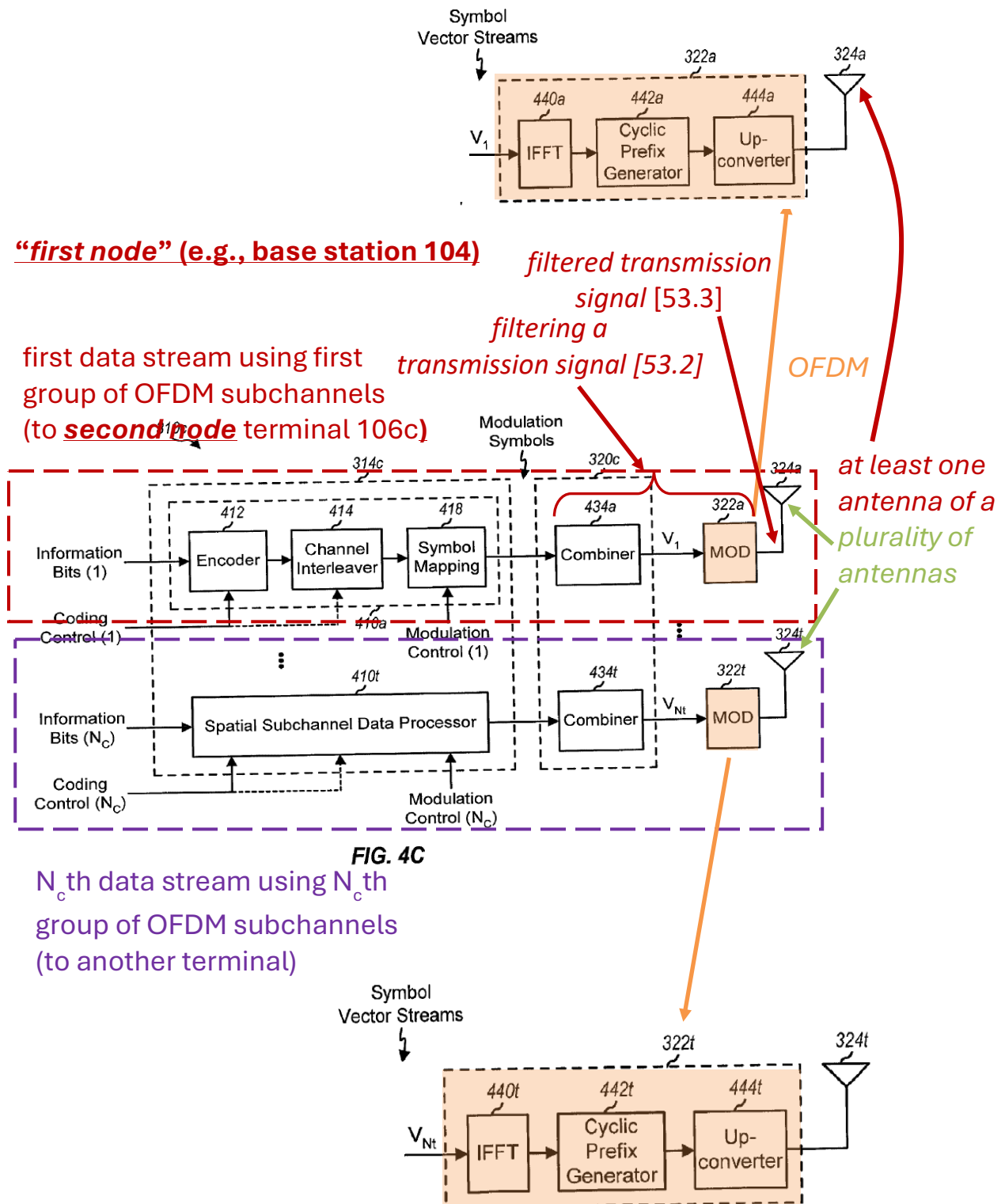
First, Walton discloses or renders obvious *the filtered transmission signal is a filtered first transmission signal that is transmitted to the second node* for the same reasons as presented in element [53.3] because this claim language is substantially the same as [53.3]. Ex.1003, ¶120.

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. Ex.1005, [0160], [0166]-[0167], and “OFDM” is a “communication scheme,” *id.*, [0170]. Ex.1003, ¶121.

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.” Ex.1005, [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]. Ex.1003, ¶122.

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). Ex.1003, ¶123.



Ex.1005, Figures 4C and 4D (partial) (annotated); Ex.1003, ¶123

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 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 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”). See Ex.1003, ¶124.

For example, employing elements of IEEE-802.11a (which uses OFDM), such as a 5 GHz band, Ex.1007, 3, modulation of OFDM subcarriers, “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, Ex.1005, [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. Ex.1003, ¶125.

Note that the '720 patent specification itself does not identify any particular aspect of an *OFDM protocol* that makes it *IEEE 802.11-based*, as compared to OFDM modulation in general, 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.”). Ex.1003, ¶126.

Motivation to Combine Walton and IEEE-802.11a

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) 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. Ex.1003, ¶127 (citing Ex.1015, 4-5).

Combining Walton and IEEE-802.11a merely amounts to the use of a known technique (e.g., 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 products

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. Ex.1003, ¶128.

A POSITA would have had a reasonable expectation of success of incorporating teachings of IEEE-802.11a into Walton's system 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 networks that employ IEEE 802.11a protocols. Walton's base station 104 is also known as an "access point," which is a device that coordinates transmissions in IEEE 802.11 networks, and other MIMO systems that employ OFDM explicitly share some of the characteristics specified in IEEE 802.11a. Ex.1003, ¶129 (citing Exs. 1013 and 1014). As another example, Bohnke confirms that assigning certain subcarriers as

“empty” subcarriers that carry no data (as in Walton), Ex.1008, [0082], results in “minimum changes required in current standards,” such as “IEEE 802.11a,” *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. Ex.1003, ¶129 (citing Exs. 1014, 4:1-27 and 1016, 3:42-57), ¶¶130-131.

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

Walton discloses or renders obvious element [53.8.2].

