

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. IPR2023-00866

**PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 9,788,346**

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TABLE OF AUTHORITIES

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PETITIONER’S EXHIBIT LIST

Exhibit No.	Description
1001	U.S. Patent No. 9,788,346 (“the ’346 Patent”)
1002	Excerpts of Prosecution history of U.S. Patent No. 9,788,346 (“Prosecution history”)
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 Stipulation
1012	Plaintiff LG Electronic Inc.’s Preliminary Claim Constructions and Supporting Materials
1013	Defendants’ Amended Patent Rule 4-2 Disclosures

Exhibit No.	Description
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) a.k.a., IEEE 802.11-2007 Recommendation
1015	U.S. Patent 8,705,645 (“Sadowsky et al.”)
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
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)

Exhibit No.	Description
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 9, 10, 12, 13, 14, and 16 (the “Challenged Claims”) of U.S. Patent No. 9,788,346 (“the ’346 patent,” Ex. 1001).

The ’346 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 ’346 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 ’346 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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Petitioners consent to electronic service by email at the following email addresses:

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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 '346 patent is available for IPR and Petitioners are not barred or estopped from requesting IPR challenging the claims of the '346 patent under 37 C.F.R. § 42.101.

B. Claims for Which Review Is Requested

Petitioners request IPR of claims 9, 10, 12, 13, 14, and 16 of the '346 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	9, 10, 13, 14
2	35 U.S.C. § 103	Maltsev, Agrawal, Fracchia	12 and 16
3	35 U.S.C. § 103	Maltsev, Agrawal, Sadowsky	12 and 16
4	35 U.S.C. § 103	Maltsev and Xhafa	9, 10, 13, 14
5	35 U.S.C. § 103	Maltsev, Xhafa, Fracchia	12 and 16
6	35 U.S.C. § 103	Maltsev, Xhafa, Sadowsky	12 and 16

D. Claim Constructions

Consistent with its positions in the Related Litigation, Petitioners propose construction of “station,” “access point (AP)”, and “Very High Throughput” in accordance with the ’346 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 ’346 patent. *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576 (Fed. Cir. 1996)).

1. “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 ¶¶85-90.

2. Access Point/AP

In its P.R.3-2 Submission of Preliminary Claim Constructions, Patent Owner proposed construction of “Access Point/AP” as “the station included in an Access Point (such as in a wireless router at home).” Ex. 1012 at p. 5. In its P.R.3-2 Submission of Preliminary Claim Constructions, Petitioners proposed construction of “Access Point/AP” as “an entity that has station (STA) functionality and provides access to the distribution services, via the wireless medium (WM) for associated STAs.” Ex. 1013 at p. 7, citing Ex. 1014, definition 3.3 at p. 5, *See*, Ex. 1006 at ¶¶91-94.

3. Very High Throughput/VHT

In its P.R.3-2 Submission of Preliminary Claim Constructions, Patent Owner proposed construction of “Very High Throughput/VHT” as “a next generation of the IEEE 802.11n WLAN system, now known as 802.11ac or Wi-Fi 5.” Ex. 1012 at p. 4. In its P.R.3-2 Submission of Preliminary Claim Constructions, Petitioners proposed construction of “Very High Throughput/VHT” as “processing speed of 1 Gbps or more in the multi-channel environment.” Ex. 1013 at p. 6, citing Ex. 1001 at 3:26-31; 3:23-26; 6:16-19; and 6:29-32. *See*, Ex. 1006 at ¶¶95-99.

Petitioners submit that their proposed constructions are correct, but that the analysis in this Petition applies under both proposed constructions. *Id.* at ¶¶90, 94, 99.

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 ’346 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*.

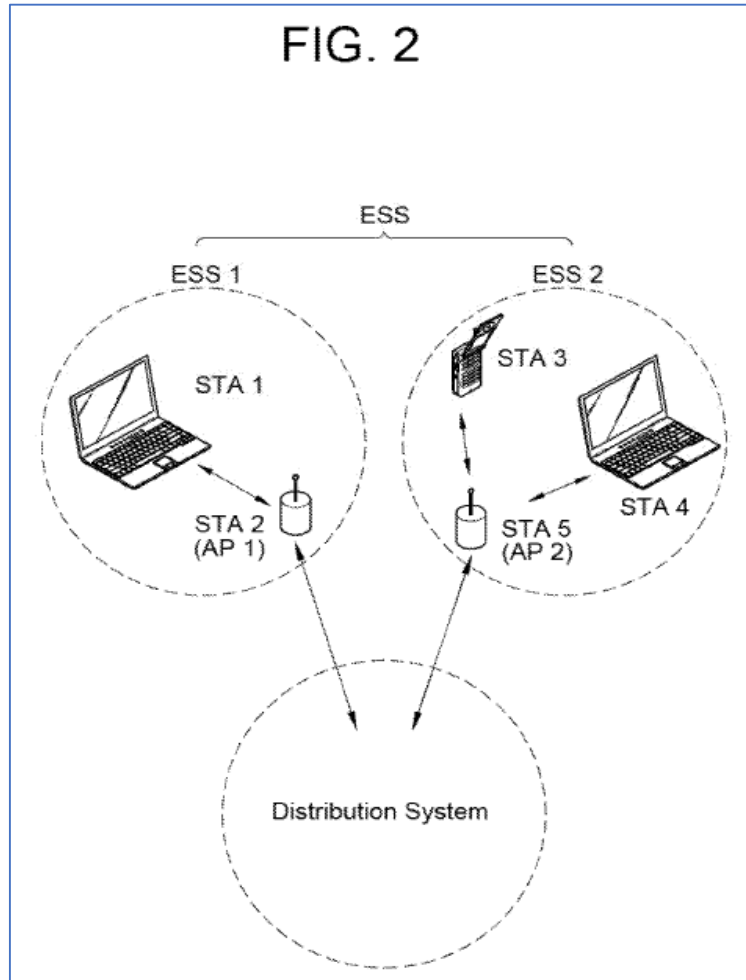
V. THE '346 PATENT

A. Summary of the '346 Patent

The '346 patent, entitled “Channel Access Method for Very High Throughput (VHT) Wireless Local Access Network System and Station Supporting the Channel Access Method” issued on October 10, 2017, from an application filed on November 21, 2016. This application claims priority to a Korean patent application filed on June 18, 2008. Ex. 1001 at (30).

The '346 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.

FIG. 2 of the '346 patent is a schematic view showing an exemplary structure of a wireless local access network (WLAN) system. *Id.* at 5:33-35.



Ex. 1001 at FIG. 2

The '346 patent discusses the use of several conventional technologies, including the RTS/CTS protocol, bonding of multiple OFDM subchannels, use of the MAC Protocol Layer, and using Multiple Antennas at the Transmitter and Receiver (MIMO). Ex. 1006 at ¶¶59-65. As discussed below each of these was known before the priority date of the '346 patent and several of these

technologies were known to increase the throughput of a communications system.

See, Id. at ¶¶42, 66-80.

B. Known Functionality Described by the '346 Patent

The '346 patent references known technologies explained below.

1. 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. The RTS/CTS protocol was initially defined for use in Wi-Fi networks in the 802.11-1999 recommendation, long before the '346 patent's priority date. Ex. 1006 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 '346 patent specification (*See e.g.*, Ex. 1001 at FIG. 1 and 2:21-34) and the (RTS/CTS) functions described by the '346 patent specification (*See e.g., id.* at 2:48-57) and is also included in the Challenged Claims (defined below).

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.

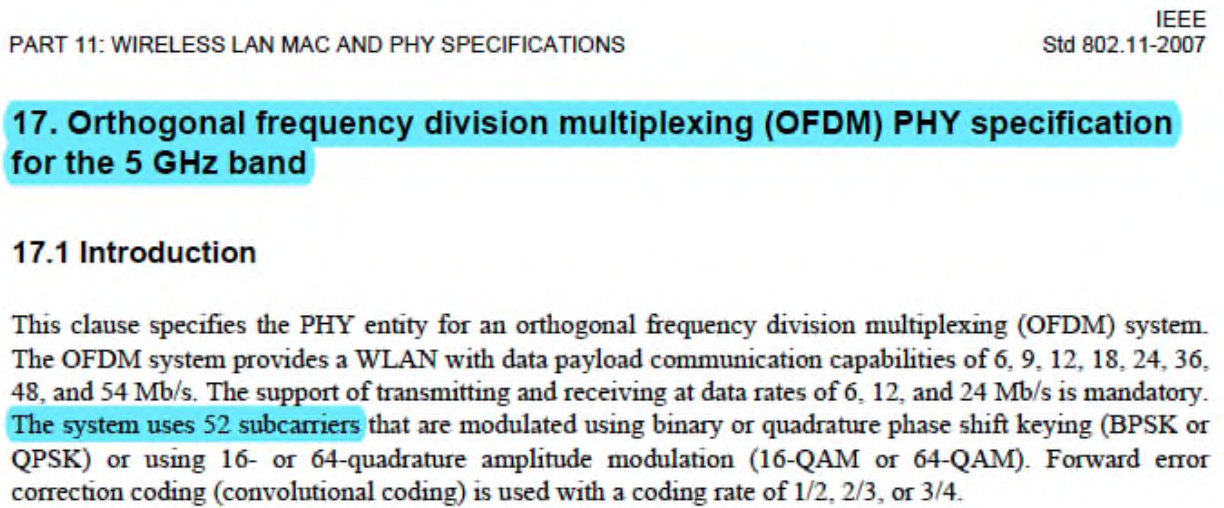
The RTS/CTS exchange also performs both a type of fast collision inference and a transmission path check. If the return CTS is not detected by the STA originating the RTS, the originating STA may repeat the process (after observing the other medium-use rules) more quickly than if the long data frame 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 '346 patent.

2. OFDM and Sub-Channel Operation

Orthogonal Frequency Division Multiplexing (OFDM) operation is a specific type of multiplexing method defined for some of the IEEE 802.11 recommendations and is relevant for the Challenged Claims. 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. As also described by the passages below, the 802.11-2007 recommendation also defined OFDM operation and the use of multiple subchannels on the radio interface 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. *Id.* at ¶¶39, 73.



Ex. 1014 at p. 591 (emphasis added).

Thus, the concepts of using an OFDM physical layer with multiple subchannels were known well in advance of one year before the priority date of the '346 patent and also were not novel to the '346 patent.

3. Multiple Input Multiple Output (MIMO) technique

Multiple Input Multiple Output (MIMO) technique is method that typically uses multiple antennas at the transmitter that are concurrently transmitting output data and multiple antennas at the receiver are receiving the transmitted data. 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. The '346 patent admits that MIMO configurations using multiple antennas in both a transmitter and a receiver to

optimize the data rate in the 802.11n OFDM system previously existed as stated by the passage below taken from the “Background of the Invention” section of the specification specifically describing the prior art 802.11n standard. Ex. 1001 at 2:7-20; *see* Ex. 1006 at ¶¶35-37, 72-74.

4. A Plurality of Network Interface Cards (NICs)

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 ¶¶76-80. The ’346 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 ’346 patent. Ex. 1009 at p. 7, Ex. 1006 at ¶¶76-80.

C. Summary of the Prosecution History of the ’346 Patent

As originally filed, the ’346 patent comprised 6 claims. Ex. 1002 at pp. 1-2. (November 21, 2016, Claims).

The examiner rejected the claims under the doctrine of obviousness-type double patenting and stated that claims would be allowable if a Terminal Disclaimer was filed. *Id.* at pp. 3-16. (January 31, 2017, Non-Final Rejection). Applicant cancelled claims 2, 3, 5, and 6, and added claims 7-20. *Id.* at pp. 18-22.

