

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MEDIATEK INC. and
MEDIATEK USA, INC.
Petitioners,

v.

NIPPON TELEGRAPH AND TELEPHONE CORPORATION,
Patent Owner.

Case No. TBD
Patent No. 7,280,551

DECLARATION OF TIM A. WILLIAMS, Ph.D.

MediaTek Exhibit 1003 MediaTek v. Nippon

TABLE OF CONTENTS

I.	PERSONAL AND PROFESSIONAL BACKGROUND	1
II.	MATERIAL REVIEWED AND CONSIDERED	3
III.	MY UNDERSTANDING OF PATENT LAW	6
	A. Anticipation	7
	B. Obviousness.....	7
IV.	PERSON OF ORDINARY SKILL IN THE ART (“POSA”).....	10
V.	OVERVIEW OF THE ’551 PATENT	12
	A. Technology Background	12
	1. The 802.11-1999 WiFi Standard.....	13
	2. Multi-Channel Transmission.....	16
	3. Multiple Input, Multiple Output (MIMO) Antennas	19
	B. THE ’551 PATENT.....	23
	1. The Alleged Problem in the Prior Art.....	23
	2. The Purported Solution	26
	C. Summary of Claims.....	31
	D. Prosecution History	35
VI.	GROUND FOR UNPATENTABILITY	36
	A. <u>Ground 1</u> : Claims 1, 3, 5, and 7 Would Have Been Obvious Over Shpak (Ex. 1005) in View of Ho (Ex. 1006).....	36
	1. Shpak (Ex. 1005).....	36
	2. Ho (Ex. 1006).....	42
	3. Implementing Shpak in View of Ho	47
	4. Independent Claim 1	53
	a. [1PRE] A wireless packet communication method for transmitting a plurality of wireless packets simultaneously by using [1] multiple wireless channels determined to be idle by carrier sense, [2] a single wireless channel determined to be idle and MIMO, or	

[3] the multiple wireless channels and the MIMO, the method comprising:	53
(1) The Scope of the Preamble.....	53
(2) Shpak-Ho Meets the Preamble	56
b. [1A] setting a mandatory channel that is always used for transmission; and.....	61
c. [1B] transmitting the wireless packets by using a wireless channel/wireless channels that includes/include the mandatory channel, only when the mandatory channel is idle.	63
5. Dependent Claim 3: The wireless packet communication method according to claim 1 or 2, wherein the plurality of wireless packets transmitted simultaneously are set to have a same or equivalent packet time length that corresponds to a packet size or a transmission time.....	64
6. Independent Claim 5	67
a. [5PRE] A wireless packet communication apparatus for transmitting a plurality of wireless packets simultaneously by using multiple wireless channels determined to be idle by carrier sense, a single wireless channel determined to be idle and MIMO, or the multiple wireless channels and the MIMO, the apparatus comprising:	67
b. [5A] a unit setting a mandatory channel that is always used for transmission; and	69
c. [5B] transmitting the wireless packets only when the mandatory channel is idle by using a wireless channel or wireless channels that includes/include the mandatory channel.....	70
7. Dependent Claim 7: The wireless packet communication apparatus according to claim 5 or 6, wherein the plurality of wireless packets transmitted simultaneously are set to have a same or equivalent packet time length that corresponds to a packet size or a transmission time.....	70
B. Ground 2: Claims 1, 3-5, 7-8 Would Have Been Obvious Over Shpak (Ex. 1005) in View of Lundby (Ex. 1008).....	71

1.	Shpak (Ex. 1005).....	71
2.	Lundby (Ex. 1008)	71
3.	Implementing Shpak in View of Lundby.....	76
4.	Independent Claim 1	85
	a. [1PRE] A wireless packet communication method for transmitting a plurality of wireless packets simultaneously by using [1] multiple wireless channels determined to be idle by carrier sense, [2] a single wireless channel determined to be idle and MIMO, or [3] the multiple wireless channels and the MIMO, the method comprising:	85
	(1) The Scope of the Preamble.....	85
	(2) Shpak-Lundby Meets the Preamble.....	85
	b. [1A] setting a mandatory channel that is always used for transmission; and.....	87
	c. [1B] transmitting the wireless packets by using a wireless channel/wireless channels that includes/include the mandatory channel, only when the mandatory channel is idle.	88
5.	Dependent Claim 3: The wireless packet communication method according to claim 1 or 2, wherein the plurality of wireless packets transmitted simultaneously are set to have a same or equivalent packet time length that corresponds to a packet size or a transmission time.....	89
6.	Dependent Claim 4: The wireless packet communication method according to claim 1 or 2, further comprising simultaneously transmitting wireless packets selectively using the multiple wireless channels or the MIMO in accordance with a number of pieces of data or a number of MIMOs that depends on a channel condition.	92
7.	Independent Claim 5	94
	a. [5PRE] A wireless packet communication apparatus for transmitting a plurality of wireless packets simultaneously by using multiple wireless channels determined to be idle by carrier sense, a single wireless	

channel determined to be idle and MIMO, or the multiple wireless channels and the MIMO, the apparatus comprising:	94
b. [5A] a unit setting a mandatory channel that is always used for transmission; and	95
c. [5B] transmitting the wireless packets only when the mandatory channel is idle by using a wireless channel or wireless channels that includes/include the mandatory channel.	96
8. Dependent Claim 7: The wireless packet communication apparatus according to claim 5 or 6, wherein the plurality of wireless packets transmitted simultaneously are set to have a same or equivalent packet time length that corresponds to a packet size or a transmission time.....	97
9. Dependent Claim 8: The wireless packet communication apparatus according to claim 5 or 6, further comprising: a unit simultaneously transmitting wireless packets selectively using the multiple wireless channels or the MIMO in accordance with a number of pieces of data or a number of MIMOs that depends on a channel condition.....	97
C. Ground 3: Claims 1-3 and 5-7 Would Have Been Obvious Over Bugeja (Ex. 1007) in View of Ho (Ex. 1006)	98
1. Bugeja (Ex. 1007)	98
2. Ho (Ex. 1006).....	105
3. An Obvious Implementation of Bugeja in View of Ho	105
4. Independent Claim 1	111
a. [1PRE] A wireless packet communication method for transmitting a plurality of wireless packets simultaneously by using [1] multiple wireless channels determined to be idle by carrier sense, [2] a single wireless channel determined to be idle and MIMO, or [3] the multiple wireless channels and the MIMO, the method comprising:	111
(1) The Preamble's Scope	111
(2) Bugeja-Ho Meets the Preamble.....	112

b.	[1A] setting a mandatory channel that is always used for transmission; and.....	114
c.	[1B] transmitting the wireless packets by using a wireless channel/wireless channels that includes/include the mandatory channel, only when the mandatory channel is idle.	118
5.	Dependent Claim 3: The wireless packet communication method according to claim 1 or 2, wherein the plurality of wireless packets transmitted simultaneously are set to have a same or equivalent packet time length that corresponds to a packet size or a transmission time.....	120
6.	Independent Claim 5	121
a.	[5PRE] A wireless packet communication apparatus for transmitting a plurality of wireless packets simultaneously by using multiple wireless channels determined to be idle by carrier sense, a single wireless channel determined to be idle and MIMO, or the multiple wireless channels and the MIMO, the apparatus comprising:	122
b.	[5A] a unit setting a mandatory channel that is always used for transmission; and	123
c.	[5B] transmitting the wireless packets only when the mandatory channel is idle by using a wireless channel or wireless channels that includes/include the mandatory channel.....	125
7.	Dependent Claims 7: The wireless packet communication apparatus according to claim 5 or 6, wherein the plurality of wireless packets transmitted simultaneously are set to have a same or equivalent packet time length that corresponds to a packet size or a transmission time.....	126
8.	Independent Claim 2	127
a.	[2PRE] A wireless packet communication method for transmitting a plurality of wireless packets simultaneously by using multiple wireless channels determined to be idle by carrier sense, a single wireless channel determined to be idle and MIMO, or the	

multiple wireless channels and the MIMO, the method comprising.....	127
(1) The Scope of the Preamble.....	127
(2) Bugeja-Ho Meets the Preamble.....	128
b. [2A] distinguishing an STA A from an STA B, the STA A for which a mandatory channel is set, the STA B for which no mandatory channel is set, the mandatory channel being always used for transmission; and	131
c. [2B] when wireless packets are addressed to said STA A, transmitting the wireless packets to said STA A by using a wireless channel/wireless channels that includes/include the mandatory channel, only when the mandatory channel is idle; and	136
d. [2C] when wireless packets are addressed to said STA B, transmitting the wireless packets to said STA B by using idle wireless channel(s).....	137
9. Dependent Claim 6: A wireless packet communication apparatus for transmitting a plurality of wireless packets simultaneously by using multiple wireless channels determined to be idle by carrier sense, a single wireless channel determined to be idle and MIMO, or the multiple wireless channels and the MIMO, the apparatus comprising a unit distinguishing an STA A from an STA B and determining destinations of the wireless packets so as to transmit wireless packets addressed to said STA A only when said mandatory channel is idle by using a wireless channel or wireless channels that includes/include a mandatory channel, and to transmit wireless packets addressed to said STA B by using idle wireless channel or channels, the mandatory channel being always used for transmission, the STA A for which the mandatory channel is set, the STA B for which no mandatory channel is set.	140
D. Ground 4: Claims 4 and 8 Would Have Been Obvious Over Shpak-Ho or Bugeja-Ho in view of Thielecke.....	142
1. Shpak-Ho Combination.....	142

2.	Bugeja-Ho Combination	142
3.	Thielecke (Ex. 1035).....	142
4.	Obvious Implementations of Shpak-Ho and Bugeja-Ho in view of Thielecke.....	145
5.	Dependent Claim 4: The wireless packet communication method according to claim 1 or 2, further comprising simultaneously transmitting wireless packets selectively using the multiple wireless channels or the MIMO in accordance with a number of pieces of data or a number of MIMOs that depends on a channel condition.	149
6.	Dependent Claim 8: The wireless packet communication apparatus according to claim 5 or 6, further comprising: a unit simultaneously transmitting wireless packets selectively using the multiple wireless channels or the MIMO in accordance with a number of pieces of data or a number of MIMOs that depends on a channel condition.....	151
VIII.	CONCLUSION AND SIGNATURE	153

I, Tim A. Williams, declare:

1. I have been retained by Wolf, Greenfield & Sacks, P.C., counsel for Petitioners MediaTek Inc. and MediaTek USA, Inc. to assess claims 1-8 (the “challenged claims”) of U.S. Patent No. 7,280,551 (“the ’551 Patent”). I am being compensated for my time at my standard rate of \$675 per hour, plus actual expenses. My compensation is not dependent in any way upon the outcome of Petitioners’ petition for *inter partes* review of the ’551 Patent.

I. PERSONAL AND PROFESSIONAL BACKGROUND

2. I earned a Bachelor of Science degree in Electrical Engineering (BSEE) from Michigan Technological University in 1976. In 1982, I earned a Master’s degree, also in Electrical Engineering (MSEE), from the University of Texas at Austin. I earned a Doctor of Philosophy (Ph.D.) in Electrical Engineering also from the University of Texas at Austin, in 1985. My doctorate dissertation was “Digital Signal Processing Techniques for Acoustic Log Data.” In 1991, I earned a Master of Business Administration degree from the University of Texas at Austin as well.

3. I have over 40 years of professional experience in wireless communications and telecom technology, including roles in large corporations as well as start-ups and consulting work. My career has included the design, implementation, and sale of many wireless components and systems, including for

Institute of Electrical and Electronics Engineers (IEEE) 802.11-based wireless local area network (WLAN) at 2.4 GHz, 5.0 GHz, and 60 GHz.

4. For example, from 1979 through 1991, I held the positions of Senior Engineer, Senior Member of the Technical Staff, and Member of the Technical Staff at Motorola, Inc. My work at Motorola, Inc. included serving as business manager, project leader, and senior technical member for projects relating to the development of various cellular modems, transceivers, and transcoders.

5. As another example, in 1991, I co-founded Wireless Access, Inc., a start-up company focused on the Narrow Band PCS equipment market and which developed the over the air protocols, subscriber equipment, and integrated circuits to deploy 2-way paging services. I held the positions of Co-Founder, Chief Technical Officer, Vice President of Engineering, and Vice President of Business Strategy at Wireless Access, Inc. until it was sold to Glenayre Electronics in 1998.

6. As another example, between 1998 and 2000, I was the Chief Technology Officer and Advisory Board Member of Picazo Communications, which built and sold software PBXs Telephony equipment using VoIP and Circuit Switched Technologies.

7. As another example, in 2004, I founded DoceoTech Inc., which provides training for engineers in Wireless, Networking, and Telephony technologies. Since 2004, I have served as the Chairman of DoceoTech Inc.

8. From, 1999 to 2000, I was also an Interim CEO and Advisory Board Member of Atheros Communications, which built ICs for wireless LAN products including 802.11-based LANs.

9. I was the founder and CEO of JetQue Inc., which developed messaging solutions for mobile environments.

10. I was the founder and CEO of SiBEAM Inc., which developed high speed networking ICs for 60 GHz wireless LAN networking.

11. I hold over 25 United States patents in wireless and signal processing technology, as well as numerous patent applications in the same field.

Additionally, I am a Patent Agent registered with the U.S. Patent and Trademark Office since January 2002.

12. I have provided my opinions and/or testimony as an expert witness in topics relating to, for example, wireless communication technologies in matters before the International Trade Commission, U.S. district courts, and the U.S. Patent Trial and Appeals Board.

13. My curriculum vitae is provided as Exhibit 1004.

II. MATERIAL REVIEWED AND CONSIDERED

14. My findings, as explained below, are based on my years of education, research, experience, and background in fields related to wireless signal communications, including WiFi and cellular communications technologies, as

well as by investigation and study of relevant materials for this declaration. When developing the opinions set forth in this declaration, I assumed the perspective of a person having ordinary skill in the art, as set forth in Section IV below. In forming my opinions, I have studied and considered the materials identified in the list below.

Exhibit	Description
1001	U.S. Patent No. 7,280,551 (“the ’551 Patent”)
1002	File History for U.S. Patent No. 7,280,551 (“the ’551 FH”)
1005	U.S. Patent Appl. Pub. No. 2003/0206532 A1 (“Shpak”)
1006	U.S. Patent Appl. Pub. No. 2003/0169769 A1 (“Ho”)
1007	U.S. Patent Appl. Pub. No. 2003/0220112 A1 (“Bugeja”)
1008	U.S. Patent No. 6,560,292 B1 (“Lundby”)
1009	U.S. Patent Appl. Pub. No. 2002/0159431 A1 (“Moulsley”)
1010	U.S. Patent No. 6,591,107 (“Sonetaka”)
1014	U.S. Patent Appl. Pub. No. 2003/0086437 A1
1015	U.S. Patent Appl. Pub. No. 2003/0171115 A1
1016	U.S. Patent Appl. Pub. No. 2003/0222818 A1
1017	U.S. Patent No. 7,215,928
1018	U.S. Patent No. 6,987,819
1019	U.S. Patent Appl. Pub. No. 2002/0193146 A1
1020	U.S. Patent No. 7,224,704
1021	U.S. Patent No. 6,426,723
1022	U.S. Patent No. 7,317,770
1023	U.S. Patent No. 6,862,271
1024	U.S. Patent No. 6,941,110
1025	U.S. Patent No. 7,106,715
1026	U.S. Patent No. 7,408,907
1027	U.S. Patent No. 7,301,924
1028	U.S. Patent No. 7,039,412
1029	Certified Translation of Kurosaki et al., “100Mbit/s SDM-COFDM over MIMO Channel for Broadband Mobile Communications,” Technical Reports of the Institute of Electronics, Information and Communication Engineers, AP 2001-96, RCS2001-135 (2001-10).
1030	U.S. Patent No. 6,895,443

1031	U.S. Patent No. 7,006,451
1032	U.S. Patent No. 7,020,110
1033	U.S. Patent No. 7,031,249
1034	U.S. Patent No. 7,076,263
1035	U.S. Patent Appl. Pub. No. 2003/0003863 A1
1036	U.S. Patent No. 7,133,677
1037	U.S. Patent No. 7,321,762
1038	U.S. Patent No. 7,352,718
1039	U.S. Patent No. 7,421,046
1040	U.S. Patent No. 7,570,929
1041	U.S. Patent No. 7,586,884
1042	U.S. Patent Appl. Pub. No. 2002/0022483 A1
1043	U.S. Patent Appl. Pub. No. 2002/0078235 A1
1044	U.S. Patent No. 7,092,374
1050	U.S. Patent No. 6,411,608
1051	Internet Archive WayBack Machine, March 24, 2000, https://web.archive.org/web/20000324233339/http://standards.ieee.org/catalog/IEEE802.11.html

III. MY UNDERSTANDING OF PATENT LAW

15. In developing my opinions, I discussed various relevant legal principles with Petitioners' attorneys. I understood these principles when they were explained to me and have relied upon such legal principles, as explained to me, in the course of forming the opinions set forth in this declaration. My understanding in this respect is as follows:

16. I understand that "*inter partes* review" (IPR) is a proceeding before the United States Patent & Trademark Office for evaluating the patentability of an issued patent's claims based on prior-art patents and printed publications.

17. I understand that, in this proceeding, Petitioners have the burden of proving that the challenged claims of the '551 Patent are unpatentable by a preponderance of the evidence. I understand that "preponderance of the evidence" means that a fact or conclusion is more likely true than not true.

18. I understand that, in IPR proceedings, claim terms in a patent are given their ordinary and customary meaning as understood by a person of ordinary skill in the art ("POSA") in the context of the entire patent and the prosecution history pertaining to the patent. If the specification provides a special definition for a claim term that differs from the meaning the term would otherwise possess, the specification's special definition controls. I have applied these standards in preparing the opinions in this declaration.

19. I understand that for an invention claimed in a patent to be patentable, it must be, among other things, new (novel) and not obvious from the prior art.

A. Anticipation

20. I understand that, for a patent claim to be “anticipated” by the prior art (and therefore not novel), each and every limitation of the claim must be found, expressly or inherently, in a single prior art reference. I understand that a claim limitation is disclosed for the purpose of anticipation if a POSA would have understood the reference to disclose the limitation based on inferences that a POSA would reasonably be expected to draw from the express teachings in the reference when read in light of the POSA’s knowledge and experience.

21. I understand that a claim limitation is inherent in a prior art reference if that limitation is necessarily present when practicing the teachings of the reference, regardless of whether a person of ordinary skill recognized the presence of that limitation in the prior art.

B. Obviousness

22. I understand that a patent claim may be unpatentable if it is obvious in view of a single prior-art reference or a combination of prior-art references.

23. I understand that a patent claim is obvious if the differences between the subject matter of the claim and the prior art are such that the subject matter as a whole would have been obvious to a person of ordinary skill in the relevant field at

the time the invention was made. Specifically, I understand that the obviousness question involves a consideration of:

- the scope and content of the prior art;
- the differences between the prior art and the claims at issue;
- the knowledge of a person of ordinary skill in the pertinent art; and
- if present, objective factors indicative of non-obviousness, sometimes referred to as “secondary considerations.” To my knowledge, the Patent Owner has not asserted any such secondary considerations with respect to the ’551 Patent.

24. I understand that in order for a claimed invention to be considered obvious, a POSA must have had a reason for combining teachings from multiple prior-art references (or for altering a single prior-art reference, in the case of obviousness in view of a single reference) in the fashion proposed.

25. I further understand that in determining whether a prior-art reference would have been combined with other prior art or with other information within the knowledge of a POSA, the following are examples of approaches and rationales that may be considered:

- combining prior-art elements according to known methods to yield predictable results;

- simple substitution of one known element for another to obtain predictable results;
- use of a known technique to improve similar devices in the same way;
- applying a known technique to a known device ready for improvement to yield predictable results;
- applying a technique or approach that would have been “obvious to try,” *i.e.*, choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success.
- known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations would have been predictable to one of ordinary skill in the art;
- some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior-art reference or to combine prior-art reference teachings to arrive at the claimed invention. I understand that this teaching, suggestion, or motivation may come from a prior-art reference or from the knowledge or common sense of one of ordinary skill in the art.

26. I understand that for a single reference or a combination of references to render the claimed invention obvious, a POSA must have been able to arrive at the claims by altering or combining the applied references.

IV. PERSON OF ORDINARY SKILL IN THE ART (“POSA”)

27. I have been informed and understand that for purposes of assessing whether prior-art references disclose every element of a patent claim (thus “anticipating” the claim) and/or would have rendered the claim obvious, the patent and the prior-art references must be assessed from the perspective of a person having ordinary skill in the art (“POSA”) to which the patent is related, based on the understanding of that person at the time of the patent claim’s priority date. I have been informed and understand that a POSA is presumed to be aware of all pertinent prior art and the conventional wisdom in the art and is a person of ordinary creativity. I have applied this standard throughout my declaration.

28. The ’551 Patent involves technology in the field of wireless signal communications systems, as I discuss in Section V.B.1-.2 below. I have been asked to provide my opinions as to the state of the art in this field by September 2003. I use this timeframe because the face of the ’551 Patent indicates an earliest claimed priority date of September 9, 2003. *See* Ex. 1001, (30). Whenever I offer an opinion in this declaration about the knowledge of a POSA, the manner in which a POSA would have understood the claims of the ’551 Patent or its

description, the manner in which a POSA would have understood the prior art, or what a POSA would have been led to do based on the prior art, I am referencing the timeframe just before September 9, 2003, even if I do not say so specifically in each case. However, my opinion on the level of ordinary skill would not be different if the priority date of the '551 Patent were its PCT filing date of September 9, 2004, Ex. 1001, (22), or its U.S. filing date of October 14, 2005, Ex. 1001, (86).

29. I understand that the Patent Owner may attempt to prove that the alleged invention recited in the challenged claims was conceived at some time prior to the earliest claimed priority date on the face of the patent (September 9, 2003). At the time of this declaration, I am unaware of the Patent Owner having alleged an earlier conception date or produced any evidence to establish an earlier conception date.

30. In my opinion, a person of ordinary skill in the art in the timeframe just before September 9, 2003 (or 2004 when the '551 Patent's non-provisional application was filed) ("POSA") would have had a B.S. in Electrical Engineering, or the equivalent, and 3-4 years of experience designing wireless packet communication devices, including 802.11-compliant devices. More education could substitute for experience, and vice versa. This person would have been

capable of understanding and applying the teachings of the '551 Patent and the prior-art references discussed in this declaration.

31. By 2003, I held a Ph.D. in Electrical Engineering, and I had over 15 years of research and industry experience with wireless signal communications systems, including Wireless LAN and Cellular communications systems, including in connection with my roles as a Senior Engineer at Motorola, Inc., a co-founder, CTO, and VP of Engineering at Wireless Access, Inc., and interim CEO at Atheros Communications. *See, e.g.*, Paragraphs 4-5, 8 above. Therefore, I was a person of more than ordinary skill in the art during the relevant timeframe. However, I worked with and managed many people who fit the characteristics of the POSA, and I am familiar with their level of skill. When developing the opinions set forth in this declaration, I assumed the perspective of a person having ordinary skill in the art, as set forth above.

V. OVERVIEW OF THE '551 PATENT

A. Technology Background

32. The '551 Patent relates to a method and apparatus for “simultaneously transmitting a plurality of wireless packets by using multiple channels or Multiple Input Multiple Output (MIMO).” Ex. 1001, 1:15-19. Its background introduces three prior art concepts that form the foundation for the patent’s purported invention: (1) the IEEE 802.11-1999 WiFi standard, which was one part of the

standard that was shared by the more well-known standards 802.11a and 802.11b, (2) multiple wireless channel transmission techniques, and (3) multiple input, multiple output (MIMO) transmission techniques.

1. The 802.11-1999 WiFi Standard

33. The '551 Patent acknowledges that “conventional wireless packet communication apparatus[es]” communicated over a wireless channel in accordance with the 802.11-1999 standard. *Id.*, 1:23-29. The 802.11-1999 standard is the foundation for the more commonly known standards 802.11a and 802.11b, which were supplements to the 802.11-1999 standard. *See* Ex. 1014, [0010]. As a widely-implemented and well-known standard, IEEE made the 802.11-1999, 802.11a, and 802.11b standards readily available for anyone to download from the IEEE website, including non-members and general members of the public. I recall engineers at Atheros actively followed and contributed to the development of the 802.11 standard, and reviewed and relied on the 802.11b standard extensively during my time as interim CEO from 1999 to 2000. Ex. 1051 is consistent with my recollection. Ex. 1051 is an Internet Archive record of a page on the IEEE’s website as of March 24, 2000, listing the IEEE’s “Catalog” for “WIRELESS (802.11),” which I accessed at:

<https://web.archive.org/web/20000324233339/http://standards.ieee.org/catalog/IEE802.11.html>. Ex. 1051 confirms that as of March 24, 2000, 802.11-1999,

802.11a-1999, and 802.11b-1999 were available to purchase by IEEE members and members of the public. Ex. 1014 is also consistent with my recollection that the IEEE 802.11-1999 standards were publicly available before September 2003. Ex. 1014 is a U.S. Patent Application that was filed November 7, 2002 and claims priority to provisional applications filed in late 2001. *See* Ex. 1014, (22), (60). Ex. 1014 at [0010] notes “[t]he IEEE 802.11 Wireless LAN Standard is published in three parts as IEEE 802.11-1999; IEEE 802.11a-1999; and IEEE 802.11b-1999, which are available from the IEEE, Inc. web site <http://grouper.ieee.org/groups/802/11>.” I also note that during prosecution of the ’551 Patent, the applicants submitted to the PTO excerpts of the 802.11-1999 standard covering carrier sense, which I discuss in ¶ 35 below. Ex. 1002, 135-153.

34. Wireless communications systems communicate over “channels.” One common way in the prior art (and to this day) to define a channel is based on the center frequency of the carrier waves of the signals being transmitted over the channel. *See, e.g.*, Ex. 1015, [0011] (“[T]he channel actually represents the center frequency that the transceiver within the wireless-enabled device’s radio and access point uses....”). The 802.11b standard, for example, operates in the Industrial, Scientific, Medical (ISM) frequency band, which ranges between 2,400 and 2,483.5 MHz, and thus is more commonly referred to as the 2.4 GHz frequency band. Within the 2.4 GHz ISM band, “[t]he 802.11b standard defines 14

channels designated as channels 1 through 14,” starting at 2,412 MHz, with each subsequent channel spaced 5 MHz apart. Ex. 1015, [0009]. In the United States, “only channels 1 through 11” are permitted. Ex. 1015, [0009]. In practice, however, only three channels (channels 1, 6 and 11) are typically used to ensure that the spectrums of simultaneous transmissions over each channel are non-overlapping, which is done so that “access points that are within range of each other” can “avoid contention between access point and wireless-enabled devices.” Ex. 1015, [0009], [0011].