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,” Ex.1005, [0010], 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. Ex.1003, ¶133.

Second, as explained in the analysis of element [53.4], Walton’s CSI includes a “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,” Ex.1005, [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 (OFDM subchannels) is an example of a *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]. Ex.1003, ¶134.

Walton also discloses or renders obvious element [53.8.2] in an additional or alternative way. As explained in the analysis of element [53.4], 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.” Ex.1005, [0209]. An increase/decrease in transmit power for a group of transmission channels results in an overall increase/decrease in transmit power, as does increasing/decreasing the transmit power in a given transmission channel, both of which are disclosed by Walton. *Id.*; Ex.1003, ¶135.

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 claim element [53.8]. Ex.1003, ¶136.

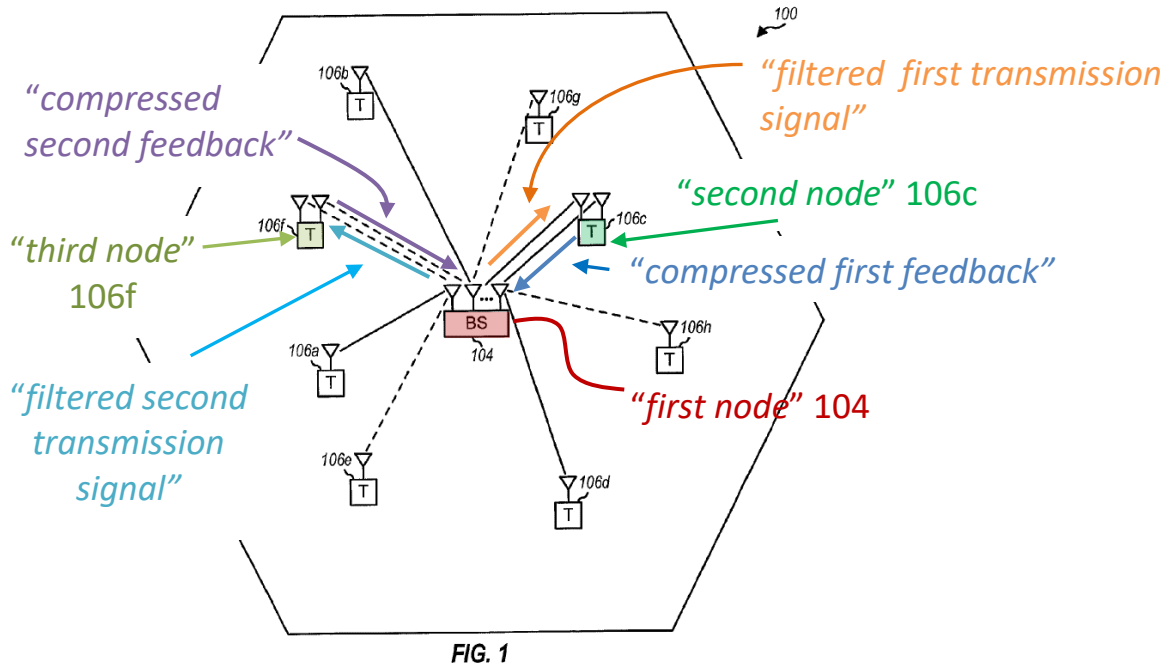
[53.9] and further comprising: transmitting, using the 802.11-based OFDM protocol, a filtered second transmission signal, simultaneously with the filtered first transmission signal, to the third node using a second power that is based on the decompressed second feedback.

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

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* Ex.1005, [0024], [0134], [0225]. Accordingly, Walton-802.11a likewise renders obvious

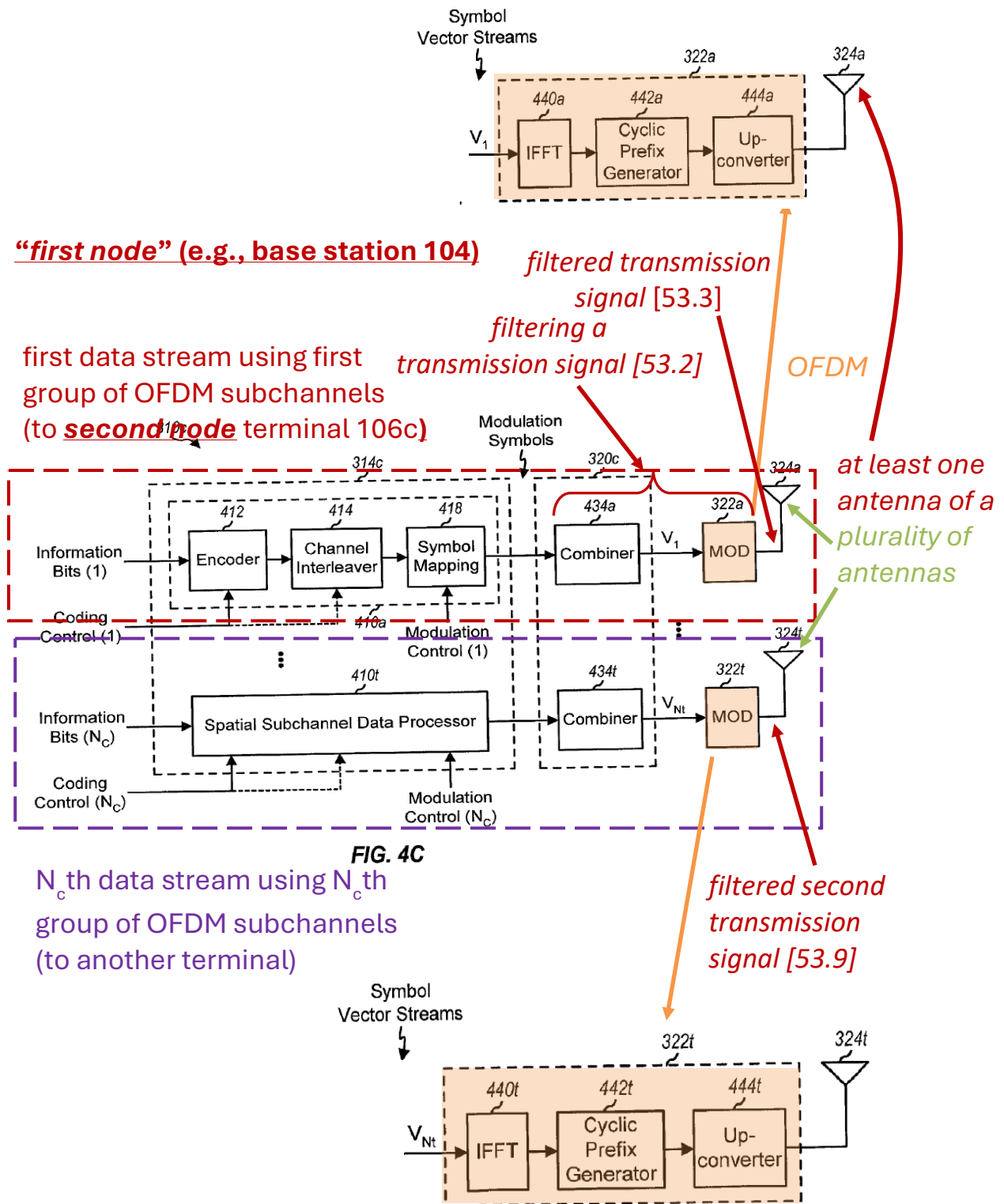
transmitting, using the 802.11-based OFDM protocol, a filtered second transmission signal ... to the third node using a second power that is based on the decompressed second feedback. Ex.1003, ¶¶138-139.

