

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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Shenzhen TCL New Technology Co., Ltd.
TCL Optoelectronics Technology (Huizhou) Co., Ltd.
TCL Overseas Marketing Ltd.
TCL Technology Group Corporation (f/k/a TCL Corp.),

Petitioners

v.

LG Electronics Inc.,
Patent Owner

Case No. IPR2023-00869

**PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 10,499,431**

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PETITIONER’S EXHIBIT LIST

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1001	U.S. Patent No. 10,499,431 (“the ’431 Patent”)
1002	Excerpts of prosecution history of U.S. Patent No. 10,499,431
1003	U.S. Patent 7,349,436 (“Maltsev et al.”)
1004	U.S. Patent Publication 2007-0147322 (“Agrawal et al.”)
1005	U.S. Patent Publication 2007-0266157 (“Xhafa et al.”)
1006	Declaration of Mark R. Lanning
1007	C.V. of Mark R. Lanning
1008	IEEE P802.11 Wireless LANs: Proposal for PAR and 5 Criteria for Very High Throughput (VHT) SG for Below 6 GHz Operation, De Courville, Marie; Engwer, Darwin; Kraemer, Bruce; De Vegt, Rob; Erceg, Vinko; Perahta, Eldad; Fracchia, Roberta; Rouquette, Stephanie, (May 12, 2008)
1009	On the Feasibility of 1Gbps for Various MAC/PHY Architectures, Fracchia, Roberta, (March 2008)
1010	LG Electronics, Inc. Complaint for Case 2:22-cv-00122-JRG. 04/21/2022
1011	Fintiv declaration
1012	Plaintiff LG Electronic Inc.’s Preliminary Claim Constructions and Supporting Materials
1013	Defendants’ Amended Patent Rule 4-2 Disclosures
1014	IEEE Standard for Information Technology; Telecommunications and Information Exchange between Systems; Local and Metropolitan Area Networks, Specific Requirements: PART 11” Wireless LAN Medium Access Control (MAC) and Physical Layer Specifications (2007)

Exhibit No.	Description
1015	Reserved
1016	Reserved
1017	Reserved
1018	IEEE 802.11n WLAN Standard by electronics-notes. https://www.electronics-notes.com/articles/connectivity/wifi-ieee-802-11/802-11n.php
1019	What You Need to Know About Wi-Fi 4 (IEEE 802.11n – Keenetic. March 22, 2022 (Not a prior art article).
1020	802.11n Primer, Whitepaper by AirMagnet Wireless Network Assurance, August 05, 2008.
1021	IEEE P802.11 - Wireless LANs: TGn Channel Models; doc.: IEEE 802.11-03/940r4; May 10, 2004
1022	Adrian Stephens—Maltsev co-inventor’s Bio
1023	Chapter A1.A of Gast IEEE 802.11n book.
1024	The History of WiFi: 1971 to Today (Cablefree), May 18, 2017.
1025	IEEE Plenary Meeting 11-08-0428-00-0000-minutes-working-group-march-2008
1026	IEEE SA - About the New Standards Committee (NesCom)
1027	How does 802.11n get to 600Mbps? By Wirevolution.com dated 09/07/2007. https://wirevolution.com/2007/09/07/how-does-80211n-get-to-600mbps/ .
1028	Reserved
1029	IEEE 802.11-10/0780r2. IEEE submission for Joint Multichannel CSMA.

I. INTRODUCTION

Petitioners request *Inter Partes* Review (“IPR”) of claims 1, 2, 4, 5, 7, 8, 10, 11, and 13-16 (the “Challenged Claims”) of U.S. Patent No. 10,499,431 (“the ’431 patent,” Ex. 1001).

The ’431 patent relates to a channel access mechanism in a very high throughput (VHT) WLAN (wireless local access network) system. Ex. 1001 at 1:27-30. The patent is directed to a device that transmits a plurality of request to send (RTS) frames though a plurality of subchannels and receives at least one clear to send (CTS) frame though at least one idle subchannel. *Id.* at Abstract.

Petitioners submit multiple references to demonstrate that the claimed invention would have been obvious to a person of ordinary skill in the art (“POSITA”) at the time of the alleged invention. Accordingly, Petitioners respectfully request that the Board institute *inter partes* review and cancel the Challenged Claims.

II. MANDATORY NOTICES

A. Real Parties-in-Interest

TCL Electronics Holdings Ltd. (f/k/a TCL Multimedia Technology Holdings, Ltd.), TCL Industries Holdings Co., Ltd., TCL Industries Holdings (H.K.) Limited, TTE Technology, Inc. (d/b/a TCL North America), TTE Corporation, TCL Moka International Limited, TCL Moka Manufacturing S.A. de

C.V., TCL King Electrical Appliances (Huizhou) Co. Ltd., Manufacturas Avanzadas S.A. de C.V., TCL Smart Device (Vietnam) Co., Ltd., Shenzhen TCL New Technology Co., Ltd., TCL Optoelectronics Technology (Huizhou) Co., Ltd., TCL Overseas Marketing Ltd., and TCL Technology Group Corporation (f/k/a TCL Corp.), (collectively “Petitioners”) are the real parties-in-interest.

B. Related Matters

As of the filing date of this petition, the ’431 patent is involved in litigation in the Eastern District of Texas, captioned *LG Electronics Inc. v. TCL Electronics Holdings Ltd. (f/k/a TCL Multimedia Technology Holdings, Ltd.) et al.*, Case No. 2:22-cv-00122-JRG (“Related Litigation”). LG Electronics Inc. is referred to herein as “Patent Owner” or “PO”. Petitioners are not aware of any other judicial or administrative matter involving the ’431 patent.

C. Lead and Back-Up Counsel

Petitioners provide the following designation of counsel:

Lead Counsel: Jeremy D. Peterson (Reg. No. 52,115)

Backup Counsel: Bradford A. Cangro (Reg. No. 58,478)

D. Service Information

Pursuant to 37 C.F.R. § 42.8(b)(4), Postal mailings and hand-deliveries should be addressed to:

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Washington, DC 20015-2052
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Petitioners consent to electronic service by email at the following
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bradford.cangro@pvuslaw.com
LGE-IPRs@pvuslaw.com

III. PAYMENT OF FEES

In accordance with 37 C.F.R. § 42.103(a), the required fees are submitted herewith. If any additional fees are due at any time during this proceeding, the Office is authorized to charge such fees to Deposit Account No. 60-3815.

IV. REQUIREMENTS FOR *INTER PARTES* REVIEW UNDER 37 C.F.R. § 42.104

A. Grounds for Standing

Pursuant to 37 C.F.R. § 42.104(a), Petitioners certify that the '431 patent is available for IPR and Petitioners are not barred or estopped from requesting IPR challenging the claims of the '431 patent under 37 C.F.R. § 42.101.

B. Claims for Which Review Is Requested

Petitioners request IPR of claims 1, 2, 4, 5, 7, 8, 10, 11, and 13-16 of the '431 patent.

C. Statutory Grounds of Challenge

The specific statutory grounds on which the challenges are based are as follows:

Ground	Statute	Reference(s)	Claim(s)
1	35 U.S.C. § 103	Maltsev and Agrawal	1, 2, 4, 5, 7, 8, 10, 11, and 13-16
4	35 U.S.C. § 103	Maltsev and Xhafa	1, 2, 4, 5, 7, 8, 10, 11, and 13-16

D. Claim Constructions

1. Background

Consistent with its positions in the Related Litigation, Petitioners propose construction of “station” in accordance with the ‘431 patent's intrinsic evidence and, when appropriate, extrinsic evidence. *Phillips v. AWH Corp.*, 415 F3d 1303 (Fed. Cir. 2005) (*en banc*). Petitioners submit that the remaining claim terms be afforded their plain and ordinary meanings as understood by POSITA at the time of the purported invention of the ‘431 patent. *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576 (Fed. Cir. 1996).

2. Construction of “Station”

In its P.R.3-2 Submission of Preliminary Claim Constructions, Patent Owner proposed construction of “station/STA” as “plain and ordinary meaning, which includes an Access- Point (AP) station (such as a wireless router at home) or

a non-AP station (such as a laptop, smartphone, or smart television), that includes Medium Access Control (MAC) and a physical layer interface to the wireless medium.” Ex. 1012 at p. 3.

In their P.R.3-2 Submission of Preliminary Claim Constructions, Petitioners proposed construction of “station/STA” as “a device that contains an IEEE 802.11- conformant media access control (MAC) and physical layer (PHY) to the wireless medium (WM).” Ex. 1013 at p. 5. This is the definition for this term provided in the 802.11 standard. *See*, Ex. 1014 at definition 3.136., p. 14, *See*, Ex. 1006 at ¶¶88-90.

Petitioners submit that their proposed constructions are correct, but that the analysis in this Petition applies under both proposed constructions. *Id.* at ¶90.

E. How the Construed Claims Are Unpatentable

Pursuant to 37 C.F.R. § 42.104(b)(4), Petitioners provide an explanation of how the construed claims of the ’431 patent are unpatentable under the statutory grounds identified in Section VII, *infra*.

F. Supporting Evidence

Pursuant to 37 C.F.R. § 42.104(b)(5), Petitioners identify the exhibit numbers of the supporting evidence relied upon to support the challenges in section VII, *infra* and in Petitioners’ Exhibit List, *supra*.

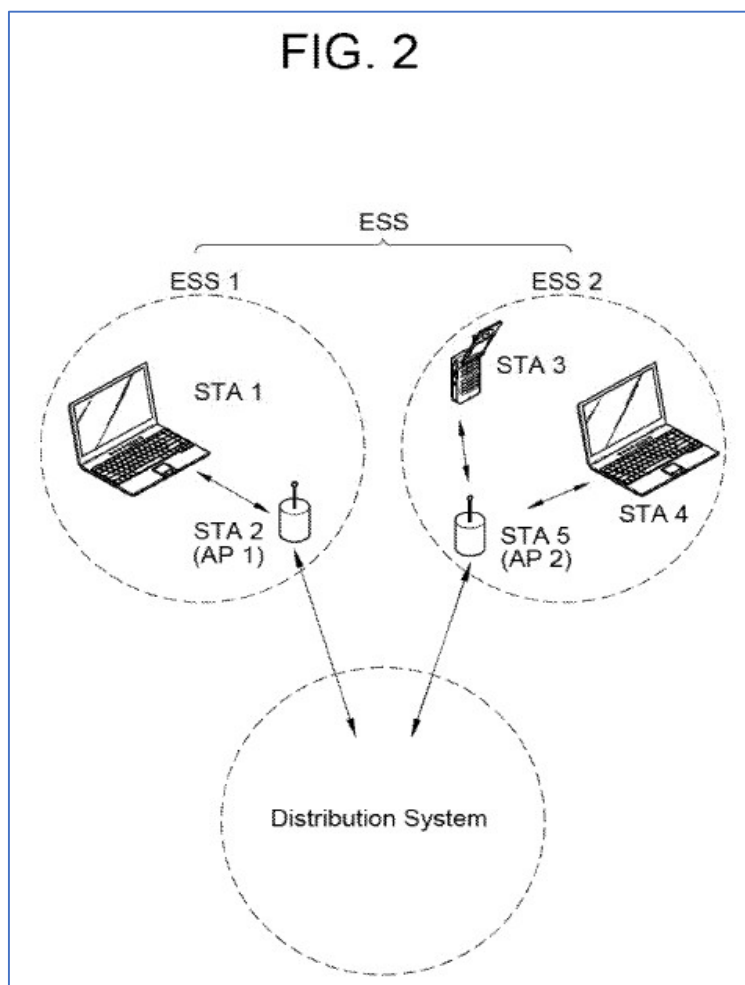
V. THE '431 PATENT

A. Summary of the '431 Patent

The '431 patent, entitled “Channel Access Method for Very High Throughput (VHT) Wireless Local Access Network System and Station Supporting the Channel Access Method” issued on December 3, 2019, from an application filed on September 19, 2017. This application claims priority to a Korean patent application filed on June 18, 2008. Ex. 1001 at (30).