(May 1, 2017, Claims). Applicant also submitted a Terminal Disclaimer. A Notice of Allowance was issued on June 8, 2017. *Id.* at pp. 26-33. (June 8, 2017, 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 '346 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

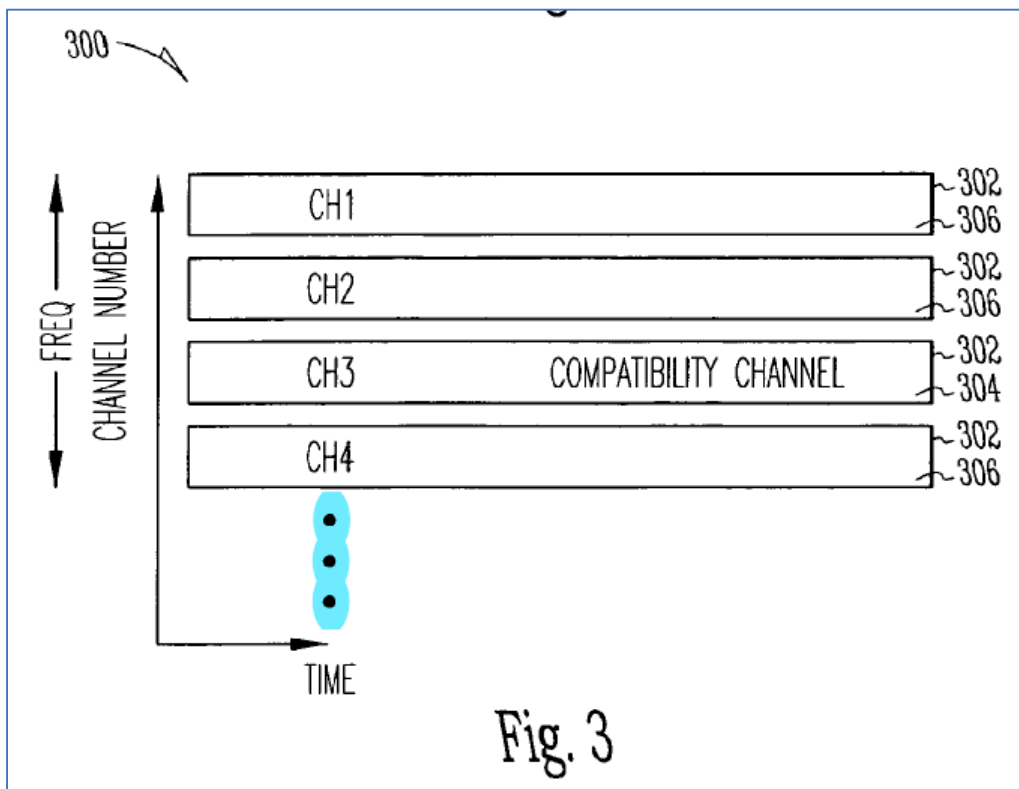
A. U.S. Patent 7,349,436 – Maltsev et al. (Ex. 1003)

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 communication stations (STA). 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 ¶¶100-104.

Maltsev discloses using four or more 20 MHz subchannels to get a higher data throughput using a combined channel size of 80 MHz or greater. *Id.* at ¶104. These are prominent features of the Challenged Claims of the '346 patent.

FIG. 3 illustrates the use of four or more channels and 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 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 4:47-49, Ex. 1006 at ¶¶104-106.



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; Ex. 1006 at ¶¶104-106.

B. U.S. Patent Publication 2007-0147322 - Agrawal et al. (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 network utilizing an OFDM physical layer with multiple subchannels. The RTS/CTS protocol is used to contend for subcarriers. RTS/CTS signals transmitted over the subcarriers resolve which subcarriers may transmit data frames. Ex. 1004 at Abstract, [0006], [0037], [0062],

and [0067]. Agrawal 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 discloses detailed circuitry used in a wireless station compatible with the 802.11 standard. Ex. 1006 at ¶¶107-112.

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

U.S. Patent Publication 2007-0266157 to Xhafa is directed to 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 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 ¶¶113-118.

D. The IEEE VHT Amendment (Ex. 1008)

IEEE P802.11 Wireless LANs: Proposal for PAR and 5 Criteria for Very High Throughput (VHT) SG for Below 6 GHz Operation, (“VHT

Amendment,” Ex. 1008) identifies criteria for the successor to the IEEE 802.11n standard, including at least a VHT device having multistation throughput of 1Gbps.

a) Demonstrated system feasibility.

Feasibility of multiple STAs 1Gbps and single link 500Mbps MAC SAP throughput links has been assessed in simulations and presented in documents 11-08-0307-01-0vht (<https://mentor.ieee.org/802.11/file/08/11-08-0307-01-0vht-on-the-feasibility-of-1gbps-for-various-mac-phy-architectures.ppt>) and 11-08-0535-00-0vht (<https://mentor.ieee.org/802.11/file/08/11-08-0535-00-0vht-phy-and-mac-throughput-analysis-with-80-mhz-for-vht-below-6-ghz.ppt>) for 80MHz bandwidth operation.

Ex. 1008 at p. 7 (emphasis added).

The VHT Amendment was published on May 12, 2008, and is prior art under pre-AIA 35 U.S.C. §102(a). Ex. 1006 at ¶¶119-120.

E. On the Feasibility of 1Gbps for Various MAC/PHY Architectures, Fracchia, Roberta, (March 2008) (“Fracchia,” Ex. 1009)

This feasibility study is cited in a link in a footnote of the VHT Amendment (Ex. 1008) in the section titled “Demonstrated system feasibility.” Fracchia was published on March 17, 2008, and is prior art under pre-AIA 35 U.S.C. §102 (a). Ex. 1006 at ¶¶121-127.

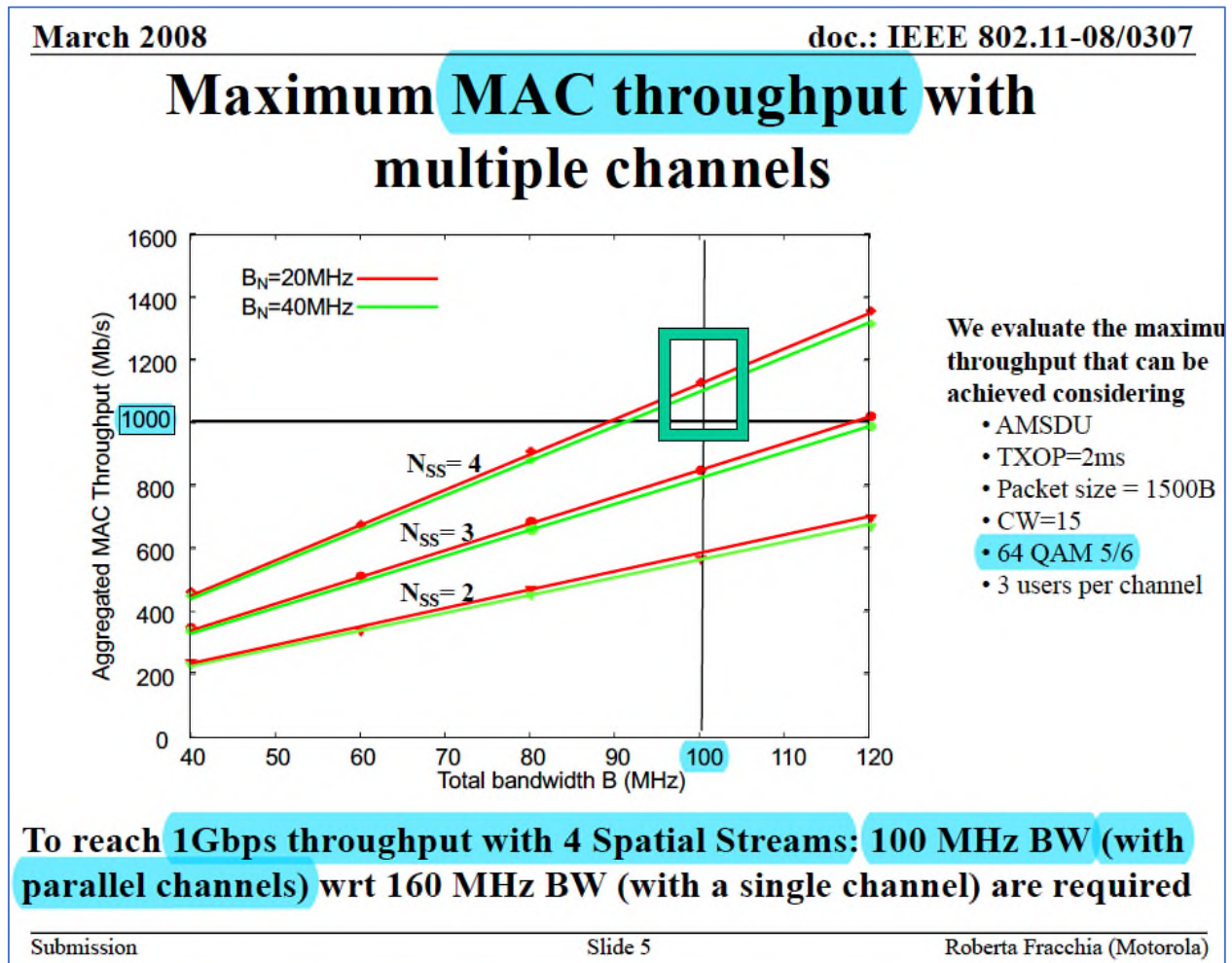
Fracchia documents the effort to increase throughput to 1Gbps and higher.

Abstract

This analysis provides inputs on the technical feasibility of achieving 1Gbps aggregated MAC SAP throughput for below 6GHz amendment, by using different MAC layers which manage the access to different parallel channels

Ex. 1009 at p. 2 (emphasis added).

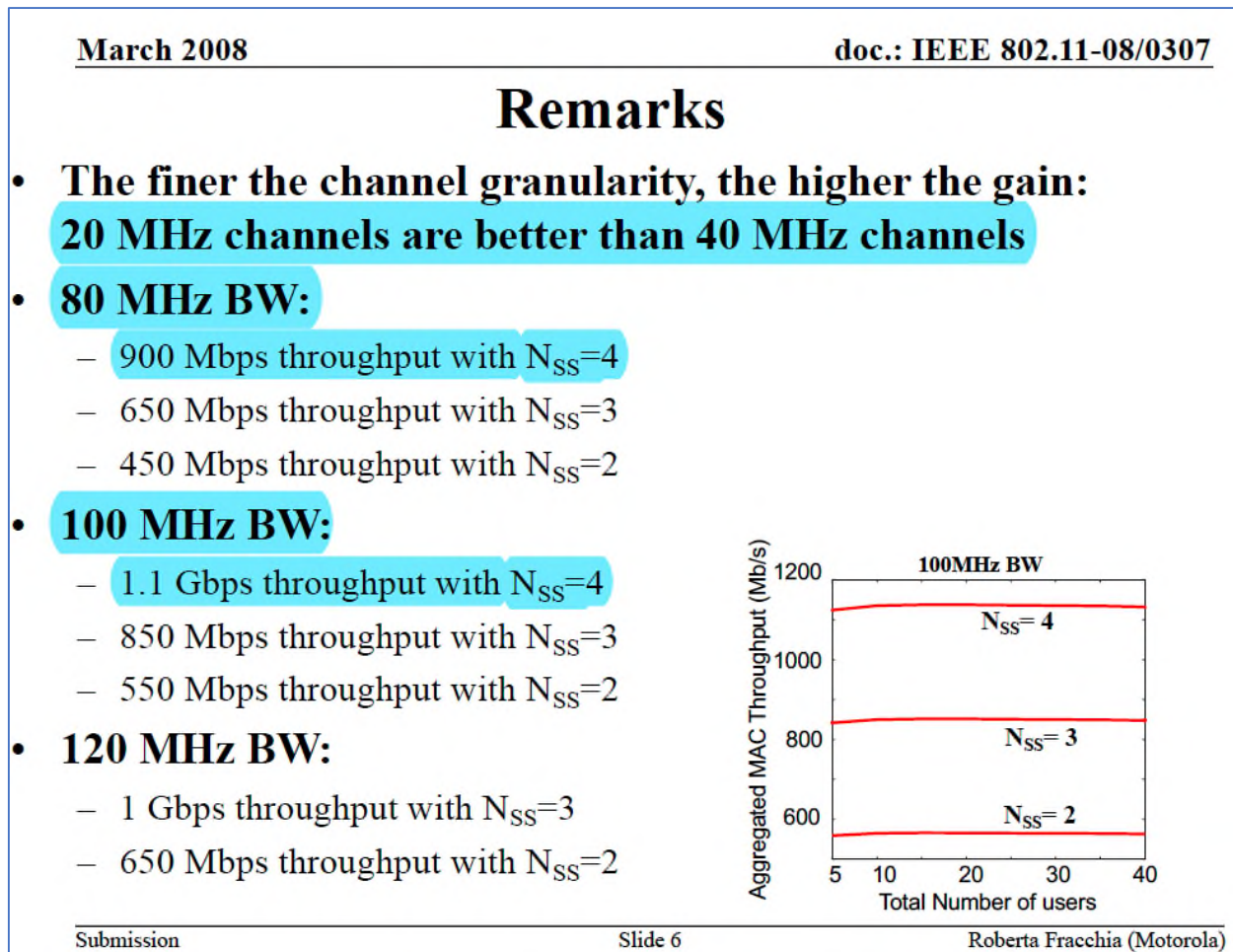
The text states criteria of 1 Gbps aggregated MAC SAP throughput using different parallel channels.