Second and with regard to “*simultaneously*,” Walton discloses simultaneous (concurrent) transmission of OFDM signals to different terminals. Ex.1005, [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]; Ex.1003, ¶140.



Ex.1005, Figure 1 (annotated), Ex.1003, ¶140

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 a label added for element [53.9].



Ex.1005, Figures 4C and 4D (partial) (annotated); Ex.1003, ¶141

D. Ground-2: Claim 53 is obvious over Walton, IEEE-802.11a, and McFarland

1. Brief Summary of the Prior Art

Walton and IEEE-802.11a are discussed above in Ground-1.

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. Ex.1003, ¶63.

2. Claim 53

Claim elements [53.0]-[53.1] and [53.3]-[53.9] are taught by Walton and IEEE-802.11a, as discussed in Ground-1 above. Walton combined with McFarland renders obvious element [53.2], as discussed below. Ex.1003, ¶¶142-143, 159-166.

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

Continuing with the analysis of claim element [53.2] in Ground-1 above, to the extent PO argues that Walton does not disclose or render obvious [53.2], such would have been obvious in view of McFarland.

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.” Ex.1006, [0039] (“a subset” of frequencies can used “by simply inputting zero magnitude signals” on the

frequencies “that are not to be used”). Ex.1003, ¶146.

McFarland addresses OFDM transmission, Ex.1006, [0006], which, like Walton, uses an “Inverse Fast Fourier Transform (iFFT) processor,” *id.*, [0007]. For context, McFarland further uses “carrier” and “subcarrier” interchangeably in the context of OFDM. Ex.1006, [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. Ex.1005, [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]; Ex.1003, ¶147.

McFarland describes “changing the number of carriers in active use,” Ex.1006, [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, Ex.1005, [0009]-[0010]) are filtered out “by simply inputting zero magnitude signals” for the IFFT on those carriers, as illustrated in Figure 8. McFarland’s teaching that realizes “power savings from using a smaller number of carriers,” Ex.1006, [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”); Ex.1003, ¶148.