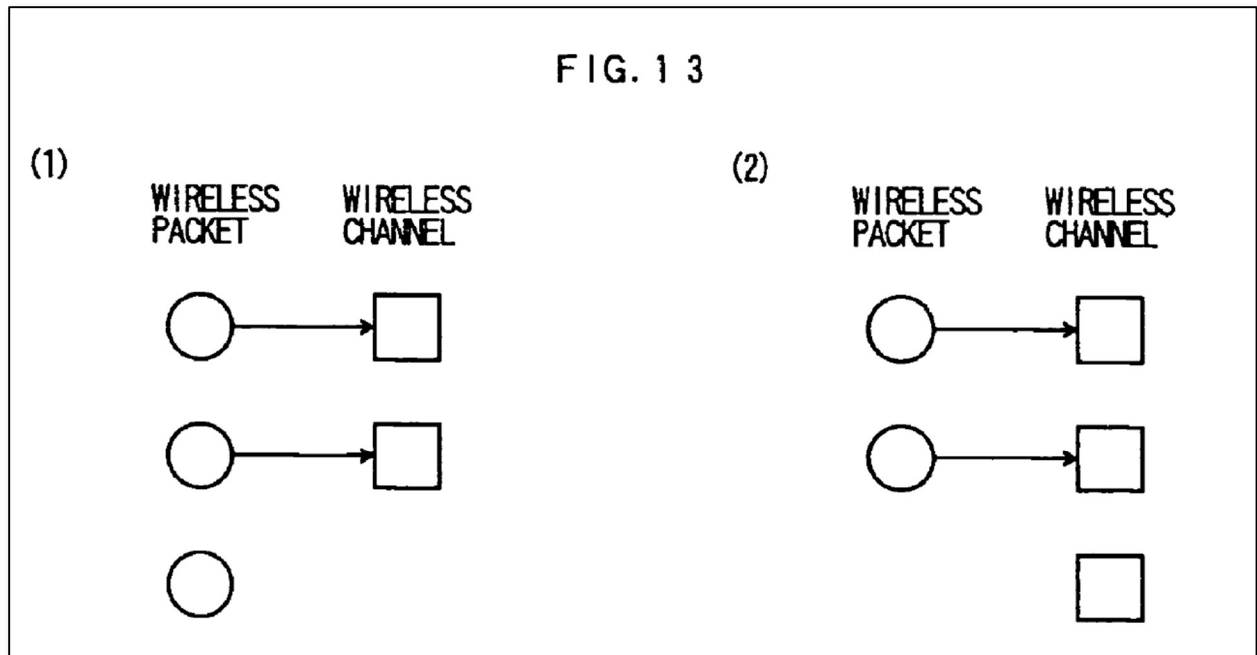
35. Before communicating on a channel, a conventional 802.11-1999 system uses a technique called carrier sense multiple access with collision avoidance (CSMA/CA) to determine whether the channel is available. “CSMA is a protocol used to avoid signals colliding and cancelling each other out.” Ex. 1025, 2:33-36; Ex. 1002, 136 (Excerpt from 802.11-1999: “The fundamental access method of the IEEE 802.11 MAC is a DCF known as *carrier sense multiple access with collision avoidance* (CSMA/CA),” which is used to “sense the medium the medium to determine if another STA is transmitting. If the medium is not determined to be busy (see 9.2.1), the transmission may proceed.”). These potentially colliding signals could be from other 802.11 device, but the potentially interfering signals could also be from non-802.11 devices that operate within the same band; for example, Bluetooth, cordless telephones, microwave ovens, baby

monitors are just some of the devices that typically operate in the 2.4 GHz ISM band used by 802.11b device. Ex. 1026, 1:15-27, 7:18-51 (noting that “devices operating in the[ISM bands] will inevitably interfere with the operation of each other”). Before transmitting, an 802.11 device or node “first ‘listens’ to ensure no other node is transmitting” (i.e., senses whether the channel is idle) and will only transmit “[i]f the communications channel is clear” (i.e., idle). Ex. 1033, 2:36-40. The sensing of the channel is performed by a clear channel assessment (CCA) protocol. Shpak, [0005]. The ’551 Patent confirms as background knowledge that “[i]n a conventional wireless packet communication apparatus,... the wireless packet communication apparatus performs carrier sense to detect whether or not that wireless channel is idle,” and cites systems implementing 802.11-1999, thus confirming that 802.11-1999 devices were packet-based communication apparatuses that sensed whether a wireless channel was idle before transmitting packets over the designated channel. Ex. 1001, 1:24-41.

2. Multi-Channel Transmission

36. All other things being equal (e.g., bandwidth of the channel, noise and interference within the channel, etc.), each communications channel can convey the same amount of data in the same amount of time (i.e., they can have equal data rates). Thus, it was well-known in the prior art that one simple way to increase the amount of data transmitted in a communications system was to use more than one

of the available channels. Bugeja (Ex. 1007), [0046] (noting that “a client has the capability of simultaneously transmission on all three channels, transmission to the access point can be up to three times faster”). As I discussed in Section V.A.1 above, a transmitter in an 802.11b system will perform carrier sense to check whether the channel is idle before transmitting over that channel. Thus, when multiple channels are to be used, carrier sense is applied to both channels, consistent with the 802.11b standard. The ’551 Patent confirms this was part of a POSA’s background knowledge, and explains that rather than using a single wireless channel to transmit data, POSAs had developed methods “in which, when multiple wireless channels are found idle by carrier sense, a plurality of wireless packets are transmitted by using the [multiple] wireless channels.” Ex. 1001, 1:43-48. “This method is generally describes with reference to FIGS. 13 and 14,” where Figures 13(1) and 13(2) (copied below) each depict a scenario in which two wireless packets are transmitted simultaneously over two idle wireless channels (Ex. 1001, 1:49-55):



37. In Figure 13(1), there are three wireless packets to be sent but only two idle wireless channels; thus only two of the three packets are transmitted simultaneously using the two idle channels. Ex. 1001, 1:49-52. In Figure 13(2), there are now only two wireless packets to be sent, but now there are three idle wireless channels. Thus, the two packets are transmitted simultaneously using two of the three idle channels. Ex. 1001, 1:52-55.

38. Thus, the '551 Patent acknowledges as background information using multiple channels to simultaneously transmit data packets was well-known by September 2003. I agree that this was well-known by 2003, and it is corroborated by various prior art references. For example, Ex. 1042 notes as background information that the IEEE 802.11 standard (specifically 802.11b) supports “3 non-overlapping RF channels” ([0007]-[0009]), and discloses an embodiment where

“one or more of the wireless access points may each utilize a plurality of the RF channels, e.g., may use each of the non-overlapping channels 1, 6 and 11 to effectively provide up to three times the normal capacity,” by “selecting obtain[ing] higher bandwidth when appropriate” ([0154]). Similarly, Lundby (Ex. 1008), discloses a system where a base station determines whether “a bit stream should be transmitted on a single channel or... in portions over two channels” (4:25-30). As another example, Bugeja discloses that “[w]ith both a multichannel client and multichannel access point, downloads to the client and uploads from the client are three times faster when all three channels are used” ([0046]).

3. Multiple Input, Multiple Output (MIMO) Antennas

39. In addition to increasing the capacity of a communication by using additional channels, by the year 2003 POSAs also knew that capacity of a single channel could be increased using Multiple Input, Multiple Output (MIMO) techniques. The '551 Patent acknowledges that MIMO was conventional as of the time of the invention. Ex. 1001, 1:56-63 (citing Ex. 1029 (Kurosaki)). As the '551 Patent explains, MIMO allows different wireless packets to be “transmitted from a plurality of antennas at the same time on the same wireless channel.” *Id.*, 1:61-63. By September 2003, POSAs knew a benefit of MIMO was that it allowed the capacity of a single wireless channel to be multiplied without increasing the bandwidth (range of frequencies) of the channel. The capacity is increased by

creating multiple, independent “subchannels” within the overall channel, which might be referred to as a “MIMO channel” when used for MIMO transmissions. By increasing the capacity of a single wireless channel, MIMO increases the rate at which data can be transmitted from an access point to a device (or vice versa), with the potential increase depending on the number of subchannels that are created. As Ex. 1019 notes at [0066], in a MIMO system, “the increase in throughput approaches N times the throughput of a single transmit system configured as a SIMO system or a system with no receive diversity, such as a SISO system, where N is equal to the minimum number of antennas at the transmitter or receiver.”

40. To create the MIMO subchannels, POSAs understood that it required multiple antennas on the transmitting side of the channel and multiple antennas on the receiving side of the channel, where the number of potential subchannels depended on how many antennas were on each side. For example, if there are two antennas on each side of the channel, two subchannels are possible; if there are three antennas on each side of the channel, three subchannels are possible; and so on. However, if there are, for example, three antennas on one side of the channel, but only two antennas on the other side, then only two MIMO subchannels are possible. As corroborating evidence, Ex. 1034 at 1:31-38 explains as background information that “[a] *MIMO Channel* formed by N_T transmit and N_R receive antenna may be decomposed into N_S independent channels, with $N_S \leq \min \{N_T,$

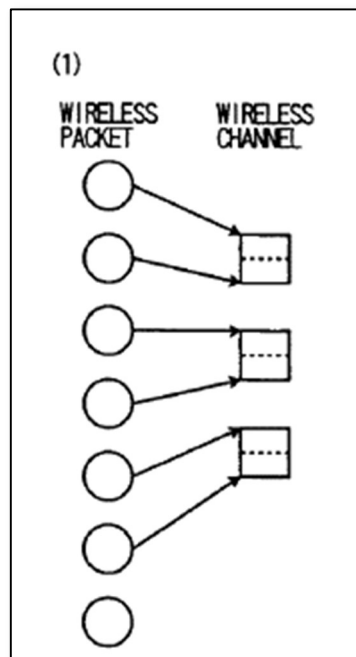
$N_R\}$. Each of the N_S independent channels is also referred to as a spatial ***subchannel*** (or a transmission channel) of the MIMO channel and corresponds to a dimension.”¹

41. By creating independent subchannels, all transmitter antennas in a MIMO system can simultaneously send independent data streams of packets using the same carrier frequency on the MIMO channel; that is, the independent data streams of packets can be sent over the same wireless frequency channel, thereby multiplying the capacity of the channel without requiring additional bandwidth (e.g., without requiring an additional frequency channel to send the same amount of data in the same amount of time). As corroborating evidence that MIMO was a well-known way to multiply the capacity of a wireless channel, Ex. 1019 at [0031] explains that “[u]sing Multiple Input-Multiple Output, MIMO, the transmitter can send ***multiple independent data streams on the same carrier frequency*** to a user.” Similarly, Ex. 1018, 1:18-23 teaches that “[o]ne such communication design known in the art is Multiple-Input/Multiple-Output (MIMO) and is a means of ***transmitting multiple data streams on the same time-frequency channel*** to a single receiver. The MIMO strategy involves deploying multiple antennas on both the transmitter and the receiver.” Thus, in “a single carrier MIMO system” “the

¹ All emphases have been added unless otherwise indicated.

entire system bandwidth is treated as a single frequency channel.” Ex. 1032, 7:40-42.

42. Figure 14(1) of the '551 Patent (below) depicts a MIMO scenario in which six data packets are “transmitted simultaneously” over three different wireless channels, each of which has been converted into two sub-channels using MIMO techniques (Ex. 1001, 1:61-2:10):



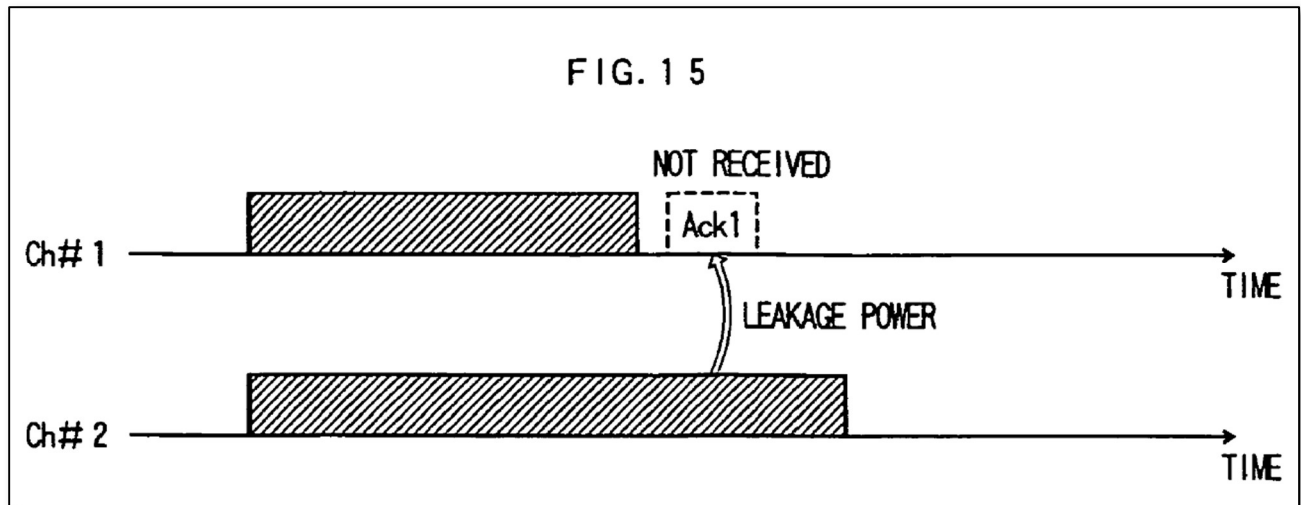
43. As seen in Figure 14(1), implementing MIMO in this manner can double the capacity of each of the three wireless frequency channels compared to a conventional non-MIMO system, which, as illustrated in Figure 13(2), could only transmit up to three packets simultaneously; thus, in the example illustrated in Figure 14(1), each MIMO channel has two MIMO subchannels and thus can simultaneously transmit two data packets at the same time and frequency (thus

allowing six packets total to be sent across the three channels), whereas a conventional system could only send one packet at one time in each channel (thus allowing only three packets total, as illustrated in FIG. 13).

B. THE '551 PATENT

1. The Alleged Problem in the Prior Art

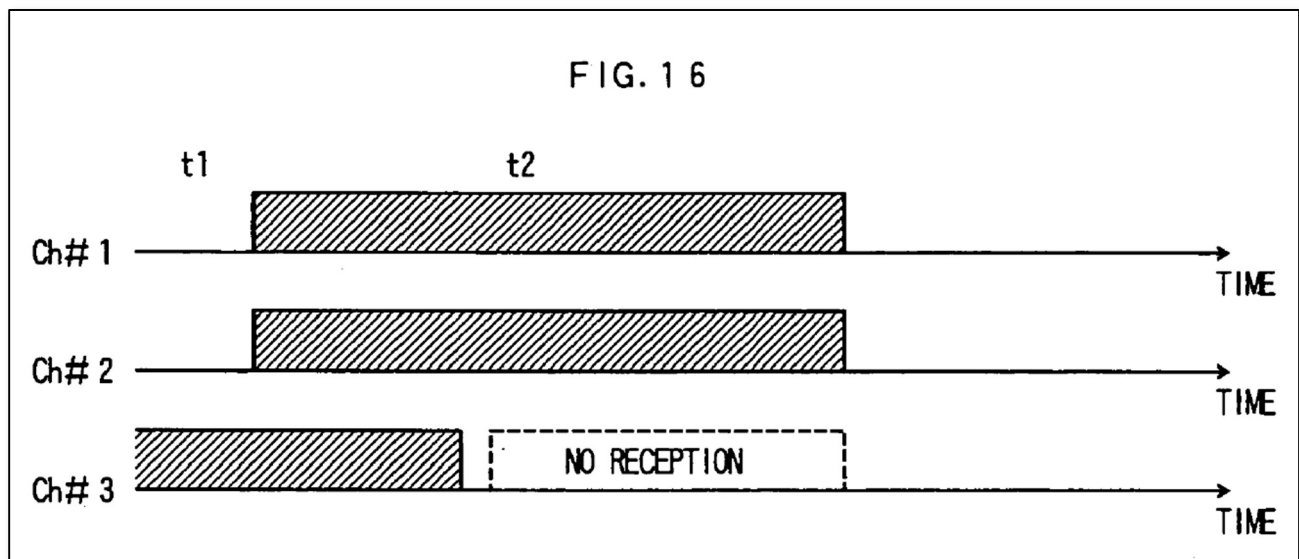
44. The '551 Patent states that when “the center frequencies of multiple wireless channels used at the same time are close to each other, an effect of leakage power from one wireless channel to a frequency region used by another wireless channel becomes large” and “becomes a problem” because an “acknowledgement packet (ACK)” —which is used to acknowledge the successful transmission of a packet—may be lost, causing the transmitter that was waiting for the ACK to resend a previous packet, thereby reducing the effective data rate of the system. Ex. 1001, 2:30-38. Figure 15 (below) illustrates an example of the purported “leakage power” problem. As seen in Figure 15 (below), there are two channels: channel Ch#1 and channel Ch#2:



45. In this example, two wireless packets are transmitted simultaneously across channels 1 and 2 (one packet on each channel), but the time needed to transmit the packet on channel 1 is less than the time needed to transmit the packet on channel 2. Ex. 1001, 2:38-44. As a result of the packet on channel 1 being received, an ACK (“Ack1”) is sent back on channel 1. The difference in transmission times over the two channels, however, creates a potential scenario in which the station receiving the packet on channel 1 sends its ACK message back to the transmitting station, i.e., Ack1, while the packet on channel 2 is still being transmitted. Ex. 1001, 2:44-51. According to the ’551 Patent, power leaking from the ongoing channel 2 transmission may cause the ACK on channel 1 to be lost such that the transmitting station on channel 1 never receives it and believes its transmission failed, which would likely cause that transmitting station to resend the packet that it did not receive an ACK for, thereby reducing the throughput of the system. Ex. 1001, 2:44-51. The ’551 Patent explains, however, that POSA had

overcome the problem depicted in Figure 15 had been overcome in the art by reconfiguring wireless packets to have “equal or equivalent packet time lengths,” which is the “time required to transmit the wireless packets.” Ex. 1001, 2:61-3:9. This would help avoid the above scenario, where packets sent simultaneously are received at different times, and thus acknowledged at different times.

46. According to the '551 Patent, using data packets with the same packet time lengths did not overcome the leakage problem in a different scenario depicted in Figure 16. As seen in Figure 16 (below), there are three channels: channels 1, 2, and 3:



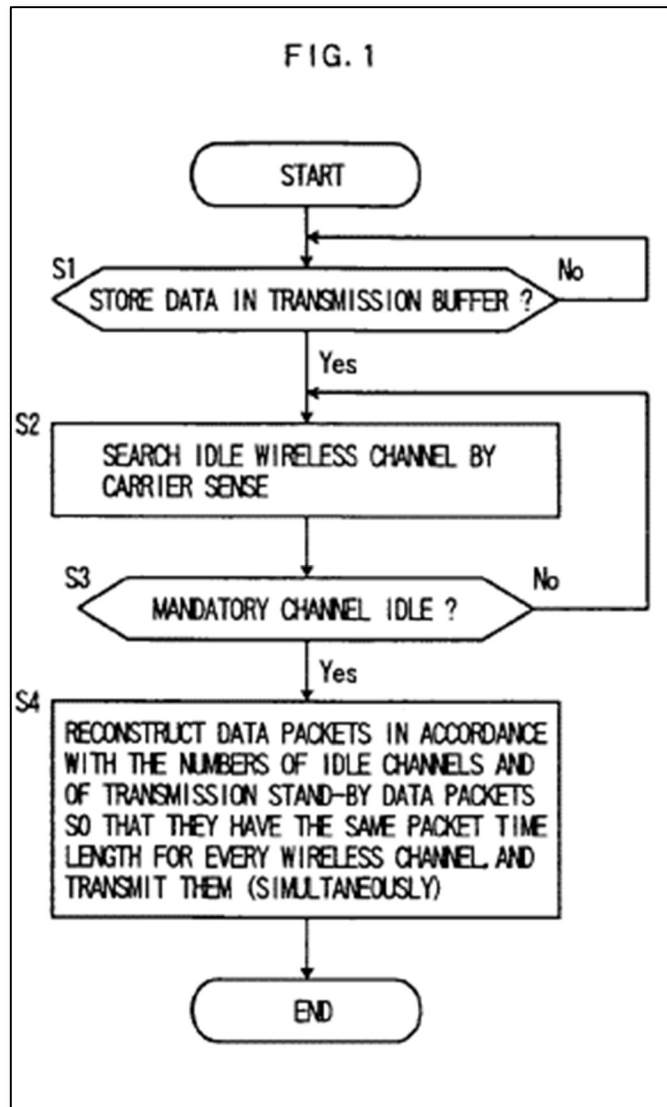
47. As the '551 Patent explains, “[a]t timing t_1 , wireless channels #1 and #2 of a transmit-side STA are idle, while a wireless channel #3 is busy.” Ex. 1001, 3:10-11. Because channels 1 and 2 are idle, a transmitting device thus “transmits wireless packets having the same packet time length by using the idle wireless

channels #1 and #2,” but when channel 3 becomes idle at a later timing t2, another device may determine channel 3 is idle and start to send wireless packet to the transmitting device on channel 3. Ex. 1001, 3:12-20. However, because wireless packets are still being transmitted on channels 1 and 2 at timing t2, the wireless packet sent to the transmitting device on channel 3 is lost due to power leakage from channels 1 and 2. Ex. 1001, 3:21-24. “In other words, the [device] in transmission cannot receive a wireless packet transmitted on a wireless channel that is adjacent to the wireless channel being in transmission.” Ex. 1001, 3:24-27.

48. The “object” of the ’551 Patent is to solve this latter purported problem of power leakage from outgoing and incoming transmissions occurring on adjacent channels. Ex. 1001, 3:33-35.

2. The Purported Solution

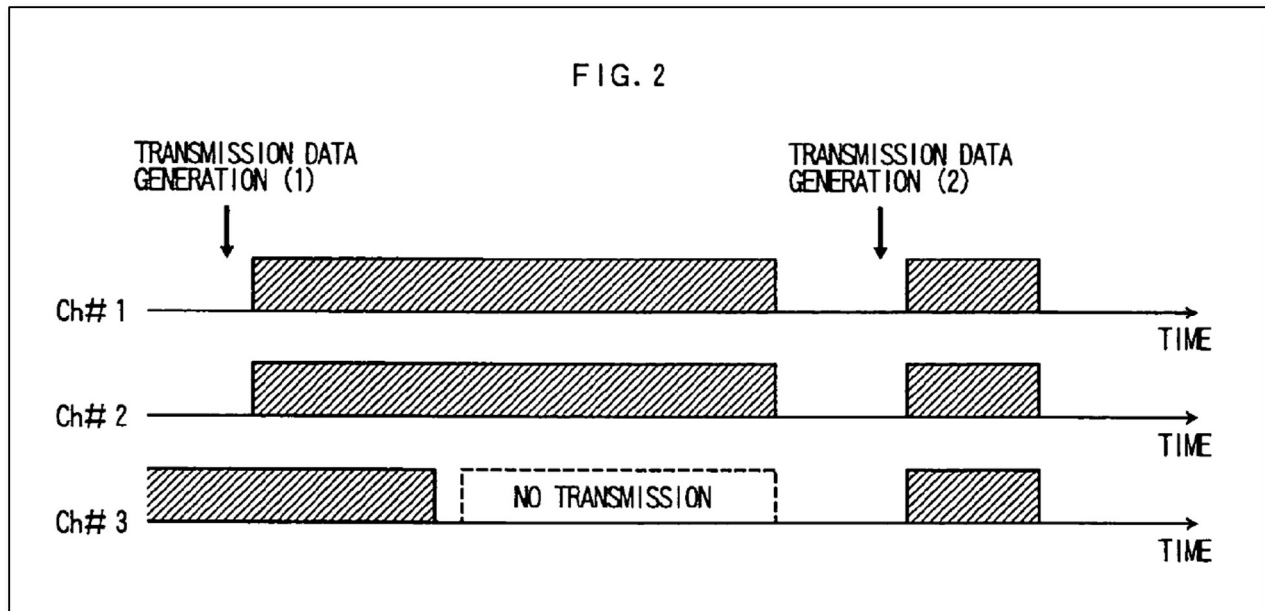
49. To solve this purported problem from leakage across adjacent wireless channels during simultaneous transmission of wireless packets, the ’551 Patent teaches setting a “mandatory channel” that is “always used” to transmit wireless packets over “a wireless channel or wireless channels.” Ex. 1001, 3:44-49. Figure 1 (below) provides a flowchart for using a “mandatory channel” in an exemplary embodiment of the alleged invention. Ex. 1001, 5:48-50.



50. At step S1, data to be transmitted is stored in a transmission buffer, and at step S2 the STA (station) uses conventional “carrier sense” technology (the only carrier sense technology discussed in the patent) to search for idle channels. Ex. 1001, 5:62-65. If the STA determines that the mandatory channel is not idle, the STA returns to step S2 “to the search of an idle wireless channel.” Ex. 1001, 5:67-6:2. If the STA determines that the mandatory channel is idle (step S3), then it uses one of the three “known data packet reconstruction methods,” to split a data

packet in the transmission buffer into a number of same-length packets equal to the total number of idle channels identified (i.e., the mandatory channel plus any additional idle wireless channels). Ex. 1001, 5:66-6:7. Thus, as the '551 Patent explains, if there is a single data packet in the transmission buffer and there are three idle wireless channels (e.g., the mandatory channel and two other channels), that single packet is reconstructed into three same-length packets to be transmitted over the three idle channels. Ex. 1001, 6:13-16. If there are three data packets and only two idle channels (including the mandatory channel), one packet can be “divided into two portions and the two portions are connected to data packets” for transmission over each channel. However divided, the reconstructed data packets are then transmitted simultaneously over the number of idle channels. Ex. 1001, 6:7-8.

51. Figure 2 (below) depicts a timing chart for an embodiment of the alleged invention. Ex. 1001, 5:50-52. In Figure 2's embodiment, there are three wireless channels and “the wireless channel #1 is set as a mandatory channel for every STA.” *Id.*, 5:52-54.



52. In the Figure 2 example, at time (1) wireless channels 1 and 2 are idle, while channel #3 is busy transmitting a wireless packet. Ex. 1001, 5:63-66. If channel 3 were the mandatory channel, then the STA could not transmit packets over idle channels #1 and #2 at time (1) because the mandatory channel is not also idle. Ex. 1001, 5:67-6:2. But, in the example disclosed in connection with Figure 2, channel #1 is the mandatory channel, and therefore the STA can reconstruct buffered data into two wireless packets, and send those two packets simultaneously over channels #1 and #2 (the mandatory channel and an additional idle channel), as seen in Figure 2. Ex. 1001, 6:2-11.

53. At some point later on, wireless channel #3 subsequently becomes idle, but it cannot be used for data transmission (“no transmission”) because at that point in time the mandatory channel—i.e., channel #1—is not also idle. Ex. 1001, 6:33-35. Only when mandatory channel #1 becomes idle again can a wireless

packet be sent over channel #3, and because channels #1 and #2 become idle at the same time, once mandatory channel #1 becomes idle again, a single data packet can be reconstructed into three wireless packets and sent over channels #1, #2, and #3 simultaneously as shown on the right side of Figure 2. Ex. 1001, 6:35-42.

54. Thus, the “mandatory channel” is the channel “always used for transmission” from the perspective of the transmitting STA such that wireless packets are transmitted “by using a wireless channel or wireless channels that includes/include the mandatory channel, only when the mandatory channel is idle.” Ex. 1001, 3:46-49. In other words, “[t]ransmission is not performed when the mandatory channel is not idle... even if there is another wireless channel [that is idle].” Ex. 1001, 3:53-57; *see also* Ex. 1001, 5:55-58 (“When the mandatory channel is busy, each STA does not perform transmission even if there is other idle wireless channel. That is, no transmission is performed.”).