The '431 patent relates to a channel access mechanism in a very high throughput (VHT) WLAN (wireless local access network) system. Ex. 1001 at 1:27-30. The disclosed IEEE 802.11 access network (WLAN) systems are also referred to as various versions of Wi-Fi standards (“The IEEE 802.11n is a technical standard relatively recently introduced to overcome a limited data rate which has been considered as a drawback in the WLAN.”) *Id.* at 2:7-9. The patent is directed to a device that transmits a plurality of request to send (RTS) frames though a plurality of subchannels and receives at least one clear to send (CTS) frame though at least one idle subchannel. *Id.* at Abstract; Ex. 1006 at ¶56.

FIG. 2 of the '431 patent is a schematic view showing an exemplary structure of a wireless local access network (WLAN) system. *Id.* at 5:33-35; *see also* Ex. 1006 at ¶¶57-58.



Ex. 1001 at FIG. 2

B. Known Functionality Described by the ‘431 Patent

The ‘431 patent references conventional technology known well before its priority date. These known technologies are explained below in detail.

1. The RTS/CTS Protocol

The Request To Send/Clear To Send (RTS/CTS) protocol is expressed as a prominent limitations in the Challenged Claims. The RTS/CTS protocol is a request/response mechanism where the station that wants to send data to another

station must first send it a request (RTS) and wait for a positive response (CTS) before sending the data. Ex. 1006 at ¶59. This protocol was initially defined in the 802.11-1999 recommendation, long before the ‘431 patent’s priority date. *Id* at ¶¶67-69. As shown by the passages below, Section 9.2 of the 802.11-2007 standard defines the Distributed Coordination Function (DCF) described by the ‘431 patent specification (*See e.g.*, Ex. 1001 at FIG. 1 and 2:25-38) and the (RTS/CTS) functions described by the ‘431 patent specification (*See e.g.*, *id.* at 2:52-61) and included in the Challenged Claims.

9.2 DCF

The basic medium access protocol is a DCF that allows for automatic medium sharing between compatible PHYs through the use of CSMA/CA and a random backoff time following a busy medium condition. In addition, all individually addressed traffic uses immediate positive acknowledgment (ACK frame) where retransmission is scheduled by the sender if no ACK is received.

The RTS/CTS exchange also performs both a type of fast collision inference and a transmission path check. If the return CTS is not detected by the STA originating the RTS, the originating STA may repeat the process (after observing the other medium-use rules) more quickly than if the long data frame had been transmitted and a return ACK frame had not been detected.

Ex. 1014 at p. 256 (emphasis added).

Thus, the DCF and the RTS/CTS functionality were defined much before one year before the priority date of the ‘431 patent.

2. OFDM and Sub-Channel Operation

Orthogonal Frequency Division Multiplexing (OFDM) OFDM is a method of data transmission where a single high-speed stream of data bits is

divided into multiple lower-speed data streams and these data streams are typically transmitted on the same number of closely spaced narrowband subchannel frequencies instead of using a single wideband channel frequency. Ex. 1006 at ¶¶70. OFDM operation and the use of multiple subchannels on the radio interface is referred to as the PHYsical (PHY) layer. The OFDM physical layer was initially defined for 802.11a amendment released in 1999 before it was rolled up into this 2007 recommendation. Ex. 1006 at ¶¶70-71. Thus, the concepts of using an OFDM physical layer with multiple subchannels were known well in advance of the priority date of the ‘431 patent and also were not novel to the ‘431 patent.

3. Multiple Input Multiple Output (MIMO) technique

MIMO is a technique that typically uses multiple antennas at the transmitter and the receiver. Thus, multiple antennas are transmitting output data and multiple antennas are receiving input data. The data to be transferred can be communicated over these multiple antennas based on many different methods to either increase the reliability of the data being received or to increase the overall data throughput rate. In one relevant MIMO configuration, each transmit antenna is paired with a receive antenna (antenna pair) and a different stream of data is communicated over each antenna pair, which multiplies the data throughput by the number of antenna pairs being used. Ex. 1006 at ¶¶72. The ‘431 patent explains in the “Background of the Invention” section of the specification that MIMO using

multiple antennas in both a transmitter and a receiver to optimize the data rate in an OFDM system preexisted the '431 patent. Ex. 1001 at 2:11-24; Ex. 1006 at ¶¶73-74.

4. A Plurality of Network Interface Cards (NICs) Each Having an Independent Radio Interface

Network Interface Cards (NICs) are typically used in a computer type device to transmit and receive the physical (PHY) layer signals that are to be communicated over the radio frequency interface between IEEE 802.11 Wi-Fi stations. *Id.* at ¶76. The '431 patent describes a "NIC" (Network Interface Card) in each box of Fig. 3 as "each NIC independently operates a MAC/PHY module." Ex. 1001 at 6:54-57. The prior art "Fracchia" (Ex. 1009) explains that this technology existed well before the priority date of the '431 patent. Ex. 1009 at p. 7, Ex. 1006 at ¶¶76-80.

C. Summary of the Prosecution History of the '431 Patent

As originally filed, the '431 patent comprised 16 claims. Ex. 1002 at pp. 1-2. (September 19, 2017, Claims).

The examiner rejected claims 1-16 under the judicially created doctrine of obviousness-type double patenting. Further, the examiner states that claims 1-16 would be allowable if a Terminal Disclaimer is filed to overcome the double patenting rejections. *Id.* at pp. 5-19. (July 16, 2018, Non-Final Rejection).

In response to the initial Office Action, the applicant submitted a Terminal Disclaimer to overcome the double patenting rejections. On November 29, 2018, the examiner issued a Notice of Allowance. *Id.* at pp. 29-37. (November 29, 2018 Notice of Allowance and Fees Due).

After a Notice of Allowance dated November 29, 2018, the applicant submitted a Request for Continued Examination (RCE) and presented amendment in which claims 1-8, 12, and 16 are canceled, claims 9 and 13 are amended to clarify the features, and claims 17-26 are added. *Id.* at pp. 40-45. (February 28, 2019, Claims). On April 4, 2019, the examiner issued a Notice of Allowance. *Id.* at pp. 47-55. (April 4, 2019 Notice of Allowance and Fees Due).

In response, the applicant submitted a Request for Continued Examination (RCE) and presented amendment in which claims 17, 20, 23, and 25 are amended to improve form and clarify. *Id.* at pp. 58-63. (June 20, 2019, Claims). Thereafter, the examiner issued a Notice of Allowance. *Id.* at pp. 65-73. (July 25, 2019 Notice of Allowance and Fees Due).

D. Level of Ordinary Skill in the Art

A POSITA at the time of the alleged invention of the '431 patent would have held at least a degree in electrical engineering, computer engineering, computer science or a similar discipline, with at least two years of relevant industry or research experience, including experience designing or implementing

Wireless Local Area Networks (WLANs). Additional work or research experience can substitute for less or different education, and vice-versa. A person of ordinary skill in the art would also have had familiarity with the IEEE 802.11 WLAN (Wi-Fi) technical standards, recommendations, and amendments) at the time. Ex. 1006 at ¶¶49-54.

VI. OVERVIEW OF THE PRIOR ART

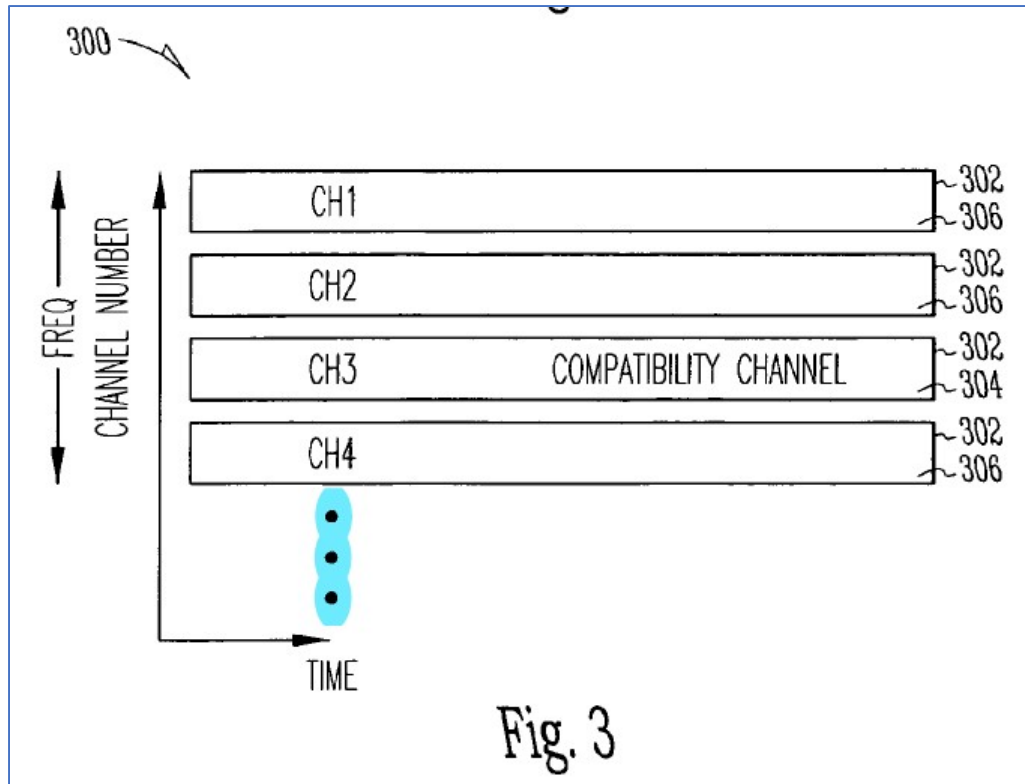
A. U.S. Patent 7,349,436 – Maltsev et al. (Ex. 1003)

Maltsev et al. (“Maltsev”) issued on March 25, 2008, from an application filed on September 30, 2003, and is prior art under pre-AIA 35 U.S.C. §§102 (a) and (e). Maltsev is directed to a high-throughput (HT) communication station (STA) and method for communicating over a primary and a secondary channel. Ex. 1003 at Abstract. Adrian Stephens, a named inventor of the Maltsev patent, was a member of several of the IEEE working groups that created the IEEE 802.11-2007 amendment. Ex. 1006 at ¶¶93-94.

Maltsev discloses using four or more 20 MHz subchannels to get a higher data throughput a combined channel size of 80 MHz or greater. *Id.* at ¶96. These are prominent features of the Challenged Claims of the ‘431 patent.

Referring to Fig. 3, Maltsev illustrates the use of four or more channels within an allocated portion of frequency spectrum and also states that the subchannels may be 20 MHz channels such that the frequency spectrum

comprises at least a contiguous 80 MHz portion. Ex. 1003 at 4:32-53. Fig 3 lists channels 1 – 4 (CH1- CH4) and, by including the 3 highlighted dots below the list of channels indicates that the number of channels could be greater than four. See e.g., Ex. 1003 at 3:45-47 and 4:41-49; Ex. 1006 at ¶97.



Ex. 1003 at Fig. 3 (highlighting added).

Maltsev utilizes the RTS/CTS protocol and OFDM. *Id.* at 2:18-35; 3:11-14; 6:1-7; 7:24-30; 7:45-47; 8: 27-33.

B. U S. Patent Publication 2007-0147322 - Agrawal (Ex. 1004)

Agrawal was published on June 28, 2007, and issued on November 5, 2013, as USP 8,576,872. It is prior art under pre-AIA 35 U.S.C. §§102 (a) and (e).