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

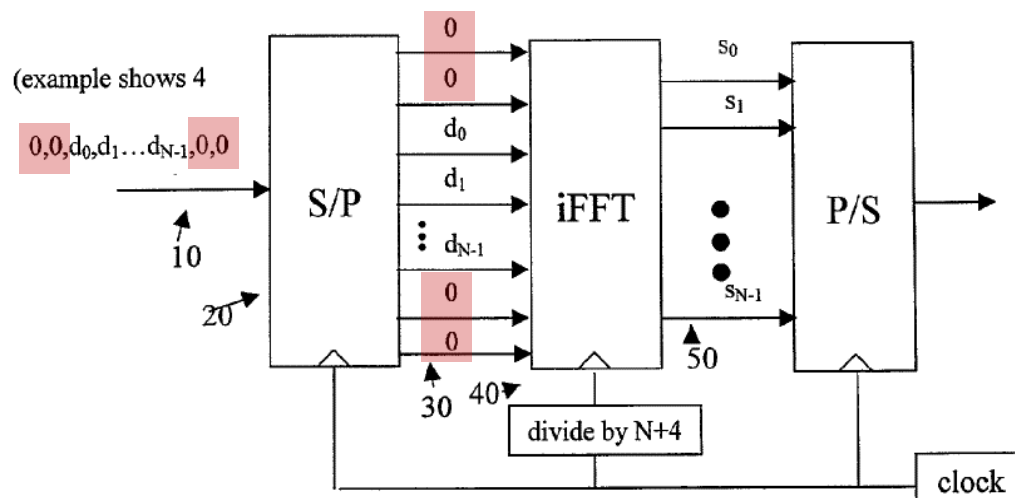
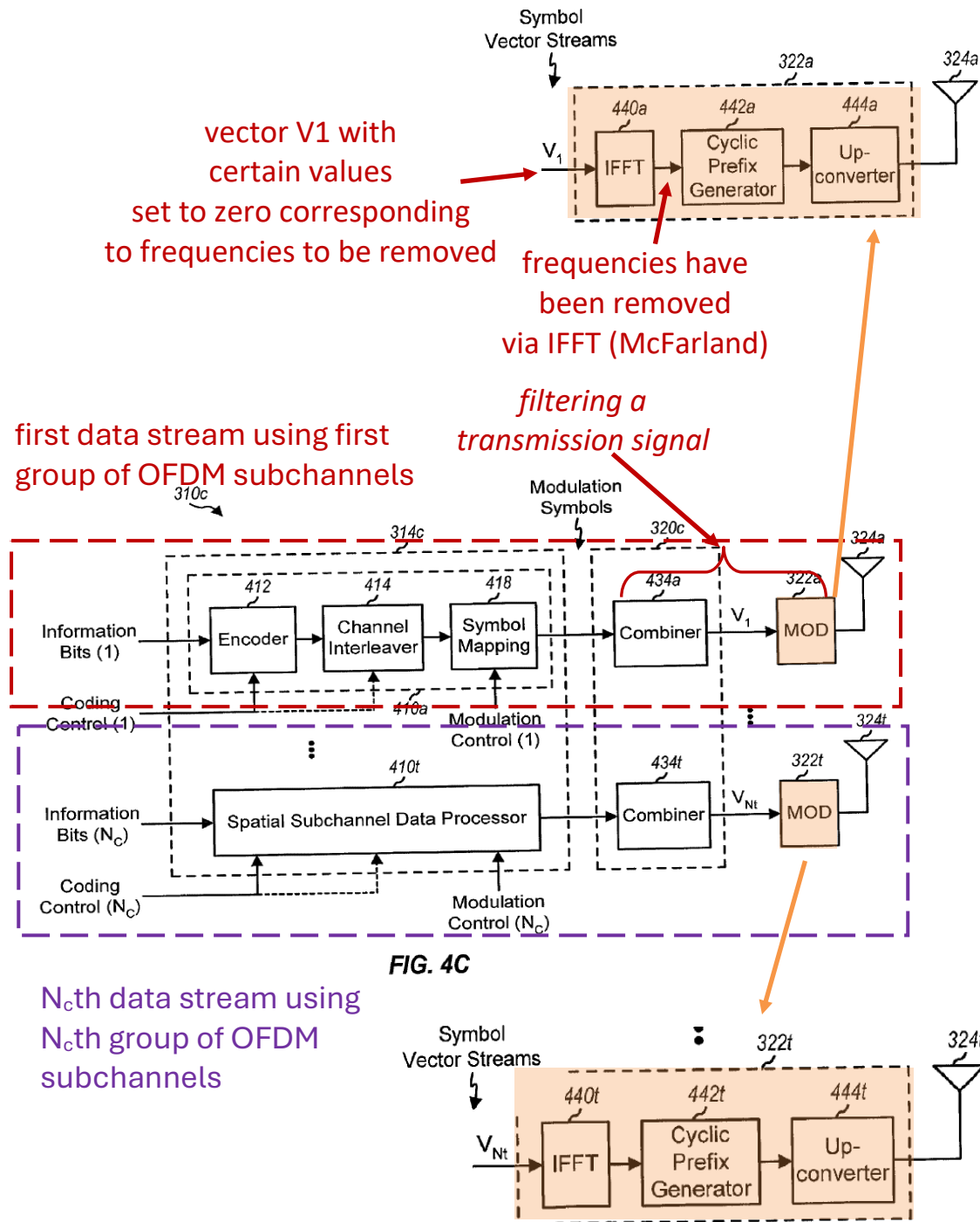


FIG. 8

Ex.1006, Figure 8 (annotated); Ex.1003, ¶148

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.” Ex.1005, [0160]. “*Filtering a transmission signal*” is indicated in a figure below that

combines Figures 4C and 4D of Walton, in view of McFarland. Ex.1003, ¶149.



Ex.1005, Figures 4C and 4D (partial) (annotated); Ex.1003, ¶149

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 detailed description where the phrase "to remove power," as in the claim language, is used. Referring to Figure 13, the '720 patent describes "transmit excision" further with regard to an inverse FFT (or IFFT):

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; Ex.1003, ¶150.

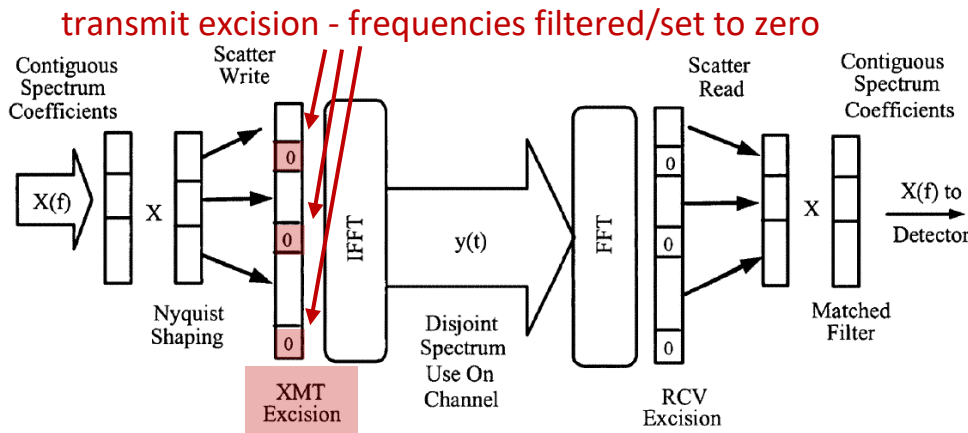


FIG. 13

Ex.1001, Figure 13 (annotated); Ex.1003, ¶150

Also, note that claim 94 of the '720 patent confirms that transmit excision is a form of filtering, reciting “*the filtering utilizes transmit excision.*” Ex.1003, ¶150.

Motivation to Combine Walton and McFarland

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.” Ex.1006, [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, Ex.1005, [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. Ex.1003, ¶152.

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.” Ex.1005, [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 these carriers in an OFDM signal “are not to be used.” Ex.1006, [0039], [0006], [0007], [0009]; Ex.1003, ¶153.

Walton combined with McFarland represents use of known technique

(McFarland's IFFT technique in Figure 8 to remove "carriers that are not to be used," Ex.1006, [0037]-[0039]) to improve similar devices (Walton's OFDM transmitter system/base station of Figure 4C with OFDM modulator 322 illustrated in Figure 4D, Ex.1005, [0158]-[0160], [0166]-[0167], [0134]) in the same way (ease of implementation with little circuitry change and no IFFT change and power savings). Ex.1003, ¶154.