55. As Section VI below demonstrates, using a mandatory channel to transmit wireless packets simultaneously was known in the art, and implementing such a channel to utilize MIMO or join with other channels for simultaneous transmissions would have been obvious given the conventional nature of MIMO and/or multi-channel transmission techniques, as I discuss below.

C. Summary of Claims

56. Independent claim 1 is reproduced below with labels added before each limitation for reference:

[1PRE] A wireless packet communication method for transmitting a plurality of wireless packets simultaneously by using multiple wireless channels determined to be idle by carrier sense, a single wireless channel determined to be idle and MIMO, or the multiple wireless channels and the MIMO, the method comprising:

[1A] setting a mandatory channel that is always used for transmission;
and;

[1B] transmitting the wireless packets by using a wireless channel/wireless channels that includes/include the mandatory channel, only when the mandatory channel is idle.

57. Independent claim 5 is directed to a “wireless packet communication apparatus” that performs the method recited in claim 1 using a “unit”:

[5pre] 5. A Wireless packet communication apparatus for transmitting a plurality of Wireless packets simultaneously by using multiple Wireless channels determined to be idle by carrier sense, a single Wireless channel determined to be idle and MIMO, or the multiple Wireless channels and the MIMO, the apparatus comprising

[5A] a unit setting a mandatory channel that is always used for transmission, and

[5B] transmitting the Wireless packets only when the mandatory channel is idle by using a wireless channel or wireless channels that includes/include the mandatory channel.

58. Independent claim 2 (annotated below) has the identical preamble as claim 1, but different limitations in its body:

[2PRE] A wireless packet communication method for transmitting a plurality of wireless packets simultaneously by using multiple wireless channels determined to be idle by carrier sense, a single wireless channel determined to be idle and MIMO, or the multiple wireless channels and the MIMO, the method comprising:

[2A] distinguishing an STA A from an STA B, the STA A for which a mandatory channel is set, the STA B for which no mandatory channel is set, the mandatory channel being always used for transmission; and;

[2B] when wireless packets are addressed to said STA A, transmitting the wireless packets to said STA A by using a wireless channel/wireless channels that includes/include the mandatory channel, only when the mandatory channel is idle; and

[2C] when wireless packets are addressed to said STA B, transmitting the wireless packets to said STA B by using idle wireless channel(s).

59. Independent claim 6 is directed to a “wireless packet communication apparatus” that performs the method recited in claim 2:

6. A wireless packet communication apparatus for transmitting a plurality of wireless packets simultaneously by using multiple

wireless channels determined to be idle by carrier sense, a single wireless channel determined to be idle and MIMO, or the multiple wireless channels and the MIMO, the apparatus comprising

a unit distinguishing an STA A from an STA B and determining destinations of the wireless packets so as to transmit wireless packets addressed to said STA A only when said mandatory channel is idle by using a wireless channel or wireless channels that includes/include a mandatory channel, and to transmit wireless packets addressed to said STA B by using idle wireless channel or channels, the mandatory channel being always used for transmission, the STA A for which the mandatory channel is set, the STA B for which no mandatory channel is set.

60. The dependent claims add minor implementation-level details the '551 Patent concedes were known in the art. Dependent claims 3 and 7 depend from either independent claims 1/5 or 2/6, respectively, and further limit the independent claims by requiring that “the plurality of wireless packets transmitted simultaneously are set to have a same or equivalent packet time length that corresponds to a packet size or a transmission time.” As explained earlier in Paragraph 45, the '551 Patent concedes “making equal or equivalent packet time lengths” was a “known method” by September 2003. Ex. 1001, 2:61-66.

61. Dependent claims 4 and 8 depend from independent claims 1/5 or 2/6, respectively, and further limit the independent claims by requiring “simultaneously

transmitting wireless packets selectively using the multiple wireless channels or the MIMO in accordance with a number of pieces of data or a number of MIMOs that depends on a channel condition.” As I explained earlier in Paragraph 39, the ’551 Patent concedes POSAs knew techniques existed in September 2003 in which “[t]he number of MIMOs [i.e., MIMO sub-channels] is determined in accordance with the propagation coefficients and the like.” Ex. 1001, 2:1-3. POSAs understand that “the propagation coefficients” are indicative of the channel conditions, and in a conventional MIMO system are used to determine how many MIMO subchannels should be used. As corroborating evidence, Ex. 1023 at 1:43-46 notes as background information that the “sub-channels of a MIMO system may experience different channel conditions...[, c]onsequently, the data rates that may be supported by the spatial sub-channels may be different from sub-channel to sub-channel.” Thus, Ex. 1035 (“Thielecke”) at [0031] corroborates, “[d]epending on the channel conditions, it could be that the potential rate of one or more strata [the term this reference uses for MIMO sub-channels, *see* [0020]] is very small. Then, it is usually advantageous to reduce the number of strata, i.e. the number of independent strata.” In other words, it was known in the prior art to adjust the number of MIMO subchannels (or the amount of data sent on each subchannel) depending of the channel conditions.

D. Prosecution History

62. I have reviewed the prosecution history of the '551 Patent (Ex. 1002) in connection with interpreting the '551 Patent's claims. The challenged claims were originally rejected as obvious over U.S. Patent Application Publication No. 2002/0159431 ("Moulsley," Ex. 1009) in view of U.S. Patent No. 6,591,107 ("Sonetaka," Ex. 1010). Ex. 1002, 291-292. The examiner found Moulsley discloses a method for transmitting a plurality of wireless packets simultaneously using multiple wireless channels, but did not explicitly disclose the use of a mandatory channel that was always used for transmission. Ex. 1002, 291 (citing Moulsley, [0009]-[0015], claims 1-2, 9-10, 14). The Examiner found that Sonetaka disclosed a mandatory channel, and that it would have been obvious to implement Moulsley to use Sonetaka's mandatory. Ex. 1002, 291-292.

63. In response, the applicants agreed Moulsley discloses a technique for transmitting a plurality of wireless packets simultaneously using multiple wireless channels, Ex. 1002, 306, but argued Sonetaka does not disclose the use of a mandatory channel, Ex. 1002, 306-308. According to the applicants, Sonetaka discloses a "special" channel that was reserved for high priority traffic but which was used only if no other channel was available for the high priority traffic. Ex. 1002, 306-307. Such a reserved channel that was "not normally used" was not a mandatory channel as claimed, the applicants argued, because it is "reserved for

high priority traffic only,” whereas the claimed “mandatory channel” is “regularly used for packet transmission, no matter the degree of priority of traffic.” Ex. 1002, 307. As the applicants explained, “in the present invention, if the ‘mandatory channel’ is idle, packet transmission is enabled, if not, packet transmission is prohibited.” Ex. 1002, 307. The Examiner thereafter allowed the challenged claims, without further explanation. Ex. 1002, 316.

VI. GROUNDS FOR UNPATENTABILITY

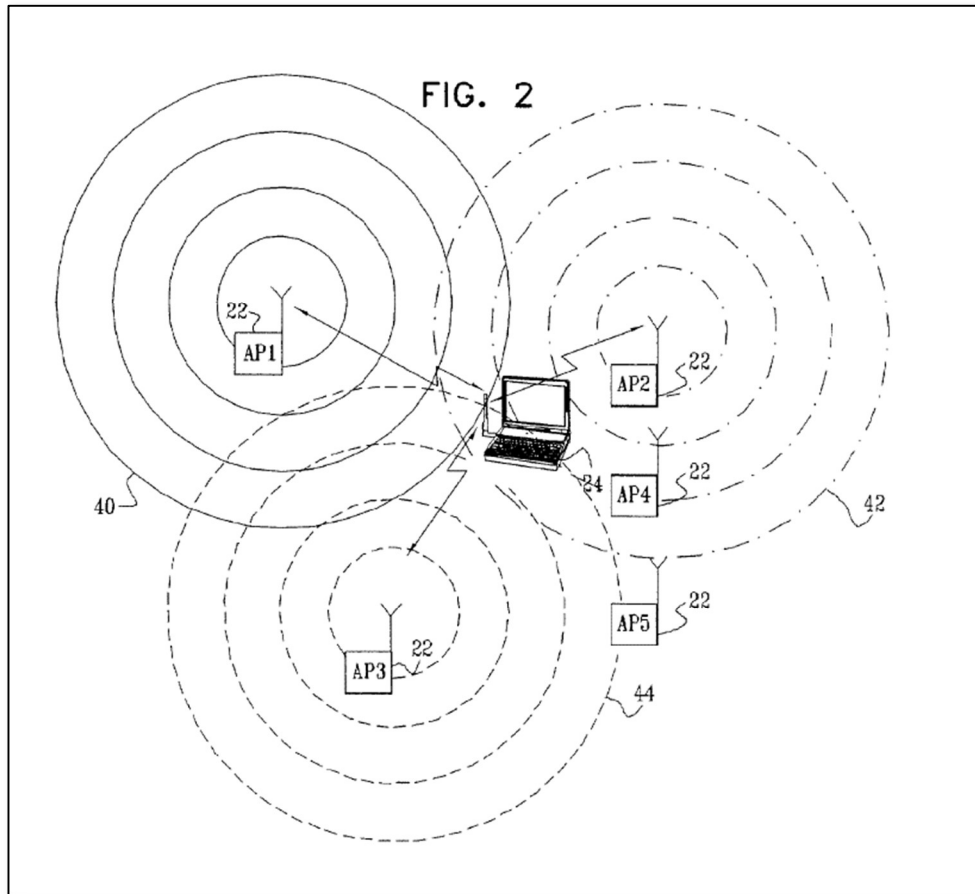
A. Ground 1: Claims 1, 3, 5, and 7 Would Have Been Obvious Over Shpak (Ex. 1005) in View of Ho (Ex. 1006)

1. Shpak (Ex. 1005)

64. Shpak is a U.S. Patent Application Publication that published on November 6, 2003 and was filed on August 7, 2002. Shpak, (22). I understand that Shpak is therefore prior art to the ’551 Patent. Shpak is not cited on the face of the ’551 Patent and it was not considered during prosecution of the ’551 Patent. *See generally* Ex. 1002.

65. Shpak discloses a “method for mobile communication [that] includes arranging a plurality of access points in a wireless local area network (WLAN) to communicate on a common frequency channel with a mobile station.” Shpak, Abstract. As I discuss in Sections VI.A.4.b below, Shpak’s “common frequency channel” meets the claimed “mandatory channel” because it is the channel over which wireless packets must be transmitted in Shpak’s WLAN.

66. An exemplary system implementing Shpak's method is depicted in Figure 2, which illustrates "simultaneous radio communications between mobile station 24 and multiple access points 22 [AP1-AP5] in system 20":



Shpak, [0028], [0036].

67. As Shpak explains, consistent with my discussion of a POSA's background knowledge in Section V.A.1 above, "because of bandwidth and regulatory limitations," WLANs (wireless LANs) operating in the United States were limited to three of the available frequency channels in the 2.4GHz band for

802.11b, while those operating in certain foreign countries like Japan were limited to a single channel. Shpak, [0006].

68. In FIG. 2 (above), access points 22 (AP1, AP2, AP3) all operate “on the same band,” e.g., the 2.4GHz band used in 802.11b, “over which mobile station 24 seeks to communicate.” Shpak, [0036]; *see also* Shpak, [0006]. To arrange for communication between the access points and the mobile station on this “common frequency channel,” the access points (“APs”) first “transmit beacon signals on their common frequency channel,” consistent with conventional 802.11b procedures. Shpak, [0037]; *see also* Shpak, FIG. 3 (step 50) (“access points transmit beacons on assigned channel”). Because “access points AP1, AP2 and AP3 share the same BSSID [BSS identification]... they appear logically to the mobile to be a single, extended, distributed access point, which has multiple antennas at different locations.” Shpak, [0037]. The APs “are mutually synchronized” so that “the beacon signals transmitted by the access points are interlaced to avoid collision between them.” Shpak, [0037]. “When mobile station 24 receives a beacon signal of sufficient strength, it extracts” information from the signal and uses that information to send an uplink signal to the access points in the form of an association request message. Shpak, [0038]; *see also* FIG. 3 (steps 52, 54).

69. “[T]o maintain 802.11 compatibility in system 20,” upon receiving the mobile station’s uplink signal having “an association request message that is addressed to the BSSID” shared by access points AP1-AP3, the access points “carry out an arbitration procedure” to arbitrate among themselves to determine which access point should respond to the mobile station’s association request message. Shpak, [0039]-[0042]; *see also* FIG. 3 (steps 56, 58). The “winning access point” answers the association request message with an acknowledgement (ACK), and subsequently sends an association response message to the mobile station. Shpak, [0043]; *see also* FIG. 3 (step 60). With the mobile station now associated with the access point, the winning access point then continues “its downlink transmission to the mobile station as appropriate.” Shpak, [0043]; *see also* FIG. 3 (step 62). Shpak explains that data transmitted from the winning access point to the mobile station only occurs over the common frequency channel. Shpak, [0022], [0024], claim 1. This is consistent with Shpak’s goal of “enhancing the coverage and speed of WLAN systems” having multiple access points that “operat[e] on the same frequency channel.” Shpak, [0006]-[0007]. POSAs would thus characterize Shpak as a single input, single output (SISO) system, because all communications is Shpak are over the common frequency channel, using one transmission over the channel at a time.

70. Shpak characterizes its above-described “arbitration process” performed by the AP’s to determine a single “winning” AP to respond to an uplink request as novel. Shpak, [0008]-[0009]. To support this arbitration process, Shpak’s APs are coupled together, preferably by a “dedicated wire or fiber optic network,” and “communicate among themselves using a novel protocol.” Shpak, [0008].

71. POSAs understand that Shpak expressly incorporates by reference the conventional procedures of the 802.11 standards, such as 802.11b. Shpak repeatedly teaches that communication between the mobile station and the winning access point occurs in accordance with then-existing 802.11 standards. In paragraph [0003], Shpak explains that the “term ‘802.11’ is used to refer collectively to the original IEEE 802.11 standard all its variants and extensions,” and that “the access points... communicate with the mobile stations substantially in accordance with IEEE Standard 802.11.” Paragraph [0033] also expressly incorporates by reference “Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications” from the 802.11-1999 standard. In paragraph [0038], Shpak explains that the “steps taken by the mobile station, is completely in accordance with the 802.11 standard,” and thus “the present invention can be implemented in a manner that is transparent to and requires no modification of legacy mobile stations,” which is consistent with Shpak statement

in [0039] emphasizing the need “to maintain 802.11 compatibility.” And in paragraph [0046], Shpak describes WLAN transceiver 78 in each access point as “communicat[ing] over the air with mobile stations 24 in accordance with the applicable WLAN standards.” Thus, POSAs understand that access points and mobile stations in Shpak operate in accordance with then-existing 802.11 standards (e.g., 802.11b), with Shpak’s arbitration procedure used to coordinate access points in a multi-access point BSS, to determine which access point should respond and associate with a station over the common frequency channel of the BSS, according to conventional 802.11 procedures.

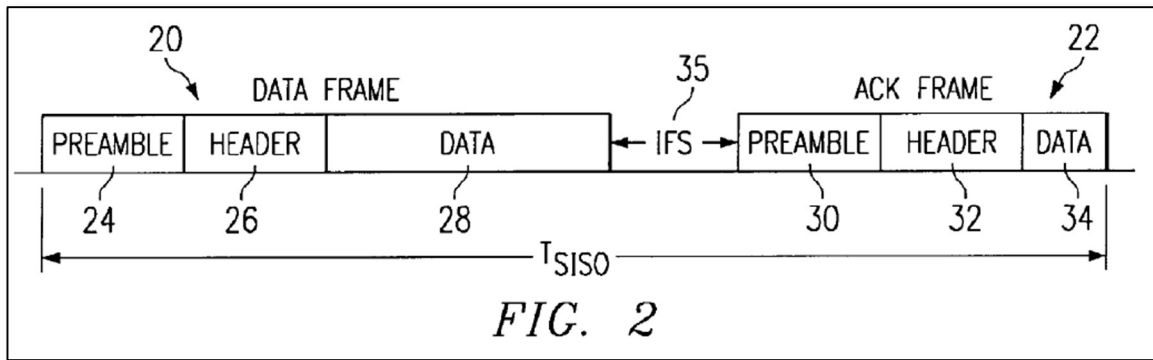
72. As Shpak explains (and was well-known in 2003 as I discussed in Section V.A.1 above), the 802.11 standards utilize “a mechanism for collision avoidance known as clear channel assessment (CCA), which requires a station to refrain from transmitting when it senses other transmissions on its frequency channel.” Though Shpak states that “this mechanism is of limited utility and can place a heavy burden on different BSSs operating on the same frequency channel,” Shpak, [0005], Shpak does not state that the CCA techniques are removed or disabled from devices implementing Shpak’s techniques; POSAs would not expect the carrier sense techniques to be removed or disabled to be consistent with Shpak’s teachings “can be implemented in a manner that is transparent to and requires no modifications to legacy mobile stations,” Shpak, [0038]-[0039]. Thus,

POSAs understand that an 802.11-compliant access point in Shpak would still perform the CCA (the CSMA/CA-based algorithm I discussed in Section V.A.1, above). *See* Ex. 1002, 136 (STA “shall [i.e., must] sense the medium” using CSMA/CA).

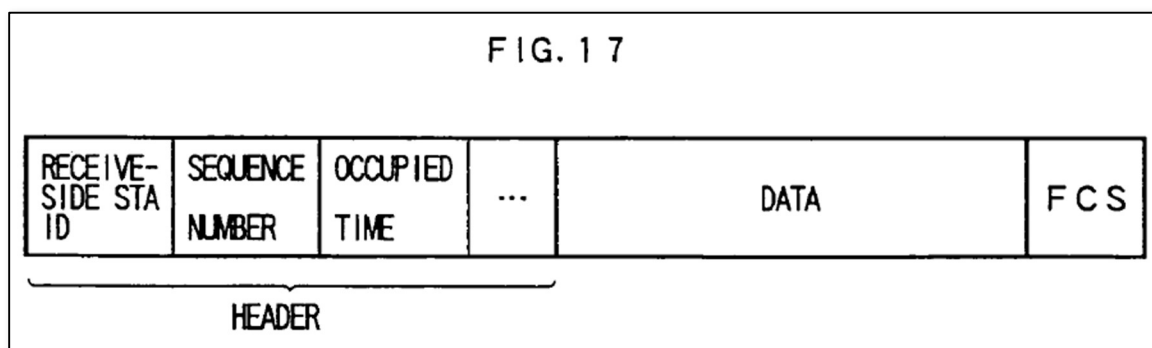
2. Ho (Ex. 1006)

73. Ho is a U.S. Patent Application Publication that published on September 11, 2003 and was filed on July 2, 2002. Ho, (22). I understand that Ho is therefore prior art to the ’551 Patent. Ho also claims priority to provisional application filed on Mar 8, 2002. Ho is not cited on the face of the ’551 Patent and it was not considered during prosecution of the ’551 Patent. *See generally* Ex. 1002.

74. Ho relates to “wireless communications,” and more specifically “to medium access control (MAC) frames and mechanisms for enabling smart antenna use, improving channel utilization, and increasing communications throughput.” Ho, [0004]. Ho’s system is described “in the context of the 802.11 family of wireless standards.” *Id.*, [0036]. Ho explains that “[i]n the context of 802.11... data frames are also referred to as MAC protocol data units (MPDUs),” which “generally comprise[] a MAC header, a data portion, and a frame check sequences (FCS) field.” Ho, [0038]. An exemplary MAC “data frame” is illustrated in FIG. 2, copied below:



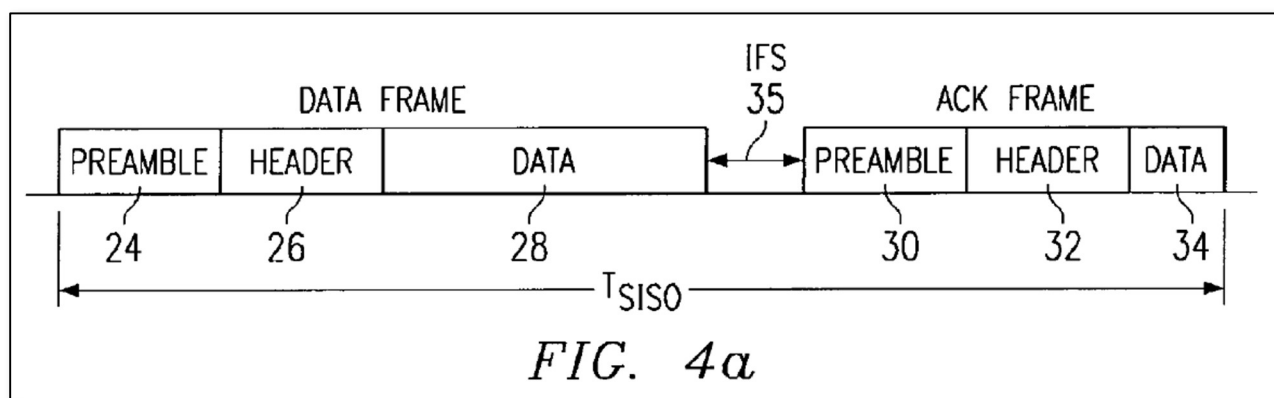
Similarly, the transmitted data packets in the '551 Patent, like Ho's data frames, include a MAC header with a data portion, as illustrated in FIG. 17 (below), which "shows a structure of a wireless *packet* used in the wireless packet communication apparatus":



The '551 Patent discloses that these data packets are generated by "add[ing] a packet header and a CRC code (FCS region)," Ex. 1001, 11:17-22, and more specifically a "MAC Header," Ex. 1001 at FIG. 3, like Ho's data frame described above. POSAs, therefore, understand that Ho's MAC data frames/MPDUs are what the '551 Patent refers to as "packets": they both have data portions, MAC header portions, and FCS portions, consistent with the MPDU structure in conventional 802.11 standards illustrated in the '551 Patent and known to POSAs.

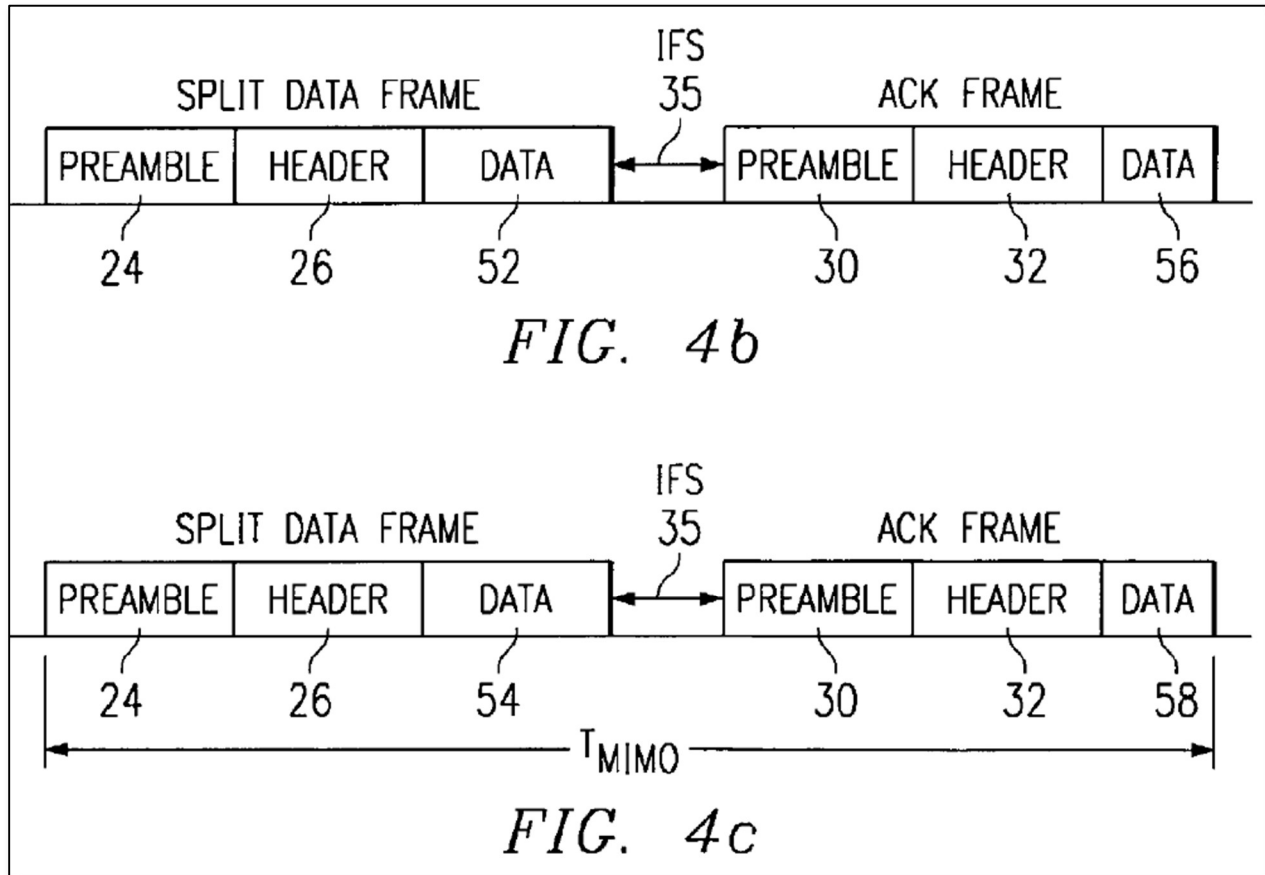
75. Ho discloses implementations of 802.11 systems having multiple input, multiple output (MIMO) configurations. In its background, Ho explains advantages to MIMO antenna configurations (Ho, [0010]), consistent with my discussion of the known advantages of prior art MIMO techniques in Section V.A.3 above. For example, Ho explains that a 2x2 MIMO configuration (which requires at least two antennas on each side of the channel) allows data to be “broken into two parts and the parts can then be transmitted simultaneously” over two independent communication links (i.e., MIMO sub-channels), which advantageously reduces the time needed to transfer the data when compared to a single input, single output (SISO) configuration, in which the entire data frame/packet is sent over a single link. Ho, [0010]. Ho also notes that “MIMO configurations exist in which more than two antennas at each station are implemented such as ‘3x3’ MIMO, etc.” Ho, [0010]. Because data can be sent more quickly, MIMO antenna configurations allow for greater data communication throughput/ speed (i.e., rates) than SISO antenna configurations allow under equal conditions. Ho, [0011]. For example, the rate at which bits can be sent can be doubled in a 2x2 MIMO channel, though the throughput will be less than double because some of the throughput is lost to the additional header information used in two packets, compared to the single header when sending a single packet over a SISO channel. Ho, [0011].