Agrawal relates to a wireless mesh network utilizing an OFDM physical layer with multiple subchannels. The RTS/CTS protocol is used to contend for one or more subcarriers. RTS signals over the desired subcarriers indicating which subcarriers the node may use to transmit data frames. Ex. 1004 at Abstract, [0006], [0037], [0062], and [0067]. Agrawal also discloses that the invention can be used for “802.11 networks.” *See e.g., Id.* at [0040]-[0041]. Further, Agrawal repeatedly references the 802.11 “Access Point” terminology. *See e.g., Id.* at [0010], [0033]-[0036]. Agrawal also defines in detail the circuitry that would be included in a wireless station compatible with the 802.11 standard. Ex. 1006 at ¶¶98-103.

C. U.S. Patent Publication 2007-0266157 - Xhafa (Ex. 1005)

U.S. Patent Publication 2007-0266157 to Xhafa is directed to techniques for reducing/eliminating data collisions on wireless network channels including in Wi-Fi systems defined by the 802.11a, b, g, and n recommendations. Ex. 1005 at [0002], [0004]. Xhafa was published on November 15, 2007, and is prior art under pre-AIA 35 U.S.C. §§102(a) and (e).

Xhafa also describes the 802.11n physical layer where the OFDM subchannels are 20 MHz and two subchannels can be combined to make a “super channel” with a bandwidth of 40 MHz. *See e.g., Id.* at [0003]. Xhafa further uses the RTS/CTS protocol as required by the Challenged Claims. Ex. 1006 at ¶¶104-109.

VII. DETAILED GROUNDS OF UNPATENTABILITY

Below is an explanation of each proposed ground of unpatentability as well as an identification of the specific portions of the evidence that support each ground. Claims 1, 7, and 13 are independent method claims and claims 4, 10, and 15 are corresponding independent apparatus claims. There is significant overlap among the independent claims and this Petition addresses claims by grouping identical or nearly identical limitations for analysis. Some limitations appear identically in all independent claims are identical. The following table identifies the grouping of claims by specific limitations. In the table, “1[2],” for example, refers to Claim 1, Limitation [1]. Some terms are highlighted in the limitations for assistance in identifying minor differences among otherwise identical limitations.

Claim/ [Limitation No.]	Limitation
4[1], 10[1], 15[1]	a transceiver; and
4[2], 10[2], 15[2]	a processor operatively connected to the transceiver and configured to:
1[1], 4[3], 7[1], 10[3], 13[1], 15[3]	receiving/instruct to receive, a plurality of request to send (RTS) frames from a station through a plurality of subchannels, each of the plurality of RTS frames being received through a corresponding one of the plurality of subchannels, each of the plurality of subchannels having a 20 megahertz (MHz) bandwidth;
1[2], 4[4], 7[2], 10[4]	transmitting/instruct to transmit <u>at least one</u> clear to send (CTS) frame in response to at least one of the plurality of RTS frames to the station, through <u>at least one</u>

	idle subchannel of the plurality of subchannels, each of the <u>at least one</u> CTS frame being transmitted through a corresponding one of the at least one idle subchannel; and
13[2], 15[4]	transmitting/instruct to transmit, <u>a plurality of</u> clear to send (CTS) frames in response to at least one of the plurality of RTS frames to the station through <u>a plurality of</u> idle subchannels of the plurality of subchannels, each of the <u>plurality of</u> CTS frames being transmitted through a corresponding one of the plurality of idle subchannels; and
1[3], 4[5], 7[3], 10[5], 13[3], 15[5]	receiving/instruct to receive a data frame from the station after transmitting the at least one CTS frame,
1[4], 4[6]	wherein each of the at least one CTS frame includes channel information related <u>to the at least one</u> idle subchannel through which the at least one CTS frame is transmitted by the first station, and the data frame is received through the at least one idle subchannel indicated by the channel information, and
7[4], 10[6]	wherein each of the at least one CTS frame includes channel information related <u>to all of the at least one</u> idle subchannel through which the at least one CTS frame is transmitted by the first station, and the data frame is received through the at least one idle subchannel indicated by the channel information, and
13[4], 15[6]	wherein each of the plurality of CTS frames includes channel information related <u>to the plurality of</u> idle subchannels through which the plurality of CTS frames are transmitted by the first station, and the data frame is received through the plurality of idle subchannels indicated by the channel information, and
1[5], 4[7], 7[5], 10[7]	wherein a number <u>of the at least one</u> idle subchannel through which the at least one CTS frame is transmitted is equal to or less than a number of the

	plurality of subchannels through which the plurality of RTS frames are received.
13[5], 15[7]	wherein a number <u>of the plurality of</u> idle subchannels through which the plurality of CTS frames are transmitted is equal to or less than a number of the plurality of subchannels through which the plurality of RTS frames are received.

A. Ground 1: Claims 1, 2, 4, 5, 7, 8, 10, 11, and 13-16 Would Have Been Obvious in View of the Combination of Maltsev and Agrawal

Claims 1, 2, 4, 5, 7, 8, 10, 11, and 13-16 would have been obvious over the combination of Maltsev and Agrawal as explained below.

1. Motivation to Combine Maltsev and Agrawal

A POSITA would have been motivated to combine Maltsev with Agrawal for several reasons. First, Maltsev and Agrawal are concerned with solving the same problem—efficient operation of wideband OFDM wireless networks using multiple subchannels. Maltsev’s title is “Systems and Methods for High-throughput Wideband Wireless Local Area Network Communications.” Ex. 1003. Maltsev also states that it is for OFDM communications using subcarriers (subchannels):

Orthogonal frequency division multiplexing (OFDM) is an example of a multi-carrier transmission technique that uses symbol-modulated orthogonal subcarriers to transmit information within an available

spectrum. Many modern digital communication systems, **including wireless local area networks (WLANS)**, are using symbol-modulated orthogonal subcarriers as a modulation scheme to help signals survive in environments having multipath reflections and/or strong interference.

Id. 1:15-27 (emphasis added).

Agrawal relates to “wireless communications, and more particularly to reducing interference in a wireless communication environment.” Ex. 1004 at [0003]. Like Maltsev, Agrawal is also for an OFDM communications system using subchannels as it discloses:

One known variant is an **orthogonal frequency division [OFDM]** technique that effectively partitions the overall system bandwidth into multiple orthogonal subbands. These subbands are also referred to as tones, carriers, subcarriers, bins, and/or frequency channels. **Each subband is associated with a subcarrier that can be modulated with data.**

Id. at [0006] (emphasis added).

Maltsev and Agrawal both use the RTS/CTS protocol for communications between stations. Maltsev states “a RTS/CTS exchange may be used with control frames in the wideband channel with channelization information.

This may be done for almost any number of channels 302 (FIG. 3) in addition to compatibility channel 304 (FIG. 3).” Ex. 1003 at 7:45-49; Ex. 1006 at ¶¶115-116. The RTS/CTS protocol is also employed by Agrawal. Ex. 1004 at Abstract, [0006], [0037], [0062], and [0067].

Maltsev and Agrawal disclose that their respective inventions apply to 802.11 Wi-Fi networks. Maltsev states “[t]he frame formats of embodiments of the present invention may be suitable for WB OFDM data communication systems and may be implemented in IEEE 802.11 standards for HT communication units. Ex. 1003 at 11:18-21. Agrawal states “[w]ith regard to a multi-hop wireless mesh network medium access control, approaches may include carrier sense multiple access/collision avoidance (CSMA/CA), and request-to-send/clear-to-send CSMA/CA is a protocol for carrier transmission in 802.11 networks (RTS/CTS). “ Ex. 1004 at [0040].

A POSITA would have had a reasonable expectation of success for such combination. Both Maltsev and Agrawal employ the RTS/CTS protocol in the conventional manner long known in the art. The teachings of Agrawal enhance the use of the RTS/CTS protocol by allowing CTS signals to be returned on a subset of the subchannels, i.e., only the idle subchannels, even if the number of idle subchannels is less than the total number of subchannels, while maintaining the functionality of the RTS/CTS protocol. Ex. 1006 at ¶¶112-118.

2. Independent Claims 1, 4, 7, 10, 13, and 15

- a. Limitations: Claims 1, 7, and 13, Limitation [pre] “A method for a wireless communication system, the method comprising” and Claims 4, 10, and 15, Limitation [pre]: “A device comprising:”**

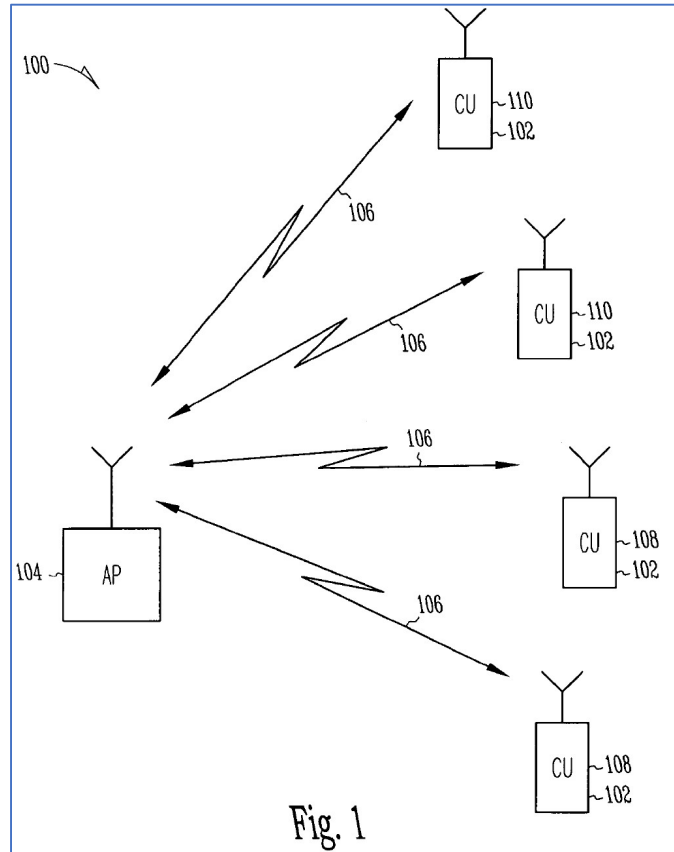
To the extent the preamble of claims 1, 7, 13, Limitation [pre], is limiting, Maltsev and Agrawal both disclose a method for receiving data in a wireless communication system. Ex. 1006 at ¶¶119-126.

The Preambles of claims 4, 10, and 15, i.e., “A device comprising,” are not limiting.

- b. Claims 4, 10, and 15, Limitation [1]: “a transceiver; and”**

Claims 4, 10, and 15, Limitation [1], are identical and will be analyzed with reference to Claim 4, Limitation [1].

As shown in FIG. 1 communication environment 100 include one or more communication units (CUs) 102, which communicate with access points (AP) 104 over wireless communication links 106. CUs 102 may include, for example, mobile units such as portable computers with wireless communication capability and wireless handsets. Ex. 1003 at 2:3-35.



Id. at Fig. 1.

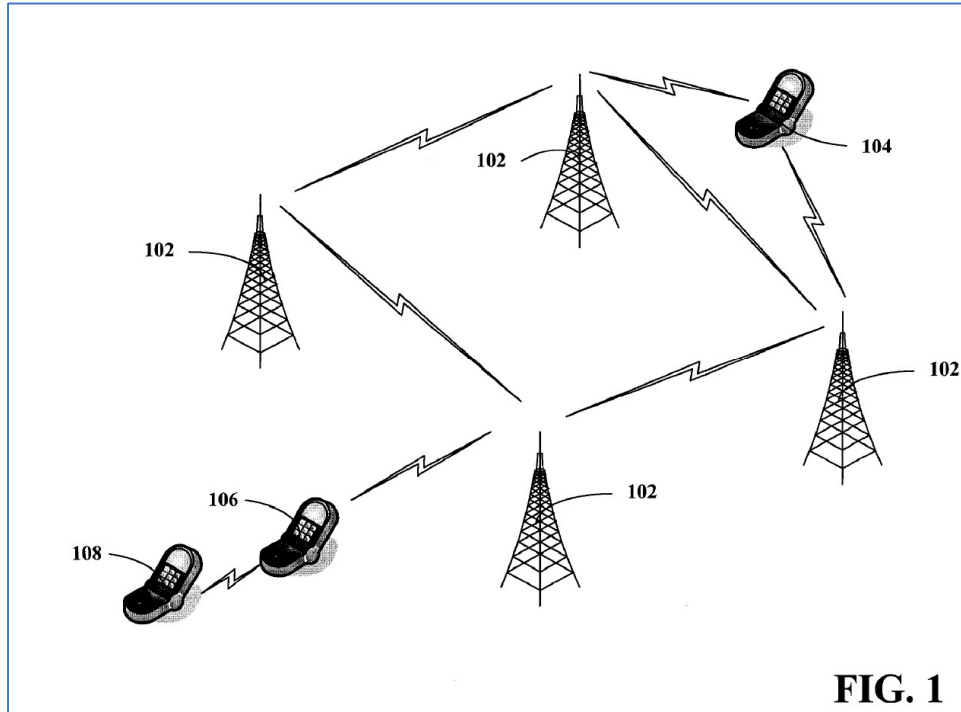
Maltsev teaches that CUs 102 and AP 104 communicate in accordance with standards including IEEE) 802.11 standards. *Id.* at 2:18-28.