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 (which also uses an IFFT) because McFarland's teachings are compatible for implementation in Walton. *See, e.g.*, Ex.1005, [0158]-[0160] ("modulator 322" of Figure 4C described with respect to Figure 4D); [0166]-[0167] (OFDM modulator 322 using IFFT); Ex.1006, [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, Ex.1005, [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, Ex.1006, [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. Ex.1003, ¶155.

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,” Ex.1006, [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 claim element [53.2]. Ex.1003, ¶¶156-158.

E. Ground-3: Claim 53 is obvious over Walton, IEEE-802.11a, and Peterson

1. Brief Summary of the Prior Art

Walton and IEEE-802.11a are discussed above in Ground-1.

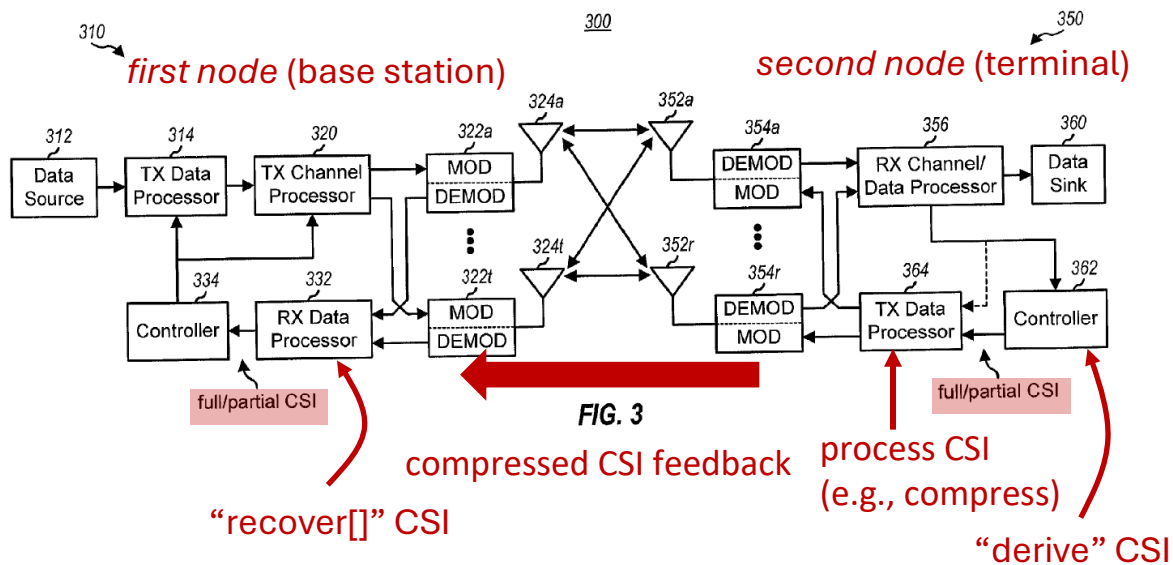
While Walton describes compressing feedback and performing “complementary” processing to recover the feedback, Walton does not explicitly use the claim term *decompression*. However, Peterson (a computer networking textbook pre-dating the ’720 patent by several years) confirms that decompression would have been the complementary process to Walton’s compression. Ex.1003, ¶67.

2. Claim 53

Claim elements [53.0]-[53.5] and [53.8.1]-[53.9] are taught by Walton and IEEE-802.11a, as discussed in Ground-1 above. *See* Ex.1003, ¶¶167-172, 182-184. Walton combined with Peterson renders obvious elements [53.6]-[53.7], discussed below.

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

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*) (Ex.1005, [0134]), as illustrated in annotated Figure 3, reproduced from [53.4] below. *Id.*, [0221]-[0223].



Ex.1005, Figure 3 (annotated); Ex.1003, ¶174

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,” Ex.1005, [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, Ex.1005, [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* (e.g., 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. Ex.1003, ¶175.

Motivation to Combine Walton and Peterson

Walton describes sending CSI “differentially” or using “other compression” techniques. Ex.1005, [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; Ex.1003, ¶176.

In addition to describing differential compression, Walton says that “other compression” techniques may be used, Ex.1005, [0221], which expressly teaches a POSITA to consider other types of compression techniques for implementation. 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. Ex.1005, [0205]; Ex.1003, ¶177.

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, 357 (describing data “transmitted over a network”), similar to Walton’s, and the combination would merely use those techniques for their intended purpose. Ex.1003, ¶178-179.

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

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

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]. Ex.1003, ¶181.

F. Ground-4: Claim 53 is obvious over Walton, IEEE-802.11a, McFarland, and Peterson

Claim elements [53.0]-[53.1], [53.3]-[53.5] and [53.8.1]-[53.9] are obvious over Walton and IEEE-11a as discussed above in Ground-1.

Claim element [53.2] is obvious over Walton and McFarland, as discussed above in Ground-2.

Claim elements [53.6]-[53.7] are obvious over Walton and Peterson, as discussed above in Ground-3. Ex.1003, ¶¶185-195.

G. Ground-5: Claim 95 is obvious over Walton, IEEE-802.11a, and Bohnke

[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;*

Elements [95.0]-[95.3] are identical to elements [53.0]-[53.3], respectively. Therefore, Walton alone or combined with IEEE-802.11a renders obvious elements [95.0]-[95.3] for the same reasons as Ground-1 [53.0]-[53.3]. Ex. 1003, ¶¶196-197.

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

Walton discloses or renders obvious element [95.4].