76. Ho's Figures 4a to 4c "show timing sequences associated with the SISO and MIMO antenna configurations" ([0025]), and are used to illustrate the advantages of conventional MIMO techniques. FIG. 4a (below) depicts a conventional data frame (packet) transmitted by a single antenna, where it takes time T_{SISO} to transmit the data frame and receive an ACK Frame in response (Ho, [0009]):



77. With MIMO, the single data frame in FIG. 4A can be divided into multiple (e.g., two) smaller data frames ("split data frames") that can be transmitted simultaneously over the MIMO "communication links." Ho, [0010]. As the '551 Patent concedes (1:61-63) and POSAs understand multiple MIMO communications links are sub-channels within the single wireless channel, as I discussed above in Section V.A.3. *See also* Ex. 1020, 2:13-49 (sharing two of the same inventors as Ho and also demonstrating multiple MIMO subchannels in a single wireless channel). Two MIMO split data frames (packets) are shown below in Figures 4b and 4c, having the same Preamble and Header 26 as the SISO data

frame, but both frames can be simultaneously transmitted and acknowledged in time T_{MIMO} :



78. As Ho explains, time T_{MIMO} is less than time T_{SISO} because MIMO allows the conventional data frame's payload 28 for SISO communication to be divided into smaller data payloads 52 and 54 and transmitted simultaneously in parallel over the MIMO subchannels. Ho, [0010]. The station receiving the MIMO data frames reassembles the fields 52 and 54 into a single data packet, as was done in a conventional MIMO system. Ho, [0010].

79. Because the transmission time is reduced using MIMO, a MIMO-implemented wireless communication system can transmit at a higher rate than a

traditional single input, single output (SISO) system. Ho, [0011]-[0012].

Naturally, the higher the rate, the more data the system can transmit in the same amount of time.

3. Implementing Shpak in View of Ho

80. Ho recognizes that “any improvement to the efficiency of wireless communication is desirable.” Ho, [0014]. The efficiency of a communication system can be measured by its throughput, which is how much data is transmitted after accounting for overhead and retransmissions, etc. Ho teaches MIMO can improve the efficiency (e.g., throughput) of a single input, single output (SISO) wireless system such as the 802.11-based system disclosed in Shpak. Ho, [0009]-[0011]; Paragraphs 69, 75 above. A POSA would have had numerous reasons to implement Shpak’s system such that its access points and mobile stations utilized multiple antennas to perform MIMO transmissions over Shpak’s “common frequency channel.”

81. First, the implementation would have improved Shpak’s system. As I discussed above in Section V.A.1 about the known benefits of MIMO, and in Section VI.A.2 above about the similar benefits recognized by Ho, [0009], MIMO improves data transmission speed by allowing more data to be sent over the same frequency channel without increasing the channel’s bandwidth (i.e., MIMO makes efficient use of bandwidth to increase data rates). A POSA would have understood

Shpak to disclose a conventional single input, single output (SISO) system in which an access point transmits use one antenna to transmit packets to a mobile station over one “common frequency channel.” *See, e.g.*, Abstract, claim 1. The embodiments disclosed in FIGS. 4-5 of Shpak, for example, only depict signal antennas, and so only support SISO communications in these configurations. As Ho discloses and POSAs knew based on the background knowledge I discussed above in Sections V.A.1 and VI.A.2, MIMO was a known technique to improve SISO systems, by using multiple antennas to increase the rate by which data can be transmitted from an access point to a mobile device over a single frequency channel in an 802.11 WLAN system, like those considered by Shpak. Ho, [0009]. A POSA would have known that modifying Shpak’s system to utilize MIMO rather than SISO would have advantageously increased the system’s transmission rate in a bandwidth efficient manner, which would have motivated a POSA to make this modification. Indeed, Ex. 1027 at 1:50-52 corroborates that POSAs knew that MIMO desirably “increase[s] data carrying capacity” for 802.11 systems. And Ex. 1021, notes as background information (1:20-31) that the demand to “increase[] the capacity” of WLAN networks has led to MIMO “being investigated for use in cellular and WLAN applications.”

82. Second, a POSA would have been motivated to add MIMO to Shpak’s 802.11 system because MIMO had already been incorporated into systems using

existing 802.11 standards and was being proposed for the next-generation 802.11 standard, because of the efficiency and transmission rate gains provided by MIMO. Ex. 1021, 1:20-31. As additional corroborating evidence, Ex. 1022 at 1:29-33 provides as background knowledge that MIMO is “most likely to be *the dominant solution* in future broadband wireless communication systems” and that “MIMO techniques have been incorporated into several standards... such as the IEEE 802.11 a wireless LAN.” Ex. 1027 at 1:50-52 similarly notes as background information by its July 15, 2002 filing date that “[i]t is desirable to apply MIMO techniques to IEEE 802.11 systems to increase data carrying capacity[.]” As the ’551 Patent concedes as background information (1:56-61), by September 2003 it was known that MIMO could be incorporated into 802.11 networks, independent of MIMO processing.

83. Third, implementing Shpak in a conventional MIMO configuration would have involved no more than the use of a known technique (MIMO) to improve similar devices (802.11-compliant WLANs) in the same way (increased data rates, increased bandwidth efficiency) to yield a predictable result (an improved WLAN system employing a conventional MIMO technique). As I discussed in Paragraphs 81-82 above, MIMO techniques had been investigated and incorporated into existing 802.11 systems with success, demonstrating that MIMO

was known to be compatible with 802.11 standards, because the packets on each MIMO subchannel could be structured consistent with 802.11 requirements.

84. Adapting Shpak to incorporate the conventional MIMO technique Ho discloses in its Background would have been within a POSA's capabilities. The adaption would have involved (a) modifying Shpak's access points and mobile stations to utilize (if they did not already) multiple antennas, and (b) configuring the WLAN transceivers on the access points and mobile stations to implement Ho's background MIMO technique. As Ho confirms MIMO technology was conventional as of September 2003. Ho, [0006]-[0014]. The '551 Patent itself admits that MIMO wireless transmission techniques—which require multiple transmitter and receiver antennas—were known before September 2003. Ex. 1001, 1:56-2:3 (describing a “known MIMO technique” in which “different wireless packets are transmitted from a plurality of antennas at the same time on the same wireless channel”). And Shpak teaches that its access points “generally have multiple antennas” already, Shpak, [0052], which would have facilitated a conventional MIMO implementation that relies on multiple antennas. Using ordinary skill, POSAs would have been able to adapt the antennas for MIMO transmissions. POSAs understood that 802.11 set a baseline defining, e.g., the data rates, packet structures, etc., but that access points were “typically provided with sufficient processing, software, etc.,... to provide additional features [above the

802.11 baseline] that are developed by a vendor.” Ex. 1050, 4:39-43. This was done so that vendors could differentiate themselves, by offering additional features above those required by 802.11 standards, such as Ho’s background MIMO technique. Moreover, as I explained in Paragraphs 81-82 above (citing Ex. 1022, 1:29-32; Ex. 1027, 1:50-52), combining 802.11 systems with MIMO techniques had already been proposed and implemented in the prior art, demonstrating that it would have been routine by 2003 to implement an 802.11-based WLAN like those taught in Shpak using the background knowledge of MIMO disclosed in Ho. And Ho, itself, teaches how to incorporate MIMO into 802.11 systems. Ho, [0015].

85. That Ho and Shpak both describe techniques compliant with then-existing 802.11 standards underscores the compatibility of their teachings. Shpak, [0003]; Ho, [0035]-[0038]. Indeed, as I discussed above in Paragraph 74, a POSA would have readily recognized the MIMO data frames depicted in Ho’s Figures 4a-4c to be MAC protocol data units, which are the “packets” transmitted in the ’511 Patent, which are the data frames (packets) utilized in 802.11 WLANs like Shpak’s. Ho, [0035] (“In the context of 802.11...data frame are referred to as MAC protocol data units MPDUs.”); Shpak, [0033] (“the access points and mobile stations communicate with one another in accordance with one of the standards in the IEEE 802.11 family and observe 802.11 medium access control (MAC) layer conventions”). Because Ho’s MIMO data frames are compliant with “802.11

medium access control (MAC) layer conventions” (Shpak, [0033]), a POSA would have recognized that utilizing Ho’s MIMO data frames in Shpak would have been consistent with Shpak’s desire to “maintain 802.11 compatibility.” Shpak, [0039].

86. In the proposed combination, which I will refer to as “Shpak-Ho” or the “Shpak-Ho combination,” Shpak’s access points and stations utilize multiple antennas to communicate over their “common frequency channel,” utilizing the conventional MIMO data frames depicted in Ho’s Figures 4b and 4c. That is, the common frequency channel would have been implemented as a MIMO channel. Consistent with Shpak’s express teachings, the devices would have otherwise “maintain 802.11 compatibility,” including the standard’s use of “clear channel assessment,” Shpak, [0005], [0039], as I discussed in Sections V.A.1 and VI.A.1 above. The use of “clear channel assessment,” i.e., carrier sense, is standard in 802.11-compliant implementations and would have minimized packet collisions, for example, collisions that could occur when a mobile device attempts to transmit data to an access point over the “common frequency channel” at the same time that the access point was attempting to transmit data to the mobile device on that “common frequency channel.” Shpak-Ho access points would have used clear channel assessment for the same reason any 802.11 access point would (e.g., to avoid transmitting on a channel that is not idle, because it is occupied by another device, e.g., an access point in another BSS that did not participate in Shpak’s

arbitration process, or a non-802.11 device, e.g., a Bluetooth device operating in the 2.4 GHz band, as I discussed in Section V.A.1 above).

87. As I explain in Sections VI.A.4-.7 below, the Shpak-Ho combination meets claims 1, 3, 5, 7.

4. Independent Claim 1

- a. [1PRE] A wireless packet communication method for transmitting a plurality of wireless packets simultaneously by using [1] multiple wireless channels determined to be idle by carrier sense, [2] a single wireless channel determined to be idle and MIMO, or [3] the multiple wireless channels and the MIMO, the method comprising:**

88. Shpak-Ho discloses the preamble of claim 1 for the reasons I discuss in this Section below.

(1) The Scope of the Preamble

89. The preamble to claim 1 recites a “wireless packet communication method for transmitting a plurality of wireless packets simultaneously by using” one of three different transmission techniques: “[1] multiple wireless channels determined to be idle by carrier sense, [2] a single wireless channel determined to be idle and MIMO, or [3] the multiple wireless channels and the MIMO.” Options [1] and [3] require the use of multiple channels (without and with MIMO respectively), whereas option [2] requires only the use of a single MIMO-implemented channel.

90. As the three transmission options are joined by the word “or,” POSAs would have understood this to be disjunctive list of alternatives, claiming a prior art “wireless packet communication method for transmitting a plurality of wireless packets simultaneously” that uses *any* one of the three transmission techniques meets the preamble. A disjunctive interpretation is also the only interpretation that makes sense because packets cannot be transmitted “simultaneously by using *multiple* wireless channels determined to be idle” *and* “*a single* wireless channel determined to be idle.” Moreover, the third option includes multiple wireless channels and MIMO. If the preamble was conjunctive, not disjunctive, the third option would be superfluous because it would already be covered by the combination of options 1 and 2 and there would be no need to combine MIMO and multiple channels in a third option.

91. Understanding the preamble’s use of the “disjunctive” interpretation of the preamble is also consistent with the intrinsic evidence as understood by a POSA, which never suggests that the claimed “invention” requires a device somehow transmitting on *both* a single MIMO-implemented channel *and* multiple channels.

92. First, the specification of the ’551 Patent repeatedly describes the claimed invention as encompassing a wireless packet communication method for transmitting a plurality of wireless packets simultaneously by using *any* one of

three transmission techniques identified in the preamble, not all three together.

The '551 Patent's Abstract states that the disclosed method is for "using multiple wireless channels determined to be idle by carrier sense, a wireless channel determined to be idle and MIMO, *or* the multiple wireless channels and the MIMO." The patent makes similar statements at 3:39-44, 3:61-66, 4:23-28, and 4:35-40. In each of these sections, the patent explains that the invention involves using one of three transmission techniques recited in the claims.

93. Second, the specification explains—repeatedly—that the plurality of wireless packets may be transmitted by using only one wireless channel. Ex. 1001, 3:44-49 ("transmitting the wireless packets by using a wireless *channel* or wireless channels"), 3:50-52 ("transmission is performed by using the wireless *channel(s)*"), 4:3-7 (same), 4:28-34 ("transmitting the wireless packets by using the multiple wireless channels or the wireless *channel*"); 4:45-51 (same).

94. Third, the prosecution history of the '551 Patent further demonstrates that the applicants understood the claimed invention to cover transmission via only one channel. The applicants characterized the claimed "invention" of claims 1 and 5, to the examiner as transmitting wireless packets "by using *one* or more wireless channel(s)." Ex. 1002, 307. The applicants thus understood the claims to cover methods and devices that transmitted wireless packets over one wireless channel, which is only consistent with the option in the preamble reciting MIMO on a single

channel. Similarly, the Examiner originally rejected the claims by citing prior art that disclosed only one of the three transmissions techniques. Ex. 1002, 291-292. The applicants did not argue that the use of only one transmission technique distinguished the claims from the prior art. Thus, the applicants themselves did not understand claim 1 (or claim 5) to require wireless packets be transmitted using all three transmissions techniques since two of the techniques (options [1] and [3]) require *multiple* channels; instead, the claims could be met by using just *one* (MIMO) channel.

95. Thus, the intrinsic records reveals the applicants used “or” according to its customary meaning, i.e., as designating alternatives, and thus POSAs understand claim 1 to cover a method that practices any one of the three transmission options.

(2) *Shpak-Ho Meets the Preamble*

96. An access point in Shpak-Ho performs the method recited in the preamble of claim 1, over “a single wireless channel determined to be idle and MIMO.”

97. Shpak-Ho uses Shpak’s access points to communicate “in accordance with one of the standards in the IEEE 802.11 family and observe the 802.11 medium access control (MAC) layer conventions.” Shpak, [0033]. As Shpak explains, the access points “communicate on a common frequency channel with a

mobile station.” Shpak, [0011]; *see also id.*, [0006] (explaining that in some countries “only one channel is available”). Shpak repeatedly states that the communication is over the “common frequency channel.” Shpak, [0022] (“a plurality of access points...communicate on a common frequency channel with a mobile station”), [0024] (describing access point as including “a radio transceiver, which is configured to communicate on a predetermined frequency channel with a mobile station”), [0037], [0051] (describing APs as communicating on “the same WLAN frequency channel”); claim 1 (“arranging a plurality of access points in a wireless local area network (WLAN) to communicate on a common frequency channel with a mobile station”), claim 13 (same). Shpak further notes that mobile stations “attempt[] to initiate communications in a given frequency *channel*.” Shpak, [0008].

98. Shpak-Ho’s access point implement the conventional MIMO technique disclosed in Ho’s Background (Ho, [0009]-[0010], FIGS. 4a-4c), and communicate over the MIMO sub-channels created on the common frequency channel, as I discussed in Section VI.A.3 above, to send multiple packets simultaneously over the common frequency channel. In a 2x2 MIMO configuration, for example, the Shpak-Ho access point would divide a conventional 802.11 wireless data packet, i.e., one “observ[ing] the 802.11 MAC layer conventions” (Shpak, [0033]) into two separate data packets that would be

communicated “simultaneously” over the “common frequency channel” the access points use to communicate with a mobile device. *See, e.g.*, Ho, [0010]; Shpak, [0011], [0022]. Ho illustrates a conventional MIMO technique that converts one data frame intended for a SISO channel into two identical data frames, one for each MIMO subchannel. Ho, [0010]-[0011]. As I explained in Section VI.A.2 above, POSAs understand that Ho’s data frame is a “packet” because, like the packets disclosed in the ’551 Patent, the data frames have payloads, MAC headers, and CRC regions, consistent with 802.11 requirements for formatting packets. The Shpak-Ho access points thus perform the claimed “wireless packet communication method for transmitting a plurality of wireless packets simultaneously by using...a single wireless channel” that is a “MIMO” channel (i.e., the preamble’s transmission option [2]).

99. The preamble further requires that the claimed “a single wireless channel” be “determined to be idle.” The Shpak-Ho access points and mobile devices “communicate with one another in accordance with one of the standards in the IEEE 802.11 family,” and thus the APs would utilize the “802.11 standard... mechanism for collision avoidance known as clear channel assessment (CCA), which requires a station to refrain from transmitting when it *senses* other transmissions on its frequency channel.” Shpak, [0005]. As I discussed in Paragraph 35 above, POSA would have known “clear channel assessment” is a

form of carrier sense that determines whether a channel is idle before (i.e., refraining from) transmitting. As further corroborating evidence that POSAs understand conventional 802.11 devices to use carrier sense, Ex. 1037 at 1:42-49 explains that in an IEEE 802.11 network “a station or access point will *wait until the channel is idle* before attempting to transmit a signal,” consistent with the “Carrier Sense Multiple Access (CSMA) mechanism,” where the clear channel assessment (CCA) is the result of the carrier sensing. *See* Ex. 1002, 136.

100. Shpak’s novel “arbitration process” involves only communication among the APs to determine which access points will respond to a mobile station’s uplink association request and communicate with the station. Shpak, [0007]-[0026]. However, this arbitration procedure does not alter the communication protocol between the “winning” access point and the mobile station, which occurs according to 802.11 and thus is relies on the clear channel assessment (CCA) protocol because, as I discussed above in Sections V.A.1 and VI.A.3, CCA is standard in 802.11-compliant WLANs, and Shpak is clear that communication between its access points and mobile stations is 802.11 compliant. Shpak, [0005], [0033], [0038] (noting that Shpak’s arbitration procedure requires “no modification of legacy mobile stations”). POSAs would have understood that for CCA to work in a CSMA/CA access mechanism, all devices in the network must use CCA. If, in contrast, only legacy devices had continued to use CCA, the legacy devices would

have had difficulty gaining access to the channel if other devices were able to access the channel without sensing the legacy device's use of the channel; similarly, packets transmitted by the legacy devices would have experienced significant interference from other devices if those devices accessed the channel without sensing whether it were idle.

101. CCA thus prevents collisions in Shpak's system the same way it does in any other 802.11-compliant system. For example, CCA prevent collisions occurring (1) when a mobile station is transmitting on the "common frequency channel" at the same time an access point wishes to use the channel, (2) when multiple stations are using the same common frequency channel, (3) when transmissions from other nearby "access points on the same frequency channel that did not receive an uplink signal from the mobile," and thus did not participate in the arbitration scheme (Shpak, [0042]), and (4) when non-802.11 devices transmit on the same frequency. As I explained in Section V.A.1 above, 802.11b systems, for example, operate on the ISM 2.4 GHz band used by a variety of devices and thus non-802.11 devices can with communications over the common frequency channel. As Ex. 1041 at 1:59-64 corroborates as background information, 802.11 networks face interference "from non-802.11 signals, such as Bluetooth, scientific equipment, medical equipment, or microwave ovens," because they operate in the same ISM band.

102. Because Shpak-Ho uses 802.11's conventional CCA technology, the "winning" access point in Shpak's arbitration scheme (i.e., the AP that communicates with the mobile station), only communicates with the mobile station on the "common frequency channel" when that channel is determined to be idle. Shpak-Ho's "common frequency channel" is thus "determined to be idle" as recited in the preamble.

b. [1A] setting a mandatory channel that is always used for transmission; and

103. Shpak-Ho's access points "set[] a mandatory channel that is always used for transmission."

104. As Shpak explains, the 802.11b standard defines 14 frequency channels in the ISM 2.4GHz band but because of "bandwidth and regulatory limitations, WLANs operating according to th[is] standard[] in the United States actually have only three frequency channels from which to choose." Shpak, [0006]. In countries like Spain, France, and Japan, the governments mandate that only a single frequency channel can be used. Shpak, [0006].

105. Shpak-Ho uses Shpak's method for "arranging a plurality of access points in a wireless local area network (WLAN) to communicate on a common frequency channel with a mobile station." Shpak, [0011]; *see also* Shpak, [0022]. A POSA understand that "arranging" access points to communicate on a "common frequency channel" requires each access point to set its WLAN transceivers to

communicate on the same (common) frequency channel. For example, Shpak, [0024], describes an “access point apparatus” that includes “a radio transceiver, which is configured to communicate *on a predetermined frequency channel* with a mobile station.” And paragraph [0046] explains that each access point has a “message processor 72” that controls a “WLAN transceiver 78” in compliance with Shpak’s invention and “the applicable WLAN standards” (e.g., 802.11b in an 802.11b implementation. Thus, in a Shpak-Ho WLAN, each AP communicates with a mobile station over only a single channel, the “common frequency channel” set for the WLAN.

106. Shpak-Ho’s “common frequency channel” meets the claimed “mandatory channel that is always used for transmission.” As Shpak explains, all communication with mobile stations and APs within Shpak’s basic service set (“the group of mobile stations communicating with the same access point,” Shpak, [0004]) occurs over the “common frequency channel.” Shpak, Abstract, [0011]-[0012], [0022], [0024], [0037], Claims 1, 13. In Shpak-Ho, multiple wireless packets are simultaneously transmitted to a mobile station within the basic service set only over the “common frequency channel” (using different MIMO subchannels)—no other frequency channel is used, consistent with Shpak’s disclosure that the single channel is “predetermined” (Shpak, [0023]). The

“common frequency channel” is thus a “mandatory channel that is always used for transmission.”

- c. **[1B] transmitting the wireless packets by using a wireless channel/wireless channels that includes/include the mandatory channel, only when the mandatory channel is idle.**

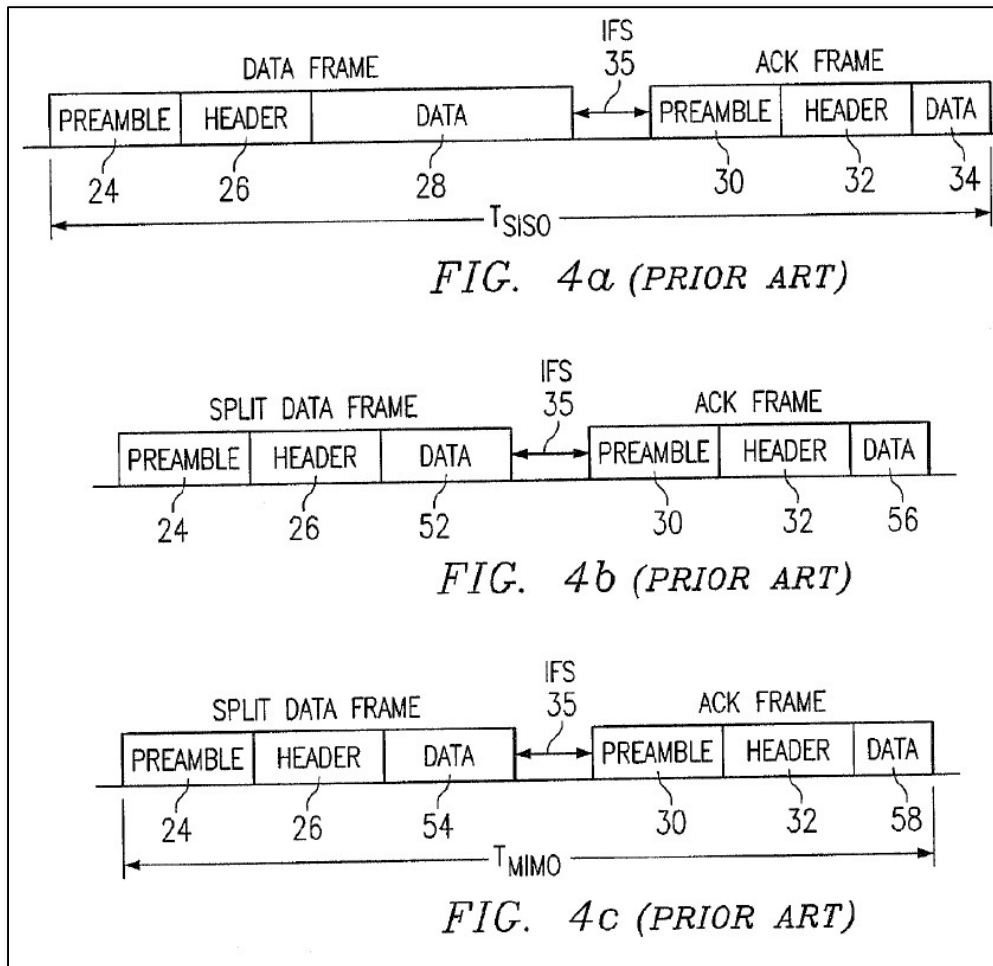
107. Shpak-Ho’s AP’s “transmit[] the wireless packets by using a wireless channel/wireless channels that includes/include the mandatory channel, only when the mandatory channel is idle.” Shpak’s “common frequency channel,” discussed in Section VI.A.4.b above, is a mandatory channel because it is the only channel used for transmissions between the winning access point and the mobile channel that sent the association request while the mobile device remains in the BSS’s coverage area. POSAs understood that these transmissions are sent by Shpak-Ho’s access point as wireless packets, in accordance with 802.11 standards, as I discussed in Section V.A.1 above (citing Ex. 1001, 1:23-42 (citing IEEE 802.11-1999 as background information for a “conventional wireless *packet* communication apparatus”)) and in Section VI.A.3 above, which explains that the MIMO data frames generated by the Shpak-Ho access point are generated according to the conventional procedure disclosed in Ho, which generates data frames (packets) for each MIMO subchannel. Moreover, because Limitation 1B covers transmitting packets “using a wireless channel” (singular) “that includes the mandatory channel,” Shpak-Ho’s disclosure of transmitting packets using the

mandatory “common frequency channel” meets this limitation. Finally, as explained in Section VI.A.3 above, access points in Shpak-Ho use the customary clear channel assessment (CCA) technology in 802.11 WLAN standards as part of the CSMA/CA access mechanism, and thus would have only used the mandatory “common frequency channel” when the carrier sense mechanism determined it is idle. *See* Ex. 1002, 136 (STA “shall [i.e., must] sense the medium” using CSMA/CA).

5. Dependent Claim 3: The wireless packet communication method according to claim 1 or 2, wherein the plurality of wireless packets transmitted simultaneously are set to have a same or equivalent packet time length that corresponds to a packet size or a transmission time.

108. Claim 3 depends from claim 1, and requires “the plurality of wireless packets transmitted simultaneously are set to have a same or equivalent packet time length that corresponds to a packet size or a transmission time.” The ’551 Patent states that “packet time lengths” is the “time required to transmit the wireless packets.” Ex. 1001, 2:64-65. Ho discloses that wireless packets on different MIMO subchannels take the same amount of time to be transmitted on each subchannel, corresponding to an equal packet size or transmission time. Ho, [0010], FIG. 4b, 4c.

109. Ho’s MIMO technique “divide[s] the data payload 28” of a SISO data frame “into two smaller fields 52 and 54,” as illustrated in FIG. 4 (Ho, [0010]):



110. As I discussed in Section VI.A.2 above, each of Ho’s “split data frames” is a “packet.” Ho discloses that one “known” technique for dividing the payload data 28 in the SISO data frame “put[s] all of the even bits of data field 28 into field 52 and the odd bits into field 54.” Ho, [0010]. Thus, when data field 28 has an even number of bits, data fields 52 and 54 have the same size; and when data field 28 has an odd number of bits, data fields 52 and 54 have an equivalent size, because they would differ by only a single bit. POSAs also understand that the entire split data frames (packets) have the same (or equivalent) overall size because Ho further discloses that “preamble and header fields 24 and 26 must be

maintained in their entirety.” Ho, [0011]. That is, preamble 24 in the SISO data frame and two MIMO split data frames are equally sized, and the same is true for header 26. By assigning all of the preambles and headers the same character references 24 and 26 in the figures and specification of Ho, Ho reinforces to POSAs that they have the same size. Thus, the preambles and headers also equal sized across the data frames and the overall data frames/ packets are equal sized.