Id. at p. 5 (emphasis added).

The slide above shows that the 1 Gbps requirement would be significantly exceeded (Green Rectangle) when using a 100 MHz bandwidth (as shown by the 100 MHz bandwidth highlighted in Blue on the horizontal axis) using four MIMO Spatial Streams ($N_{ss} = 4$). The 1000 Aggregated MAC

Throughput (Mb/s) is highlighted in Blue on the vertical axis (1 Gbps). The “64 QAM 5/6” highlighted in Blue on the right side of the diagram was one of the existing modulation (64 QAM) and error correction (5/6) methods defined in the prior art 802.11n recommendation.



Id. at p. 6 (emphasis added).

A POSITA would have understood multiple relevant pieces of information are disclosed in the slide above: (1) using two 20 MHz subchannels is better than using a single 40 MHz subchannel for data throughput; (2) that an 80

MHz channel bandwidth would provide 900 Mbps data throughput (almost 1 Gbps) when using four OFDM 20 MHz subchannels and four MIMO Spatial Streams ($N_{SS}=4$); and (3) a 100 MHz channel bandwidth (greater than 80 MHz) with four OFDM 25 MHz subchannels or five 20 MHz subchannels would provide a data throughput above 1 Gbps. Ex. 1006 at ¶¶125-127.

F. U.S. Patent 8,705,645 – Sadowsky et al. (Ex. 1015)

US 8,705,645 patent (“Sadowsky”) issued on April 22, 2014, from an application filed on June 6, 2012, and claiming priority to application no. 10/750,587 filed on December 29, 2003, (USP 7,394,858). Ex. 1015 at (63). Sadowsky’s title is “MIMO Transmitter and Method for Transmitting OFDM Symbols” and it is prior art against the ’346 patent under pre-AIA 35 U.S.C. §§102 (a) and (e).

Sadowsky is directed to an OFDM transmitter that transmits data on OFDM subcarriers of at least 20 MHz and significantly increases the data throughput of an OFDM system by using multiple-input multiple-output (MIMO) techniques. Sadowsky teaches that instead of transmitting from one antenna at the transmitter to one antenna at the receiver (1 antenna pair), multiple antenna pairs can be used to transmit multiple streams of data between multiple antenna pairs concurrently in parallel. Because the antennas at the transmitter and the receiver are physically (spatially) separated (even by a small distance) the data throughput

is multiplied by the number of these “spatial streams.” Ex. 1015 at Abstract. The data throughput of the system is multiplied by the number of these transmitter/receiver antenna pairs when they are configured to carry a separate spatial stream of data. *Id.* at 7:5-15. Sadowsky discloses embodiments that comply with IEEE 802.11 Wi-Fi standards operating in the relevant 2.4 GHz and 5 GHz Wi-Fi frequency spectrum. *Id.* at 2:14-17.

Sadowsky teaches that higher MIMO data throughput can be achieved without increasing the frequency bandwidth of the OFDM system. For example, given a 100 MHz bandwidth OFDM system, Sadowsky’s technology multiplies the data throughput many times using MIMO without increasing the system bandwidth above 100 MHz. *Id.* at 1:27-34. Consistent with Maltsev, Sadowsky also teaches that “a wideband channel may comprise up to four or more subchannels, and each subchannel may have up to forty-eight or more orthogonal data subcarriers.” *Id.* at 5:38-41. Sadowsky also uses the RTS/CTS protocol. *Id.* at 8:64-67; *see*, Ex. 1006 at ¶¶128-137.

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 9 is an independent method claim and claim 13 is an independent

apparatus claim. For efficiency purposes independent claims 9 and 13 will be considered together.

A. Ground 1: Claims 9, 10, 13, and 14 Would Have Been Obvious in View of the Combination of Maltsev and Agrawal

Claims 9, 10, 13 and 14 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. at 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:

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 ¶¶141-142.

Agrawal also employs the RTS/CTS protocol. 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 ¶¶138-145.

2. Independent Claims 9 and 13

Claim 13 is a device version of method claim 9. Claim 13 recites a transceiver and a processor and recites that the processor is instructed to perform three operations identical to three of the method steps of claim 9. Due to the close similarity of the two asserted independent claims, they will be analyzed together with reference to Limitations in the following table, which assigns each limitation a number, e.g., “[1].”

Method Claim 9	Device Claim 13
Limitation 9[pre] A method for receiving data in a wireless communication system, method comprising:	Limitation 13[pre] A device comprising:
	Limitation 13[1] a transceiver; and
	Limitation 13[2] a processor operatively connected to the transceiver and configured to:
Limitation 9[1] receiving, by a first station,	Limitation 13[3] instruct the transceiver to receive
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, each of the plurality of subchannels having a 20 megahertz (MHz) bandwidth;	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,
Limitation 9[2] transmitting, by the first station,	Limitation 13[4] instruct the transceiver to transmit

at least one clear to send (CTS) frame in response to at least one of the plurality of RTS frames to the second station through at least one idle subchannel of the plurality of subchannels; and	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, and
Limitation 9[3] receiving, by the first station, a data frame from the second station after transmitting the at least one CTS frame,	Limitation 13[5] instruct the transceiver to receive a data frame from the station after transmitting the at least one CTS frame,
Limitation 9[4] wherein the at least one CTS frame includes channel information related to the at least one idle subchannel through which the 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	Limitation 13[6] wherein the at least one CTS frame includes channel information related to the at least one idle subchannel through which the CTS frame is transmitted by the device and the data frame is received through the at least one idle subchannel indicated by the channel information, and
Limitation 9[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.	Limitation 13[7] 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.

a. Limitations: 9[pre] “A method for receiving data in a wireless communication system, method comprising:”/13[pre]: “A device comprising:”

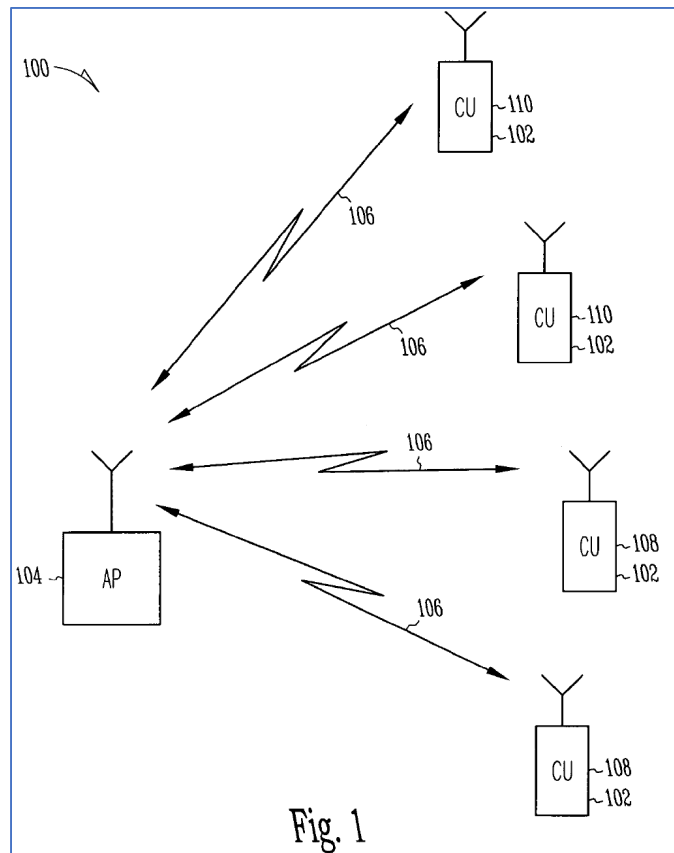
To the extent the preamble of claim 9, Limitation 9[pre], is limiting, Maltsev and Agrawal both disclose a method for receiving data in a wireless communication system. Ex. 1006 at ¶¶146-153.

The Preamble of claim 13 is not limiting.

b. Limitation 13[1]: “a transceiver; and”

Maltsev teaches this limitation.

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.

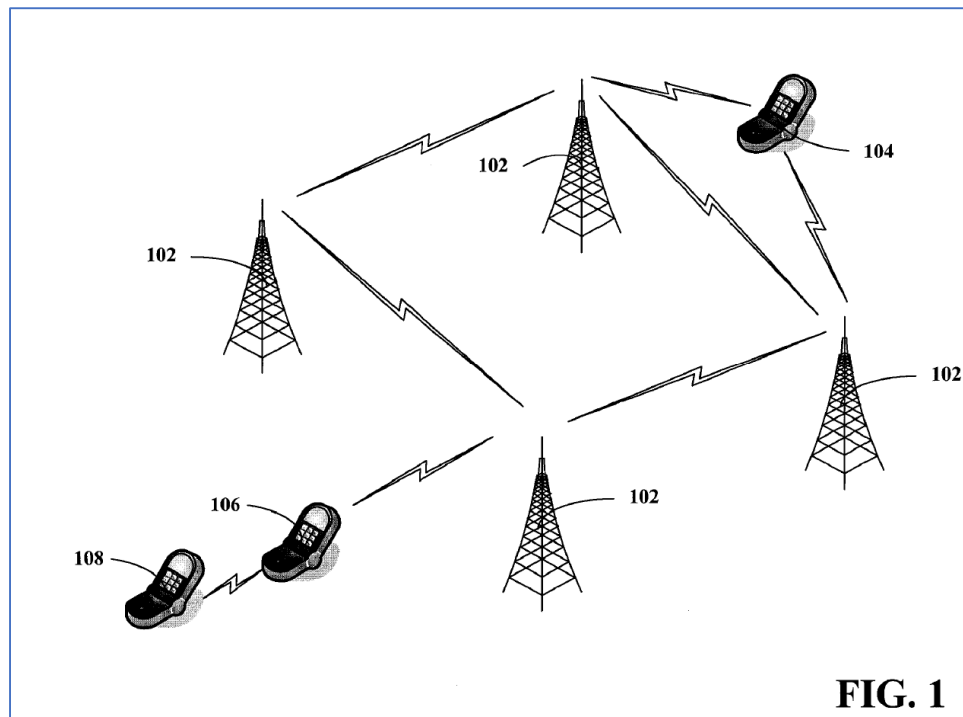


Id. at Fig. 1.

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].



Ex. 1004 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].