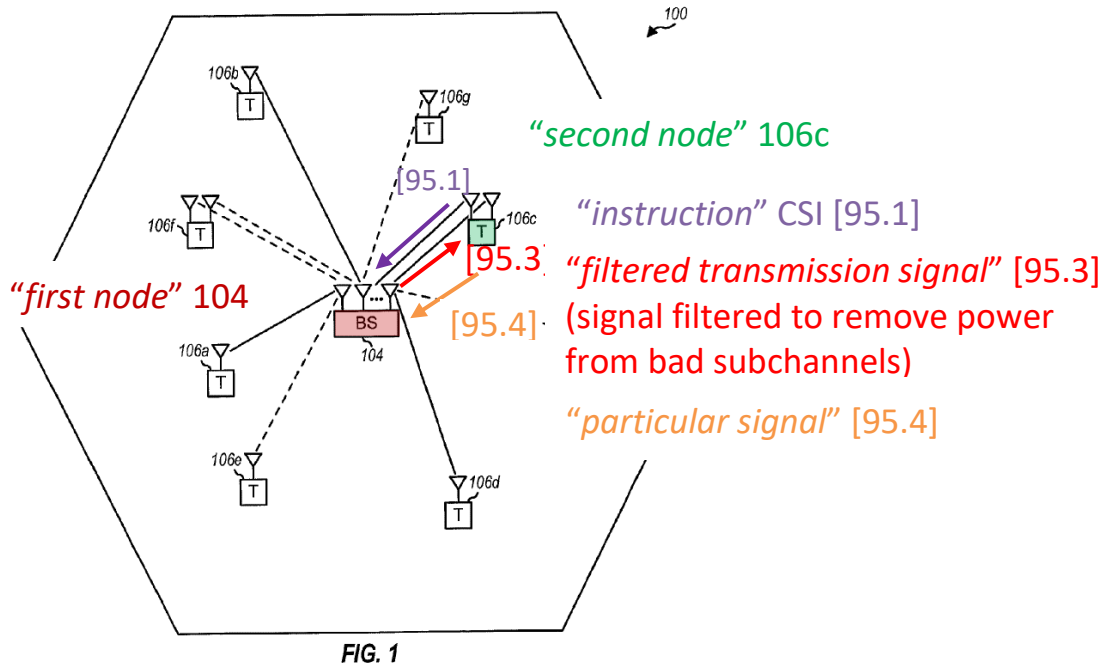
Walton's teachings that disclose or render obvious [95.1]-[95.3] (corresponding to [53.1]-[53.3]) relate to data transmission on the downlink from a

transmitter system of base station 104 (*first node*) to a receiver system of terminal 106c (*second node*). Ex.1005, [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.” Ex.1005, [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*). Ex.1005, [0225], [0024]; *see also* [0134]; Ex.1003, ¶199.

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. Ex.1005, [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. Ex.1005, [0212], [0142] (“[p]ilot data” is “data of [a] known pattern”), [0192]; Ex.1003, ¶200.

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 (Ex.1005, [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). Ex.1003, ¶201.



Ex.1005, Figure 1 (annotated); Ex.1003, ¶201

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). Ex.1003, ¶202.

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

Walton discloses or renders obvious element [95.5].

First, Walton discloses or renders obvious *generating a feedback* at the base

station 104. As explained in the analysis of element [53.4], 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," Ex.1005, [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). Ex.1005, [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]; Ex.1003, ¶204.

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 ...," Ex.1005, [0208] (and recall that OFDM frequency

subchannels are example transmission channels, *see* [53.1] and Ex.1005, [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.**”); Ex.1003, ¶205.

For example, the “the SNR of the k-th transmission channel” may be computed “based on the received pilot signals.” Ex.1005, [0192]. The received pilot signals “may be transmitted “in a subset or **all of the selected transmission channels,**” as an example. *Id.*, [0142].¹ 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. Ex.1005, [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]-

¹ 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.**” Ex.1003, ¶206, n.3.

[0071] (“Received SNR...for transmission channel k in group j” is proportional to “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 (Ex.1005, [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). Ex.1003, ¶¶206-207.

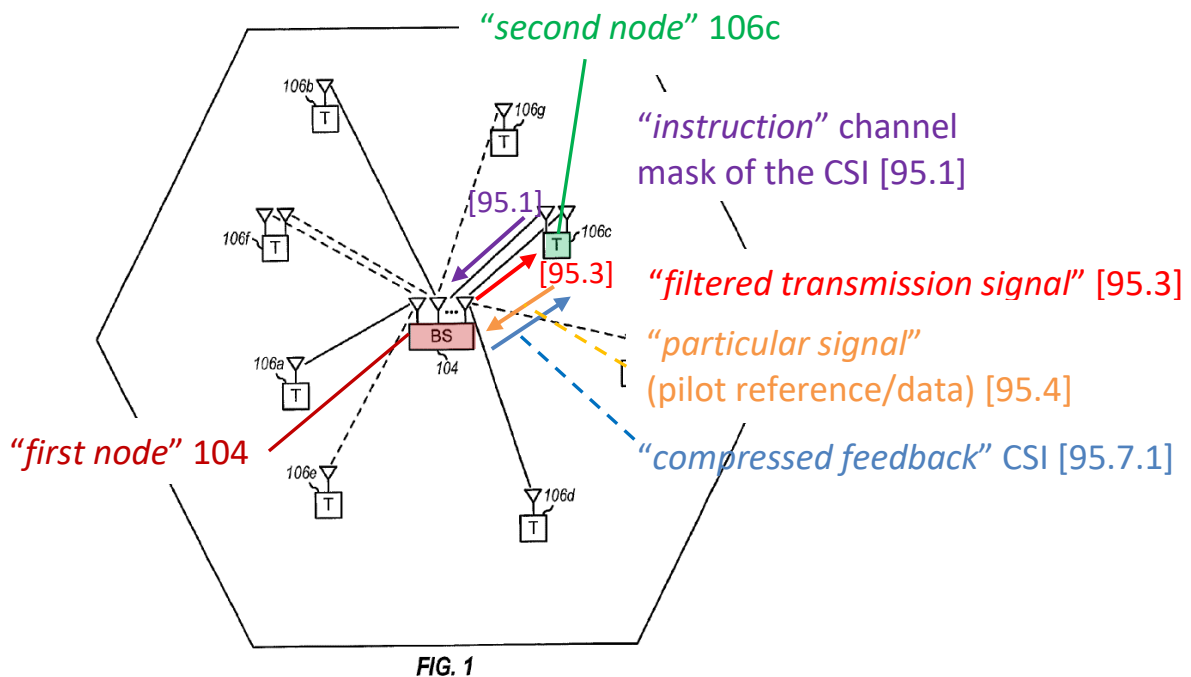
[95.6] *compressing the feedback; and*

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” applied to CSI besides differential updates can be used, Ex.1005, [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”). Ex.1003, ¶208.