111. As shown in Ho’s Figures 4a-c (above), these same length packets require the same time to complete transmission, specifically a time equal to T_{MIMO} minus the IFS (InterFrame Space interval, a length of time defined by the 802.11 standard) and the ACK Frame (which Ho explains are “maintained in their entirety” for both packets, Ho, [0015]), which are equal for both split data frames (packets). Ho, [0010]-[0012]. Ho further confirms that the packets take the same time to traverse the subchannels by noting that “twice as many bits” are transmitted “in *the same amount of time*” it would take to send half as many bits without MIMO. Ho, [0012]. Thus, Ho discloses a conventional implementation of a MIMO system in the prior art, where the packets sent simultaneously on different subchannels have the same packet length times that correspond to a packet size or transmission time, because the time required to transmit the wireless packets over each subchannel is the same. Ex. 1001, 2:64-65 (disclosing that “packet time lengths” is the “time required to transmit the wireless packets”). Because Shpak-

Ho implements the conventional MIMO technique disclosed in Ho (as discussed in Section VI.A.3 above), Shpak-Ho's access point transmits equal (or equivalent) packet length times, corresponding to equal (or equivalent) packet sizes or equal (or equivalent) transmission times.

6. Independent Claim 5

112. As I discussed above in Section V.C, Claim 5 of the '551 Patent is an apparatus claim that performs the method steps recited in Claim 1. Claim 5 is rendered obvious by Shpak-Ho's access point, which implements the method steps of Claim 1 for the same reasons discussed in Section VI.A.4 above, as I explain further in this Section below.

- a. **[5PRE] A wireless packet communication apparatus for transmitting a plurality of wireless packets simultaneously by using multiple wireless channels determined to be idle by carrier sense, a single wireless channel determined to be idle and MIMO, or the multiple wireless channels and the MIMO, the apparatus comprising:**

113. The preamble of Claim 5 recites a "wireless packet communication apparatus for transmitting a plurality of wireless packets simultaneously by using" one of the three packet transmission techniques recited in the preamble of Claim 1. As with Claim 1's preamble, the three different transmission techniques in Claim 5's preamble are joined by the word "or." Thus, for the same reasons I discussed in Section VI.A.4.a.1 above for limitation [1PRE], POSAs understand that a

“wireless packet communication apparatus for transmitting a plurality of wireless packets simultaneously” that is capable of using any of the three techniques meets the claim.

114. Shpak discloses an “access point *apparatus* for deployment in a wireless local area network (WLAN)... for mobile *communication*.” Shpak, [0023]. As I discussed in Section VI.A.3 above, Shpak-Ho access points are 802.11b access points utilizing multiple antennas to perform MIMO transmission techniques over Shpak’s “common frequency channel.” Thus, the Shpak-Ho access point meets a “wireless packet communicating apparatus.” As I discussed in Section VI.A.4.a.(2) above, the Shpak-Ho access point transmits a plurality of wireless packets simultaneously by using “a single wireless channel determined to be idle and MIMO,” by using the conventional MIMO technique taught by Ho, implementing 802.11’s conventional carrier sense assessment technique (a CSMA/CA algorithm) to determine when the MIMO channel is idle before commencing transmissions over the channel. *See* Ex. 1002, 136.

115. Thus, for the reasons I discuss above in Section VI.A.4.a.(2) with respect to limitation [1PRE], the access point in Shpak-Ho meets Claim 5’s preamble.

b. [5A] a unit setting a mandatory channel that is always used for transmission; and

116. Shpak's access point is a conventional 802.11 access point apparatus that includes a "message processor 72" that configures transceiver 78 "to communicate on a *predetermined frequency channel* with mobile stations." Shpak, [0024], [0046], claim 25. The message processor "interacts with and controls" the "WLAN transceiver 78, in compliance with the collaboration protocol," and the transceivers "communicate over the air with mobile stations 24 in accordance with the applicable WLAN standards." Shpak, [0046]. The Shpak-Ho access point's message processor thus selects the "predetermined frequency channel" from among the channels defined in the standard (e.g., from among Channels 1, 6 or 11 in an 802.11b implementation in the United States), and configures the transceiver to use that channel for its transmissions with mobile stations. Shpak, [0006], [0046]; *see* Section V.A.1 above. As I discussed in Section VI.A.4.b above, the "predetermined frequency channel" is a "mandatory channel that is always used for transmission." Thus, a POSA would have understood that message processor 78 (a "unit") sets this predetermined frequency channels to be the "mandatory channel that is always used for transmission," as claimed. Thus, using its message processor, an access point in Shpak-Ho meets limitation 5A for the same reasons it performs the method recited in limitation 1A, as I discussed in Section VI.A.4.b above.

- c. **[5B] transmitting the wireless packets only when the mandatory channel is idle by using a wireless channel or wireless channels that includes/include the mandatory channel.**

117. As discussed in Section VI.A.6.b above, the Shpak-Ho access point include a message processor, which is “configured to communicate [i.e., transmit] on a predetermined frequency channel [i.e., the mandatory channel] with a mobile station.” Shpak, [0024]. As I discussed in Section VI.A.4.c above in connection with limitation 1B, the Shpak-Ho access only communicates wireless packets on the common frequency channel (mandatory channel) using MIMO transmissions when the channel is determined to be idle, according to 802.11’s clear channel assessment (CAA) carrier sense protocol. Thus, an access point in Shpak-Ho meets limitation 5B for the same reasons it performs the method recited in limitation 1B, as I discussed above in Section VI.A.4.c.

- 7. **Dependent Claim 7: The wireless packet communication apparatus according to claim 5 or 6, wherein the plurality of wireless packets transmitted simultaneously are set to have a same or equivalent packet time length that corresponds to a packet size or a transmission time.**

118. Claim 7 requires claim 5’s (or claim 6’s) “wireless packet communication apparatus,” which is met by Shpak-Ho’s access point for the reasons discussed above in Section VI.A.6.a. Claim 7 also requires that claim 5’s apparatus is configured such that “the plurality of wireless packets transmitted simultaneously are set to have a same or equivalent packet time length that

corresponds to a packet size or a transmission time,” which is the same limitation added by Claim 3 to the method of Claim 1 or 2, which I discussed above in Section VI.A.5. Thus, Shpak-Ho meets this limitation for the same reasons discussed above in Section VI.A.5 for Claim 3.

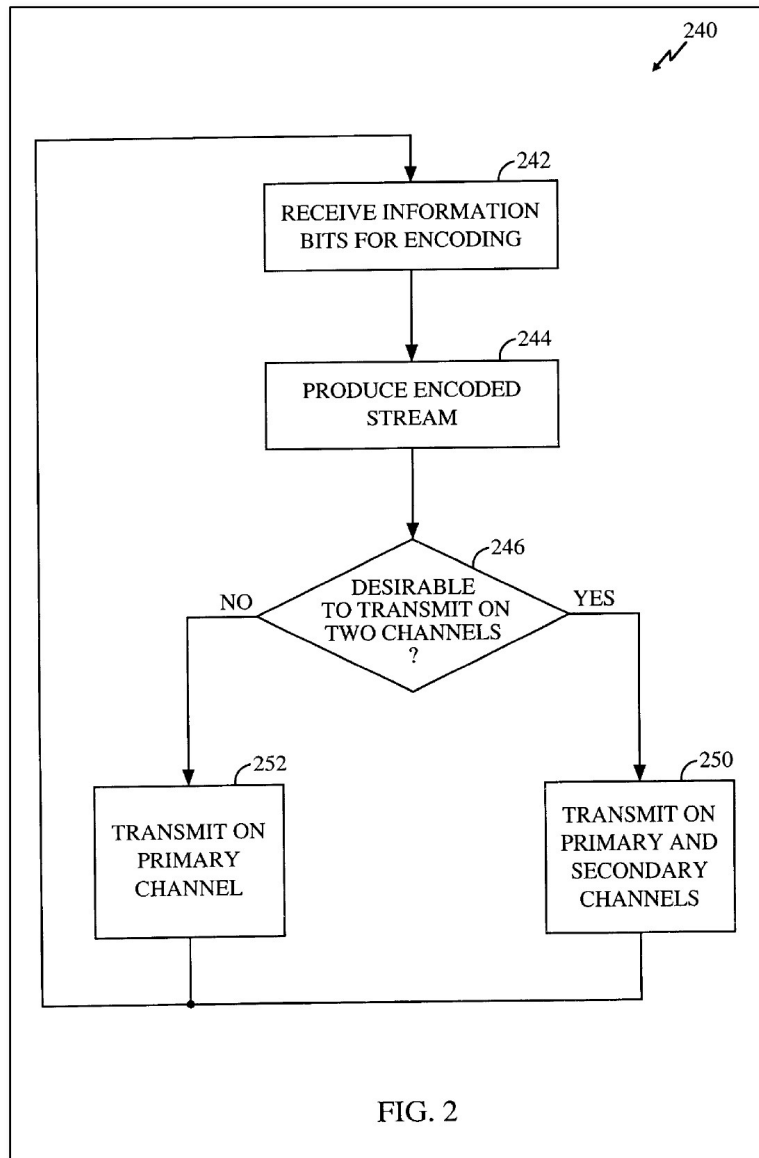
B. Ground 2: Claims 1, 3-5, 7-8 Would Have Been Obvious Over Shpak (Ex. 1005) in View of Lundby (Ex. 1008)

1. Shpak (Ex. 1005)

119. Shpak’s disclosure was discussed in Section VI.A.1 above.

2. Lundby (Ex. 1008)

120. Lundby is a U.S. Patent that was filed on April 7, 2000 and issued on May 6, 2003. Lundby, (22), (45). I understand that Lundby is therefore prior art to the ’551 Patent. Lundby was not considered during prosecution of the ’551 Patent. *See generally* Ex. 1002. Lundby discloses a method for “improving the transmission of information signals in a communication system having a base station and a remote station.” Lundby, Abstract. As illustrated in FIG. 2 below, Lundby teaches the transmitting device (e.g., base station) determines whether it is desirable to transmit signals over one channel (a primary channel) or two channels (a primary and secondary channel). Lundby, 4:25-30:



121. Lundby's process begins when the base station has an "information bit stream to be transmitted to a remote station." Lundby, 3:51-53. The information bit stream is first error correction "encoded into a lower rate encoded bit stream to decrease the required E_b/N_o needed to transmit the bits to a remote station." Lundby, 3:55-57. (E_b/N_o is a measure of the signal-to-noise ratio (SNR) for a digital communication.) Then, at decision block 246, "it is determined whether a

single standard rate encoded bit stream should be transmitted on a single channel [the ‘primary channel’] or whether a lower rate encoded bit stream should be transmitted in portions over two channels [the ‘primary and secondary channels’].” Lundby, 4:26-30. This decision can be based on “[a]ny parameter(s),” “[t]he only criterion... is whether the parameter can be used to optimize the communication system in some way.” Lundby, 4:30-52. This teaching applies to any “embodiment[] that can determine whether transmitting data to a particular remote station across two channels will optimize the communication system.” Lundby, 5:49-53. Lundby teaches that “[a] straightforward way to make the decision is to have the transmitter recognize that it is transmitting at a high power level... and that it should switch from one transmit stream to two transmit streams.” Lundby, 4:37-43.

122. If “it is determined that the communication system will benefit from transmitting data to a particular remote station across two channels,” different portions of the bit stream are transmitted across both the primary and secondary channels, where those portions can be “of equal length” or “varying length.” Lundby, 6:5-8, 6:22-27. Conversely, if it is determined that the system would not benefit from using two channels for a particular transmission, “the process proceeds to block 252,” to “transmit on the primary channel” only. Lundby, 6:8, FIG. 2. Thus, Lundby’s primary channel is *always* used by the base station to

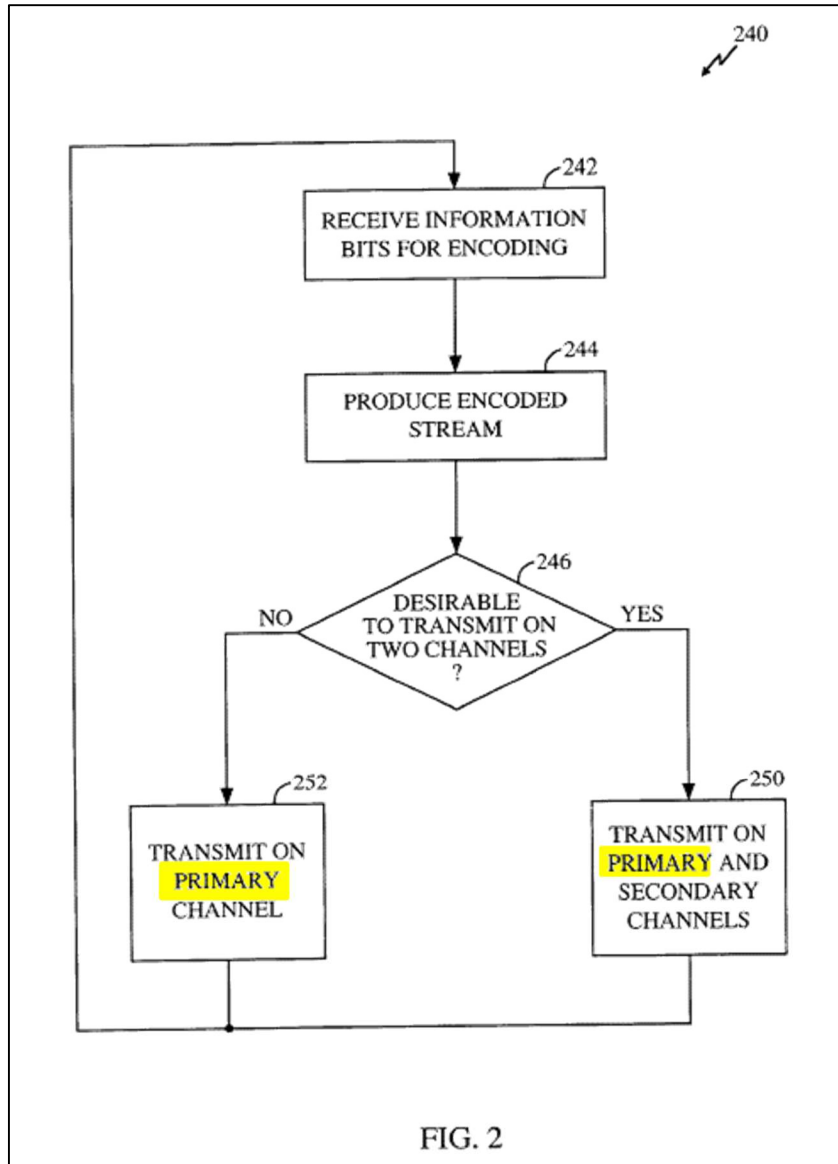
transmit to the remote station, whereas “[t]he secondary channel can be established when needed or it can already be in use.” Lundby, 6:30-34.

123. Though Lundby’s preferred embodiments are CDMA systems using channel (error correction) coding, a POSA would have recognized that Lundby’s teaching applied to any telecommunication system that had multiple available channels, such as an 802.11b system (which generally has up to three frequency channels available, as I discussed in Section V.A.1 above). The decision tree in Lundby’s FIG. 2, for example, is independent of the type of wireless communication being used. Similarly, POSAs would have understood that Lundby’s teachings are also independent of whether channel coding was used, because the benefits of using an additional channel can be determined without error coding. Indeed, Lundby explains that its teaching applies to any “embodiment[] that can determine whether transmitting data to a particular remote station across two channels will optimize the communication system.” Lundby, 5:49-53. Lundby further underscores that the invention is not limited to a cellular system by stating that “[t]he present invention relates to communication *in general* and, in particular, to improving the transmission of information *in a communications system*.” Lundby, 1:7-9. Lundby’s independent claims similarly claim the invention broadly, as an invention “for improving the transmission of information signals *in a communication system*,” without limiting to a particular

type of communication system. Lundby, 20:33-34, 22:4-5. POSAs would have also understood that CDMA base stations are analogous to WLAN access points, reinforcing the applicability and benefits of Lundby's teachings to WLAN systems. Indeed, WLAN access points are often referred to as base stations, because an access point is "the counterpart of the base station of a mobile cellular communications system." Ex. 1014, [0009]; Bugeja, [0003] (corroborating evidence that in a wireless LAN the "base station [is] known as an access point (AP)"). For example, Lundby's exemplary basis for the decision of whether to transmit on one versus two channels – if the transmission power on one channel exceeds a threshold (Lundby, 4:37-43) – would have benefitted 802.11 systems in the same manner, because POSAs knew that in WLAN systems it is often "desirable to reduce the transmission power... to conserve the battery power of one or both the access point system [] a mobile communication unit." Ex. 1040, 9:36-41. Thus, POSAs would have understood that the "generic principles" of Lundby's disclosure – determining whether using a secondary channel in addition to a primary channel would enhance the communication system in some manner – applied to non-CDMA communication system with at least two channels, such as 802.11b. Lundby, 20:24-26 ("[T]he *generic principles defined herein* may be applied to other embodiment without the use of the inventive faculty.").

3. Implementing Shpak in View of Lundby

124. As discussed in Section VI.A.1 above, Shpak teaches using one of the available channels in an 802.11 system as a “common frequency channel” for all communications, but notes that in the United States there are “three different frequency channels from which to choose.” Shpak, [0006], [0011], [0022], [0024], [0037], [0051], claims 1, 13. As discussed in Section VI.B.2 above, Lundby teaches using a primary wireless channel in a wireless communication system for all communications and adding a secondary wireless channel when doing so is desirable. Lundby, 4:25-43. As seen in Lundby’s Figure 2, Lundby teaches transmit data either on the primary channel alone or, if desirable, transmitted on *both* the primary and secondary channels. Lundby, FIG. 2, 4:25-30.



125. A POSA would have readily seen a parallel between Lundby’s “primary” channel and Shpak’s “common frequency channel” because they serve similar roles as the default channel used by a transmitting device. Lundby, FIG. 2, 7:5-9; Shpak, [0046]. Moreover, as I discussed in Section V.A.2 above, it was well-known in the prior to communicate over multiple channels simultaneously in a WLAN system and Lundby discloses a common and accepted technique for expanding the number of wireless channels a device can utilize on an ad hoc basis

to transmit data to other devices. A POSA would have had reason to implement Shpak in view of Lundby to use Shpak's "common frequency channel" as the "primary channel" and, when desirable, add one of Shpak's other available 802.11b channels as a "secondary channel," in the manner taught by Lundby, to augment the primary channel's bandwidth such that wireless packets are transmitted on both channels simultaneously. Shpak's access point would not have otherwise changed. A POSA would have had several reasons to implement this proposed combination, which I will refer to as "Shpak-Lundby."

126. First, POSAs would have been motivated to use Lundby's technique of expanding the number of channels a device can utilize on an ad hoc basis (Lundby, FIG. 2, 4:25-55) to enhance the speed of Shpak's system, give Shpak's stated desire to "enhanc[e] the coverage and speed of WLAN systems," Shpak, [0007], because adding a secondary channel would have allowed for nearly doubling the speed of a particular access point-client communication in Shpak. POSAs would have also recognized the benefit in having Shpak's access point in particular circumstances where increased speed on an ad hoc basis is desired, such as when a particular client device begins performing a particularly data intensive operations, such as, streaming video. Lundby teaches that one "straight forward way to make the decision" to add a secondary channel is to recognize when the AP "is transmitting at a high power level." Lundby, 4:37-43. A POSA would have

understood that transmitting at a high-power level can indicate the access point's is responding to a client's request to transmit a high volume of data, and thus transmission power would be a "straightforward way" to identify when Shpak's system would benefit from adding a second channel for communicating to this client.

127. Using a second channel to transmit a portion of the data also advantageously reduces interference with nearby APs or other devices operating on the primary channel. As I explained in Section V.A.1 above, 802.11b uses the 2.4 GHz ISM band shared by many devices, beyond 802.11b, such as baby monitors and cordless phones, which a POSA would have been motivated to minimize interfering with. Ex. 1026 at 6:8-15 corroborates that POSAs knew that the various devices that operate in the unlicensed frequency band. Similarly, Ex. 1025, 2:63-65 notes as background information that signals in 802.11 systems "may also be degraded due to interference from other data transmitters or other radio frequency (RF) radiators." Ex. 1025 at 13:18-19 further corroborates that POSAs understood that the "power needed to reliably transmit at the higher data rate may be unavailable" in an 802.11 system.

128. POSAs would have also recognized that reducing the power on the primary channel helps prevents the power of an individual channel from exceeding the AP's capability and/or regulatory limits. As corroborating evidence, Ex. 1025

notes that “[t]he transmission power associated with a data signal transmitted to a particular receiving device [in an 802.11 system] may be too low” (2:63-65, 3:3-13), the data rate of the “data channel can be limited to specifications of a communication standard” (13:12-13), and the “power needed to reliably transmit data at the higher data rate may be unavailable” (13:18-19). As additional corroborating evidence of the benefits of being able to satisfy a client’s data demands without increasing transmission power of an 802.11 access point beyond a threshold, Ex. 1026 at 1:25-30 notes as background information that the FCC “sets requirements for the unlicensed bands such as limits on transmit power spectral density,” and thus POSAs understand that an access point could not increase its power indefinitely.

129. POSAs would have recognized data rate would have been an equally straightforward parameter to use as an alternative to power, so that the AP adds an additional channel when the client requests a data rate above the primary channel’s capacity. As corroborating evidence that POSAs knew that the data rate of an individual channel was often inadequate, Ex. 1025 at 3:3-13 notes that “a transmission data rate for a particular data channel may be inadequate for a high-bandwidth receiving device” because of the “maximum data rate” set by the 802.11 standard. Similarly, Ex. 1043 corroborates that an additional channel to a wireless network were known to “increase[] data transfer capabilities.” Ex. 1043, Abstract,

[0012], [0014], [0028], [0033]-[0038]. Thus, Ex. 1043 further demonstrates that POSAs knew additional channel could be added on an ad hoc basis, such as when a “mobile device” wants to “transmit data over the wireless network at greater data transfer rates,” and thus the data rates can be “adjusted in accordance with the user’s needs or desires.” Ex. 1043, [0035], [0048].

130. Second, POSAs would have been motivated to use Lundby’s technique of expanding the number of channels a device can utilize on an ad hoc basis because the implementation would have involved the use of a known technique (transmitting over one or more of the available 802.11b channels) to improve similar devices (802.11-based access points and cellular-based base stations) in the same way (increasing data rates while reducing transmission power) to yield a predictable result (an access point using an additional channel when desirable). As I explained in Paragraph 123 above, POSAs understood that Lundby’s teachings were broadly applicable to WLAN systems. Moreover, POSAs would have recognized the similarity between Shpak’s WLAN access points and Lundby’s exemplary CDMA base stations, for the reasons I discussed in Paragraphs 123 above. As additional corroborating evidence of the similarity between a WLAN access point and CDMA base station, Ex. 1014 at [0009] notes that “[t]he AP [WLAN access point] can be thought of as the counterpart of the base station of a mobile cellular communications system.” Similarly, Ex. 1016

provides at [0004] background information that 802.11 “WLANs are similar to cellular systems in that a coverage area is divided into cells (called Basic Service Sets or BSS in the WLAN nomenclature) that are controlled by a control base station, known as an Access Point” and both are “type[s] of wireless communication system in which radio frequency channels are shared.”

131. Third, POSA understood that there a finite number of predictable ways to increase the speed of communication between two devices in a fixed-bandwidth communication system like an 802.11 system, such as increasing the transmission power, increasing the modulation density (e.g., number of bits transmitted per symbol), or increasing the number of channels used (or a combination of these or other known techniques). Adding a secondary channel to increase the speed would have, therefore, been obvious to try as one of the finite number of known ways to increase the speed of communications in an 802.11b system. The result would have been predictable: devices would have communicated over multiple channels when desired to increase the speed. As corroborating evidence that using multiple channels was one of the known, predictable ways to increase communication speed, Bugeja, [0023] notes that 802.11b allowed simultaneously multi-channel transmission and Bugeja, [0037] explains that multichannel operations allow for increased download and upload speeds. And the '551 Patent itself concedes that simultaneous multi-channel

transmissions in 802.11 systems were known to a POSA by September 2003. Ex. 1001, 1:42-47. The applicants also conceded that multi-channel transmissions were known in the art during prosecution of the '551 Patent. *See* Ex. 1002, 307 (“Mousley does disclose a method to transmit plural wireless packets simultaneously by using multiple wireless channels....”).

132. POSAs would have had a reasonable expectation of success because Shpak recognizes that 802.11b systems in the United States generally had at least “three different frequency channels from which to choose,” Shpak, [0006], and the '551 Patent admits (1:45-47) it was part of a POSA’s background knowledge to be able “transmit[a plurality of wireless packets] simultaneously by using the wireless channels.” Similarly, Bugeja depicts a multi-channel 802.11-compliant access points. Bugeja, FIGS. 3-5 Abstract, [0007], [0013]-[0015], [0023], [0027]. Shpak also explicitly discloses that access points “generally have multiple antennas” already for “diversity purposes,” and operate on multiple frequency channels, and thus POSAs would have understand the multiple antennas could be used to simultaneously transmit on different frequency channels using ordinary skill, using a conventional multi-channel transmission technique. The applicants also conceded during prosecution of the '551 Patent that prior art reference Mousley (Ex. 1009) discloses multi-channel transmissions. *See* Ex. 1002, 307.

133. Lundby teaches that the receiving station can be informed about future transmissions over two channels with a simple “indicator message” that indicates signals “will be transmitted on two channels at a predetermined point in time in the future.” Lundby, 9:15-21. Thus, it would have required only ordinary skill to have Shpak’s 802.11b access point include software for determining whether adding a secondary channel would have enhanced the communications in some manner, and indicating that decision to a client station that transmissions will proceed over the primary and secondary channels. Lundby disclosing that basing the decision on transmission power is “[a] straight forward way to make the decision,” Lundby, 4:37-42, underscoring that only ordinary skill would have been required to determine whether the desired transmission rate would require a transmission power that exceeded some threshold determined to be detrimental (e.g., a level that exceed regulatory limits or excessively interfered with neighboring cells). Similarly, POSAs would have recognized that using data rates (or known parameters indicative of data rates, such as a signal-to-noise ratio or bit error rates) would have been an equally straightforward way to increase the data rate by using multiple channels when desirable. POSAs would have understood the simple point that Bugeja at [0037] makes that using three channels offers “three times speed download and uploads,” and that using two channels, as taught by Lundby, would have offered up to two times speed downloads and uploads.

134. As I explain in Sections VI.B.4-.9 below, the Shpak-Lundby combination meets claims 1, 3-5, 7-8.

4. Independent Claim 1

- a. [1PRE] A wireless packet communication method for transmitting a plurality of wireless packets simultaneously by using [1] multiple wireless channels determined to be idle by carrier sense, [2] a single wireless channel determined to be idle and MIMO, or [3] the multiple wireless channels and the MIMO, the method comprising:**

135. Shpak-Lundby meets the preamble of Claim 1 for the reasons I discuss in this Section below.

(1) The Scope of the Preamble

136. As I addressed in Section VI.A.4.a.(1) above, POSAs understand the preamble is met by a prior art “wireless packet communication method for transmitting a plurality of wireless packets simultaneously” using *any* one of the three transmission options listed in the preamble.