A POSITA would have understood that each of the CUs 102 includes a transmitter.

Agrawal also teaches this limitation.

FIG. 1 illustrates a wireless communication system 100 that includes access points 102 that receive, transmit, repeat etc., wireless communication signals with each other and with access terminals 104, 106, 108. Each access point 102 comprises a transmitter chain and a receiver chain, each of

which can in turn comprise a plurality of components such as processors, modulators, demodulators, antennas, etc. Ex. 1004 at [0033].



Id. at Fig. 1.

Referring further to Agrawal FIG. 11, on a downlink, at access point 1105, a transmit (TX) data processor 1110 receives, formats, codes, interleaves, and modulates (or symbol maps) traffic data and provides modulation symbols ("data symbols"). *Id.* at [0062].

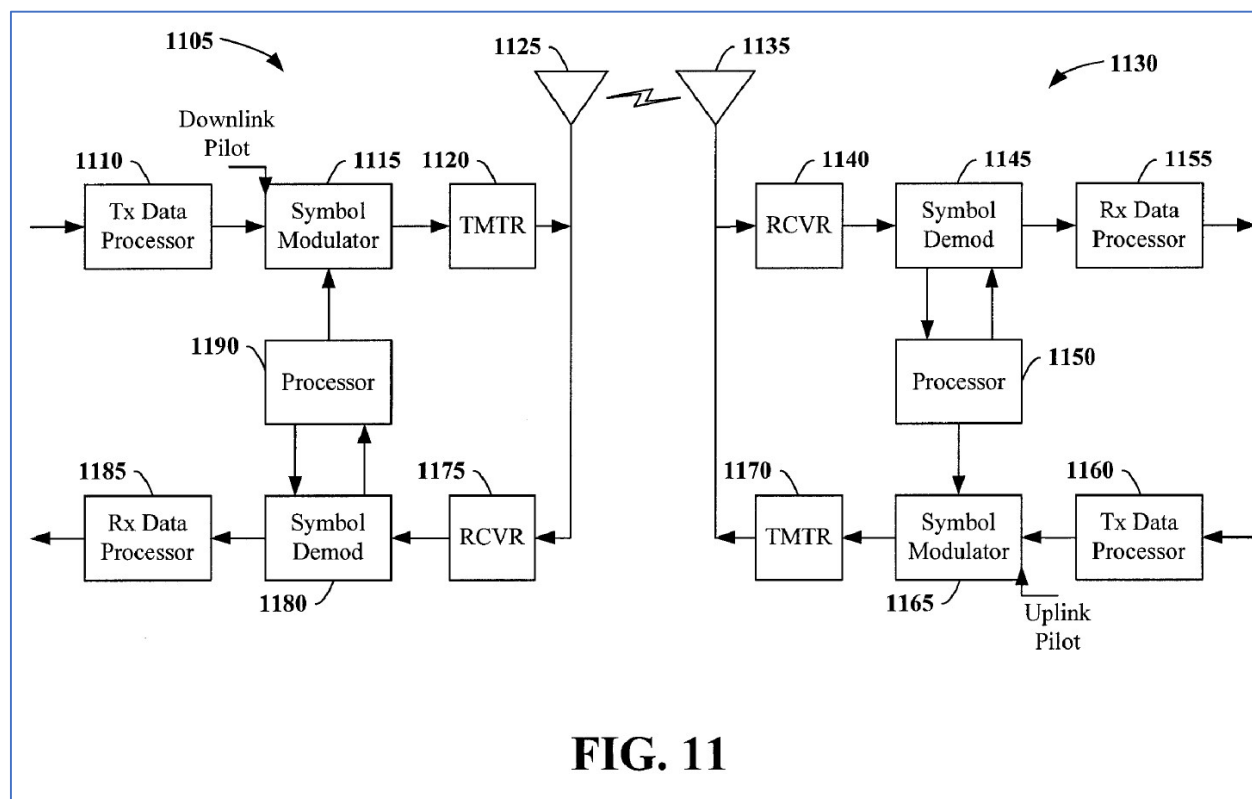


FIG. 11

Id. at Fig. 11.

At the access point AP, TMTR 1120 receives and converts the stream of symbols into one or more analog signals and further conditions (e.g., amplifies, filters, and frequency upconverts) the analog signals to generate a downlink signal suitable for transmission over the wireless channel. The downlink signal is then transmitted through an antenna 1125 to the terminals.

At terminal 1130, an antenna 1135 receives the downlink signal and provides a received signal to a receiver unit (RCVR) 1140. Receiver unit 1140 conditions the received signal and digitizes the conditioned signal to obtain samples. A symbol demodulator 1145 demodulates and provides received pilot

symbols to a processor 1150 for channel estimation. On the uplink, a TX data processor 1160 processes traffic data and provides data symbols. A transmitter unit 1170 then receives and processes the stream of symbols to generate an uplink signal, which is transmitted by antenna 1135 to access point 1105. *Id.* at [0064].

At access point 1105, the uplink signal from terminal 1130 is received by antenna 1125 and processed by a receiver unit 1175 to obtain samples. An RX data processor 1185 processes the data symbol estimates to recover the traffic data transmitted by terminal 1130. A processor 1190 performs channel estimation for each active terminal transmitting on the uplink. *Id.* at [0064], [0065].

A POSITA would have understood that both Maltsev and Agrawal teach this limitation. Ex. 1006 at ¶¶182-197.

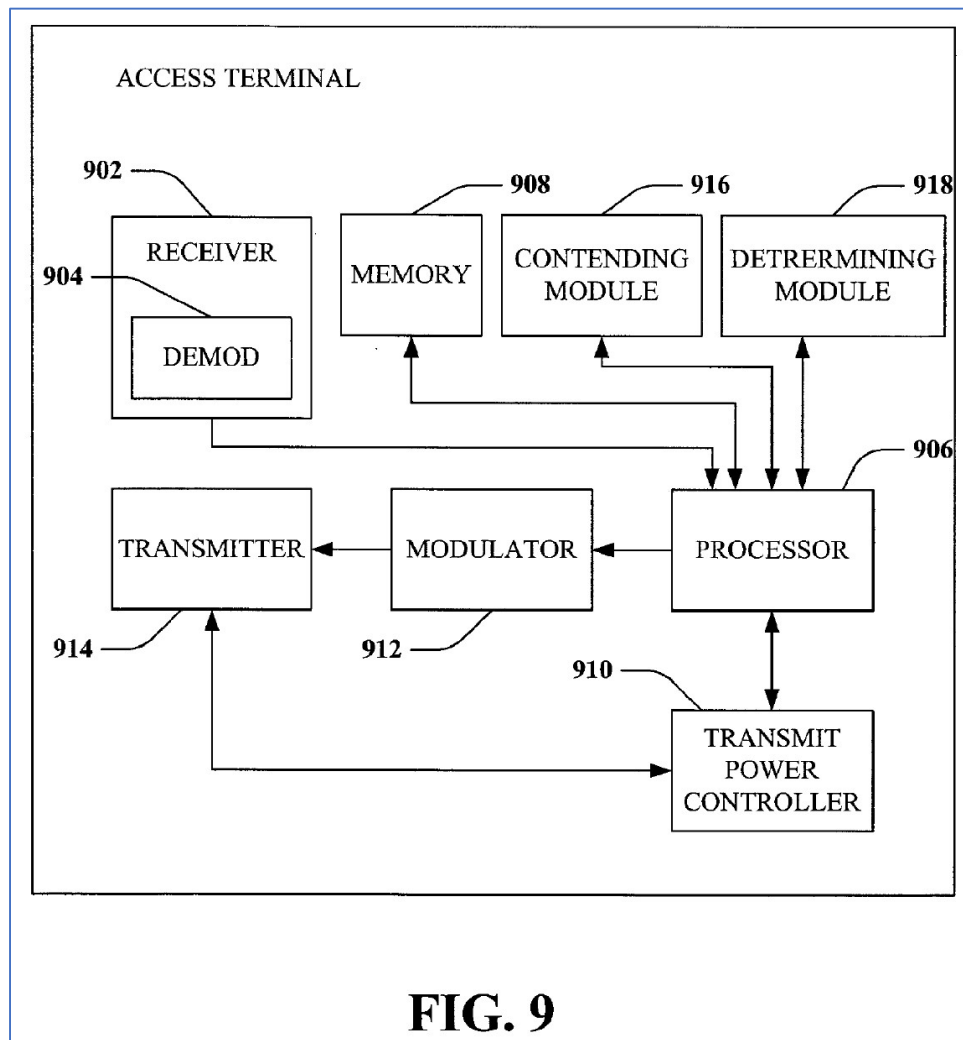
c. Claims 4, 10, and 15 Limitation [2]: “a processor operatively connected to the transceiver and configured to:”

Claims 4, 10, and 15, Limitation [2], are identical and will be analyzed with reference to Claim 4, Limitation [2].

Maltsev discloses this limitation. More specifically, CU 200 may be implemented by software-configured elements, such as processing elements including digital signal processors (DSPs) or other hardware elements such as microprocessors, DSPs, etc. Ex. 1003 at 4:6-15.

Agrawal also meets the limitation of a processor.

FIG. 9 illustrates an access terminal 900 of Agrawal that comprises a receiver 902 and a processor 906 for channel estimation and that analyzes information received by receiver 902 and generates information for transmission by transmitter 914. Processor 906 may be coupled to or include a determining module 918 that determines whether one or more contended subcarriers is available for transmissions. For instance, determining module may execute instructions for performing RTS/CTS protocols. Ex. 1004 at [0054], [0060].



Ex. 1004 at Fig. 9.

Processor 906 is further operatively coupled to transmit power controller 910, which may adjust a transmit power level for one or more of a RTS message, a CTS message, a data message in order to permit transmission over a subcarrier for which another node has won contention. A determining module determines whether contended subcarriers are available by executing instructions for performing RTS/CTS protocols. *Id.* at [0060]. The processor 906 may be implemented within one or more application specific integrated circuits (ASICs), digital signal processors (DSPs), digital signal processing devices (DSPDs), and other components. *Id.* at [0067].

Although depicted as being separate from the processor 906, it is to be appreciated that transmit power controller 910, contending module 916, and/or determining module 918 may be part of processor 906. *Id.* at [0057].