[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;*

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

As explained in the analysis of elements [95.5] and [95.6], 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*). Ex.1005, [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 includes a transmitter system for an uplink). Ex.1003, ¶211.



Ex.1005, Figure 1 (annotated); Ex.1003, ¶211

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

As explained in [53.4], [53.8.2], and [95.5], the CSI that is fed back (*feedback*), and which 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. Ex.1005, [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,” Ex.1005, [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,” Ex.1005, [0209]:

(1) a transmit power for a selected transmission channel is based on a single bit (request) or multiple bits (change in magnitude);

(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.” Ex.1003, ¶¶212-213.

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). Ex.1003, ¶214.

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. Ex.1005, [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.”); Ex.1003, ¶215.

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, Ex.1005, [0225] (“[F]or the uplink, transmitter system 310 in FIGS. 3 and

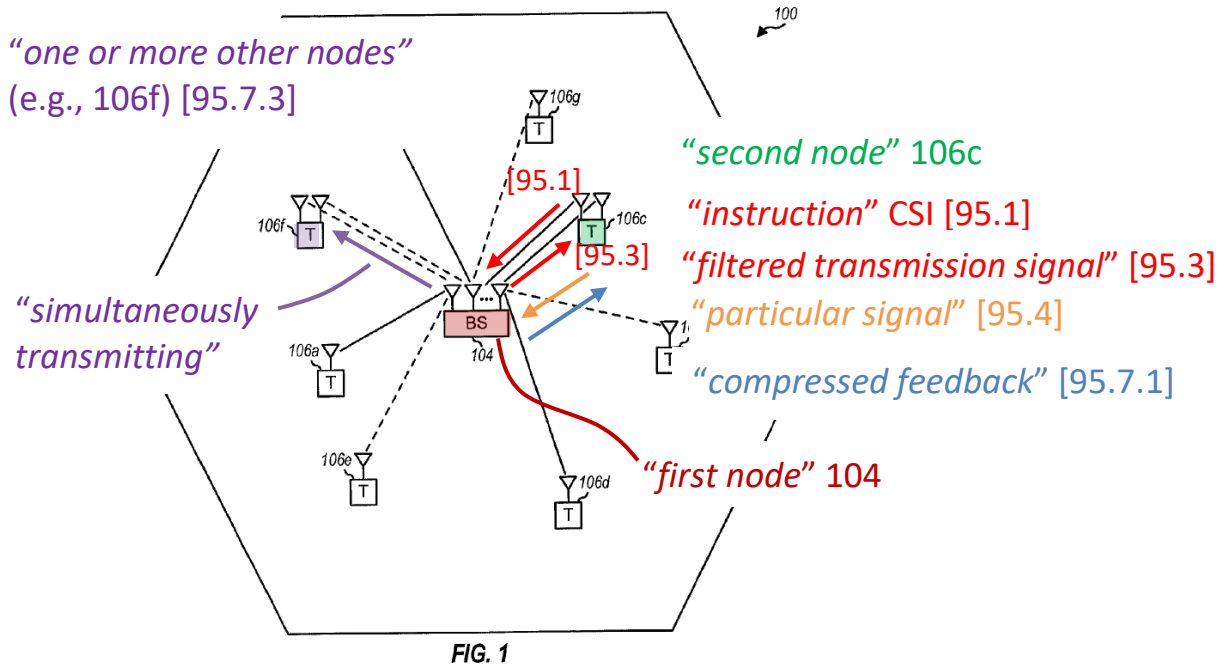
4A through 4D may represent part of a terminal.”); [0137] (“[I]f OFDM is employed, TX channel processor 320 [in transmitter system 310] provides a stream of modulation symbol vectors **for each antenna used for data transmission.**”); Figure 3 (transmitter system 310 has transmit antennas 324a-324t); *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). Ex.1003, ¶216.

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

The base station includes both a transmitter system 310 and a receiver system 350, Ex.1005, [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 reason to use a "multi-channel communication system" such as a MIMO system, which is to "provide increased transmission capacity." Ex.1005, [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; Ex.1003, ¶¶217-218.

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. Ex.1003, ¶219.



Ex.1005, Figure 1 (annotated); Ex.1003, ¶219

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

Element [95.8] is broader than [53.8.1]. Therefore, Walton combined with IEEE-802.11a renders obvious [95.8] for the same reasons as [53.8.1]. Ex.1003, ¶220.

[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.

Walton combined with Bohnke renders obvious element [95.9].

First, Walton discloses or renders obvious *an update of the compressed*

feedback is repeatedly generated, compressed, and transmitted.

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. Ex.1005, [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.* Ex.1003, ¶¶222-223.

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

As explained in the analysis of element [95.7.2], 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*) satisfies [95.7.2]. Ex.1003, ¶¶224-225.

Walton also discloses that the transmission channels “typically experience different link conditions” that “vary with time” and achieve different SNRs.

Ex.1005, [0028], [0006]. Because the compressed CSI is based on SNRs (as explained for [53.4], [95.5], [95.7.2]), Ex.1005, [0204], [0208], [0209], [0221], and is reported “periodically,” Ex.1005, [0221], and because the transmit power is determined based on the compressed CSI and therefore on SNRs (as explained for [95.7.2]), Ex.1005, [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. Ex.1005, [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. Ex.1005, [0130], [0036]; Ex.1003, ¶226.

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*.

Walton discloses that CSI is “reported periodically,” Ex.1005, [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. Ex.1003, ¶¶227-228.