(2) Shpak-Lundby Meets the Preamble

137. A Shpak-Lundby access point performs the method recited in the preamble of claim 1 using the “multiple wireless channels” technique (i.e., option [1]).

138. As I discussed in Section VI.A.1 above, Shpak’s access point transmits wireless packets to mobile clients, using one of the three available channels in an 802.11b implementation as a “common frequency channel.” Shpak,

[0006], [0022], [0024], [0036]-[0037], claim 1. As I discussed in Section VI.B.3 above, based on Lundby's express teachings, the Shpak-Lundby access point transmits wireless packets simultaneously using multiple channels when desirable, using the "common frequency channel" as a primary channel and one of the other available 802.11b channels as a secondary channel. POSAs understood that these transmissions are sent by Shpak-Lundby's access point as wireless packets, in accordance with 802.11 standards, as I discussed in Section V.A.1 above (citing Ex. 1001, 1:23-42 (citing IEEE 802.11-1999 as background information for a "conventional wireless *packet* communication apparatus")). Like the Shpak-Ho access point that I discussed in Section VI.A.3 above, the Shpak-Lundby access point is 802.11 compliant and thus determines the channels to be idle before transmitting, based the "802.11 standard[']s... mechanism for collision avoidance known as clear channel assessment (CCA), which requires a station to refrain from transmitting when it *senses* other transmissions on its frequency channel." Shpak, [0005]. As I discussed in Section V.A.1 above, CCA is the physical layer algorithm used by the physical layer in an 802.11 system "to determine if the channel is clear," which is information (e.g., a "clear channel status") passed to the MAC layer to implement the CSMA/CA algorithm used "to avoid data collisions" on the channel, as corroborated by Ex. 1044 at 2:47-3:7. Ex. 1037 at 1:42-49 further corroborates that in an IEEE 802.11 network, like the one used by Shpak-

Lundby (Section VI.B.3 above) “a station or access point will wait until the *channel is idle* before attempting to transmit a signal” because of the “Carrier Sense Multiple Access (CSMA) mechanism.” *See* Ex. 1002, 136 (STA “shall [i.e., must] sense the medium” using CSMA/CA).

139. Thus, Shpak-Lundby uses “[a] wireless packet communication method for transmitting a plurality of wireless packets simultaneously by using multiple wireless channels determined to be idle by carrier sense.”

b. [1A] setting a mandatory channel that is always used for transmission; and

140. As I discussed in Sections VI.B.3 and VI.B.4.a.(2) above, the Shpak-Lundby access point uses Shpak’s common frequency channel as the “primary channel” disclosed by Lundby. As I discussed in Section VI.B.4.a.(2) above, the primary channel is “a mandatory channel that is always used for transmission,” because the Shpak-Lundby access point would have applied Lundby’s decision tree to select which channel(s) to use: (a) the “*primary* channel” or (b) the “*primary* and secondary channels” when desirable. Thus, in both of the transmissions options taught by Lundby, the primary channel is always used for transmission. That Lundby does not disclose using *only* the secondary channel, underscores that the primary channel is *always* used for transmission, as claimed. Accordingly, the Shpak-Lundby access point would have “set[] a mandatory channel [the common frequency channel] that is always used for transmission.”

- c. **[1B] transmitting the wireless packets by using a wireless channel/wireless channels that includes/include the mandatory channel, only when the mandatory channel is idle.**

141. As discussed Section VI.B.4.b above, Shpak's "common frequency channel" is a mandatory channel for the Shpak-Lundby access point because it is always used for transmissions between the access point and the station that sent the association request. These transmissions are sent as wireless packets, in accordance with 802.11 standards, as I discussed in Section VI.B.4.a.(2) above and the '551 Patent concedes is conventional in 802.11 standards. *See* Ex. 1001, 1:23-42 (citing IEEE 802.11-1999 as background information for a "conventional wireless *packet* communication apparatus"). Thus, Shpak-Lundby access points would have always sent packet transmissions using the primary (mandatory) channel, alone or in combination with Shpak-Lundby's secondary channel. As explained in Section VI.B.4.a.(2) above (citing Ex. 1037 at 1:42-49 as additional corroborating evidence), using Lundby's decision tree to transmit on the primary channel or primary and secondary channels (Lundby, FIG. 2, 4:25-30), access points in Shpak-Lundby use 802.11's clear channel assessment (CCA) technology to sense the channels and thus would have only used the mandatory "common frequency channel" when the carrier sense mechanism determined the primary channel was idle, and would not transmit data on any channel until the primary channel was detected as being idle.

5. Dependent Claim 3: The wireless packet communication method according to claim 1 or 2, wherein the plurality of wireless packets transmitted simultaneously are set to have a same or equivalent packet time length that corresponds to a packet size or a transmission time.

142. Claim 3 depends from claim 1, and requires “the plurality of wireless packets transmitted simultaneously are set to have a same or equivalent packet time length that corresponds to a packet size or a transmission time.” The ’551 Patent states that “packet time lengths” is the “time required to transmit the wireless packets.” Ex. 1001, 2:64-65. As I discussed in Sections VI.B.3 and VI.B.4.a.(2) above, the Shpak-Lundby access point simultaneously transmits the plurality of wireless packets over primary (mandatory) and secondary channels, where the primary channel is Shpak’s common frequency channel.

143. A POSA would have set the packets to have a same or equivalent packet length time that corresponds to a packet size or a transmission time for numerous reasons.

144. First, Lundy expressly discloses that the “portions transmitted [on each channel] are of equal length.” Lundby, 6:22-23. This would have at least suggested to POSAs to use the same transmission rates on each channel as the simplest implementation of transmitting on two channels, thereby resulting in the same packet time lengths on each channel, corresponding to the same packet sizes.

145. Second, as I discussed in Sections VI.B.4.c above, the Shpak-Lundby access point would not have begun transmitting on the primary and secondary channels until both channels were unoccupied (i.e., idle), which means the total time the channels are occupied is determined based on the channel having the longer packet time length. Subsequent transmissions cannot occur until both channels are unoccupied (i.e., idle), for the reasons discussed in Sections V.A.1, VI.B.4.a.(2), VI.B.4.c above, and so there would be no benefit to having one channel complete its transmissions earlier than the other. As Ex. 1025 at 5:43-51 (and at 10:35-67) corroborates, POSAs understood that “[w]hile packets may be sent simultaneously, an extended durations” of a packet on one channel “in comparison to a duration of a packet transmitted on another channel... can inhibit a throughput of [the] first channel.” Thus, a POSA would have been motivated to free up the channels as quickly as possible, which a POSA would have understood would have occurred when the packet length times were equal.

146. Third, as the '551 Patent concedes and prior art corroborates, there were “known methods” for breaking packets into smaller packets having equal packet time lengths and reconstructing the larger packets at the receiving end. Ex. 1001, 6:12-27. As I discussed in Section VI.A.2 above, Ho corroborates that it was known to transmit packets over two MIMO subchannels having equal packet time lengths, Ho, FIG. 4, [0010]-[0012]. Thus, implementing Shpak-Lundby to use

equal packet length times on its channels would have been the use of a known technique to improve similar devices (devices simultaneously transmitting over multiple wireless channels or subchannels) in the same way (equalizing the packet time lengths so that the overall transmission time is minimized).

147. Fourth, it would have been obvious to try having equal packet length times as one of the finite number (two) of predictable, known solutions for selecting the size of simultaneously transmitted packets over multiple channels, i.e., either with equal/equivalent or unequal/inequivalent packet time lengths that corresponds to equal packet lengths or a transmission time.

148. A POSA would have had a reasonable expectation of success having equal packet time lengths because Lundby expressly taught to transmit packets with an “equal length” (i.e., size). Lundby, 6:22-25, 9:67-10:2. It would have required only ordinary skill to divide data between primary and secondary channels to achieve equal or equivalent packet length times. For channels that had the same data rates, equal or equivalent packet length times would have been achieved by sending equal sized packets on the channels. For channels that had different data rates, equal or equivalent packet length times would have been achieved by sending unequal sized packet sizes, with the sizes determined from the data rates. For example, a channel that had twice the data rate as the other channel would

have carried packets that were twice as large, resulting in equal or equivalent packet length times.

6. Dependent Claim 4: The wireless packet communication method according to claim 1 or 2, further comprising simultaneously transmitting wireless packets selectively using the multiple wireless channels or the MIMO in accordance with a number of pieces of data or a number of MIMOs that depends on a channel condition.

149. Claim 4 depends from claim 1, and recites that the method further comprises “simultaneously transmitting wireless packets selectively *using the multiple wireless channels* or the MIMO *in accordance with a number of pieces of data* or a number of MIMOs that depends on a channel condition.” The ’551 Patent discloses that “[i]n accordance with this selection, wireless packets are reconstructed to have the same packet time length for the number of idle channels.” Ex. 1001, 8:17-19.

150. The emphasis added to the claim language in the paragraph above illustrates that claim 4 covers the multi-channel transmission aspect of the patent’s Fifth Embodiment (discussed at 8:8-22), which, in turn, refers back to the First Embodiment’s packet reconstruction techniques (discussed at 5:63-6:11). With that reconstruction technique, data packets are constructed such that each packet has the “same packet time length for every wireless channel in accordance with the number of idle channels and the number of transmission stand-by data packets.” Ex. 1001, 6:2-7; FIG. 3. For example, as seen in FIG. 3, if there is one data packet

and two wireless channels, the single packet is split into two equal-sized packets, but if there are three packets and two channels, then the three packets are reconstructed into two equal-sized packets. Ex. 1001, 6:12-33. That is, the multiple wireless channels are used in accordance with a number of pieces of data. The '551 Patent admits that these reconstruction methods were “known.”

151. As discussed in Section VI.B.4.a.(2) above, the Shpak-Lundby access point simultaneously transmits wireless packets using multiple wireless channels: Shpak's common frequency channel (the mandatory/ primary channel) and an additional 802.11 channel (the secondary channel). A POSA would have had reason to use these wireless channels in accordance with a number of pieces of data, as this was an admittedly known technique (as I explained in the paragraph directly above). For example, if two pieces of data (e.g., two data frames) were to be transmitted, it would have been a simple design choice for Shpak-Lundby access point to have transmitted one packet on the primary channel, and the other on the secondary channel, as this would have been consistent with Lundby's teaching to divide the bit stream into equal streams, one for each channel. Lundby, 6:9-23. As discussed in Section VI.B.5 above, it would have been obvious to make this division to achieve the same or equivalent packet time lengths on each channel, and thus claim 4 would have been obvious for the same reasons discussed regarding claim 3.

7. Independent Claim 5

152. As I discussed above in Section V.C, Claim 5 of the '551 Patent is an apparatus claim that performs the method steps recited in Claim 1. Claim 5 is rendered obvious by Shpak-Lundby's access point (an apparatus) that implements those method steps for the same reasons discussed in Section VI.B.4 above with respect to Claim 1, as I explain further in this Section below.

- a. **[5PRE] A wireless packet communication apparatus for transmitting a plurality of wireless packets simultaneously by using multiple wireless channels determined to be idle by carrier sense, a single wireless channel determined to be idle and MIMO, or the multiple wireless channels and the MIMO, the apparatus comprising:**

153. The preamble of Claim 5 recites a “wireless packet communication apparatus for transmitting a plurality of wireless packets simultaneously by using” one of the three packet transmission techniques recited in the preamble of Claim 1. As with Claim 1's preamble, the three different transmission techniques in Claim 5's preamble are joined by the word “or.” Thus, for the same reasons I discussed in Section VI.B.4.a.(1) above for limitation [1PRE], POSAs understand that a “wireless packet communication apparatus for transmitting a plurality of wireless packets simultaneously” using any of the three techniques meets the claim.

154. Shpak discloses an “access point *apparatus* for deployment in a wireless local area network (WLAN)... for mobile *communication*.” Shpak,

[0023]. As I discussed in Sections VI.B.3 and VI.B.4.a.(2) above, Shpak-Lundby are 802.11b access points (apparatuses) that transmit conventional 802.11 wireless packets. Thus, the Shpak-Lundby access point meets a “wireless packet communicating apparatus.” As I discussed in Section VI.B.4.a.(2) above, the Shpak-Lundby access point transmits a plurality of wireless packets simultaneously by using “multiple Wireless channels determined to be idle by carrier sense,” by implementing 802.11’s conventional carrier sense assessment technique (a CSMA/CA algorithm) to determine when the wireless channels are idle before commencing transmissions over the channels. *See* Ex. 1002, 136.

155. Thus, for the reasons I discuss above in Section VI.B.4.a.(2) with respect to limitation [1PRE], the access point in Shpak-Lundby meets Claim 5’s preamble.

b. [5A] a unit setting a mandatory channel that is always used for transmission; and

156. Shpak discloses a conventional 802.11 access point apparatus that includes a “message processor,” which is a “unit,” that is “configured to control the transceiver,” Shpak, [0025], which is “configured to communicate on a predetermined frequency channel with mobile stations.” Shpak, [0024]. In accordance with the 802.11 standard, the access point’s radio transceiver unit can select the communications channel to use as the “predetermined frequency channel” from among the channels defined in the standard (e.g., from among

Channels 1, 6 or 11 in an 802.11b implementation in the United States). Shpak, [0006]; *see* Section V.A.1 above. As I discussed in Section VI.B.4.b above, the “predetermined frequency channel” is a “mandatory channel that is always used for transmission.” Thus, the message processor in the Shpak-Lundby access point, which configures the transceivers used to transmit over the mandatory channel, is a unit that meets limitation 5A for the same reasons the access point performs the method recited in limitation 1A, as I discussed in Section VI.B.4.b above.

- c. **[5B] transmitting the wireless packets only when the mandatory channel is idle by using a wireless channel or wireless channels that includes/include the mandatory channel.**

157. As discussed in Section VI.B.7.b above, the Shpak-Lundby access point include a message processor (Shpak, [0025]) that controls the radio transceiver unit, which is “configured to communicate [i.e., transmit] on a predetermined frequency channel [i.e., the mandatory channel] with a mobile station” (Shpak, [0024]). As I discussed in Section VI.B.4.c above in connection with limitation 1B, the Shpak-Lundby access point only communicates on the common frequency channel (mandatory channel) when it is determined to be idle, according to the 802.11’s clear channel assessment (CCA), which is part of 802.11’s CSMA/CA carrier sense, medium access protocol, discussed in Section V.A.1 above. *See* Ex. 1002, 136 (STA “shall [i.e., must] sense the medium” using CSMA/CA). Thus, an access point in Shpak-Lundby meets limitation 5B for the

same reasons it performs the method recited in limitation 1B, as I discussed above in Section VI.B.4.c.

- 8. Dependent Claim 7: The wireless packet communication apparatus according to claim 5 or 6, wherein the plurality of wireless packets transmitted simultaneously are set to have a same or equivalent packet time length that corresponds to a packet size or a transmission time.**

158. Claim 7 requires claim 5's "wireless packet communication apparatus," which is met by Shpak-Lundby for the reasons discussed above in Section VI.B.7. Claim 7 also requires that claim 5's apparatus is configured such that "the plurality of wireless packets transmitted simultaneously are set to have a same or equivalent packet time length that corresponds to a packet size or a transmission time," which is the same limitation added by Claim 3 to the method of Claim 1 or 2. Thus, Shpak-Lundby meets the limitation of Claim 7 for the same reasons discussed above in Section VI.B.5 for Claim 3.

- 9. Dependent Claim 8: The wireless packet communication apparatus according to claim 5 or 6, further comprising: a unit simultaneously transmitting wireless packets selectively using the multiple wireless channels or the MIMO in accordance with a number of pieces of data or a number of MIMOs that depends on a channel condition.**

159. Claim 8 requires claim 5's "wireless packet communication apparatus," which is met by Shpak-Lundby for the reasons discussed above in Section VI.B.7. Claim 8 also requires a "unit simultaneously transmitting wireless packets selectively using the multiple wireless channels or the MIMO in

accordance with a number of pieces of data or a number of MIMOs that depends on a channel condition,” and thus the unit performs the limitation added by Claim 4 to the method of Claim 1 or 2. As discussed in Section VI.B.7.b above, the Shpak-Lundby access point includes a message processor (a unit) that configures the transceiver, which simultaneously transmits wireless packets to mobile stations using multiple 802.11 wireless channels. Using this transceiver controlled by the message processor unit, the Shpak-Lundby transmits wireless packets in accordance with the number of pieces of data, in the manner required by Claim 4 (as discussed in Section VI.B.6 above), thereby meeting the limitation added by Claim 8.

C. Ground 3: Claims 1-3 and 5-7 Would Have Been Obvious Over Bugeja (Ex. 1007) in View of Ho (Ex. 1006)

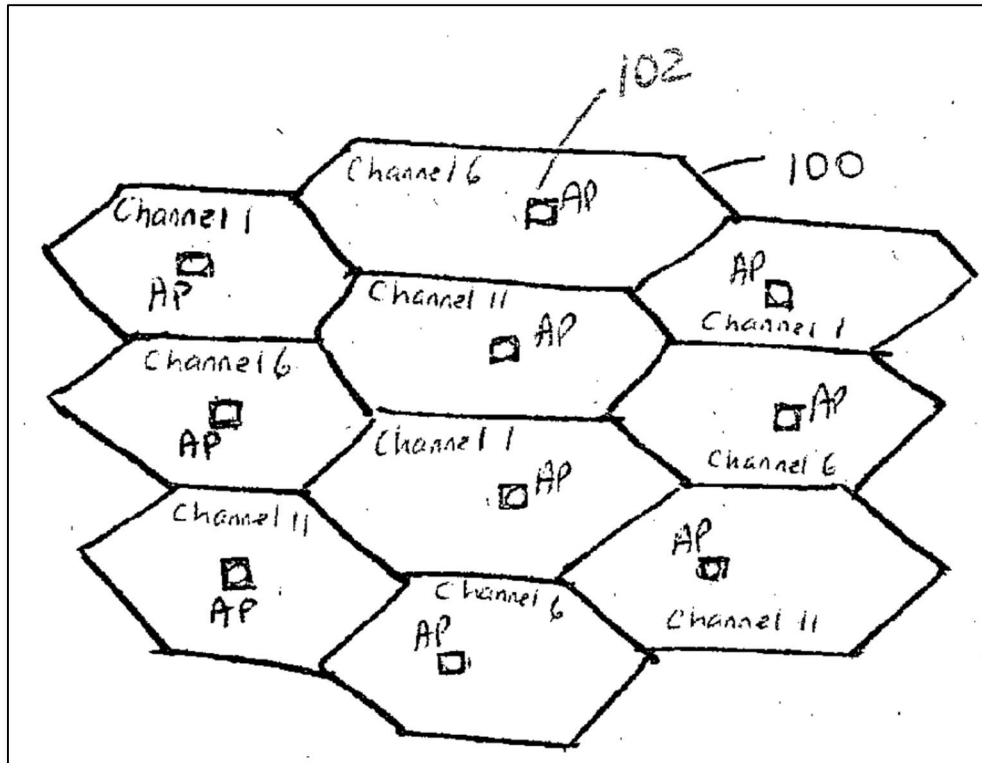
1. Bugeja (Ex. 1007)

160. Bugeja is a U.S. Patent Application Publication that was filed on January 3, 2002 and published on November 27, 2003. Bugeja, (22), (43). I understand that Bugeja is therefore prior art to the ’551 Patent. Bugeja was not considered during prosecution of the ’551 Patent. *See generally* Ex. 1002.

161. Bugeja discloses a system and method for using “multichannel wireless access points or base stations.” Bugeja, Abstract. The disclosure “is applicable to *all wireless networks* including cellular.” Bugeja, [0028]. Consistent with my discussion about above in Section V.A.1 conventional 802.11 systems,

Bugeja explains that conventional wireless local area networks (WLANs) compliant with the IEEE 802.11b standard provided three independent channels on which access points can communicate with clients, i.e., channels 1, 6 and 11. Bugeja, [0004]-[0005], [0023]-[0024], [0027].

162. Bugeja teaches that in these conventional 802.11b-based WLANs, “[e]ach access point is configured to operate on a channel which does not interfere with the channel assigned to an adjacent access point.” Bugeja, [0004]. An example of a conventional WLAN is shown in Figure 1 (below) with each access point 102 assigned to one of the three available channels (1, 6 or 11), with adjacent access points transmitting over one of the other available channels. Bugeja, [0005]. Consistent with conventional 802.11 procedures, a mobile client sends a request to communicate on each of the three available channels, and then communicates with the access point that responds to the request based on strength of the received signals. Bugeja, [0006] (“each client communicates with the access point having the highest signal strength”).

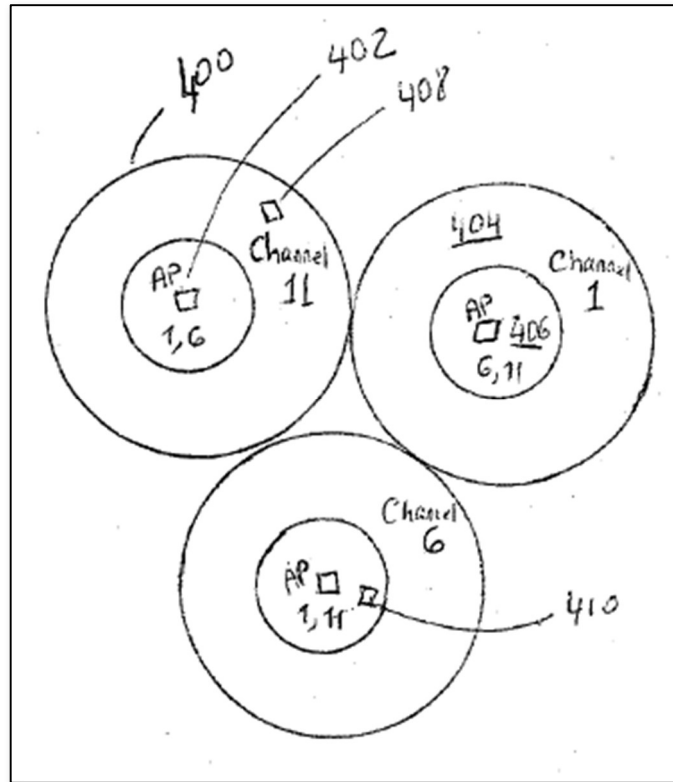


163. According to Bugeja, a drawback to conventional 802.11b implementations was having a single access point serve multiple clients on a single channel. Bugeja, [0006]. This a drawback because, as Bugeja explains, “[t]here is a finite bandwidth available for communicating with an access point which is shared by all mobile clients within the cell 100.” Bugeja, [0006]. Thus, “[a]s the number of clients close to a particular access point 102 increases, the bandwidth available for clients within the cell 100 decreases accordingly,” so, for example, if there are two clients, they each have effectively “half of the available bandwidth for the channel assigned to the access point.” Bugeja, [0006]. In other words, as the access point served more and more mobile clients, the effective bandwidth available for each client is reduced in proportion to the number of clients.

164. To overcome this limitation of conventional 802.11b-compliant implementations, Bugeja proposes using conventional multi-channel access points that can communicate simultaneously on all three available 802.11b-channels, but in a manner that minimizes interference between adjacent cells that use an alternative 802.11b channel as their primary channels. Bugeja, [0007]-[0009]. In Bugeja's implementation, consistent with a conventional 802.11 implementation, an access point sets one of the three available 802.11b-channels as its primary channel, e.g., channel 1, and it transmits at full power on that channel so as to reach clients on the outer edge of the access point's cell. Bugeja, [0007], claims 1, 11. The other two channels are then assigned as secondary channels to the access point, e.g., channels 6 and 11, and transmitted at lesser power. Bugeja, [0007], claims 1, 11. Each access point can thus use all three channels simultaneously without increasing the risk of inter-cell interference because the lower transmit power of the secondary channels is designed to have their signal energy attenuate significantly before reaching an adjacent cell.

165. Figure 4 (below) illustrates an embodiment of Bugeja's system. Bugeja, [0014]. Three access points 402 are positioned at the center of each cell 400 that represents the coverage area within which a client 408, 410 can communicate with a particular access point. Bugeja, [0030]. Each access point is assigned one of the three available 802.11b-channels as its full-powered primary

channel, and then assigned the other two channels as its lesser-powered secondary channels. Bugeja, [0030]. Each access point transmits on its primary channel using full power and less power on its secondary channels. Bugeja, [0030]. The full-powered primary channel provides complete coverage within the access point's cell, while the less-than-full-powered secondary channels cover a smaller amount of the cell, called the "inner region." Bugeja, [0033]-[0034]. For example, the AP in the cell in the top-left cell uses Channel 11 for the full power channel, to communicate with clients in the output region (the region between the two circles around the AP), and uses Channels 1 and 6 at lesser power for communication with clients in the inner region. Because channel 11 is the full-power primary channel, it is the only channel that has sufficient power to reach the outer region of the cell, and thus is generally the only channel that can be used to communicate with stations in the outer region. Bugeja, [0033] ("A client in the outer region 404 communicates *only with* the full power primary channel.").



166. When a mobile client enters a cell, it transmits a “beacon” signal announcing its presence, by “hop[ing] among the available channels until it receives a response from an access point.” Bugeja, [0031]. Bugeja teaches that “[a]ccess points typically have some form of power detection to determine whether to accept transmission from a client,” based on whether “the signal is too weak indicating that the client is too far aware from the access point.” Bugeja, [0031]. The multi-channel access point assigns the device to either its primary channel or one of its secondary channels “based on detected signal strength,” which can be assigned by “refusing to communicate with the client” until the client “hop[s] to a better channel.” Bugeja, [0032]. If the signal strength indicates that the mobile client, e.g., client 408 in Figure 4, is in the “outer region” of the access point’s cell,

then the client is always assigned the primary channel.” Bugeja, [0032].

Conversely, if the signal indicates the mobile client is in the inner region, e.g., client 410 in Figure 4, it is “assigned the primary channel or any of the secondary channels, but likely one of the secondary channels to free the primary for peripheral [outer-region] clients.” Bugeja, [0032]; *see also* [0035], claims 2-3, 9, 12-13, 19. “Thus more bandwidth is available for clients in the inner region 410 close to the access point,” Bugeja, [0032], because these clients generally will not share bandwidth with clients in the outer region, which communicate over the full power channel.

167. Bugeja explains that its multi-channel access point advantageously allows multiple client devices to receive full channel bandwidth as each can be assigned to one of the three available 802.11b channels, compared to conventional implementations where one channel’s bandwidth is split among all client devices. Bugeja, [0035]. For example, if there are two devices in the inner region and one in the outer region, each device can receive the full bandwidth from one of the three available 802.11b channels. Bugeja’s Figure 4 embodiment also permits multi-channel capable inner-region clients to access two or more channels simultaneously, in order to increase the download and upload speeds to the access points. Bugeja, [0037].

2. Ho (Ex. 1006)

168. Ho's disclosure was discussed in Section VI.A.2 above.

3. An Obvious Implementation of Bugeja in View of Ho

169. Ho recognizes "any improvement to the efficiency of wireless communication is desirable" and teaches MIMO improves the efficiency of a SISO-based system. Ho, [0009]-[0011], [0014].

170. Although Bugeja's Figure 4 embodiment utilizes a multi-channel access point that can transmit simultaneously on three channels, POSAs would have understood each to be a SISO channel. Bugeja, [0053], [0059], FIGS. 8-10. Based on Ho, a POSA would have had numerous reasons to implement Bugeja's system such that its APs and stations utilized MIMO transmissions over Bugeja's primary and secondary channels.