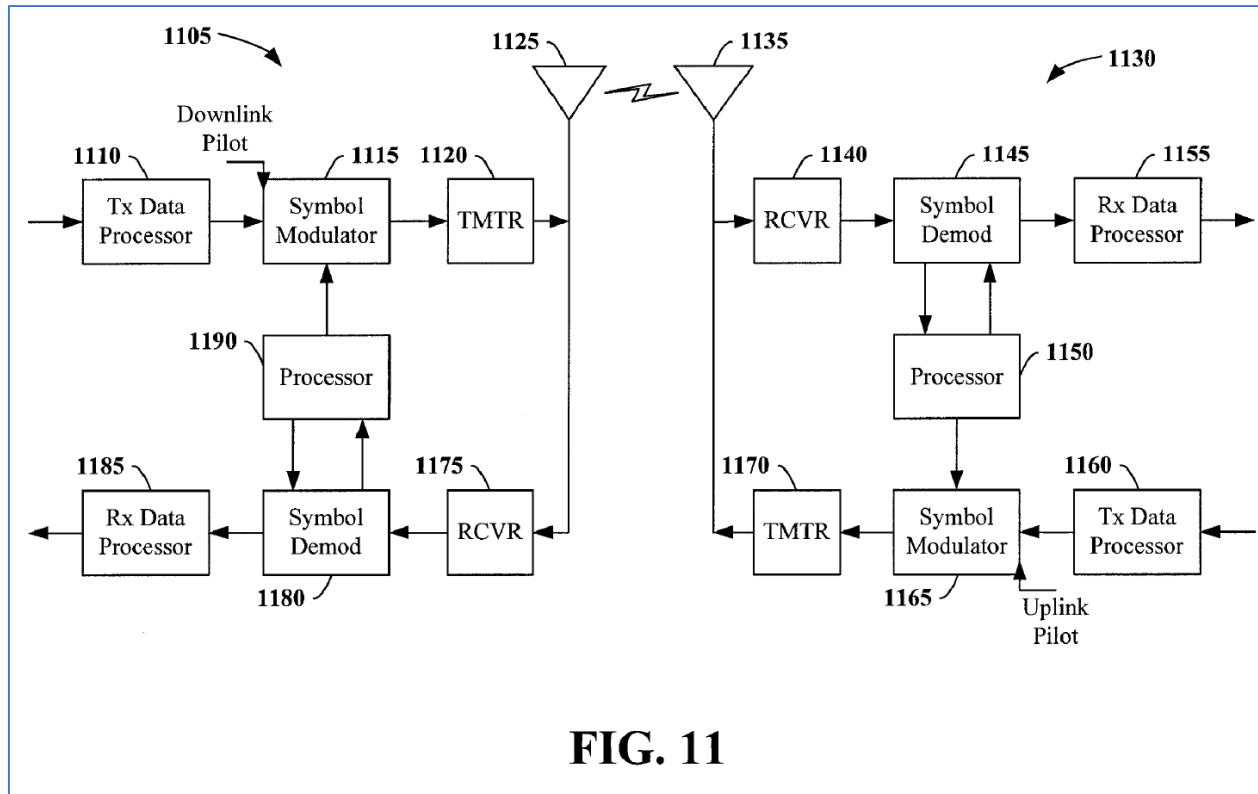


FIG. 11

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 Limitation 13[1]. Ex. 1006 at ¶¶197-212.

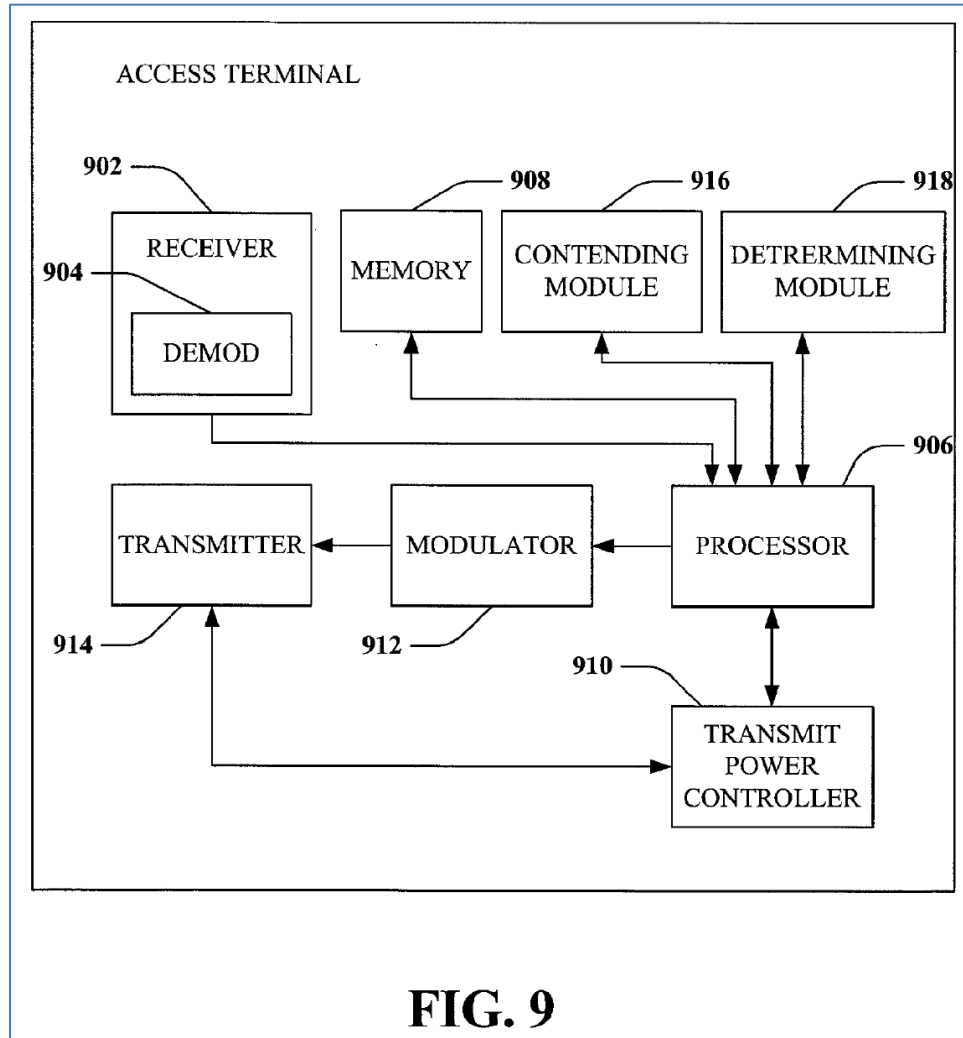
c. Limitation 13[2]: “a processor operatively connected to the transceiver and configured to:”

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 of Agrawal illustrates an access terminal 900 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 is coupled to or includes 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/CTS message, a data message 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].

Maltsev and Agrawal both meet Limitation 13[2]. Ex. 1006 at ¶¶213-219.

- d. Limitations 9[1]/13[3]: “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, each of the plurality of subchannels having a 20 megahertz (MHz) bandwidth;”**

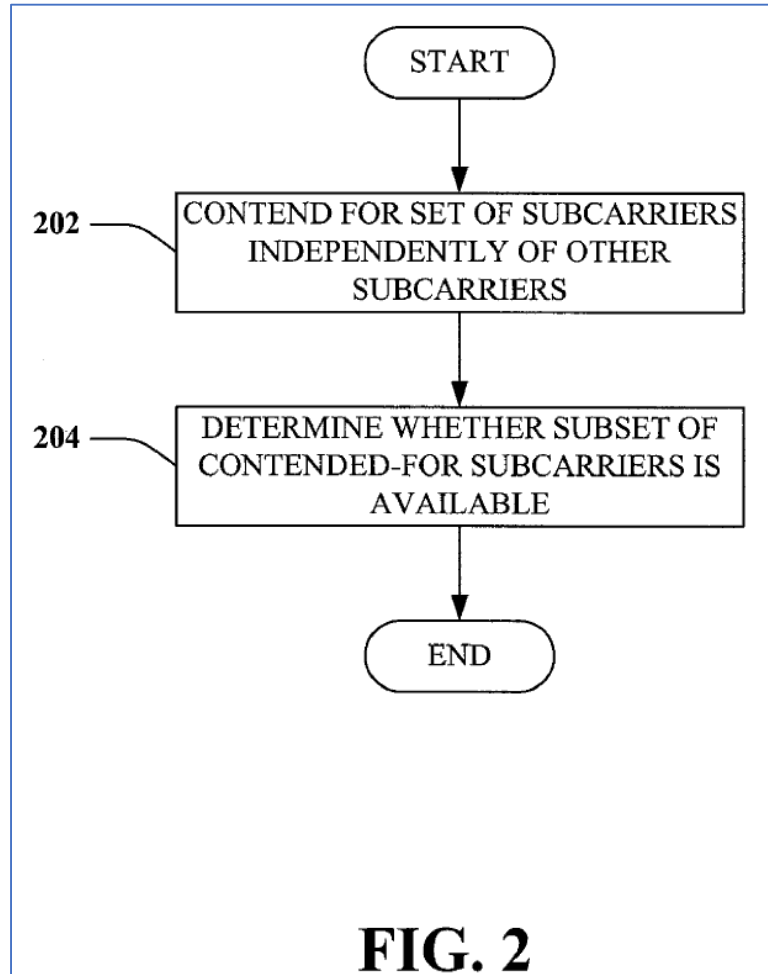
Maltsev discloses the use of the RTS/CTS protocol in communications between two stations, such as two CUs 102 and a CU 102 and an Access Point (AP) 104. Ex. 1003 at 7:45-47, FIG. 1. Sending RTS signals over a plurality of subchannels is a way for the sender [second station in claim 9] to inform a targeted receiver [station 1 in claim 9] that it 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 receive at least 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 ¶154.

The CUs 102 may comprise both wider-band CUs 108 and narrower-band CUs 110. Narrower-band CUs 110 may communicate on a single channel while wider-band CUs 108 may communicate on one or more channels. Wider-band CUs 108 may be referred to as high-throughput (HT) CUs, and in some embodiments, wider-band CUs 108 may communicate in accordance with an IEEE 802.11 standard for HT WLAN communications. Narrower-band CUs 110 may communicate in accordance with the IEEE 802.11(a/g) standard for WLAN communications. The terms narrower-band and wider-band refer to relative communication bandwidths that are utilized by the communication units. For example, narrower-band CUs 110 may communicate on a single narrow band channel (e.g., a 20 MHz channel), while wider-band CUs 108 may communicate on one or more subchannels using a wider bandwidth (e.g., channels of up to 80 MHz or greater). Ex. 1006 at ¶155.

The AP 104 may communicate with both wider-band CUs 108 and narrower-band CUs 110. Ex. 1003 at 3:29-50. A POSITA would have understood that an 80 MHz channel in a wider-band CU 108 would operate with four 20 MHz subchannels and for a 100 MHz channel (greater than 80 MHz), CU 108 would operate with four 25 MHz subchannels or five 20 MHz subchannels. Thus, the text of Maltsev in combination with FIG. 3 indicated 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. Ex. 1006 at ¶155. Moreover, a POSITA would have understood that the probability of all the available subchannels having acceptable noise characteristics to support a High Throughput connection would not always be 100 percent. 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.*

FIG. 2 of Agrawal illustrates a methodology 200 that uses the CTS/RTS protocol to contend for subcarriers in a multi-carrier wireless communication environment Ex. 1004 at [0038].



Ex. 1004 at FIG. 2.

At 202, a node contends for a subcarrier independently of other subcarriers. For instance, when available bandwidth is divided into separate and distinct subcarriers, an RTS/ CTS protocol is executed to contend for each subcarrier independently. *Id.* at [0044]. A station may transmit an RTS signal over a set of subcarriers and at 204, may determine whether a subset of the contended subcarriers is available for use during a subsequent transmission. The determination of subcarrier availability may be based on, for instance, CTS signals

received over all or a subset of the contended subcarriers, i.e., the subcarriers over which RTS signals were sent. Thus, the station may submit an RTS over each specific subcarrier over which the terminal would like to transmit. *Id.* at [0038].

The second station sends an RTS and waits for a CTS response from the first station on each subcarrier. Agrawal discloses transmitter a 1-bit RTS on each of the desired subcarriers and then utilizing the subset of subcarriers over which it receives CTS signals. *Id.* The first (CTS transmitting) station determines subchannel quality from a received RTS signal on the subchannel and indicates the idle/busy state or other channel condition of a subchannel by the selective transmission of a CTS signal over idle subchannels and the non-transmission of a CTS signal over busy subchannels.