Walton’s terminals either were understood to be mobile or 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,” Ex.1005, [0028], because other references, such as Bohnke at [0065], confirm that understanding. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1372-74 (Fed. Cir. 2019). 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,” Ex.1005, [0028], [0006], which is at least suggestive that Walton’s terminals are mobile. Ex.1003, ¶230 (citing Ex.1013, [0010]). Furthermore, in network architectures the same as in Walton, a “mobile station” is described as another term for “terminal.” Ex.1013, [0031] (also compare Figure 1 to Ex.1005, 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, Ex.1003, ¶230 (citing 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.1003, ¶¶229-230.

For mobile wireless communication channels, such as those that occur in Walton's system when its terminals are mobile, the "coherence time" refers to the period of time that a channel remains relatively constant, or does "not change significantly," making coherence time a key parameter in the engineering design. Ex.1003, ¶231 (citing Ex.1015, 19 ("The coherence time is the duration over which the channel characteristics do not change significantly.")). Bohnke recognizes the importance of "coherence time." *Id.*, [0065].

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]) that implements IEEE 802.11a at a 5GHz carrier frequency, per Ex.1008,

[0066]-[0069], [0074]; Ex.1003, ¶232.

Bohnke provides numerical examples of coherence time for “mobile radio channels.” Ex.1008, [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 [53.0], [53.8.1], [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

Ex.1008, [0068]-[0070]. As shown in the table, the coherence time for these 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. Ex.1003, ¶233.

Because the coherence time refers to a period when the channel can be considered constant, a POSITA would have understood to update the CSI as well as the transmit power at least as often, if not more often, as the coherence time to

compensate for when the channels might be expected to vary. And because all the coherence times are less than one second, it would have been obvious to update for time periods less than one second (e.g., assume as part of the design that the coherence time is 15 ms to cover all speeds of 1 km/hr or less). 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. Ex.1003, ¶234 (citing Ex.1011, 108, 109, 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.")). 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., 15 ms). *Id.*

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. Ex.1003, ¶¶235-236 (citing Ex.1008, [0074], [0066], [0140]).

H. Ground-6: Claim 95 is obvious over Walton, IEEE-802.11a, Bohnke, and McFarland

Elements [95.0]-[95.3] are identical to elements [53.0]-[53.3], respectively.

Therefore, the combination of Walton, McFarland, and IEEE-802.11a renders obvious elements [95.0]-[95.3] for the same reasons as Ground-2 [53.0]-[53.3]. The remaining elements [95.4]-[95.9] are taught by the combination of Walton and Bohnke, as discussed above in Ground-5. Ex.1003, ¶¶237-243.

X. SOTERA STIPULATION

Real party-in-interest Lenovo Group Limited (LGL) has **already filed** the following stipulation at the district court:

LGL hereby stipulates that, if the PTAB institutes an IPR proceeding on the grounds presented for claims 53 and 95 of the '720 patent in [this IPR], LGL will not pursue an invalidity defense in the [related] district court litigation that the patent claims subject to the instituted IPR are invalid based on grounds that were raised or reasonably could have been raised during this IPR (i.e., any ground that could have been raised under 35 U.S.C. §§ 102 or 103 on the basis of prior art patents or printed publications).

Ex.1024.

XI. CONCLUSION

Petitioners have established a reasonable likelihood that the Challenged Claims are unpatentable.

Respectfully submitted,

Dated: April 29, 2025
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XII. MANDATORY NOTICES

A. Real party-in-interest

The real parties in interest include Intel Corporation, Lenovo (United States) Inc., Motorola Mobility LLC, and Lenovo Group Limited.

B. Related matters

Pursuant to 37 C.F.R. § 42.8(b)(2), to the best knowledge of the Petitioners, the '720 Patent is or was involved in the following district court litigations:

- *USTA Technology, LLC v. Lenovo Group Limited et al*, 4-24-cv-00515 (EDTX). Trial is currently not scheduled and the earliest proposed date for the final pretrial conference in the parties' competing schedules is for November 18, 2026 (Ex.1026, 11), which would occur *after* a Final Written Decision.
- *USTA Technology, LLC v. Google LLC f/k/a Google Inc.*, 6-22-cv-01214 (WDTX)
- *USTA Technology, LLC v. Google LLC*, 4-23-cv-03748 (NDCA)
- *USTA Technology, LLC v. Samsung Electronics Co., Ltd. et al*, 4-24-cv-00517 (EDTX)
- *USTA Technology, LLC v. LG Electronics, Inc. et al*, 4-24-cv-00516 (EDTX)
- *USTA Technology, LLC v. AT&T Inc. et al*, 4-24-cv-00513 (EDTX)
- *USTA Technology, LLC v. AsusTek Computer Inc. et al*, 4-24-cv-00512 (EDTX)

- *USTA Technology, LLC v. Motorola Mobility LLC*, 3-24-cv-02659 (NDTX)
- Reexamination No. 90/019,702, filed on October 14, 2024 by Unified Patents, LLC. Note that the reexamination is directed to a subset of the claims of the '720 patent that do not include claim 95, which is one of the Challenged Claims in this Petition.

C. Lead and back-up counsel and service information

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Please address all correspondence in this proceeding to lead and back-up counsel. Petitioners consent to service in this proceeding by email at the addresses above.

CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), Petitioners hereby certify, in accordance with and reliance on the word count provided by the word-processing system used to prepare this Petition, that the number of words in this paper is 13,897. Pursuant to 37 C.F.R. § 42.24(d), this word count excludes the table of contents, table of authorities, mandatory notices under § 42.8, certificate of service, certificate of word count, appendix of exhibits, and any claim listing.

Dated: April 29, 2025

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CERTIFICATE OF SERVICE

The undersigned certifies that, in accordance with 37 C.F.R. § 42.6(e) and 37 C.F.R. § 42.105, service was made on Patent Owner as detailed below.

Date of service April 29, 2025

Manner of service PRIORITY MAIL EXPRESS

Documents served Petition for *Inter Partes* Review Under 35 U.S.C. § 312 and 37 C.F.R. § 42.104 of U.S. RE47,720;
Petitioner's Power of Attorney;
Petitioners' Exhibit List;
Exhibits 1001-1026.

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