171. First, MIMO would have improved Bugeja's data rates because, as Ho at [0009] explains, MIMO was a known technique used to improve data transmission speeds of conventional systems. The known transmission speed benefit of MIMO is further corroborated by Ex. 1032 at 1:32-35, which notes as background information that a "MIMO system can provide improved performance (e.g., increased transmission capacity) if the additional dimensionalities created by multiple transmit and receive antennas are utilized." Similarly, Ex. 1027 at 1:50-52 notes as background information as of at least its July 15, 2002 filing date that

“[i]t is desirable to apply MIMO techniques to IEEE 802.11 systems to increase data carrying capacity[.]” POSAs would have understood Bugeja to disclose a conventional multi-channel SISO system in which an access point (AP) uses multiple transmit modems to transmit individual streams of conventional 802.11 wireless packets to stations over primary and secondary channels. Bugeja, [0023]-[0028]. As Ho discloses ([0009]) and other prior art corroborates (e.g., Ex. 1032, 1:32-35), MIMO was known to improve SISO systems by increasing data transmission rates, without increasing the channel’s bandwidth requirements, as I discussed in Section V.A.3 above. One problem with conventional SISO systems that Bugeja seeks to address is how to allocate bandwidth to multiple clients in an 802.11 WLAN network; Bugeja, [0006] notes that the “bandwidth available for clients...decreases” as “the number of clients...increases” because of the “finite bandwidth available for communicating.” As I explained in Section V.A.3 above, MIMO was a known way to increase the transmission speed of frequency channels without requiring more bandwidth or transmission power. Thus, a POSA would have known that modifying Bugeja’s system to utilize MIMO rather than SISO over each its channels would have advantageously increased the transmission rates on each channel in a bandwidth-efficient manner, and thus would have been motivated to make this modification.

172. Second, a POSA would have been motivated to add MIMO to Bugeja's system (for example Bugeja's Figure 4 embodiment), because MIMO had already been incorporated into similar 802.11-based systems and was being proposed for the next-generation 802.11 standard, as I explained in Section V.A.3 above. As additional corroborating evidence, Ex. 1022 at 1:29-32 provides as background knowledge that MIMO is "most likely to be *the dominant solution* in future broadband wireless communication systems" and that "MIMO techniques have been incorporated into several standards... such as the IEEE 802.11 a wireless LAN." As the '551 Patent concedes as background information (1:56-61), by September 2003 it was known that MIMO could be incorporated into 802.11 networks. *See also* Ex. 1027, 1:50-52. And Ho, itself, teaches how to incorporate MIMO into 802.11 systems. Ho, [0015].

173. Third, implementing Bugeja in a conventional MIMO configuration would have involved no more than the use of a known technique (MIMO) to improve similar devices (802.11-compliant WLANs) in the same way (increased data rates, increased bandwidth efficiency) to yield a predictable result (an improved WLAN system employing a conventional MIMO technique). As I discussed in Paragraph 81 above, MIMO techniques had been investigated and incorporated into existing 802.11 systems with success, demonstrating that MIMO was known to be compatible with 802.11 standards, because the packets on each

wireless channel could be structured consistent with 802.11 requirements, independent of MIMO processing.

174. Adapting Bugeja to incorporate the conventional MIMO technique Ho discloses in its Background would have been within a POSA's capabilities. The adaption would have involved (a) modifying Bugeja's access points and mobile stations to utilize (if they did not already) multiple antennas, and (b) configuring the WLAN transceivers on the access points and mobile stations to implement Ho's background MIMO technique. As Ho confirms MIMO technology was conventional as of September 2003. Ho, [0006]-[0014]. The '551 Patent itself admits that MIMO wireless transmission techniques—which require multiple transmitter and receiver antennas—were known before September 2003. Ex. 1001, 1:56-2:3 (describing a “known MIMO technique” in which “different wireless packets are transmitted from a plurality of antennas at the same time on the same wireless channel”). The adaption would have involved connecting all of Bugeja's amplifiers (one for each channel) to each of multiple antenna in accordance with Ho's MIMO, using conventional MIMO techniques. Using ordinary skill, POSAs would have been able to adapt the antennas, amplifiers, and modems for MIMO transmissions. POSAs understood that 802.11 set a baseline defining, e.g., the data rates, packet structures, etc., but that access points were “typically provided with sufficient processing, software, etc.,... to provide additional features [above the

802.11 baseline] that are developed by a vendor.” Ex. 1050, 4:39-43. This was done so that vendors could differentiate themselves, by offering additional features above those required by 802.11 standards, such as Ho’s background MIMO technique. Alternatively, Bugeja-Ho could have been implemented in MIMO-ready APs and mobile stations, which Ho confirms and the ’551 Patent admits were conventional as of September 2003. Ho, [0006]-[0014]; Ex. 1001, 1:56-2:3. As I explained in Paragraph 82 above, combining 802.11 systems with MIMO techniques had already been proposed and implemented in the prior art, demonstrating that it would have been routine by 2003 to implement an 802.11-based WLAN like those taught in Bugeja using the background knowledge of MIMO disclosed in Ho.

175. That Ho and Bugeja both describe techniques compliant with then-existing 802.11 standards underscores the compatibility of their teachings. Bugeja, [0023]-[0028]; Ho, [0035]-[0038]. As Ex. 1022 at 1:29-33 corroborates, “MIMO techniques have been incorporated into several standards of various wireless applications, such as the IEEE 802.11 a wireless LAN... and the WCDMA standards,” which used spread spectrum modulation like 802.11b. As I discussed above in Paragraphs 74, a POSA would have readily recognized the MIMO data frames depicted in Ho’s Figures 4a-4c to be MAC protocol data units, which are the “packets” transmitted in the ’511 Patent, which are the data frames (packets)

utilized in 802.11 WLANs like Bugeja's. Ho, [0035] ("In the context of 802.11...data frame are referred to as MAC protocol data units MPDUs."); Bugeja, [0023]-[0030], FIG. 4 (depicting exemplary 802.11b embodiment). Because Ho's MIMO data frames are 802.11 data frames, a POSA would have recognized that utilizing Ho's MIMO data frames in Bugeja would have been consistent with Bugeja's compatibility with the IEEE 802.11b protocol, such as the embodiment in Bugeja's FIG. 4. Bugeja, [0023]-[0028].

176. In this combination, which I will refer to as "Bugeja-Ho" or the "Bugeja-Ho combination," Bugeja's APs and stations utilize multiple antennas to simultaneously communicate multiple packets over MIMO subchannels on the primary channel for clients in the outer region of a cell, and on the secondary channels for clients in the inner region of a cell, utilizing the conventional MIMO data frames (MPDU packets) in Ho's Figures 4b-4c. The devices would otherwise maintain 802.11 compatibility, including 802.11b's use of "Carrier Sense Multiple Access with Collision Avoidance," which "works by sensing the medium for activity before every transmission and deferring the transmission if the medium is active." Bugeja, [0040]. As I discussed in Section V.A.1 above, carrier sense was standard in 802.11-compliant implementations and minimized packet collisions from nearby devices using the same frequency channel. Thus, Bugeja-Ho's access points would have used clear channel assessment for the same reason any 802.11

access point would (e.g., to avoid transmitting on a channel that is not idle, because it is occupied by another device, e.g., an access point in another BSS, or a non-802.11 device, e.g., a Bluetooth device operating in the 2.4 GHz band, as I discussed in Section V.A.1 above).

177. As I explain in Sections VI.C.4-.9 below, the Bugeja-Ho combination meets claims 1-3 and 5-7. In Sections VI.C.4-.7 below, I begin with Claims 1 and 3 and their parallel apparatus claims 5 and 7, and in Section VI.C.8-.9 I discuss independent claim 2 and dependent claim 6.

4. Independent Claim 1

- a. [1PRE] A wireless packet communication method for transmitting a plurality of wireless packets simultaneously by using [1] multiple wireless channels determined to be idle by carrier sense, [2] a single wireless channel determined to be idle and MIMO, or [3] the multiple wireless channels and the MIMO, the method comprising:**

178. Bugeja-Ho meets claim 1's preamble for the reasons I explain in this Section below.

(1) The Preamble's Scope

179. As I addressed in Section VI.A.4.a.(1) above, POSAs understand the preamble is met by a prior art "wireless packet communication method for transmitting a plurality of wireless packets simultaneously" using *any* one of the three transmission options listed in the preamble.

(2) *Bugeja-Ho Meets the Preamble*

180. Bugeja's access points (APs), implemented in Bugeja-Ho to utilize the MIMO technique in Ho's Background, meet claim 1's preamble using "a single wireless channel determined to be idle and MIMO," i.e., the preamble's option [2] when, for example, those access points transmit wireless packets to an outer-region client using a primary channel processed as a MIMO channel according to Ho's teachings to implement a conventional MIMO technique in an 802.11 system.

181. As I explained in Section VI.C.1 above, each of Bugeja's access points (APs) is assigned one of the three available 802.11b-channels as its (full-power) primary channel, and the other two channels as (lesser-power) secondary channels. Bugeja, [0030]. A Bugeja access point assigns a client within its cell to either the primary or a secondary channel based on the client's location, which is determined from the received signal strength. Bugeja, [0031]-[0032].

182. Implemented to use Ho's MIMO technique (Ho, [0009]-[0010], FIGS. 4a-4c), Bugeja-Ho's access points divide a conventional 802.11 wireless data packet into multiple separate packets that would be communicated "simultaneously" over the MIMO subchannels of the primary channel the access point (AP) exclusively uses to communicate with an outer-region client. Ho, [0010]; Bugeja, [0028]-[0033], claim 9, FIG. 4. As I explained in Section VI.C.1 above, outer-region clients can only use the primary channel as it is the only

channel with sufficient power in the outer region. Bugeja, [0033]. Thus, the Bugeja-Ho's access points performs the claimed "wireless packet communication method for transmitting a plurality of wireless packets simultaneously by using" transmission option [2], i.e., "a single wireless channel" (i.e., Bugeja's primary channel), which is "determined to be idle [as addressed in the paragraph below] and MIMO."

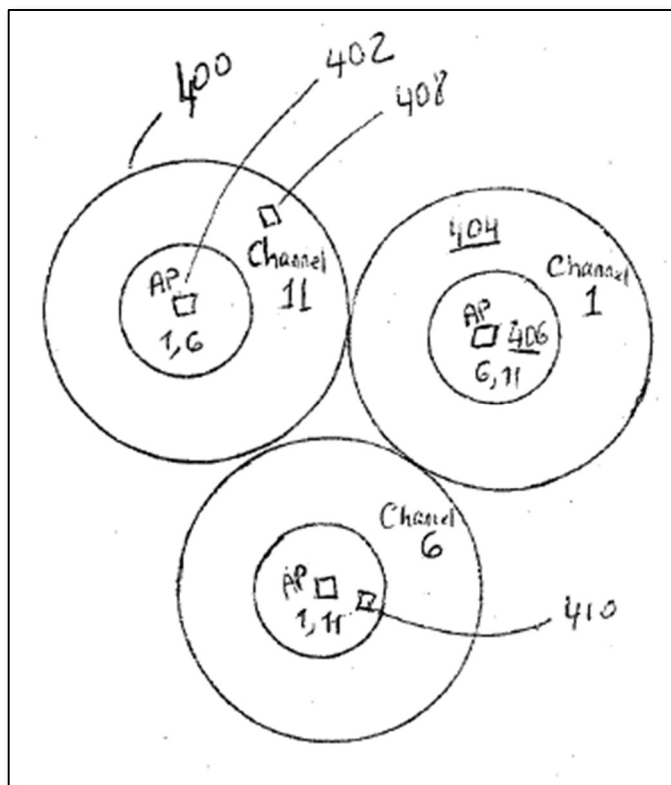
183. "As in conventional systems," Bugeja's APs' "basic [channel] access mechanism is Carrier Sense Multiple Access with Collision Avoidance (CDMA/CA)," which "works by sensing the medium for activity before every transmission and deferring the transmission if the medium is active [i.e. not idle]." Bugeja, [0040]. As I discussed in Sections V.A.1 above, and Ex. 1037 at 1:42-49 corroborates, in an IEEE 802.11 network "a station or access point will wait until the *channel is idle* before attempting to transmit a signal" because of the "Carrier Sense Multiple Access (CSMA) mechanism" used by the Bugeja-Ho access point. Bugeja, [0040]. See Ex. 1002, 136 (STA "shall [i.e., must] sense the medium" using CSMA/CA). Thus, when transmitting over the primary channel to an outer-region device, Bugeja-Ho's access points transmit only when the primary channel is "determined to be idle," using 802.11's conventional CSMA/CA channel access protocol.

b. [1A] setting a mandatory channel that is always used for transmission; and

184. Bugeja-Ho's access points "set[] a mandatory channel that is always used for transmission" for the reasons discussed below in this Section.

185. Bugeja-Ho uses Bugeja's access points, which sense a client's location and assign clients to different channels based on their location in the cell determined from their received signal strength, as I discussed above in Sections VI.C.1 and VI.C.4.a.(2). Bugeja, [0008], [0031]-[0032], claims 2-3, 12-13.

186. Bugeja's Figure 4 provides an example of "a wireless Local Area Network having a plurality of multi-channel access points" (Bugeja, [0014]):



187. When client 408 enters the top-left cell 400, the access point in the center of cell 400 senses the client's location, and determines if it resides in outer region 404 or inner region 406. Bugeja, [0031]-[0032]. Because client 408 is in the cell's outer region, access point 402 assigns it to channel 11 as that is the only channel transmitting at full power and thus the only one serving the cell's outer region. Bugeja at [0033] explains that the outer-region client "communicates *only* with the full power primary channel" at thus, in this cell, the outer-region "client is assigned to channel 11" ([0035]). Any other outer-region client the access points senses would also be assigned only to primary channel 11 because "[c]lients in the outer region 404 share...the full-power channel[.]" Bugeja, [0035]; *see also* claims 2-3, 12-13. Thus, if a client is sensed to be in the outer region, then channel 11 is the channel the client must use to communicate with access point 402 – it "communicates *only with* the full power primary channel"; it cannot use the other channels because they are intentionally made too weak to reach the outer region, "so as not to interfere with the primary channels of adjacent multichannel access points." Bugeja, [0033]. This is consistent with claim 9's and 19's disclosure that the mobile "client is *restricted to* primary channels in an outer region of the cell."

188. Conversely, when a client is sensed to be in the inner region, it is assigned to one (or both) of the two secondary channels, i.e., channel 1 or 6. Bugeja, [0032]. Although inner-region clients "may" also be assigned the primary

channel (i.e., channel 11 in the exemplary cell), Bugeja discloses a preference not to do so to “give more bandwidth on channel 11 to the outer region 404.” Bugeja, [0035]. Bugeja explains at [0032] that inner-region clients are “likely” assigned “one of the secondary channels to free the primary for peripheral clients,” and thus avoid the bandwidth-sharing problem that Bugeja discussed in [0006]. Thus, as Bugeja explains ([0037]), “clients in the outer region 404 also benefit because they have reduced bandwidth sharing in general with other clients in the inner region 406 who can be shifted to other channels.”

189. Thus, in Bugeja-Ho, an access point’s primary channel is a “mandatory channel that is always used for transmission” to outer-region clients because that channel is always used when the access point transmits packets to outer-region clients, for the reasons I just explained. Bugeja, [0033], [0035], claims 2-3, 9, 12-13, 19, FIG. 4. Thus the mandatory channel is an indispensable channel for communications with clients in the outer region of the cell. *See* Ex. 1002, 307.

190. I further note that the fact that the access point can also communicate with inner-region clients on other channels, i.e., the secondary channels, while the access point only communicates with the outer-region clients on the primary channel, does not detract from the primary channel being “always used for transmission,” as claimed. This is because a POSA would have understood the

“always used for transmission” requirement of limitation 1A applies to one or more clients (e.g., outer-region client(s)) for whom a “mandatory channel” is “set,” but not all clients must have such a “mandatory channel.”

191. This is reinforced by the intrinsic evidence. For example, the ’551 Patent explains that “reduction of throughput can be suppressed” when a system includes mobile stations for which no mandatory channel is set even if a mandatory channel is set for other mobile stations (i.e., devices). Ex. 1001, 11:64-12:10. That is, the system includes a mandatory channel for one mobile station, even though other stations do not have a designated mandatory channel. Similarly, claim 2, like claim 1, recites setting a “mandatory channel [] always used for transmission” for one station (A), but also expressly recites not setting the mandatory channel for a different station (B) and sending transmissions over a different channel that need not be the mandatory channel to station B. Ex. 1001, 12:26-35; 7:13-40. In other words, claim 2 shows the inventors intended “always used for transmission” to be limited to transmissions to a particular device for which a mandatory channel is set, and to not limit the access point to using the mandatory channel for all its transmissions to all devices, including those for which the mandatory channel was not set. Had the applicants intended claim 1 to require a mandatory channel be “set” for all devices the AP transmits data to, the applicants could have included

such language in the claims. However, the applicants did not add that language to the claims and a POSA would not have understood the claims to require it.

192. Finally, even if the preamble required all transmissions to all clients always use the mandatory channel (it does not), Bugeja-Ho's AP still practices the claimed method at least in scenarios where all clients are outer-region clients so that all communications from the access point would have been over the primary channel, for the reasons discussed in Paragraphs 164-166, 187 above. This scenario is depicted in the top-left cell 400 of Figure 4, which only shows a single client station (device) 408 in the cell, without any client devices in the inner region.

c. [1B] transmitting the wireless packets by using a wireless channel/wireless channels that includes/include the mandatory channel, only when the mandatory channel is idle.

193. Bugeja's access points, implemented in Bugeja-Ho to utilize MIMO technique as I discussed in Section VI.C.3 above (citing Ho, [0009]-[0010], FIGS. 4a-4c), "transmit[] the wireless packets by using a wireless channel/wireless channels that includes/include the mandatory channel, only when the mandatory channel is idle."

194. As I discussed in Section VI.C.3 above, the Bugeja-Ho access points transmit data in accordance with the 802.11 standards implemented by Bugeja access points implement, such as the 802.11b standard. Bugeja, [0028], [0044],

[0052]. As the '551 Patent concedes, 802.11 standards utilize “wireless packets” for transmissions. Ex. 1001, 1:23-42. In particular, as I explained in Section VI.A.2 above, Ho’s Figure 4b-4c illustrate the 802.11-compliant wireless packets Bugeja-Ho’s access points transmit over the MIMO subchannels, which are formed by splitting the data payload of a SISO 802.11 packet, and appending appropriate packet headers to the individual data frames (packets). Ho, [0009]-[0010]. As I explained in Section VI.A.2 above, POSAs understand that Ho’s data frame is a “packet” because, like the packets disclosed in the '551 Patent, the data frames have payloads, MAC headers, and CRC regions, consistent with 802.11 requirements for formatting packets.

195. As I discussed Section VI.C.4.b above, Bugeja-Ho’s access points would have always sent wireless MIMO packet transmissions to an outer-region client using the primary channel, which meets the claimed “mandatory channel.” Thus, Bugeja-Ho’s AP would transmit packets “by using a wireless channel” (singular) “that includes . . . the mandatory channel,” as claimed. As I discussed in Sections VI.C.4.a.(2) and VI.C.4.b above, Bugeja-Ho’s access points would have only transmitted over the primary (mandatory) channel if it was sensed to be idle using 802.11’s CSMA/CA channel access protocol, i.e., “carrier sense,” as Bugeja expressly teaches is conventional in these systems. Bugeja, [0040]; *see* Ex. 1002, 136.

5. Dependent Claim 3: The wireless packet communication method according to claim 1 or 2, wherein the plurality of wireless packets transmitted simultaneously are set to have a same or equivalent packet time length that corresponds to a packet size or a transmission time.

196. Claim 3 depends from claim 1, and requires “the plurality of wireless packets transmitted simultaneously are set to have a same or equivalent packet time length that corresponds to a packet size or a transmission time.” The ’551 Patent states that “packet time lengths” is the “time required to transmit the wireless packets.” Ex. 1001, 2:64-65. As I discussed above in Sections VI.A.2 and VI.A.5, Ho discloses that wireless packets on different MIMO subchannels using its conventional MIMO technique take the same amount of time to be transmitted on each subchannel, corresponding to an equal packet size or transmission time, thereby having the same or equivalent packet time lengths. Ho, [0010], FIG. 4b, 4c. As illustrated in FIGS. 4b and 4c, that time equals T_{MIMO} minus the IFS (InterFrame Space interval, a length of time defined by the 802.11 standard) and the ACK Frame (which Ho explains are “maintained in their entirety” for both packets, Ho, [0015]).

197. The wireless packets transmitted over MIMO subchannels in Bugeja-Ho have the same structure as wireless packets transmitted over the MIMO subchannels in Shpak-Ho, because in both combinations the MIMO packets are conventional 802.11b SISO packets processed according to Ho’s teaching for

splitting these packets into individual packets for MIMO subchannels. Ho, [0010]-[0012], [0015], FIG. 4b, 4c. Because Bugeja-Ho implements the conventional MIMO technique disclosed in Ho (Section VI.C.3 above), Bugeja-Ho's access point transmits equal (or equivalent) packet length times, corresponding to equal (or equivalent) packet sizes or equal (or equivalent) transmission times. Thus, Bugeja-Ho's access points meet claim 3's requirements for the same reasons Shpak-Ho's access points do.

6. Independent Claim 5

198. Claim 5 recites an apparatus that performs the method of claim 1. As discussed in Section VI.C.4 above, Bugeja-Ho's access point practices claim 1's method and thus meets claim 5's apparatus, for the reasons discussed in this Section below.

199. The only additional limitation claim 5 adds is requiring the "apparatus" that performs the transmission method include a "unit" that performs the transmission steps recited in claim 1. Bugeja-Ho discloses this unit, as I explain in this Section below.

- a. **[5PRE] A wireless packet communication apparatus for transmitting a plurality of wireless packets simultaneously by using multiple wireless channels determined to be idle by carrier sense, a single wireless channel determined to be idle and MIMO, or the multiple wireless channels and the MIMO, the apparatus comprising:**

200. The preamble of Claim 5 recites a “wireless packet communication apparatus for transmitting a plurality of wireless packets simultaneously by using” one of the three packet transmission techniques recited in the preamble of Claim 1. As with Claim 1’s preamble, the three different transmission techniques in Claim 5’s preamble are joined by the word “or.” Thus, for the same reasons I discussed in Section VI.C.4.a.(2) above for limitation [1PRE], POSAs understand that a “wireless packet communication apparatus for transmitting a plurality of wireless packets simultaneously” that is capable of using any of the three techniques meets the claim.

201. As I discussed in Sections VI.C.1 and VI.C.4.a.(2) above, Bugeja discloses an “*apparatus* [an access point] for increasing available bandwidth to mobile clients in a wireless local area network.” Bugeja, [0007]. As I discussed in Sections VI.C.3 and VI.C.4.a.(2) above, Bugeja-Ho access points are 802.11b access points utilizing multiple antennas to perform MIMO transmission techniques over Bugeja’s primary (mandatory) channel. Thus, the Bugeja-Ho access point meets a “wireless packet communicating apparatus.”

202. As I discussed in Section VI.C.4.a.(2) above, the Bugeja-Ho access point transmits a plurality of wireless packets simultaneously by using “a single wireless channel determined to be idle and MIMO,” by using the conventional MIMO technique taught by Ho, implementing 802.11’s conventional carrier sense assessment technique (a CSMA/CA algorithm) to determine when the MIMO channel is idle before commencing transmissions over the channel. *See also* Section V.A.1 above (discussing 802.11’s CSMA/CA); Ex. 1002, 136.

203. Thus, for the reasons I discuss above in Section VI.C.4.a.(2) with respect to limitation [1PRE], the access point in Bugeja-Ho meets Claim 5’s preamble.

b. [5A] a unit setting a mandatory channel that is always used for transmission; and

204. As I explained in Sections VI.C.3 and VI.C.6.a.(2) above, Bugeja-Ho uses Bugeja’s access point, which is a conventional 802.11 access point that “assigns channels based on detected signal strength,” where clients in the outer region “communicate[] only with the full power primary channel,” Bugeja, [0031]-[0033], which is a mandatory channel for the reasons discussed in Section VI.C.4.b above. Bugeja’s FIG. 8 illustrates “a typical access point,” which includes a Direct Memory Access (DMA) controller which uses “control signals 808) to store data “received from the wireless networks by the wireless network interface 800.” As illustrated in Bugeja FIG. 9, Bugeja’s access points include a “multi-channel

mode/controller.” Bugeja, [0050]-[0055], FIG. 9. The multi-channel mode/controller includes “respective receive modems 924, 925, 928 per channel and a respective transmit modem 930, 932, 934 per channel.” Bujega, [0052]. A POSA understands the transmit modes are configured by the controller “to transmit on a different channel having a respective carrier frequency.” Bugeja, [0053]. As illustrated in FIG. 9, control signals are sent over the control signal lines exiting the multi-channel modem controller, to set the mandatory channel using a particular transmit modem using “[c]ontrollable power amplifiers 908, 942, 944 coupled to the respective outputs of the pre-amplifiers 910, 946, 948.” Bugeja, [0054]. POSAs understand the multi-channel mode/controller configures the “power control logic,” which is part of the multi-channel controller (*see* FIG. 9), “which controls the power of the transmitted analog signal for each channel through the respective power control signal.” Bugeja, [0054]. Thus, for example, in a cell where channel 6 is the full-power primary (mandatory) channel for communication with client devices in the outer-region of the cell and channels 1 and 11 are the lesser-power secondary channels for the inner-region of the cell, the multi-channel modem controller generates “power control signals control the output of power amplifiers 908, 942, 944 such that the signal strength of analog signals transmitted for channels 1 and 11 is half the power of signals transmitted for Channel 6.” Bugeja, [0054]. That is, the “multi-channel mode/controller” in

Bugeja's access point sets the mandatory channel by generating power control signals that cause the primary (mandatory) channel to be transmitted at full power.

205. Thus, the “multi-channel mode/controller” is a “unit” that controls the access point's transmissions, by setting the primary channel (i.e., the claimed “mandatory channel”), assigning it to an outer-region client, and transmitting the wireless packets at full power to that channel using a transmit modem. Bugeja, [0031]-[0033], [0047], [0050]-[0055], FIGS. 8-10 (exemplary block diagram of AP). Thus, using its multi-channel mode/controller, an access point in Bugeja-Ho meets limitation 5A for the same reasons it performs the method recited in limitation 1A, as I discussed in Section VI.C.4.b above.

c. [5B] transmitting the wireless packets only when the mandatory channel is idle by using a wireless channel or wireless channels that includes/include the mandatory channel.

206. As discussed in Section VI.C.6.b above, the Bugeja-Ho access point include a multi-channel mode/controller, which generates control signals for that “control[] the power of the transmitted analog signal for each channel through the respective power control signal.” Bugeja, [0054], FIG. 9. As I discussed in Section VI.C.4.c above in connection with limitation 1B, the Bugeja-Ho access only communicates wireless packets on the primary (mandatory) channel using MIMO transmissions when the channel is determined to be idle, according to 802.11's CSMA/CA medium access protocol, which Bugeja teaches is

conventional in the 802.11 system its access point implements. Bugeja, [0040]; Ex. 1002, 136. Thus, an access point in Bugeja-Ho meets limitation 5B for the same reasons it performs the method recited in limitation 1B, as I discussed above in Section VI.C.4.c.