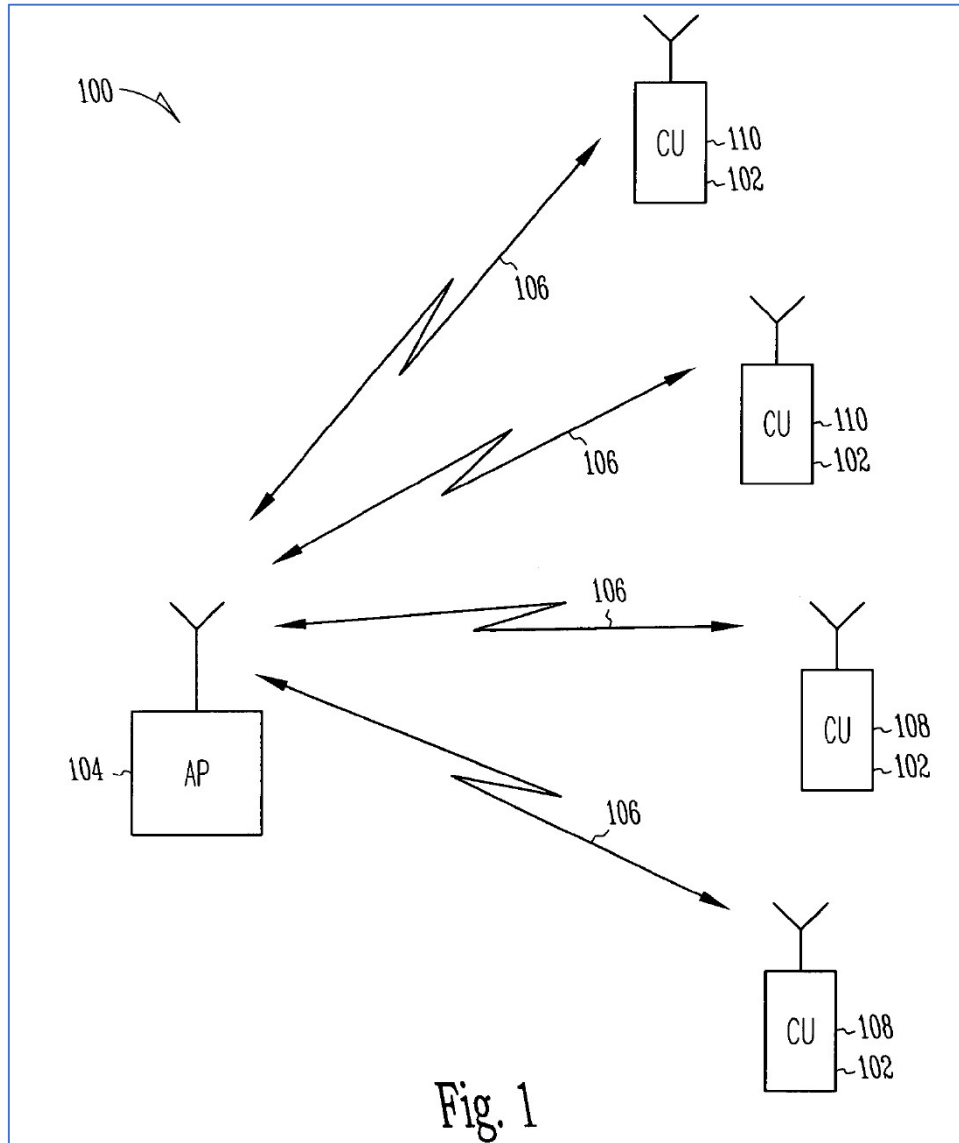
Maltsev and Agrawal both meet the processor limitation. Ex. 1006 at ¶¶198-204.

- d. **Claims 1, 7, and 13 Limitation [1] and Claims 4, 10, and 15 Limitation [3]: “receiving/instruct to receive, a plurality of request to send (RTS) frames from a station through a plurality of subchannels, each of the plurality of RTS frames being received through a corresponding one of the plurality of subchannels, each of the plurality of subchannels having a 20 megahertz (MHz) bandwidth;”**

This limitation is identical among method Claims 1, 7, and 13, Limitation [1], and device Claims 4, 10, and 15, Limitation [3], and will be discussed with reference to Claim 1, Limitation [1].

Maltsev discloses an RTS/CTS exchange used with control frames in a wideband channel with channelization information. Ex. 1003 at 7:45-47. FIG. 1 of Maltsev illustrates a communication environment 100 including one or more communication units (CUs) 102, which may communicate with one or more access points (AP) 104 over wireless communication links 106. Ex. 1003 at 2:3-8.

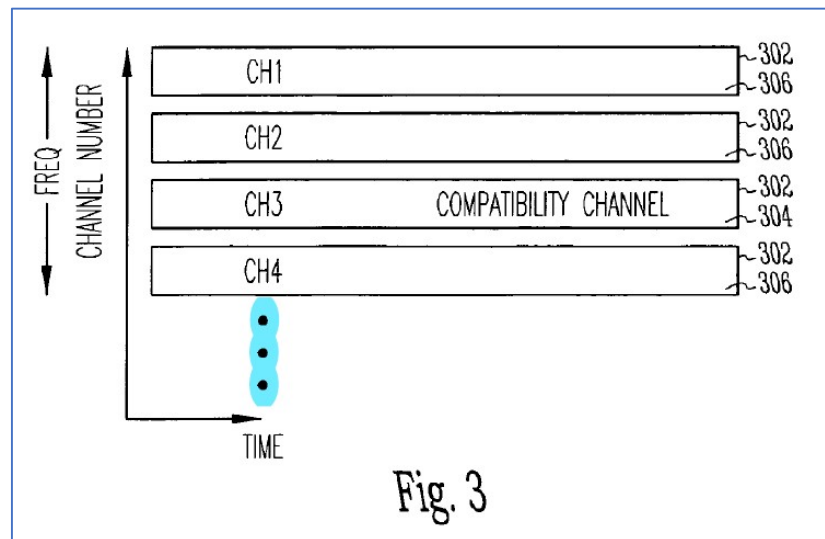
The CUs 102 may comprise both wider-band CUs 108 and narrower-band CUs 110. Wider-band CUs 108 communicate in accordance with an IEEE 802.11 standard and communicate on one or more subchannels using a wider bandwidth.



Ex. 1003 at Fig. 1.

FIG. 3 of Maltsev illustrates allocation of frequency spectrum 300 for communications among CUs 102 (FIG. 1) and for communications between CUs 102 (FIG. 1) and AP 104 (FIG. 1). *Id.* at 4:32-36. Frequency spectrum 300 may comprise a plurality of channels 302. Wider-band CUs 108 may use one or more of channels 302 simultaneously. Sending RTS signals over a plurality of

subchannels is a way for the sender (second station in claim 1) to inform a targeted receiver (first station in claim 1) that the second station has a data frame to send. By sending RTS signals over multiple subchannels the sender (second station) increases the likelihood that the receiver (first station) will actually receive one of the RTS signals and thereby locate a communication path – “an idle subchannel” -- that is not busy and is a candidate for transferring a data frame from the second station to the first station. Ex. 1006 at ¶¶127-128.



Ex. 1003 at Fig. 3 (highlighting added)

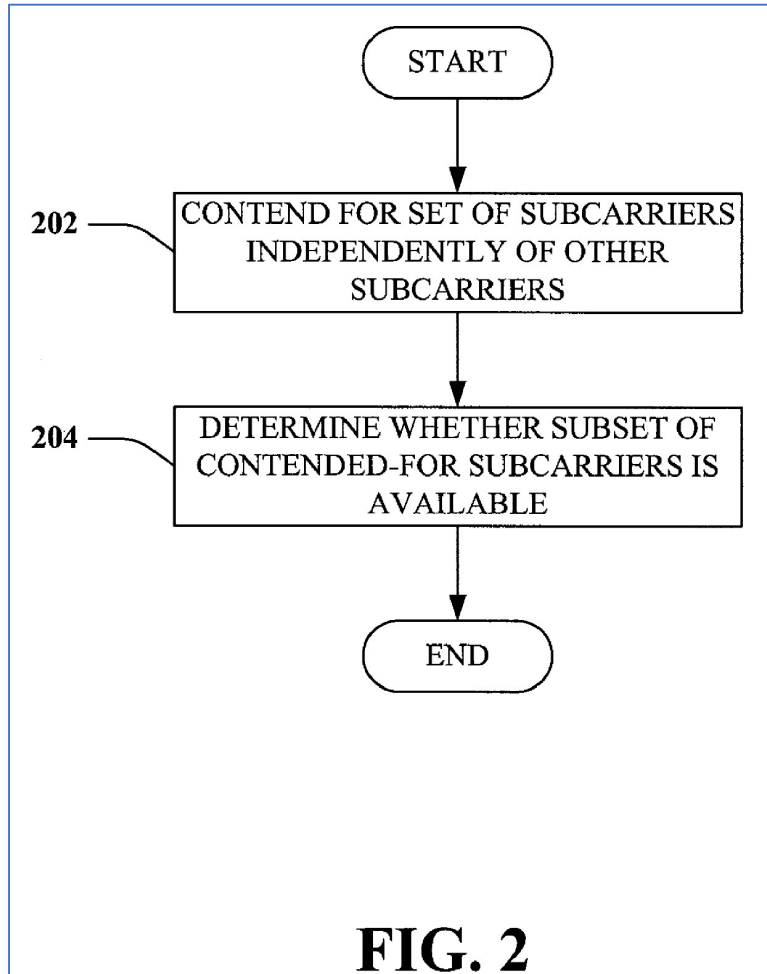
Frequency spectrum 300 is illustrated in FIG. 3 as having four channels 302 (CH1-CH4), however, embodiments of Maltsev “are equally suitable for use of more than four channels within an allocated portion of frequency spectrum 300.” *Id.* at 4:41-49. This is illustrated by the highlighted ellipses in FIG.

3. In some embodiments, the channels may be 20 MHz channels and frequency

spectrum 300 may comprise at least a contiguous 80 MHz portion of the spectrum. *Id.* at 4:41-49. Thus, the text of Maltsev in combination with FIG. 3 suggests to a POSITA that the number of subchannels and the bandwidth of each subchannel are variables that affect the throughput of a system, e.g., five or more subchannels are available for use wherein each subchannel is a 20 MHz or greater portion of the total spectrum 300.

A POSITA would also understand that the greater the number of total subchannels the lower the probability that all of the subchannels would have the acceptable noise characteristics to be used for a High Throughput connection. Therefore, a POSITA would have appreciated a situation where RTS signals would be sent on more subchannels by a second station than the number of subchannels over which CTS signals would be transmitted by a first station. *Id.*

Agrawal discloses an apparatus (“second station in claim 1”) having a transmitter that sends RTS signals over plural contended subcarriers and a receiver that receives CTS signals sent by a first station for all or a subset of contended subcarriers if they are in the idle state. Ex. 1004 at [0012]. FIG. 2 of Agrawal illustrates methodology 200 for contending for subcarriers. *Id.* at [0038].



Ex. 1004 at FIG. 2.

First, at 202, a node contends for a subcarrier independently of other sub-carriers using RTS/ CTS signal exchanges for each subcarrier independently. After a station transmits RTS signals over a set of subcarriers at 204 it is determined which of the contended subcarriers is available for use during a subsequent transmission. The determination of subcarrier availability may be based on CTS signals received over all or a subset of the contended subcarriers, i.e., the idle subcarriers over which RTS signals were sent. Thus, the station

transmits RTS signals over each specific subcarrier over which the terminal would like to transmit. *Id.* at [0038]. As one method of sending a RTS signal, Agrawal discloses sending a 1-bit RTS signal on each subcarrier and utilizing for data frame transfer the subset of subcarriers over which it receives CTS signals. *Id.* at [0044].

Agrawal teaches receiving RTS signals independently sent over each subcarrier, which meets the limitation of “receiving, by a first station, a plurality of request to send (RTS) frames from a second station through a plurality of subchannels, each of the plurality of RTS frames being received through a corresponding one of the plurality of subchannels.”

Maltsev also discloses that a channel of 80 MHz or larger can be subdivided into subchannels of 20 MHz each meeting the limitation “each of the plurality of subchannels having a 20 megahertz (MHz) bandwidth.” Thus, Maltsev modified in view of Agrawal would have rendered Limitations 1[1], 7[1], 13[1], 4[3], 10[3], and 15[3] obvious. Ex. 1006 at ¶¶127-132.