Therefore, Agrawal teaches a second station sending a plurality of RTS signals independently over a plurality or set of subchannels as recited in Limitations 9[1]/13[3]. Maltsev also discloses that a channel of 80 MHz or larger can be subdivided into subchannels of 20 MHz each. Thus, Maltsev modified in view of Agrawal discloses a second station independently sending a plurality of RTS signals over a plurality of 20 MHz subchannels where the plurality of RTS signals are received by a first station in a manner to render limitations 9[1]/13[3] obvious. Ex. 1006 at ¶¶154-159, 220.

- e. **Limitations 9[2]/13[4]: “transmitting, 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; and”**

Transmitting CTS frames can be thought of as a reply by the first station that it received one or more RTS signals sent to it by the second station over the plurality of subchannels. If no RTS signals are received by the first station then no CTS signal will be transmitted from the first station to the second station. Maltsev discloses an RTS/CTS exchange used in this manner. Ex. 1003 at 7:45-47; Ex. 1006 at ¶160.

Agrawal teaches that a node contends for a subcarrier independently of other subcarriers because the RTS/CTS protocol is executed 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, at 204. The determination of subcarrier availability may be based on, for instance, CTS signals received over all or a subset of the contended subcarriers.” *Id.*; Ex. 1006 at ¶163.

Agrawal also teaches that the RTS/CTS may be implemented on each subcarrier using one or more of a variety of approaches. “A second approach is to contend jointly across subcarriers and then encode the data packet across the

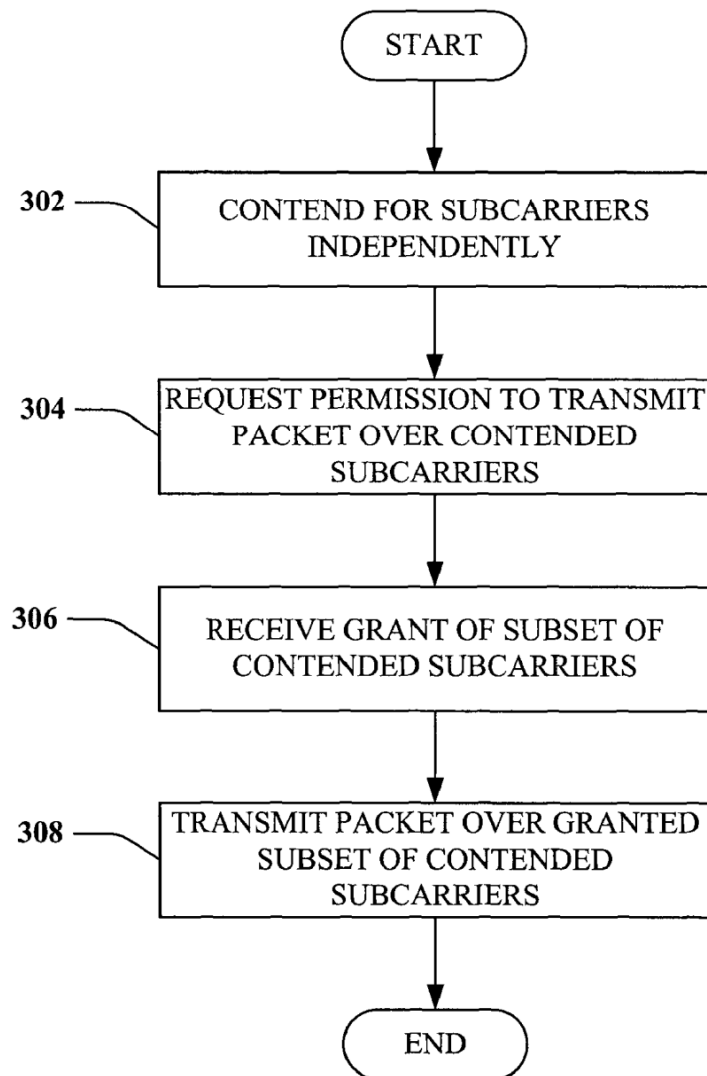
successfully achieved subcarriers. When contending jointly across subcarriers, a transmitter may send a 1-bit RTS on each of the desired subcarriers and utilize the subset of subcarriers on which it receives a CTS signal.” *Id.* at [0044].

It would have been obvious to a POSITA to modify the wider-band channel (80 MHz or greater) divided into 20 MHz subchannels as taught by Maltsev with Agrawal’s RTS/CTS protocol to send an RTS signal on each desired subchannel and to receive a CTS signal on only one or more of the subcarriers that is available, i.e., idle, to meet limitations 9[2]/13[4]. Ex. 1006 at ¶¶160-165, 221.

f. Limitations: 9[3]/13[5]: “receiving, by the first station, a data frame from the second 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 9[3]/13[5].

Agrawal also discloses using the RTS/CTS protocol as discussed with regard to Limitations 9[1]/13[1] and 9[2]/13[2].



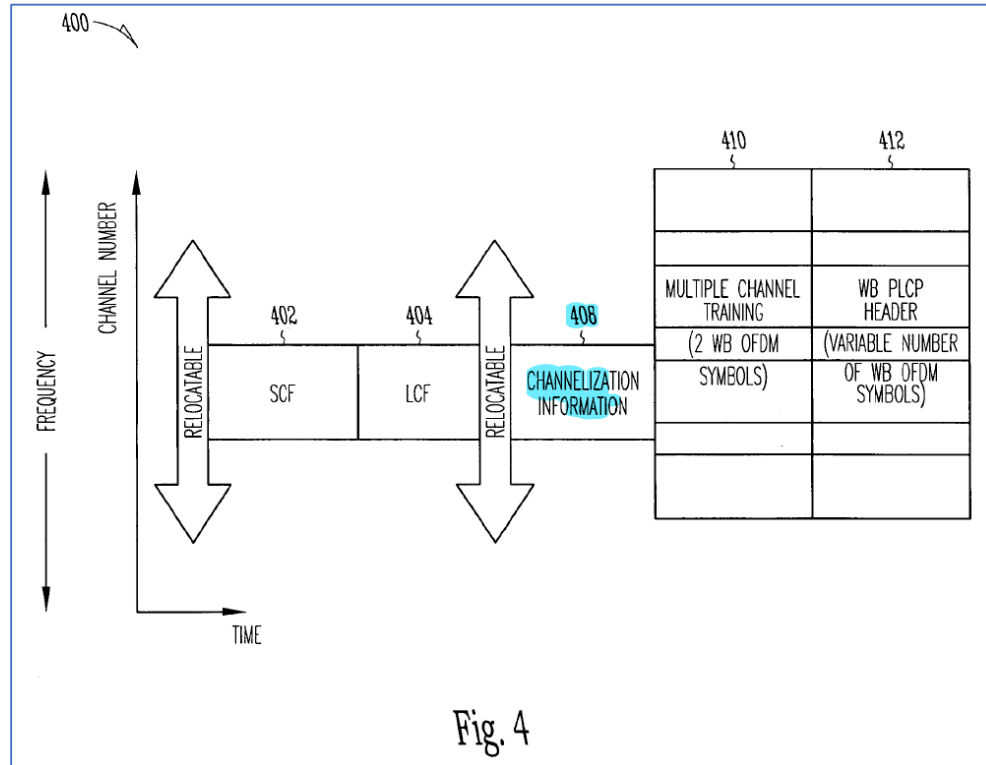
Ex. 1004 at FIG. 3.

Upon receipt of a grant (e.g., a CTS signal) for a 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 9[3]/13[5]. Ex. 1006 at ¶¶166-169, 222.

- g. Limitations: 9[4]/13[6]: “wherein the at least one CTS frame includes channel information related to the at least one idle subchannel through which the 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” many times. 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.

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



Id. at Fig. 4 (highlighting added).

Specifically, as shown by at least the captured text below describing Fig. 4, Maltsev discloses that that: (1) the frame format 400 can be used between the wider-band CUs (second station) and the AP (first station); (2) it can carry the “channelization information” 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. *Id.* 5:26-42.

Maltsev further discloses that the format 400 frames for a CU (second station) adapt dynamically to channel conditions by measuring the state of a channel and providing feedback on channel state to the AP (first station). For example, Maltsev additionally teaches that control frames can be transmitted on

any of the channels that contain an RTS/CTS exchange and the channelization information. *Id.* 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. Thus, the access terminal need not submit a request for a predetermined number of subcarriers and wait to receive a subcarrier assignment like prior art systems, but rather may submit an RTS over each specific subcarrier over which the terminal would like to transmit.” Ex. 1004 at [0038].

A POSITA would have understood from Agrawal that the CTS signal includes channel information that is used for determining the availability of the subcarrier on which the CTS signal was received and that the data frame is transmitted over the same subchannel associated with the channel information included in the CTS signal. A POSITA would have understood from Maltsev and Agrawal that the presence and use of channel information present in CTS frames render obvious Limitations 9[4]/13[6]. Ex. 1006 at ¶¶170-175, 223.

- h. Limitations: 9[5]/13[7]: “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.”**

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).

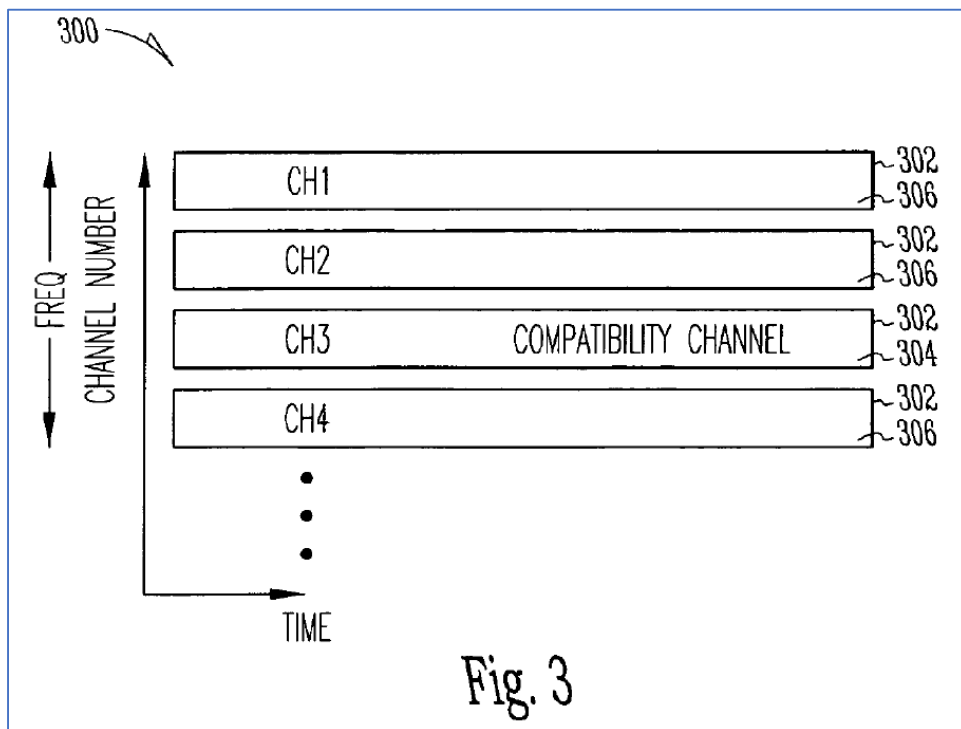
A POSITA would have understood from Agrawal that a station sending RTS signals over a plurality of subchannels is informed of available and unavailable subchannels based on the subchannels that return CTS frames and that this occurs in an environment that changes dynamically. Ex. 1004 at [0028], [0043]. Thus, Agrawal discloses receiving CTS frames over a subset of the contended subcarriers and meets limitations 9[5]/13[7] “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.”

Claims 9 and 13 are rendered obvious by the combined teachings of Maltsev and Agrawal. Ex. 1006 at ¶¶176-185, 224.

3. Claims 10/14: “The method/device of claim 9/13, wherein the number of the at least one idle subchannel is 1 or 2 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.

Fig. 3 of Maltsev illustrates an allocation of frequency spectrum 300 for communications among CUs 102 and for communications between CUs 102 (FIG. 1) and AP 104. Ex. 1003 at 4:32-36.



Id. at Fig. 3.

Wider-band CUs 108 simultaneously use a plurality of channels 302 such as the four channels (CH1-CH4) shown in Fig. 3. The aggregate spectrum of the channels used by wider-band CUs is a contiguous 80 MHz portion of the spectrum 300. Fig. 3 illustrates frequency spectrum 300 having four channels 302 (CH1-CH4) each of which is 20 MHz. *Id.* at 4:37-53. Maltsev teaches that

Although frequency spectrum 300 is illustrated as having four channels 302 (labeled as channels one through four), the scope of the invention is not limited in this respect. Embodiments of the present invention are equally suitable for use of more than four channels within an allocated portion of frequency spectrum 300. 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

Ex. 1003 at 4:41-49.

Therefore, Maltsev teaches the portion of claims 10 and 14 requiring “the number of the plurality of subchannels is 4.”

It is easy to understand that the idle/busy state and noise level of subchannels change with changes in surrounding conditions. Maltsev explains that a MAC layer of a CU is used to adapt dynamically to channel quality conditions by measuring the state of a channel and providing feedback on channel state. A

RTS/CTS exchange is used with control frames in the wideband channel 300 with channelization information. *Id.* at 7:42-49.

A POSITA would have understood that if, as shown in Fig. 3 and explained above, 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, i.e., “[a] decision about current channel state may be 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), then at any one time all or fewer than all four channels (CH1-CH4) may be determined to be idle or unavailable for transmission. Also, for a CTS signal to be transmitted in such an environment at least one of the channels CH1-CH4 must be idle.

Agrawal anticipates this environment and provides the capability for CTS signals to be transmitted over a subset of the channels contended for by the sent RTS signals. Ex. 1004 at [0044]. However, using FIG. 3 of Maltsev as a reference for even one CTS signal to be transmitted **at least one** of Maltsev's four channels (CH1-CH4) must be idle. That is, the number of idle subchannels must be 1. Thus, the combination of Maltsev modified in view of Agrawal meets claims 10/14. Ex. 1006 at ¶¶186-194, 225.

B. Ground 2: Claims 12 and 16 Are Unpatentable Under 35 U.S.C. §103 Over Maltsev in View of Agrawal Further Modified in View of Fracchia

1. Motivation to Combine Fracchia with Maltsev and Agrawal.

The Background of the Invention section of the '346 patent and Fracchia document the continuing motivation to increase the throughput of systems compatible with the various versions of the 802.11 Wi-Fi standards. This motivation continued even after the previously released 802.11n standard increased the data throughput over the previous Wi-Fi systems by ten-fold (*See e.g.*, Section V.C, *supra*).

With the widespread use of WLAN and the diversification of applications using the WLAN, there is a demand for a new WLAN system to support a higher throughput.”

Ex. 1001 at 3:6-9.

This analysis provides inputs on the technical feasibility of achieving 1Gbps aggregated MAC SAP throughput for below 6GHz amendment, by using different MAC layers which manage the access to different parallel channels.

Ex. 1009 at p. 2.

The reasons that a POSITA would combine Maltsev and Agrawal are explained in Ground 1. A POSITA would be further motivated to Fracchia with Maltsev and Agrawal for at least the following reasons.

First, they all have at least one embodiment or example that is specific to IEEE 802.11 (Wi-Fi) wireless communications. *See e.g.*, Ex. 1003 at 3:1-50; Ex. 1004 at [0040]; and Ex. 1009 at p. 3. Second, they all are in regard to OFDM wireless communications. *See e.g.*, Ex. 1003 at 2:18-32; Ex. 1004 at [0037], [0062] and [0067]; and Ex. 1009 at p. 2. Third, they are all focused on the same objective—improving the throughput (data speed) of high throughput/wideband wireless networks. *See e.g.*, Ex. 1003 at 1:7-27; Ex. 1004 at Abstract; and Ex. 1009 at pp. 2-9. Fourth, Ex. 1009 is an analysis of OFDM wideband techniques and provides specific objectives and functionality that a POSITA would have used to understand the direction of the next IEEE 802.11 release.

Fracchia (Ex. 1009) provides simulation test data that supports more than the required 1 Gbps throughput will be achieved by: (1) bonding four or more 20 MHz OFDM subchannels together.¹ As described above for Ground 1, Claims 9 and 13, Maltsev teaches that each additional bonded OFDM subchannel continues to increase the overall data throughput and four or more subchannels can be used for significant increases; (2) adding an additional MIMO spatial data

¹ The prior art 802.11n standard defines bonding two 20 MHz channels together to make a 40 MHz channel.

stream (antenna pair)² multiplies the data throughput when Maltsev's four or more bonded OFDM subchannels; and (3) exceeding 1 Gbps throughput requirement occurs when using five 20 MHz subchannels and four MIMO Spatial Streams (antennas pairs). Ex. 1006 at ¶229.

2. Claims 12/16: “The method of claim 9/13, wherein the first station is a Very High Throughput (VHT) non-Access Point (AP) station and the second station is a VHT AP station.”

It is important to note that claims 12 and 16 require a plurality of subchannels having a 20 MHz bandwidth but, in contrast to claim 10, which requires four subchannels, claims 12 and 16 place no specific limit on the number of the 20 MHz subchannels used to implement the RTS/CTS protocol. Thus, two or more subchannels and also more than four subchannels meet the “plurality” limitation. In other words, the number of the plurality of 20 MHz subchannels within the scope of claims 12 and 16 can be more than four, e.g., five subchannels.

Also, other than using the RTS/CTS protocol over the “plurality of subchannels,” as required by Claims 9/13, the claims do not recite any additional steps or technology to be applied to the prior art narrowband stations to make them Very High Throughput (VHT) stations. Moreover, based on at least the prior art 802.11n Wi-Fi recommendation (*See e.g.*, Section V) it was known before the

² As described in Ex. 1006 Sections V.C and V.B regarding the prior art 802.11n recommendation, each additional Spatial Stream (antenna pair) multiplies the data throughput when using two 20 MHz OFDM subchannels.

priority date of the '346 patent that by using two 20 MHz OFDM subchannels and four MIMO spatial streams (antenna pairs), throughput of at least 540 Mbps could be achieved. A POSITA would also have known that by doubling to four 20 MHz subchannels, as taught by Maltsev, from the two subchannels used in 802.11n but continuing to use four MIMO spatial streams (antenna pairs) as in 802.11n, and taught by prior art such as Fracchia, the throughput would double and would meet or exceed throughput of 1 Gbps in the multi-channel environment. Ex. 1006 at ¶¶231-239.

Further, a POSITA would have also understood that the 1 Gbps throughput requirement could have been met by: (1) increasing the number of bonded OFDM subchannels above four; or by (2) increasing the number of MIMO spatial streams (antenna pairs) being used above four; or (3) a combination of these two configurations. Ex. 1006 at ¶233. Also, Maltsev discloses both non-Access Point (AP) stations (Fig. 1, CU 102) and AP stations (Fig. 1, AP 104). Agrawal also discloses both non-Access Point (AP) stations (106, 108) and AP stations (102, 104). Ex. 1006 at ¶235-236.

Fracchia identified multiple OFDM configurations that would provide a throughput of 1Gbps or more. These different configurations for the next generation of the Wi-Fi protocol would have motivated a POSITA working in the field of Wi-Fi communications to consider the best combinations for the optimal

number of subchannels and MIMO spatial streams to use to meet or exceed the 1 Gbps throughput goal. Ex. 1006 at ¶237.

Fracchia clearly states that its analysis related to determining the feasibility for achieving 1 Gbps throughput for the current Wi-Fi networks (below 6 GHz) with:

Abstract

This analysis provides inputs on the technical feasibility of achieving 1Gbps aggregated MAC SAP throughput for below 6GHz amendment, by using different MAC layers which manage the access to different parallel channels

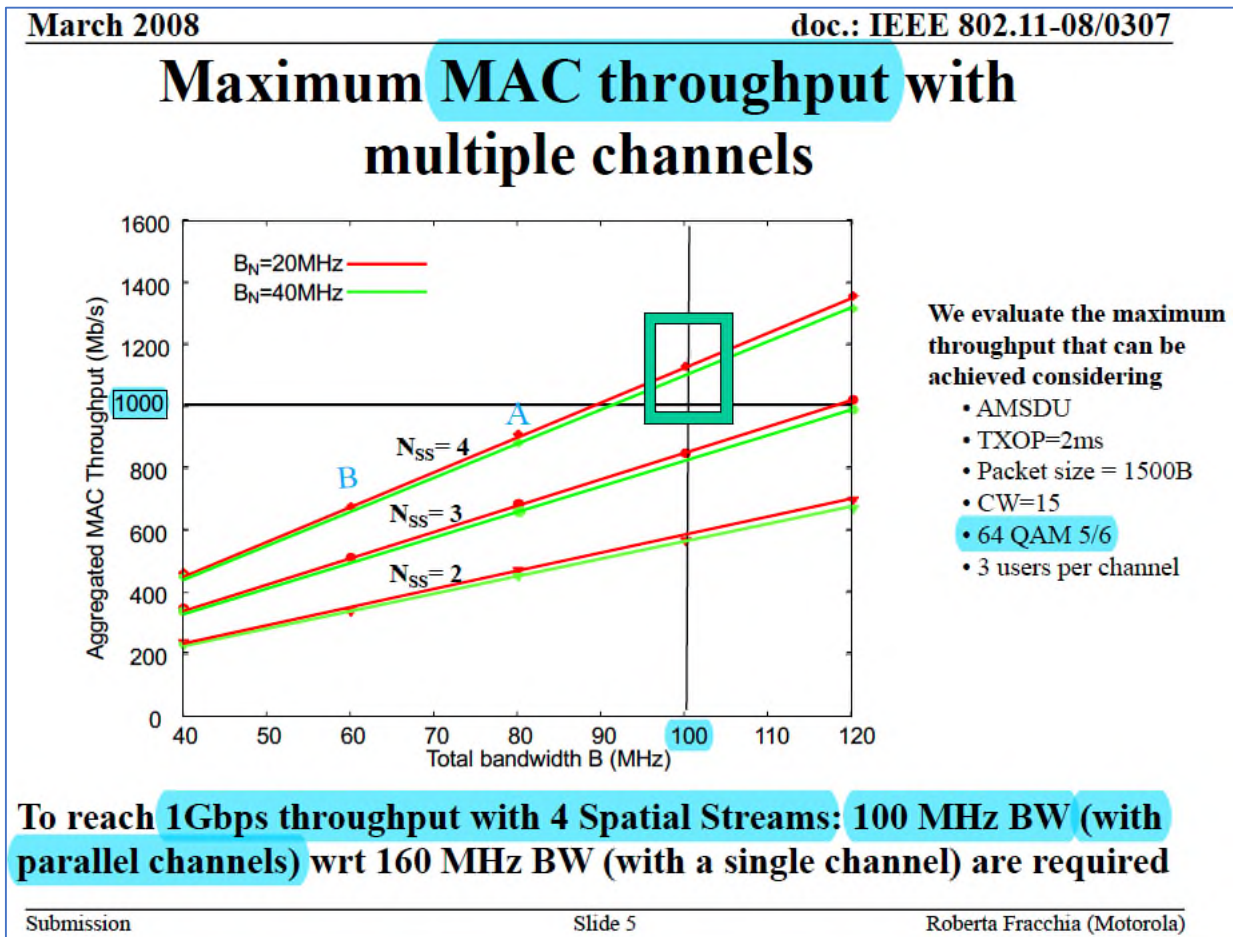
Ex. 1009 at p. 2 emphasis added.