- e. **Claims 1 and 7, Limitation [2] and Claims 4 and 10, Limitation [4]: “transmitting/instruct to transmit at least one clear to send (CTS) frame in response to at least one of the plurality of RTS frames to the station, through at least one idle subchannel of the plurality of subchannels, each of the at least one CTS frame being transmitted through a corresponding one of the at least one idle subchannel; and”**

Claims 1 and 7, Limitation [2] and Claims 4 and 10, Limitation [4] are identical and will be analyzed by specific reference to Claim 1, Limitation [2].

As discussed with respect to Claims 1, 7, and 13 Limitation [1] and Claims 4, 10, and 15 Limitation [3], Maltsev discloses an RTS/CTS exchange used with control frames in the wider-band channel with channelization information. Ex. 1003 at 7:45-47. Channels 306 may be suitable for communications depending on each individual channel's busy/idle state or channel quality. The decision about current channel state is dynamically made by a wider-band CU based on current measurements, information obtained from received packets, and statistical information. *Id.* at 4:65-5:3.

As also discussed with regard to Claims 1, 7, and 13 Limitation [1] and Claims 4, 10, and 15 Limitation [3], Agrawal teaches that a node contends for a subcarrier independently of other subcarriers. The available bandwidth is divided into separate subcarriers and an access terminal transmits an RTS signal over each subcarriers and determines whether a subset, i.e., one or more, of the

contended subcarriers is available for use during a subsequent transmission of a data frame. The determination of subcarrier availability may be based on CTS signals which are transmitted over all or a subset of the contended subcarriers, but only over subcarriers that are idle. Agrawal also teaches that the RTS/CTS may be implemented on each subcarrier by “contend[ing] jointly across subcarriers and then encode the data packet across the successfully achieved subcarriers. When contending jointly across subcarriers, a transmitter (in the second station of claim 1) may send a 1-bit RTS on each of the desired subcarriers and utilize the subset of subcarriers on which it receives a CTS signal. Ex. 1004 at [0044].

More specifically, the first station (the “receiving” station) determines subchannel quality from the RTS signals it receives over the subchannels and indicates the idle/busy state of a subchannel by the transmission to the second station of CTS signals on corresponding subchannels only the subchannels are idle. The failure of the second station to receive a CTS signal over a subchannel indicates that the subchannels is busy. Because CTS signals are only transmitted across idle subchannels, if a CTS signal is transmitted by the first station, if “at least one CTS frame” transmitted there must be “at least one idle subchannel.” Ex. 1006 at ¶¶133-138.

It would have been obvious to a POSITA to modify Maltsev in view of Agrawal to transmit “by the first station, at least one clear to send (CTS) frame

in response to at least one of the plurality of RTS frames from the second station through at least one idle subchannel of the plurality of subchannels” to meet Limitations 1[2], 7 [2], 4[4], and 10[4]. *Id.*

- f. **Claim 13, Limitation [2] and Claim 15, Limitation [4]: “transmitting/instruct to transmit a plurality of clear to send (CTS) frames in response to at least one of the plurality of RTS frames to the station through a plurality of idle subchannels of the plurality of subchannels, each of the plurality of CTS frames being transmitted through a corresponding one of the plurality of idle subchannels; and”**

Claim 13, Limitation [2] and Claim 15, Limitation [4] include an insubstantial difference in wording from Claim 1, Limitation [2] and the invalidity analysis for Claim 1, Limitation [2] applies equally to Claim 13, Limitation [2] and Claim 15, Limitation [4]. Ex. 1006 at ¶111.

- g. **Claims 1, 7, and 13 Limitation [3] and Claims 4, 10, and 15 Limitation [5]: “receiving/instruct to receive a data frame from the station after transmitting the at least one CTS frame,”**

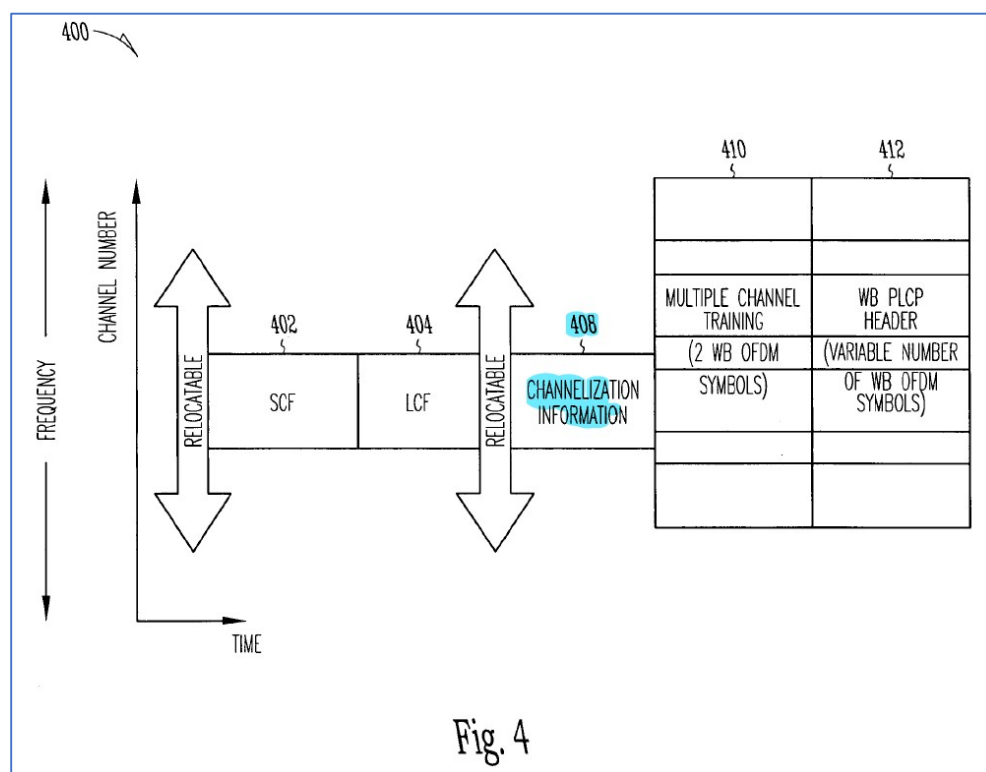
Maltsev discloses that “frames of format 500 may be used for high-speed data transmission for a dynamically changed channelization, which may be determined for a given moment from an RTS/CTS signal exchange. Ex. 1003 at 7:42-47, emphasis added. Therefore, Maltsev teaches Limitations 1[3] 7[3], 13[3], 4[5], 10[5], and 15[5].

Agrawal also discloses using the RTS/CTS protocol as discussed with regard to Limitations 1[1] and 1[2]. Upon receipt of a grant (e.g., a CTS signal) of the contended subcarrier at step 306 of FIG. 3, the method proceeds to step 308, where the data packet may be transmitted over the contended subcarrier(s). Ex. 1004 at [0039]. Therefore, Agrawal also meets Limitations 1[3], 7[3], 13[3], 4[5], 10[5], and 15[5]. Ex. 1006 at ¶¶139-142.

- h. Claim 1, Limitation [4] and Claim 4, Limitation [6]: “wherein each of the at least one CTS frame includes channel information related to the at least one idle subchannel through which the at least one CTS frame is transmitted by the first station, and the data frame is received through the at least one idle subchannel indicated by the channel information, and”**

Maltsev discloses “channel information” in the form of a “channelization field.” For example, the Abstract states that Maltsev’s frame format includes a “channelization field identifying channels that are used for communicating subsequent wideband fields of a packet, and a wideband header field communicated on the identified channels.” Ex. 1003 at Abstract. These frames are “communicated on the identified channels” means that they are communicated on the same channels as the CTS frame. Ex. 1006 at ¶143.

For example, Fig. 4 below shows this “channelization information” is contained in field 408 of the frame transmitted on the same subchannel that the CTS was received on. *Id.* at ¶144.



Ex. 1003 at Fig. 4 (highlighting added).

Specifically, Maltsev discloses that: (1) the frame format 400 can be used between the wider-band CUs and the AP; (2) it can carry the channelization field 408; and (3) this frame may be sent on a compatibility channel, such as compatibility channel 304 (FIG. 3), which may be relocatable to any of the narrower-band channels. Ex. 1003 at 5:26-42. This frame can be sent on the channel designated as the “compatibility channel” and the compatibility channel may be relocated to any of the 20 MHz narrow-band channels, the compatibility channel can be the same channel as the claimed “through the at least one idle subchannel indicated by the channel information.” Ex, 1006 at ¶¶145-146.

According to Maltsev, format 400 frames for a CU adapt dynamically to channel conditions by measuring the state of a channel and providing feedback on channel state to the AP. Maltsev additionally teaches that control frames can be transmitted on any of the channels that contain an RTS/CTS exchange and the channelization information. Ex. 1003 at 7:42-49.

According to Agrawal, the “determination of subcarrier availability may be based on, for instance, CTS signals received over all or a subset of the contended subcarriers. Ex. 1004 at [0038].

A POSITA would have understood from both Maltsev and Agrawal that CTS frames include channel information and are sent over each idle subchannel which meets the limitation of “at least one subchannel.” Limitation 1[4] and 4[6] are fully met by the combination of Maltsev and Agrawal. Ex. 1006 at ¶¶147-149.

- i. **Claim 7, Limitation [4] and Claim 10, Limitation [6]: “wherein each of the at least one CTS frame includes channel information related to all of the at least one idle subchannel through which the at least one CTS frame is transmitted by the first station, and the data frame is received through the at least one idle subchannel indicated by the channel information, and”**

Claim 7 Limitation [4] and Claim 10 Limitation [6] include an insubstantial difference in wording from Claim 1, Limitation [4] and the invalidity

analysis for Claim 1, Limitation [4] applies equally to Claim 7, Limitation [4] and Claim 10, Limitation [6]. Ex. 1006 at ¶111.

- j. **Claim 13, Limitation [4] and Claim 15, Limitation [6]: “wherein each of the plurality of CTS frames includes channel information related to the plurality of idle subchannels through which the plurality of CTS frames are transmitted by the first station, and the data frame is received through the plurality of idle subchannels indicated by the channel information, and**

Claim 13, Limitation [4] and Claim 15, Limitation [6] include an insubstantial difference in wording from Claim 1, Limitation [4] and the invalidity analysis for Claim 1, Limitation [4] applies equally to Claim 13, Limitation [4] and Claim 15 Limitation [6]. Ex. 1006 at ¶111.

- k. **Claims 1 and 7, Limitation [5] and Claims 4 and 10, Limitation [7]:” wherein a number of the at least one idle subchannel through which the at least one CTS frame is transmitted is equal to or less than a number of the plurality of subchannels through which the plurality of RTS frames are received.”**

This limitation is found in Agrawal. Agrawal teaches dividing the available bandwidth into separate and distinct subcarriers (subchannels) and implementing an RTS/CTS protocol for each subcarrier independently. Ex. 1004 at [0038]. “An access terminal may transmit an RTS signal over a set of subcarriers, and may determine whether a subset of the contended subcarriers is available for use during a subsequent transmission, [FIG. 2] at 204.” *Id.* (emphasis added).

Thus, the access terminal submits “an RTS over each specific subcarrier over which the terminal would like to transmit.” *Id.* “[A] transmitter may send a 1-bit RTS on all of the desired subcarriers and utilize the subset of subcarriers on which it receives a CTS signal.” *Id.* at [0044] (emphasis added).

A POSITA would have understood from Agrawal that a station sending RTS signals over a plurality of subchannels is informed of available and unavailable subchannels based on the subchannels that return CTS frames and that this occurs in an environment that changes dynamically. *Id.* at [0028], [0043].

Thus, Agrawal discloses receiving CTS frames over a subset of the contended subcarriers over which RTS signals were transmitted and meets limitation 1[5] “wherein a number of the at least one idle subchannel through which the CTS frame is transmitted is less than a number of the plurality of subchannels through which the plurality of RTS frames are received.”

Limitations 1[5], 7[5], 4[7], and 10[7] are obvious over the combined teachings of Maltsev and Agrawal. Ex. 1006 at ¶¶150-162.

- I. **Claim 13, Limitation [5] and Claim 15, Limitation [7]:**
“wherein a number of the plurality of idle subchannels through which the plurality of CTS frames are transmitted is equal to or less than a number of the plurality of subchannels through which the plurality of RTS frames are received.”

Claim 13, Limitation [5] and Claim 15, Limitation [7] include an insubstantial difference in wording from Claim 1, Limitation [5] and the invalidity analysis for Claim 1, Limitation [5] applies equally to Claim 13, Limitation [5] and Claim 15, Limitation [7]. Ex. 1006 at ¶111.

3. **Claims 2 and 8: “The method of claim 1/7, wherein the number of the at least one idle subchannel is 1, 2 or 4 when the number of the plurality of subchannels is 4.”**
Claims 5 and 11: “The device of claim 4/10, wherein the number of the at least one idle subchannel is 1, 2 or 4 when the number of the plurality of subchannels is 4.”

The conjunction “or” is met by satisfying either or both of the first and second conditions, therefore the presence of one or two idle subchannels meets this limitation. *SkinMedica, Inc. v. Histogen Inc.*, 727 F.3d 1187, 1199 (Fed. Cir. 2013). Maltsev combined with Agrawal discloses this limitation.

The discussion of Maltsev regarding Limitation 1[1] establishes that the frequency spectrum 300 may be comprised of four or more channels (subchannels) 302 that are each 20 MHz. Ex. 1003 at 4:37-53. This meets the claim 11 limitation “the number of the plurality of subchannels is 4.”

Channels 302 are suitable for the transfer of data frames depending on their individual channel busy/idle state or channel quality. The decision about channel state is dynamically made by a wider-band CU based on current measurements, information obtained from received packets and statistical information. *Id.* at 4:65-5:3; 7:42-49.

A POSITA would have understood that as shown in Fig. 3 the spectrum is 80 MHz divided into four 20 MHz channels 302 and that the status (“idle” or “busy”) of a channel is individually and dynamically determined depending on each individual channel's busy/idle state or channel quality. *Id.* at 4:65-5:3. Consequently, all or fewer than all four channels may be determined to be idle, but at least one subchannel must be idle for a CTS frame to be exchanged. Thus, in the situation of the transmission of one CTS frame, Maltsev meets the additional limitation of claim 11 that “the number of the at least one idle subchannel is 1.”

A POSITA would have understood from the discussion of Agrawal regarding limitation 1[2] that CTS signals may be transmitted by the first station over a subset of the subchannels over which RTS signals were originally sent to the first station by the second station. Maltsev teaches that CTS frames are transmitted only over subchannels that are idle which may be none (all subchannels are busy) or a subset of subchannels. A POSITA would have

understood that such subset of idle subchannels would include three possible states, i.e., one, two, or three idle subchannels, and that the number depended upon the dynamically-changing subchannel environment. With this knowledge a POSITA would have understood the claim 10 restriction to one or two idle subchannels to have been arbitrary and obvious in the absence of evidence of unexpected results. Ex. 1006 at ¶¶229-237.

4. Claims 14 and 16: “The method/device of claim 13/15, wherein the number of the plurality of subchannels of 4.”

This limitation “wherein the number of the plurality of subchannels of 4” is included in claims 2, 5, 8, and 11, and is fully met by Maltsev as explained by the discussion above regarding those claims.

B. Ground 2: Claims 1, 2, 4, 5, 7, 8, 10, 11, and 13-16 Would Have Been Obvious in View of the Combination of Maltsev and Xhafa

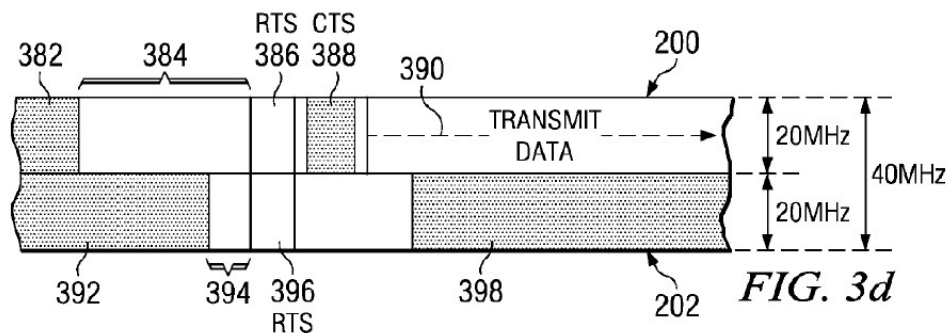
The relevance of Maltsev to the Challenged Claims was thoroughly discussed in Ground 1 and will not be repeated.

Xhafa (Ex. 1005) is entitled “Reducing Collisions in Wireless Systems” and is directed to techniques for reducing/eliminating data collisions on wireless network channels. Ex. 1005 at [0004]. Xhafa discloses Wireless Local Area Network (WLAN) systems for various IEEE 802.11 Wi-Fi standards where the access points (APs) and stations (STAs) communicate with each other by transmitting data in channels with 20 MHz bandwidths. *Id.* at [0002]. Xhafa also

teaches that access points and stations communicate with each other “ using multiple channels of 20 MHz each, effectively transmitting data in a ‘superchannel’ with 40 MHz of bandwidth.” *Id.* at [0003]. Xhafa also teaches using the RTS/CTS protocol to minimize collisions. *See e.g., Id.* at [0027].

Xhafa further teaches that when RTS signals are sent on multiple subchannels by a station, e.g., station 2 in Claim 9, CTS signals may only be received by the second station over those subchannels over which RTS signals were received by the receiving station (first station in claim 9). “Thus, because the logic 302 does not receive a CTS in response to its RTS on the extension channel 202, the logic 302 determines that the extension channel is busy and transmits data only on the control channel 200.” *Id.*

This situation is shown by FIG. 3d and is described at *id.* at [0028]-[0029].



Id. at FIG. 3d.

RTS signals 386 and 396 are sent over each of the 20 MHz subchannels. In response to the RTS signals only the CTS 388 is received on the 20 MHz channel 200. Consequently, data frame 390 is sent on the same channel over which it received the CTS. No CTS signal is sent over channel 202 because it is not idle. Thus, in the words of claim 9, a first station transmits at least one CTS frame (CTS 388) in response to at least one of the plurality of RTS frames (RTS 386 and RTS 396) from the second station through at least one idle subchannel of the plurality of subchannel.

1. Motivation to Combine Maltsev with Xhafa

A POSITA would have been motivated to combine Maltsev and Xhafa for at least a number of reasons. First, both references have at least one embodiment for 20 MHz bonded subchannel operation in a wireless OFDM system. Second, both references teach that the RTS/CTS protocol is used for more efficient operation in an IEEE 802.11 wireless network. A POSITA would look to Xhafa to understand multiple methods by which RTS/CTS protocol could be used on an OFDM system that uses multiple subchannels to transfer data on one or more of the available subchannels. Ex. 1006 at ¶¶239-245.

2. Independent Claims 1, 4, 7, 10, 13, and 15

- a. Limitations: Claims 1, 7, and 13, Limitation [pre] “A method for a wireless communication system, the method comprising” and Claims 4, 10, 15, Limitation [pre]: “A device comprising:”⁹[pre]: “A method for receiving data in a wireless communication system, method comprising:”**

Maltsev teaches Limitation 1, 7, and 13 [pre] for the reasons discussed for Ground 1, Claim 1, 7, and 13. The identical preambles of claims 4, 10, and 15 are not limiting. Ex. 1006 at ¶246.

- a. Claims 4, 10, and 15, Limitation [1]: “a transceiver:”**

Maltsev teaches this limitation. *See*, Ground 1, Claims 4, 10, 15, Limitation [1]; Ex. 1006 at ¶¶284-287.

- a. Claims 4, 10, and 15, Limitation [2]: “a processor operatively connected to the transceiver and configured to:”**

Maltsev discloses this limitation. *See*, Ground 1, Claims 4, 10, 15, Limitation [2]; Ex. 1006 at ¶¶288-289.

- b. **Claims 1, 7, and 13 Limitation [1] and Claims 4, 10, and 15 Limitation [3]: “receiving/instruct to receive, a plurality of request to send (RTS) frames from a station through a plurality of subchannels, each of the plurality of RTS frames being received through a corresponding one of the plurality of subchannels, each of the plurality of subchannels having a 20 megahertz (MHz) bandwidth;”**

Maltsev teaches this limitation for the reasons discussed regarding Ground 1, Claims 1, 7, and 13 Limitation [1] and Claims 4, 10, and 15 Limitation [3]; Ex. 1006 at ¶247.

- c. **Claims 1 and 7, Limitation [2] and Claims 4 and 10, Limitation [4]: “transmitting/instruct to transmit at least one clear to send (CTS) frame in response to at least one of the plurality of RTS frames to the station, through at least one idle subchannel of the plurality of subchannels, each of the at least one CTS frame being transmitted through a corresponding one of the at least one idle subchannel; and”**

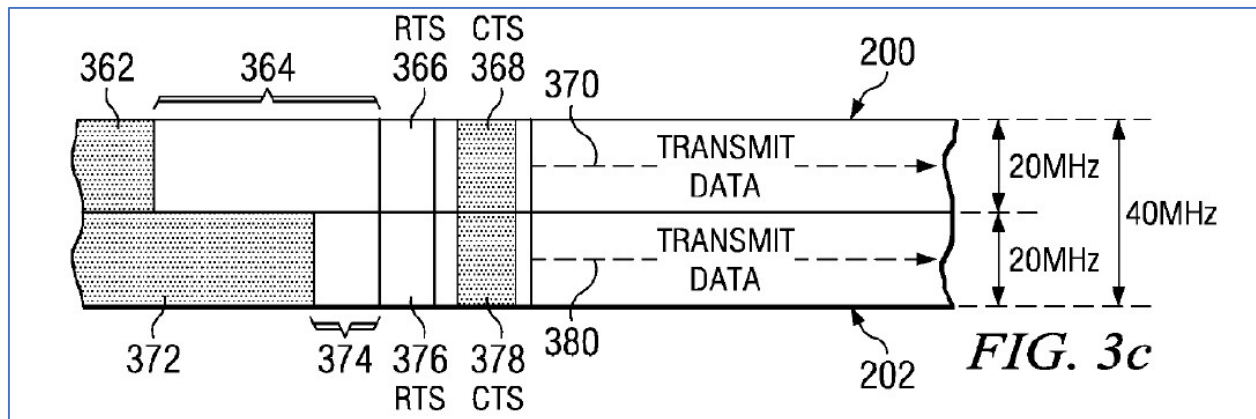
Maltsev discloses an RTS/CTS exchange used with control frames in the wider-band channel with channelization information. Ex. 1003 at 7:45-47.

Maltsev further discloses that decisions about current channel state are dynamically made by a wider-band CU based on current measurements, information obtained from received packets, and statistical information. *Id.* at 4:65-5:3.

Xhafa discloses using the same RTS/CTS protocol as used in Maltsev. While Maltsev discloses four or more subchannels, the examples of Xhafa focus on

a bandwidth of 40 MHz “super channel” comprising two 20 MHz channels 200, 202. Ex. 1005 at [0023], [0026].