As also discussed for Ground 1 above, Maltsev disclosed in Fig. 3 and its associated text that more than four subchannels can be used to increase the data throughput. Specifically, Maltsev teaches the use of the RTS/CTS protocol in a system having four or more channels within an allocated portion of frequency spectrum 300. Ex. 1003 at 4:41-49. The performance of Maltsev's four or more subchannels in a system using four spatial streams is summarized by experimental data published by Fracchia in the context of analyzing "the technical feasibility of achieving 1 Gbps aggregated MAC SAP throughput." Ex. 1009 at p. 2. As explained the RTS/CTS protocol, use of MIMO and four spatial streams, OFDM,

and the MAC SAP layers would have been well known prior to Fracchia's feasibility analysis (Section V.C.i-iv, *supra*). Fracchia establishes that 1 Gbps throughput would have been achieved by this combination of known technologies.

More specifically, Fracchia's analysis as set forth in the graph shown below indicates that an 80 MHz channel with four 20 MHz subchannels³ ($4 * 20 = 80$ MHz) could provide a MAC throughput on the X axis of around 900 Mbps (Annotation "A"), which is just below the target of 1 Gbps (1,000 Mbps). Fracchia further provides empirical support that additional subchannels provide a significant increase in the data throughput. Specifically, by increasing from three 20 MHz subchannels with a 60 MHz channel bandwidth (Annotation "B") to four 20 MHz subchannels with an 80 MHz channel (A), the MAC throughput on the X axis increases from about 700 Mbps to around 900 Mbps. From this resulting increase of about 200 Mbps in data throughput for one 20 MHz subchannel, a POSITA would have readily understood that by increasing the number of 20 MHz subchannels from four to five with a 100 MHz channel bandwidth, the data throughput would increase to well over 1Gbps as shown by green rectangle annotation. In other words, Fracchia shows that the throughput goal of 1Gbps would be exceeded when using five 20 MHz subchannels. Ex. 1006 at ¶¶239-241.

³ The throughput for 20 MHz subchannels is shown by the red line in the graph.



Ex. 1009 at p. 5 (highlighting added).

In sum, prior to the priority date of the '346 patent, Maltsev taught using the RTS/CTS protocol in a system having four or more 20 MHz subchannels. Fracchia confirmed experimentally that such a system when combined with known MIMO technology, known bonding OFDM subchannels, and known MAC protocol enhancements would result in throughput of 1 Gbps or more. All of this would have been known by, and be available to, a POSITA before the priority date of the '346 patent in the context of the well-established goal of increasing throughput under the progression of 802.11 standards. A

POSITA would have used Fracchia in combination with Maltsev and Agrawal to achieve the subject matter of claims 12 and 16. Moreover, Fracchia's experimental data would have provided a very high expectation that such a system would perform as simulated.

Claims 12 and 16 would have been obvious at the time of the alleged invention in view of the combination of Maltsev, Agrawal, and Fracchia as discussed above. This would have applied to both a "non-Access Point (AP) station" and a "VHT AP station." Ex. 1006 at ¶¶240-244.

C. Ground 3: Claims 12 and 16 Are Unpatentable Under 35 U.S.C. §103 Over Maltsev in View of Agrawal Modified in View of Sadowsky

1. Motivation to Combine Sadowsky with Maltsev and Agrawal

The motivation to combine Maltsev and Agrawal is discussed in Ground 1 above. A POSITA would also have been motivated to combine Sadowsky with Maltsev and Agrawal for multiple reasons. First, as described in Ex. 1006 at Section IX.F, Maltsev is also a co-inventor on the Sadowsky. Second, the Maltsev and Sadowsky patents were created during the same time frame. *Id.* at Section IX subsections A and F. Third, both patents relate to OFDM transmission in a wireless network with embodiments for the IEEE 802.11 Wi-Fi standard. *See e.g.*, Ex. 1003 at 3:1-50 and Ex. 1015 at 7:5-15. Fourth, both patents are focused on improving the efficiency and throughput of wideband wireless communications.

Therefore, a POSITA would have looked to Sadowsky to understand how multiple MIMO spatial streams that are being communicated using multiple antenna pairs can be combined with Maltsev's multiple bonded OFDM 20 MHz subchannels to increase the data throughput in a Wi-Fi system and how to use the RTS/CTS protocol for individual subchannels as defined in both Maltsev and Agrawal as described above in Ground 1. Ex. 1006 at ¶¶245-246.

2. Claims 12/16: “The method of claim 9, wherein the first station is a Very High Throughput (VHT) non-Access Point (AP) station and the second station is a VHT AP station.”

The construction of “Very High Throughput (VHT)” as “processing speed of 1 Gbps or more in the multi-channel environment” as set forth in Section IV.D.3, *supra*, is applicable. As explained with regard to Ground 1, claim 9, Maltsev discloses both non-Access Point (AP) stations (Fig. 1, CU 102) and AP stations (Fig. 1, AP 104). Agrawal also discloses both non-Access Point (AP) stations (106, 108) and AP stations (102, 104).

As explained with regard to Ground 1, claims 9/13 and in Ground 2, Maltsev teaches the use of the RTS/CTS protocol in a system that can have four or more 20 MHz OFDM subchannels. Ex. 1003 at 4:41-49; FIG. 3. As described in Ex. 1006 at Section IX.F, Sadowsky discloses creating many separate MIMO spatial data streams (antenna pairs) to transfer data for four or more OFDM

subchannels to increase the data throughput capability of a device. Ex. 1006 at ¶¶247-254. Specifically,

In some embodiments, transmitter 100 may transmit an OFDM symbol on a wideband communication channel. **The wideband channel may comprise one or more subchannels.** The subchannels may be frequency-division multiplexed (i.e., separated in frequency) and may be within a predetermined frequency spectrum. **The subchannels may include more than one spatial channel** and the spatial channels of a particular subchannel may use the same set of orthogonal subcarriers. In some embodiments, **a wideband channel may comprise up to four or more subchannels, and** each subchannel may have up to forty-eight or more orthogonal data subcarriers. Each subchannel may have a **number of spatial channels determined by the number of RF chains.** In some of these embodiments, the subchannels may have bandwidths of approximately **20 MHz**, and each OFDM subcarrier of each spatial channel of a subchannel may be assigned an individual spatial-frequency subcarrier modulation assignment between zero and ten or more bits per symbol. In these embodiments, **transmitter 100 may transmit the OFDM symbol over the spatial channels of the**

subchannels that comprise the wideband channel. Subchannels with greater or lesser bandwidths may also be suitable.

Ex. 1015 at 5:30-51 (emphasis added).

A POITA would have understood that Sadowsky teaches: (1) a device for use in a wireless communication system that has a channel bandwidth of 60 MHz or higher; (2) has a channel bandwidth that comprises three or more contiguous subchannels with an equal bandwidth; and (3) it can achieve a throughput of 1 Gbps or more, which are the requirements stated by the construction for a VHT device above.

Based on the teachings of Sadowsky, there are multiple configurations that a POSITA could have used to meet or exceed a 1 Gbps throughput. The two most significant variables that affect throughput taught by Sadowsky are the number of subchannels and the number of MIMO spatial streams used. Ex. 1015 at 2:23-30, 2:60-3:6, 4:47-57, 4:64-5:5 and 5:30-51. Sadowsky also teaches that each of these variables can be configured independently and the addition of a subchannel and/or a MIMO spatial stream provides significant additional throughput. *Id.* As described in Ex. 1006 at Section IX.F for Sadowsky, the addition of each OFDM subchannel provides an equal contribution to the overall throughput. *Id.* For example, the throughput for two subchannels would double the throughput of one subchannel and the throughput for four subchannels would be

double the throughput of two channels. *Id.* This concept is also supported by the prior art 802.11n Wi-Fi standard described in Ex. 1006 at Section V.C. Sadowsky also teaches that the addition of each MIMO spatial stream (antenna pair) linearly increases the throughput and then number of spatial streams can be less than 100. *Id.* at 4:64-5:5.

To achieve the 1 Gbps throughput requirement based on the teachings of Sadowski and knowledge of the prior art 802.11n standard, a POSITA would have understood from Maltsev that the two OFDM subchannels defined for 802.11n could be increased to four subchannels and the throughput would be doubled. Thus, the throughput, as stated by the '346 patent for the 802.11n standard of 540 Mbps (Ex. 1001 at 2:12-17), would be doubled to 1.08 Gbps, which exceeds the 1 Gbps requirement. Ex. 1006 at ¶258.

A POSITA would have also understood that in addition to adding additional OFDM subchannels, one or more additional MIMO spatial streams could also be added, which would further increase the throughput well above the 1 Gbps requirement. *Id.*

Having the knowledge that by using additional subchannels and/or additional MIMO spatial streams the throughput for the next generation of the Wi-Fi standard could be increased significantly would have motivated a POSITA working in the field of Wi-Fi communications to consider the best combination for

the optimal number of subchannels and MIMO spatial streams to use in order to meet or exceed the 1 Gbps throughput goal for each type of device being designed. *Id.* at ¶¶259-260.

In sum, well before the earliest priority date of the '346 patent, Maltsev and Sadowsky provided a POSITA with the tools to significantly increase data throughput in an 802.11 system. These tools included increasing the number of 20 MHz subchannels from two to four (40 MHz to 80 MHz channel bandwidth) as Maltsev had already done. In addition, Sadowsky informed a POSITA that increasing the number of MIMO streams could also multiply throughput. Ex. 1006 at ¶¶130-132 and Ex. 1015 at 4:64-5:5. Thus, a POSITA would have known that by adopting an OFDM system having four 20 MHz subchannels as taught by Maltsev and increasing the number of MIMO spatial streams from four to six or eight would have had a reasonable expectation of success in achieving data throughput of 1Gbps. The result of this combination would be a VHT device as recited in claims 12 and 16. Ex. 1006 at ¶¶250-263.

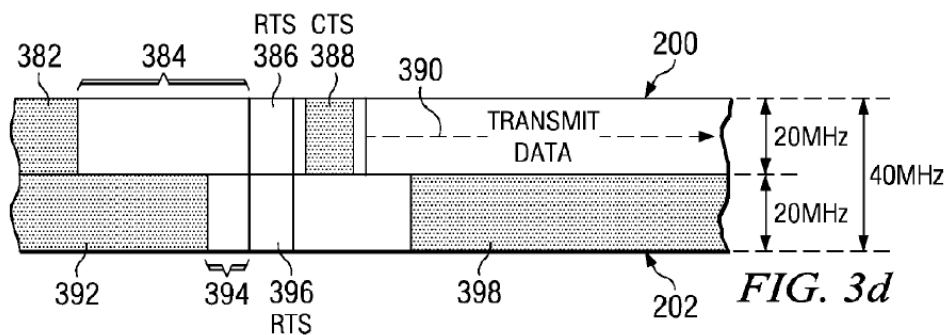
D. Ground 4: Claims 9, 10, 13, and 14 Would Have Been Obvious in View of Maltsev Modified in View of Xhafa

The relevance of Maltsev to the Challenged Claims was thoroughly discussed in Ground 1.

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. Ex. 1006 at ¶¶264-269.

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 ¶270.

2. Independent Claims 9 and 13

- a. Limitations: 9[pre]: “A method for receiving data in a wireless communication system, method comprising:” /13[pre]: “A device comprising:”**

Maltsev teaches Limitation 9[pre] for the reasons discussed for Ground 1, Claim 9, Limitation 9[pre]. Limitation 13[pre] is not limiting.

- b. Limitation 13[1]: “a transceiver; and”**

Maltsev teaches this limitation. Ground 1, Limitation 13[1]. Ex. 1006 at ¶295.

- c. Limitation 13[2]: “a processor operatively connected to the transceiver and configured to:”**

Maltsev discloses this limitation. Ground 1, Limitation 13[2]. Ex. 1006 at ¶296.

- d. Limitations 9[1]/13[3]: “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, each of the plurality of subchannels having a 20 megahertz (MHz) bandwidth;”**

Maltsev teaches this limitation for the reasons discussed regarding Ground 1, Limitations 9[1]/13[3]. Ex. 1006 at ¶¶272, 297.

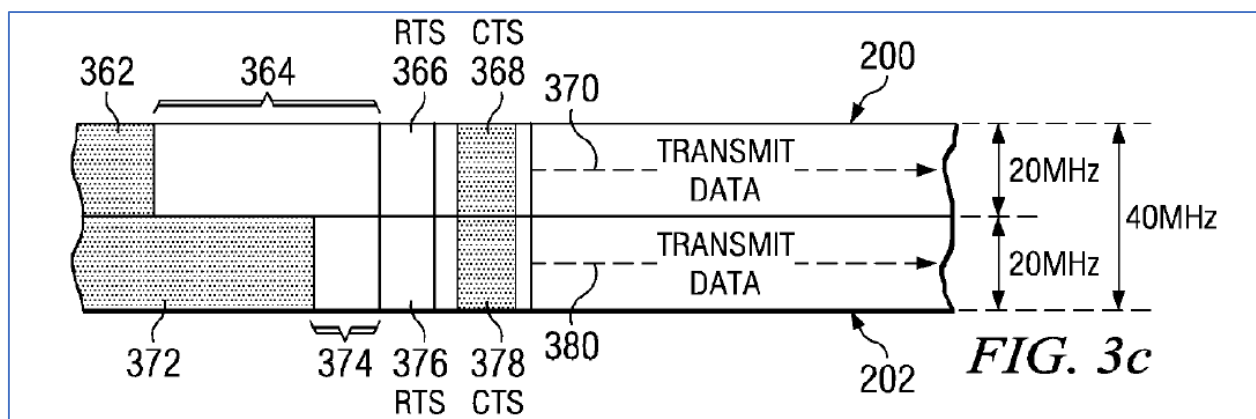
- e. **Limitations: 9[2]/13[4]: “transmitting, by the first station, at least one clear to send (CTS) frame in response to at least one of the plurality of RTS frames from the second station through at least one idle subchannel of the plurality of subchannels; and”**

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].

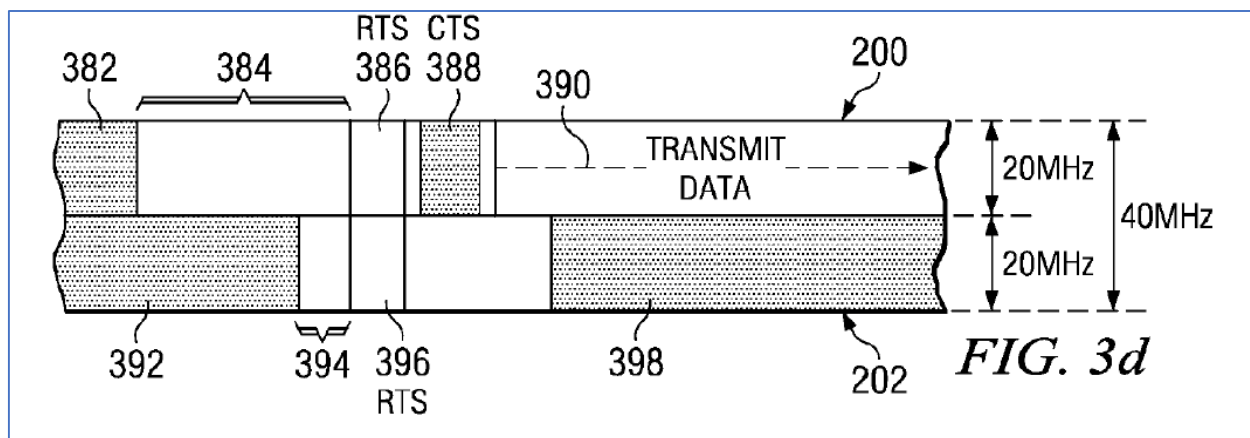
FIGs 3c and 3d shown below are relevant embodiments for the operation of Xhafa.



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 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 limitations 9[2]/13[4]. Ex. 1006 at ¶¶273-281, 298.

f. Limitations 9[3]/13[5]: “receiving, by the first station, a data frame from the second station after transmitting the at least one CTS frame,”

Maltsev teaches this limitation for the reasons discussed in Ground 1, claim 9, Limitations 9[3]/13[5]. Further, Xhafa shows this in FIG. 3d, above, and its corresponding description in the specification. *Id.* at [0029]; Ex. 1006 at ¶¶282-283, 299.

g. Limitations 9[4]/13[6]: “wherein the at least one CTS frame includes channel information related to the at least one idle subchannel through which the 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 this limitation as discussed with respect to Ground 1, claim 1, Limitations 9[4]/13[6]. Xhafa also teaches this limitation as described above regarding the embodiment of FIG. 3d and its description text. *Id.* at [0028], [0029]. Ex. 1006 at ¶¶279-281, 284-285, 300.

- h. Limitations 9[5]/13[7]: “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.”**

This additional limitation is 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 ¶286, 301.

- 3. Claims 10/14: “The method of claim 9/14, wherein the number of the at least one idle subchannel is 1 or 2 when the number of the plurality of subchannels is 4.”**

Claims 10 and 14 are obvious over the combination of Maltsev modified in view of Xhafa.

The relevance of Maltsev is discussed with regard to Ground 1, claim 10. In sum, Maltsev discloses the use of four or more 20 MHz subchannels, in Fig. 3 and Maltsev explicitly teaches an embodiment using subchannels CH1-CH4, i.e., wherein the “number of the plurality of subchannels is 4.” Ex. 1006 at ¶¶287-289.

As discussed with regard to Ground 4, limitations 9[5]/13[5], Xhafa teaches transmitting RTS signals over all 20 MHz channels that comprise the 40 MHz super channel but only receiving a CTS signal on one of the 20 MHz channels because the other 20 MHz channel was busy. A POSITA would have understood that in modifying Maltsev’s four 20 MHz subchannel embodiment in view of the

teachings of Xhafa, CTS signals would be received only on subchannels that were not busy. Maltsev further teaches that frames of format 400 are used by a MAC layer of a CU to adapt dynamically to channel quality conditions by measuring the state of a channel and providing feedback on channel state. Ex. 1003 at 7:42-47.

A POSITA would have recognized from Maltsev and Xhafa that channel conditions change dynamically as channels transition between the busy and idle states due to communication traffic from other stations over the channel. The amount of interference (noise) on each subchannel is typically different because each subchannel uses a different frequency and are affected differently. Xhafa in FIG. 3d shows a two-channel system where RTS signal are transmitted over all (both) of the 20 MHz channels 200 and 202 and a CTS signal is transmitted over only one channel because the other channel has transitioned to the busy state such that the RTS signal on that channel was not received. Thus, a POSITA would have understood, that in the four subchannel embodiment of Maltsev, if due to the dynamic transitions in channel state or different levels of interference, only two subchannels were idle or met the quality requirement, CTS signals would be received over only the remaining two idle subchannels and if only one subchannel is idle or has an acceptable interference level, only a single CTS signal would be received.

Thus, dependent claims 10 and 14 would have been obvious over Maltsev modified in view of Xhafa. Ex. 1006 at ¶¶288-293, 302.

E. Ground 5: Claims 12 and 16 Are Unpatentable Under 35 U.S.C. §103 Over Maltsev in View of Xhafa Modified in View of Fracchia

1. Motivation to Combine Fracchia with Maltsev and Xhafa

The Background of the Invention section of the '346 patent and Fracchia state the continuing motivation to increase the throughput of systems compatible with the various versions of the 802.11 Wi-Fi standards. This motivation continued even after the previously released 802.11n standard increased the data throughput over the previous Wi-Fi systems by ten-fold (*See e.g.*, Ex. 1006 at Section V.C, and ¶303.

With the widespread use of WLAN and the diversification of applications using the WLAN, there is a demand for a new WLAN system to support a higher throughput.”

Ex. 1001 at 3:6-9.

This analysis provides inputs on the technical feasibility of achieving 1Gbps aggregated MAC SAP throughput for below 6GHz amendment, by using different MAC layers which manage the access to different parallel channels.

Ex. 1009 at p.2.

Motivation to combine Maltsev and Xhafa is explained with regard to Ground 4. A POSITA would be further motivated to combine Fracchia, Maltsev and Xhafa for a number of reasons. First, the Fracchia, Maltsev, and Xhafa all have at least one embodiment or example that is specific to IEEE 802.11 (Wi-Fi) wireless communications. *See e.g.*, Ex. 1003 at 3:1-50; Ex. 1005 at [0002]-[0004]; and Ex. 1009 at p. 3. Second, they all are regarding OFDM wireless communications. *See e.g.*, Ex. 1003 at 2:18-32; Ex. 1005 at [0002]-[0003]; and Ex. 1009 at p. 2. Third, they are all focused on the same objective—improving the throughput (data speed) of high throughput/wideband wireless networks. *See e.g.*, Ex. 1003 at 1:7-27; Ex. 1005 at [0003]-[0004]; and Ex. 1009 at pp. 2-9. Fourth, Ex. 1009 is an analysis of OFDM wideband techniques and provides specific objectives and functionality that a POSITA would have used to understand the direction of the next IEEE 802.11 release. Ex. 1006 at ¶¶305-306.

Moreover, a POSITA would have had a strong expectation of success because the simulation results set forth in Fracchia verify that a system constructed as taught in Maltsev and Xhafa would provide VHT throughput of 1 Gbps or more. Ex. 1009 at p. 5.

2. Claim 12/16: “The method of claim 9/13, wherein the first station is a Very High Throughput (VHT) non-Access Point (AP) station and the second station is a VHT AP station.”

The discussion regarding Ground 2, Claims 12 and 16 establishes that Fracchia provides the motivation for an embodiment of Maltsev including five 20 MHz which Fracchia shows through simulation provides “processing speed of 1 Gbps or more in the multi-channel environment,” which is the proper construction of “Very High Throughput/VHT.” Thus, the identical, additional limitations of claims 12 and 16 are obvious over the modification of Maltsev and Xhafa in view of Fracchia. *See*, Section VII.B.2, *supra*; Ex. 1006 at ¶¶307-321.

F. Ground 6: Claims 12 and 16 Are Unpatentable Under 35 U.S.C. §103 Over Maltsev in View of Xhafa Modified in View of Sadowsky

1. Motivation to Combine Sadowsky with Maltsev and Xhafa

The motivation to combine Maltsev and Xhafa is discussed in connection with Ground 4. A POSITA would have been motivated to combine Sadowsky with Maltsev and Xhafa for multiple reasons. First, as described in Ex. 1006 at Section IX.F, Maltsev is an inventor of Ex. 1003 and is a co-inventor of Sadowsky (Ex. 1015). Second, the Maltsev and Sadowsky patents were invented during the same time frame. *See* Ex. 1006 at Section IX subsections A and F. Third, both patents are regarding OFDM transmission in a wireless network with embodiments for the IEEE 802.11 standard. *See e.g.*, Ex. 1003 at 3:1-50 and Ex.

1015 at 7:5-15. Fourth, they both are focused on improving the efficiency of wideband wireless communications.

Therefore, a POSITA would use Sadowsky to understand how MIMO spatial streams from multiple antennas can be combined with the multiple bonded 20 MHz subchannels defined in Maltsev and how to use the RTS/CTS protocol as defined in both Maltsev and Xhafa as described above in Ground 4. Ex. 1006 at ¶¶322-323.

2. Claims 12/16: “The method of claim 9/13, wherein the first station is a Very High Throughput (VHT) non-Access Point (AP) station and the second station is a VHT AP station.”

Ground 3 explains how Maltsev and Sadowsky provided a POSITA with the knowledge necessary to achieve VHT throughput by increasing the number of 20 MHz subchannels as taught by Maltsev or by increasing the number of MIMO spatial streams as taught by Sadowsky or, of course, by adopting both teachings. Thus, claims 12/16 are invalid as obvious in view of the combination of Maltsev modified in view of Xhafa and further combined with the teaching of Sadowsky for the reasons provided for Ground 3. Ex. 1006 at ¶¶324-340.

**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 '346 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, Agrawal, Fracchia, and Sadowsky are not cited on the face of the '346 patent and are not referenced in the file history of the '346 patent. Only one 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

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 13,267. 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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