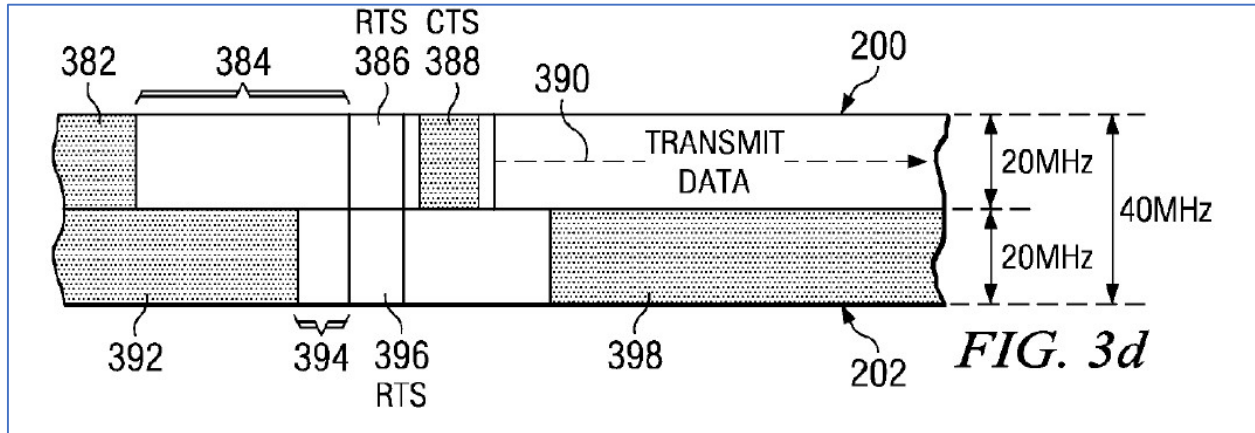
FIGs 3c and 3d shown below are relevant embodiments for the operation of Xhafa.



Ex. 1005 at FIG. 3c.

FIG. 3c shown above and its descriptive text disclose that RTS signal 366 is transmitted on channel 200 and RTS signal 376 is transmitted on channel 202. In response to the RTS signals 366, 376, CTS signals 368 and 378 are received on channels 200 and 202, respectively. *Id.* at [0025]-[0026].

FIG. 3d shows an alternate embodiment.



Ex. 1005 at FIG. 3d.

FIG. 3d and its descriptive text describe disclose that RTS signals 386 and 396 are sent on the channels 200 and 202, respectively. However, CTS signal 388 is received only on channel 388 because a collision on channel 202 prevented the RTS signal 396 from being received, i.e., channel 202 was not idle.

Consequently, data is only sent on channel 200. *See e.g., Id.* at [0028], [0029].

Xhafa would have taught a POSITA to modify Maltsev to transmit “by the first station, at least one clear to send (CTS) frame in response to at least one of the plurality of RTS frames from the second station through at least one idle subchannel of the plurality of subchannels” as recited in Limitation 1[2], 7[2], 4[4] and 10[4]. Ex. 1006 at ¶¶111, 248-257.

- d. **Claim 13, Limitation [2] and Claims 15, Limitation [4]: “transmitting/instruct to transmit a plurality of clear to send (CTS) frames in response to at least one of the plurality of RTS frames to the station through a plurality of idle subchannels of the plurality of subchannels, each of the plurality of CTS frames being transmitted through a corresponding one of the plurality of idle subchannels; and”**

Claim 13, Limitation [2] and Claim 15, Limitation [4] include an insubstantial difference in wording from Claim 1, Limitation [2] and the invalidity analysis for Ground 2, Claim 1, Limitation [2] applies equally to Claim 13, Limitation [2] and Claim 15, Limitation [4]. Ex. 1006 at ¶111.

- e. **Claims 1, 7, and 13 Limitation [3] and Claims 4, 10, and 15 Limitation [5]: “receiving/instruct to receive a data frame from the station after transmitting the at least one CTS frame,”**

Maltsev teaches Limitation 1[3], 7[3], 13[3], 4[5], 10[5], and 15[5] for the reasons discussed in Ground 1, claim 1, Limitation 1[3]. Further, Xhafa shows this in FIG. 3d, above, and its corresponding description in the specification, and also meets 1[3], 7[3], 13[3], 4[5], 10[5], and 15[5]. *Id.* at [0029]; Ex. 1006 at ¶¶258-260.

- f. **Claim 1, Limitation [4] and Claim 4, Limitation [6]:**
“wherein each of the at least one CTS frame includes channel information related to the at least one idle subchannel through which the at least one CTS frame is transmitted by the first station, and the data frame is received through the at least one idle subchannel indicated by the channel information, and”

Maltsev discloses Limitations 1[4] and 4[6] as discussed with respect to Ground 1, claim 1, Limitation 1[4]. Xhafa also teaches Limitations 1[4] and 4[6] as described above regarding the embodiment of FIG. 3d and its description text. *Id.* at [0028], [0029]; Ex. 1006 at ¶¶261-263.

- g. **Claim 7, Limitation [4] and Claim 10, Limitation [6]:**
“wherein each of the at least one CTS frame includes channel information related to all of the at least one idle subchannel through which the at least one CTS frame is transmitted by the first station, and the data frame is received through the at least one idle subchannel indicated by the channel information, and”

Claim 7, Limitation [4] and Claim 10, Limitation [6] include an insubstantial difference in wording from Claim 1, Limitation [4] and the invalidity analysis for Ground 2, Claim, 1 Limitation [4] applies equally to Claim 7, Limitation [4] and Claim 10, Limitation [6]. Ex. 1006 at ¶111.

- h. Claim 13, Limitation [4] and Claim 15, Limitation [6]: “wherein each of the plurality of CTS frames includes channel information related to the plurality of idle subchannels through which the plurality of CTS frames are transmitted by the first station, and the data frame is received through the plurality of idle subchannels indicated by the channel information, and**

Claim 13, Limitation [4] and Claim 15, Limitation [6] include an insubstantial difference in wording from Claim 1, Limitation [4] and the invalidity analysis for Ground 2, Claim 1, Limitation [4] applies equally to Claim 13, Limitation [4] and Claim 15, Limitation [6]. Ex. 1006 at ¶111.

- i. Claims 1 and 7, Limitation [5] and Claims 4 and 10, Limitation [7]: “wherein a number of the at least one idle subchannel through which the at least one CTS frame is transmitted is equal to or less than a number of the plurality of subchannels through which the plurality of RTS frames are received.”**

Limitations 1[5], 7[5], 4[7] and 10[7] are met because Xhafa discloses sending a separate RTS signal on each of two 20 MHz channels 200, 202 of the 40 MHz super-channel and receiving a CTS signal 388 on only one channel, i.e., channel 200 and not channel 202. *Id.* at FIG. 3d and [0028], [0029]; Ex. 1006 at ¶264-268.

- j. **Claim 13, Limitation [5] and Claim 15, Limitation [7]: “wherein a number of the plurality of idle subchannels through which the plurality of CTS frames are transmitted is equal to or less than a number of the plurality of subchannels through which the plurality of RTS frames are received.”**

Claim 13, Limitation [5] and Claim 15, Limitation [7] include an insubstantial difference in wording from Claim 1, Limitation [5] and the invalidity analysis for Ground 2, Claim 1, Limitation [5] applies equally to Claim 13, Limitation [5] and Claim 15, Limitation [7]. Ex. 1006 at ¶111.

3. **Claims 2 and 8: “The method of claim 1/7, wherein the number of the at least one idle subchannel is 1, 2 or 4 when the number of the plurality of subchannels is 4.”**
Claims 5 and 11: “The device of claim 4/10, wherein the number of the at least one idle subchannel is 1, 2 or 4 when the number of the plurality of subchannels is 4.”

The conjunction “or” is met by satisfying either or both of the first and second conditions, therefore the presence of one or two idle subchannels meets this limitation. *SkinMedica, Inc. v. Histogen Inc.*, 727 F.3d 1187, 1199 (Fed. Cir. 2013). Maltsev combined with Agrawal discloses this limitation.

The discussion of Maltsev regarding Ground 1, Claim 1, Limitation 1[1] establishes that the frequency spectrum 300 may be comprised of four or more channels (subchannels) 302 that are each 20 MHz. Ex. 1003 at 4:37-53. This meets the claim 11 limitation “the number of the plurality of subchannels is 4.”

Channels 302 are suitable for the transfer of data frames depending on their individual channel busy/idle state or channel quality. The decision about channel state is dynamically made by a wider-band CU based on current measurements, information obtained from received packets and statistical information. *Id.* at 4:65-5:3; 7:42-49.

A POSITA would have understood that as shown in Fig. 3 of Maltsev that the spectrum is 80 MHz divided into four 20 MHz channels 302 and that the status (“idle” or “busy”) of a channel is individually and dynamically determined depending on each individual channel's busy/idle state or channel quality. *Id.* at 4:65-5:3. Consequently, all or fewer than all four channels may be determined to be idle, but at least one subchannel must be idle for a CTS frame to be exchanged. Thus, in the situation of the transmission of one CTS frame, Maltsev meets the additional limitation of claim 11 that “the number of the at least one idle subchannel is 1.”

A POSITA would have understood from the discussion of Xhafa regarding Ground 2, Claim 1, Limitation [2] that CTS signals may be transmitted by the first station over a subset of the subchannels over which RTS signals were originally sent to the first station by the second station. Maltsev teaches that CTS frames are transmitted only over subchannels that are idle which may be none (all subchannels are busy) or a subset of subchannels. A POSITA would have

understood that such subset of idle subchannels would include three possible states, i.e., one, two, or three idle subchannels, and that the number depended upon the dynamically-changing subchannel environment. With this knowledge a POSITA would have understood the claim 10 restriction to one or two idle subchannels to have been arbitrary and obvious in the absence of evidence of unexpected results. Ex. 1006 at ¶¶311-318.

The additional limitations of claims 2, 8, 5, and 11 are rendered obvious in view of Maltsev modified in view of Xhafa because Maltsev teaches using four subchannels and Xhafa discloses sending a separate RTS signal on each subchannel and receiving a CTS signal 388 on only one channel, i.e., channel 200 and not channel 202. Ex. 1005 at FIG. 3d and [0028], [0029].

4. Claims 14 and 16: “The method/device of claim 13/15, wherein the number of the plurality of subchannels of 4.

This limitation is taught by Maltsev. Ex. 1003 at 4:41-49.

VIII. THE BOARD SHOULD NOT EXERCISE ITS DISCRETION TO DENY INSTITUTION

A. 35 U.S.C. § 314(a)

The Board should grant institution notwithstanding the parallel litigation between Patent Owner and Petitioners. Petitioner has stipulated that if the IPR of the '431 patent is instituted, it will not assert invalidity in the parallel district court proceedings based on grounds that were raised or reasonably could

have been raised in the instituted IPRs. Ex. 1011. Thus, Fintiv provides no basis for a discretionary denial in this Petition. Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation (June 21, 2022) (stating that the “PTAB will not discretionarily deny institution in view of parallel district court litigation where a petitioner presents” such a stipulation).

B. 35 U.S.C. § 325(D)

Under 35 U.S.C. § 325(d), “[i]n determining whether to institute . . . the Director may take into account whether . . . the same or substantially the same prior art or arguments previously were presented to the Office.” Maltsev and Agrawal are not cited on the face of the ’431 patent and are not referenced in the file history of the ’431 patent. Only one secondary reference, Xhafa, was referenced in the file history but was not cited by the examiner. Therefore, factors c, d, e, and f are not applicable.

This Petition shows that had the Examiner considered the combinations set forth in this Petition, the obviousness of the claims would have been manifest (factors (a) and (b)).

Thus, in this case, these factors counsel against the Board exercising its discretion under 35 U.S.C. § 325(d).

IX. CONCLUSION

Petitioners request institution of an *inter partes* review to cancel these claims.

Dated: April 21, 2023

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CERTIFICATE OF WORD COUNT

P Pursuant to 37 C.F.R. § 42.24(d), Petitioners hereby certify, in reliance on the word count feature provided by the word-processing system used to prepare this Petition, that the number of words in this Petition is 10,398. Pursuant to 37 C.F.R. § 42.24(a), words in the table of contents, table of authorities, mandatory notices under § 42.8, certificate of service, certificate of word count, appendix of exhibits, and claim listing were excluded.

Dated: April 21, 2023

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that a copy of the foregoing Petition and all exhibits and other documents filed together with the Petition were served on April 21, 2023 via Federal Express on the attorney of record for Patent Owner at the following address:

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