7. Dependent Claims 7: The wireless packet communication apparatus according to claim 5 or 6, wherein the plurality of wireless packets transmitted simultaneously are set to have a same or equivalent packet time length that corresponds to a packet size or a transmission time.

207. Claim 7 requires claim 5's "wireless packet communication apparatus," which is met by Bugeja-Ho for the reasons discussed above in Section VI.C.6. Claim 7 also requires that claim 5's apparatus is configured such that "the plurality of wireless packets transmitted simultaneously are set to have a same or equivalent packet time length that corresponds to a packet size or a transmission time," which is the same limitation added by Claim 3 to the method of Claim 1 or 2. Thus, Bugeja-Ho meets this limitation for the same reasons discussed above in Section VI.C.5 for Claim 3.

8. Independent Claim 2

- a. **[2PRE] A wireless packet communication method for transmitting a plurality of wireless packets simultaneously by using multiple wireless channels determined to be idle by carrier sense, a single wireless channel determined to be idle and MIMO, or the multiple wireless channels and the MIMO, the method comprising**

208. Claim 2's recites "A wireless packet communication method for transmitting a plurality of wireless packets simultaneously by using multiple wireless channels determined to be idle by carrier sense, a single wireless channel determined to be idle and MIMO, or the multiple wireless channels and the MIMO, the method comprising," which is identical to claim 1's preamble. Bugeja discloses the preamble for the reasons discussed in this Section below.

(1) *The Scope of the Preamble*

209. For the same reasons discussed in Section VI.C.4.a.(1) above for Claim 1's preamble, POSAs understand the preamble is met by a prior art "wireless packet communication method for transmitting a plurality of wireless packets simultaneously" using **any** one of the three transmission techniques listed in the preamble, i.e., "[1] multiple wireless channels determined to be idle by carrier sense, [2] a single wireless channel determined to be idle and MIMO, or [3] the multiple wireless channels and the MIMO."

(2) *Bugeja-Ho Meets the Preamble*

210. Bugeja's APs, implemented to utilize Ho's MIMO technique, perform a method "for transmitting a plurality of wireless packets simultaneously by using... a single wireless channel determined to be idle and MIMO," and "multiple wireless channels and the MIMO," i.e., the preamble's options [2] and [3].

211. As I discussed in Sections VI.C.3 and VI.C.4.a.(2) above, in Bugeja-Ho, the access points transmit data packets in accordance with the 802.11 standards Bugeja access points implement, such as the 802.11b standard. Bugeja, [0028], [0044], [0052]. As the '551 Patent concedes, 802.11 standards utilize "wireless packets" for transmissions. Ex. 1001, 1:23-42. Indeed, as I explained in Sections VI.A.2 and VI.C.3 above, Ho's Figure 4b-4c illustrate the 802.11-compliant wireless packets Bugeja-Ho's access points transmit over the MIMO subchannels, which are formed by splitting the data payload of a SISO 802.11 packet, and appending appropriate packet headers to the individual data frames (packets). Ho, [0009]-[0010]. As I explained in Section VI.A.2 above, POSAs understand that Ho's data frame is a "packet" because, like the packets disclosed in the '551 Patent, the data frames have payloads, MAC headers, and CRC regions, consistent with 802.11 requirements for formatting packets.

212. As I explained in Sections VI.C.3 and VI.C.4.a.(2) above, each access point in Bugeja-Ho sets one of the three available 802.11b-channels as its full-

power primary channel (e.g., channel 11), and sets the other two channels as its low-power secondary channels (e.g., channels 1 and 6). Bugeja, [0030]. As I explained in Sections VI.C.3 and VI.C.4.a.(2) above, a Bugeja-Ho access point also assigns a client within its cell to either the primary or secondary channels based on the client's location, which is determined based on the received signal's strength. Bugeja, [0031]-[0032].

213. Consistent with then-existing 802.11-standards, which permitted “systems to simultaneously use multiple channels” (Bugeja, [0023]) and were admitted “conventional wireless packet” technology (Ex. 1001, 1:23-24), each Bugeja access points transmits data simultaneously either to (a) multiple clients in its cell or (b) the same client on multiple channels. For example, “[w]ith two clients, each client can be assigned to a different channel and each receives 100% of the available bandwidth.” Bujega, [0035]. Alternatively, “three channels can be used simultaneously to upload or download when the client is located in the inner region 615 of the cell.” Bugeja, [0046]; *see also* Bugeja [0052]-[0053], [0058]-[0059], claim 1; *cf.* [0009], claims 10, 20.

214. As I discussed in Sections VI.C.3 and VI.C.4.a.(2) above, the Bugeja-Ho access point is implemented to use Ho's conventional MIMO technique. *See* Ho, [0009]-[0010], FIGS. 4a-4c. In the manner taught by Ho, the Bugeja-Ho's access point divides conventional 802.11b wireless data frames (packets) into

separate packets that are communicated “simultaneously” via MIMO over primary and/or secondary channels. Ho, [0010]; Bugeja, [0028]-[0033], [0037] (explaining a multi-channel inner-region client can receive transmissions on multiple channels), [0042] (explaining AP can “use[] all three channels to simultaneously transmit to the mobile clients”), [0053], FIG. 4. For example, the Bugeja-Ho access points (APs) send separate packets via MIMO over the primary channel, which the access point uses exclusively to communicate with an outer-region client(s), as I explained above in Sections VI.C.1, VI.C.3, and VI.C.4.a.(2). The Bugeja-Ho access point also sends separate packets via MIMO over the secondary channels the access points uses to communicate with a multi-channel inner-region client, as I explained above in Sections VI.C.1, VI.C.3, and VI.C.4.a.(2). Bugeja, [0046] (explaining multi-channel inner-region client can simultaneously use more than one channel).

215. The Bugeja-Ho AP thus performs the claimed “wireless packet communication method for transmitting a plurality of wireless packets simultaneously by using” transmission options [2] and [3]. Specifically, the access point performs option [2] when it sends MIMO packets over the primary channel to an outer-region device, and option [3] when it sends MIMO packets over two secondary channels to a multi-channel inner-region client.

216. “As in conventional systems,” Bugeja’s APs’ “basic [channel] access mechanism is Carrier Sense Multiple Access with Collision Avoidance (CDMA/CA),” which “works by sensing the medium for activity before every transmission and deferring the transmission if the medium is active [i.e. not idle].” Bugeja, [0040]. As I discussed in Section V.A.1 above, and Ex. 1037 at 1:42-49 corroborates, in an IEEE 802.11 network “a station or access point will wait until the *channel is idle* before attempting to transmit a signal” because of the “Carrier Sense Multiple Access (CSMA) mechanism” used by the Bugeja-Ho access point. *See* Section VI.C.4.a.(2); Bugeja, [0040]; Ex. 1002, 136. Thus, when transmitting over the primary channel to an outer-region device or over secondary channels to an inner-region device, Bugeja-Ho’s access points transmit only when the primary channel is “determined to be idle by carrier sense,” using 802.11’s conventional CSMA/CA channel access protocol.

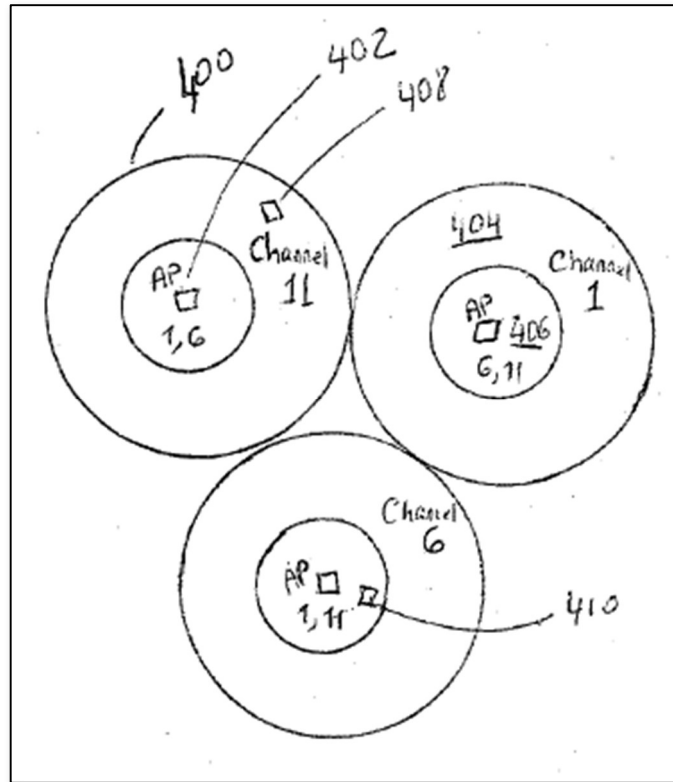
- b. [2A] distinguishing an STA A from an STA B, the STA A for which a mandatory channel is set, the STA B for which no mandatory channel is set, the mandatory channel being always used for transmission; and**

217. As I discuss in this Section below, an access point in Bugeja’s Figure 4 embodiment performs a method for “distinguishing an STA A from an STA B, the STA A for which a mandatory channel is set, the STA B for which no

mandatory channel is set, the mandatory channel being always used for transmission,” as recited in limitation 2A.

218. First, as explained in Section VI.C.4.b above, Bugeja’s access points differentiate, i.e., “distinguish,” between clients, i.e., “stations,” based on their distance from the access point and assign the clients to different channels based on their location with respect to the access point. As Bugeja discloses, “[t]he access point may sense relative distance of clients and assign secondary channels to closer clients. The access point may sense power to sense relative distance.” Bugeja, [0008], claims 2-3, 12-13.

219. Bugeja’s Figure 4 provides a useful overview of how clients are distinguished:



220. When client 408 enters the top-left cell 400, it transmits a beacon to access point 402 on each of channels 1, 6 and 11. Bugeja, [0031]. The access point then senses the relative distance of client 408 based on the signal power, and determines if the client resides in outer region 404 or inner region 406. Bugeja, [0032], [0035]. Because client 408 is determined to be in the outer region of cell 400, access point 402 assigns it to channel 11 because that is the only channel transmitting at full power and thus the only one that serves the outer region of cell 400. That is, “[a] multichannel client is *restricted* to primary channels in an outer region of the cell.” Bugeja, [0009]; Bugeja, [0046], Claims 9, 19. Thus, “[a] client in the outer region 404 communicates *only* with the full power primary channel.” Bugeja, [0033]. Any other client the access point senses is in the outer region

would also be assigned only to primary channel 11 because “[i]f the client is in the outer region 404 and channel 11 is the primary channel of the cell, the client is assigned to channel 11.” Bugeja, [0035]. Thus, “[c]lients in the outer region 404 share the bandwidth of the full-power channel, which will be greater bandwidth than the conventional frequency reuse scheme since some clients (in the inner region) are on channel 1 and channel 6.” Bugeja, [0035]; *see also* Bugeja, claims 2-3, 12-13. Stated differently, if a client is sensed to be in the outer region, then channel 11 is the channel the client must use to communicate with access point 402 because that is the only channel which has the full power and thus is the only channel designed to be consistently able to access the outer regions of the cell at sufficient power.

221. Conversely, when a client is sensed to be in inner region 402, it is assigned to one of the two secondary channels, i.e., channel 1 or 6. Bugeja, [0035]. Although Bugeja suggests clients in the inner region 402 “may” also be assigned to channel 11, it discloses a preference not to do so in order to “give more bandwidth on channel 11 to the outer region 404.” Bugeja, [0035]; *see also* Bugeja, [0032] (explaining clients in inner region are “likely” assigned “one of the secondary channels to free the primary for peripheral clients”). Thus, in reserving channel 11 to client in the outer region, “clients in the outer region 404 also benefit because they have reduced bandwidth in sharing in general with other clients in the

inner region 406 who can be shifted to other channels.” Bugeja, [0037]. Thus, clients in the inner region are assigned one of two available channels (e.g., channel 1 and/or 6), and clients in the outer region are assigned the other available channel (e.g., channel 11). Bugeja, [0035]; *see also* Bugeja, [0032], [0037], claim 9, 19.

222. As discussed in Section VI.C.4.b above, Bugeja’s primary channel is a “mandatory channel” for clients in the outer region of the cell because transmissions to clients in the outer region always use that channel, because that is the only channel that has the full power needed to consistently reach the outer region of the cell, unlike the lower power used for transmissions over the other two channel. Bugeja, [0033]. And, as discussed in Section VI.C.8.d below, neither of Bugeja’s secondary channels is a “mandatory channel” because transmission to a multi-channel, inner-region client can be sent over either secondary channel.

223. Thus, the Bugeja access point distinguishes a client (“station”) in the outer region (a “STA A”) from a client (“station”) in the inner region (a “STA B”) based on the station’s received signal strength, which is used to set the channel used to communicate with the station. Bugeja, [0032], [0035]. And as discussed in Paragraph VI.C.4.b above, Bugeja discloses that an outer-region client is assigned, i.e., “is set,” a mandatory channel that is “always used for transmission” with the outer-region client (e.g., channel 11) because it is the only channel that is at full power and thus able to consistently reach clients in the outer region, while

an inner-region client is assigned a different channel (e.g., channel 1 or 6), which is transmitted at lower power to help avoid interference with adjacent cells that use that channel as its primary (outer region) channel. Bugeja thus discloses limitation 2A.

- c. **[2B] when wireless packets are addressed to said STA A, transmitting the wireless packets to said STA A by using a wireless channel/wireless channels that includes/include the mandatory channel, only when the mandatory channel is idle; and**

224. Bugeja-Ho's access point, which is a Bugeja access point implemented to utilize Ho's MIMO technique, performs Limitation 2B's step of "when wireless packets are addressed to said STA A, transmitting the wireless packets to said STA A by using a wireless channel/wireless channels that includes/include the mandatory channel, only when the mandatory channel is idle."

225. As discussed in Sections VI.C.3 and VI.C.8.a.(2) above, the Bugeja-Ho access point transmits 802.11 compliant wireless packets. Consistent with conventional 802.11 implementations, 802.11 wireless packets include addresses information (i.e., "destination" information) for the intended recipient client. This is corroborated, for example, by Ex. 1030 at 1:26-35, which teaches as background information that "[w]hen computer communication with another over a network, they send and receive information in the form of network frames," which includes embedded "[a]ddress information," that "typically includes a source and

destination hardware address” as well as a “packet of data,” which “may also contain address information, such as a source and a destination network address.”

As explained in Section VI.C.8.a.(2) above, whenever wireless packets are addressed to an outer-region client, i.e., “said STA A,” then the primary channel, i.e., “the mandatory channel,” is used because that is the channel using full power transmissions in order to consistently reach the outer region of the cell.

Moreover, as explained in Section VI.C.4.c above, Bugeja’s access points use carrier sense (specifically the CSMA/CA mechanism I discussed in Section V.A.1 above) “[a]s in conventional systems.” Bugeja, [0040]; Ex. 1002, 136. According to a conventional 802.11 CSMA/CA access mechanism, a transmitting device “sens[es] the medium for activity before every transmission and deferring the transmission if the medium is active” (i.e., not idle). Bugeja, [0040]. Accordingly, the Bugeja-Ho access point transmits packets over the primary (mandatory) channel only when the channel is idle, as required by limitation 2B.

d. [2C] when wireless packets are addressed to said STA B, transmitting the wireless packets to said STA B by using idle wireless channel(s).

226. Bugeja-Ho’s access point, which is a Bugeja access point implemented to utilize Ho’s MIMO technique, performs Limitation 2B’s step of “when wireless packets are addressed to said STA B, transmitting the wireless packets to said STA B by using idle wireless channel(s).”

227. Bugeja explains inner-region clients with multi-channel capability can “operate multichannel” to use multiple channels. Bugeja, [0037]. As I discussed in Section VI.C.8.b above, Bugeja further teaches its primary channel should not be reserved for outer-region clients and not assigned to inner-region clients in order to reduce the bandwidth sharing by clients in the outer region. Bugeja, [0035]. Thus, an inner-region, multi-channel client seeking to “operate multichannel” to upload/download data faster would have been assigned both secondary channels, but not the primary channel. Bugeja, [0035], [0037], [0009], [0033].

228. In this scenario, whenever wireless packets are transmitted to a multi-channel, inner-region client, i.e., “said STA B,” then both secondary channels, i.e., “wireless channel(s),” are sent as MIMO channels in Bugeja-Ho, as I explained in Sections VI.C.3 and VI.C.6.a.(2) above. *See* Bugeja, [0033], [0037]. As I explained in Section VI.C.8.a.(2) above, Bugeja-Ho’s APs use carrier sense and thus would only send packets over a secondary channel via MIMO to the multi-channel, inner-region client if the channel was “idle.”

229. As I discussed in Sections VI.C.4.a.c and VI.C.8.a.(2) above, Bugeja-Ho’s access points would have only transmitted over a channel if it was sensed to be idle using 802.11’s conventional CSMA/CA channel access protocol, i.e., “carrier sense,” as Bugeja expressly teaches. Bugeja, [0040]; Ex. 1002, 136.

Thus, when both secondary channels are sensed to be idle, the packets would be sent simultaneously via MIMO over both channels, i.e., “by using idle wireless channel(s)” as recited in limitation 2C. Other times, when one secondary channel was idle and the other was not, then conventional carrier sense—as the ’551 Patent explains (1:43-48, 2:61-3:33)—would cause the AP to transmit one packet over the idle channel and wait until the other channel became idle before transmitting packets over that other secondary channel. Because the AP could use the secondary channels separately, and transmit over one of those channels when the other one is not idle, neither channel is a “mandatory” channel.

230. Accordingly, the Bugeja-Ho access point only transmits wireless packets addressed to an inner-region client (i.e., a “STA B”) over the secondary (wireless) channel(s) if the one or more channels was idle, as required by limitation 2C.

9. **Dependent Claim 6: A wireless packet communication apparatus for transmitting a plurality of wireless packets simultaneously by using multiple wireless channels determined to be idle by carrier sense, a single wireless channel determined to be idle and MIMO, or the multiple wireless channels and the MIMO, the apparatus comprising a unit distinguishing an STA A from an STA B and determining destinations of the wireless packets so as to transmit wireless packets addressed to said STA A only when said mandatory channel is idle by using a wireless channel or wireless channels that includes/include a mandatory channel, and to transmit wireless packets addressed to said STA B by using idle wireless channel or channels, the mandatory channel being always used for transmission, the STA A for which the mandatory channel is set, the STA B for which no mandatory channel is set.**

231. Claim 6 recites a “wireless packet communication apparatus” that performs the method of claim 2. As discussed in Section VI.C.8.a above, a Bugeja-Ho access point (a wireless communication apparatus) transmits wireless packets in accordance with conventional 802.11 standards, which are, as the ’551 Patent concedes, packet-based communication systems. *See* Section V.A.1 above (citing Ex. 1001, 1:23-29 as admitting that prior art 802.11 is a wireless packet communication system); Bugeja, [0007] (“A method and *apparatus* for increasing available bandwidth to mobile clients in a *wireless* local area network is provided.”); [0023]-[0025] (disclosing that the preferred embodiments are based on 802.11b or 802.11a standards). As discussed above in Section VI.C.8 above with respect to claim 2, an access point in Bugeja practices the method of claim 2

and thus discloses the apparatus in claim 6 with the additional limitation discussed in the Paragraphs below.

232. The only additional limitations claim 6 adds beyond claim 2 is requiring the “apparatus” that performs the transmission technique include a “unit” that performs the transmission steps recited in claim 2, including “distinguishing” the STA A from a STA B and “determining destinations of the wireless packets so as to transmit wireless packets.” Bugeja’s access point is an apparatus as I discussed in the Paragraph 201 above. The access point apparatus includes a “multi-channel mode/controller,” which is a “unit,” that controls the access point’s transmissions, by using one or more of “the transmit modems 930, 932, 934,” which are coupled to respect digital-to-analog converters, “for conversion to a respective analog signal to be *transmitted* over the wireless network through antenna 812.” Bugeja, [0047], [0050]-[0055], FIGS. 8-10 (exemplary block diagram of access point).

233. As I discussed in Paragraphs 74, 175, 182, the transmissions are in the form of 802.11 wireless packets. Consistent with conventional 802.11 implementations, these packets include addresses information (i.e., “destination” information) for the intended recipient device. *See* Ex. 1030, 1:26-35.

234. Thus, Bugeja-Ho’s access point (AP) is an apparatus, and it includes a “multi-channel mode/controller” that is a “unit” that performs all of steps discussed

above in connection with claim 2 as it manages packet transmissions in Bugeja-Ho, including controlling the AP's transmissions, by setting the mandatory channel, assigning it to outer-region clients, determining the destination of the wireless packet (i.e., whether its addressed to STA or STA B) using conventional 802.11 addressing, and transmitting wireless packets addressed to STA A or STA B when their assigned channel(s) were idle, as discussed in Sections VI.C.8.c and VI.C.8.d above. Bugeja, [0031]-[0033], [0047], [0050]-[0055], FIGS. 8-10 (exemplary block diagram of AP); Ho, [0057].

D. Ground 4: Claims 4 and 8 Would Have Been Obvious Over Shpak-Ho or Bugeja-Ho in view of Thielecke

1. Shpak-Ho Combination

235. The Shpak-Ho combination is discussed in Section VI.A.3 above.

2. Bugeja-Ho Combination

236. The Bugeja-Ho combination is discussed in Section VI.C.3 above.

3. Thielecke (Ex. 1035)

237. Thielecke is a U.S. Patent Application Publication that was filed on May 3, 2002 and published on January 2, 2003. Thielecke, (22), (43). I understand that Thielecke is therefore prior art to the '551 Patent. Thielecke was not considered during prosecution of the '551 Patent. *See generally* Ex. 1002.

238. Thielecke "relates to a wireless communication system for transmitting information between a transmitter having more than one transmit

antenna and a receiver having more than one receive antenna, whereby information to be transmitted is divided into a plurality of subsignals.” Thielecke, [0001].

Thielecke notes that the prior art included “link adaption (LA)” methods that used “knowledge of one or more channel parameters reflecting the current ability of the channel for transmit data reliably” to determine how to “efficiently utilise [sic] the available transmission potential of wireless communication channels.” Thielecke, [0002]. Thielecke teaches that in MIMO techniques “there are a lot more parameters influencing the transmission properties than in the conventional case” (e.g. a SISO system). Thielecke, [0005]. In light of the additional degrees of freedom in MIMO, Thielecke “present[s] a solution for best exploitation of a MIMO channel.” Thielecke, [0029]. Thielecke teaches that “[d]epending on the channel condition, it could be that the potential rate of one or more strata is very small,” Thielecke, [0031], where “strata” is the number of MIMO subchannels, Thielecke, [0031]. (Thielecke also refers to the MIMO subchannels as “layers.” Thielecke, [0043].) If one strata (subchannel) has a very low potential data rate, Thielecke teaches “it is usually advantageous to reduce the number of strata, i.e. the number of independent strata.” Thielecke, [0031]. That is, it is advantageous under certain channel conditions to use less MIMO subchannels.

239. To determine whether a subchannel will have a very small potential rate, Thielecke teaches to measure the link quality using one of a variety of

metrics, such as “error rate measurement, a noise ratio measurement, or a capacity measurement.” Thielecke, [0035]. The “different measurement methods for the link quality” that Thielecke teaches include measuring the “SINR per layer” (i.e., per subchannel) ([0059]-[0063]), calculating the singular values of the channel matrix ([0064]-[0071]), measuring the channel correlation matrix, which “reflects the type of scatterer environment that is present in the interesting time period,” and “shows whether that are strong or weak correlations in the channel matrix,” ([0072]-[0080]), and measuring word error rate (WER) or bit error rate (BER) ([0081]-[0084]).

240. Based on the measured channel conditions for each subchannel, Thielecke teaches to alter how many subchannels a MIMO device under those conditions. Thielecke, [0125]-[0133]. Thielecke teaches that one way to determine the number of layers (MIMO subchannels) to use is to “[e]nsure a certain minimum rate per layer,” in light of the “inter-layer interference” experienced on that layer (MIMO subchannel). Thielecke, [0131], Claim 18. For example, if a particular the modulation and coding scheme necessary to “cope with the inter-layer interference” was beyond the current SNR and code rate that could be used in light of the channel conditions, then the layer would be “switched off.” Thielecke, [0131]. The layer could be switched off by “switching off antennas,” Thielecke, [0127], or the MIMO processing can be adapted to reduce the number

of subchannels, with the extra antennas used for non-MIMO processing, such as space-time coding and/or diversity transmissions, Thielecke, [0133].

241. Thielecke teaches that having the ability to reduce the number of layers (MIMO subchannels) based on channel conditions is beneficial because, depending on the channel conditions, “the same data rate can be achieved with less number of layers,” and thus “the receiver becomes simpler and usually the performance improves since there are less losses due to imperfect receiver solutions.” Thielecke, [0134].

4. Obvious Implementations of Shpak-Ho and Bugeja-Ho in view of Thielecke

242. Ho discloses a typical “‘2x2’ MIMO configuration” where two stations “each include[] a pair of antennas that communicate with the pair antennas on the other station,” and notes that 3x3 MIMOs (i.e., which would have required least three antennas on each side of the communications channel, e.g., three antennas in each station) were also known. Ho, [0009]. Ho further discloses that “[i]t might also be desirable for some stations to reconfigure themselves for different types of MIMO [e.g., 2x2 versus 3x3] or SISO configurations during operation as they communicate with other stations on the network.” Ho, [0013]. That is, a single station supports SISO, 2x2 MIMO, and 3x3 MIMO configurations, and can select among the available configurations, depending on the capabilities of the other stations, or channel conditions, in the network. For

example, an access point may support 3x3 MIMO, but a mobile station may only support 2x2 MIMO, or only two of the three MIMO channels may be viable under current channel conditions, and thus communications with that mobile station could only use (or would only make sense to use) a 2x2 MIMO configuration. Thielecke confirms that MIMO configurations with more subchannels, e.g., 4x4, were also known. *See* Thielecke, [0015], [0043], FIG. 1. Thus, a Shpak-Ho access point and a Bugeja-Ho access point can reconfigure the number of MIMOs (i.e., number of MIMO subchannels) that it uses to communicate.

243. Given Thielecke, a POSA would have had reasons to implement Shpak-Ho and Bugeja-Ho such that their APs reconfigure the number of MIMO subchannels used based on channel conditions, which I will refer to as the Shpak-Ho-Thielecke access point and Bugeja-Ho-Thielecke access point, respectively

244. First, POSAs understood channel conditions affect MIMO subchannel quality. For corroborating evidence of a POSA's background knowledge of the effect of channel conditions on subchannels, Ex. 1023, at 1:43-46 notes as background information that the "sub-channels of a MIMO system *may experience different channel conditions...* [c]onsequently, *the data rates* that may be supported by the spatial sub-channels *may be different from sub-channel to sub-channel.*" Thus, one subchannel may have a relatively strong data rate, whereas channel conditions may be such that another subchannel has poor data rates. As I

explained in Section VI.D.3, Thielecke similarly teaches and explains that when subchannel conditions are poor, “reduc[ing]” the number in a MIMO system was “advantageous.” Thielecke, [0031]. The ’551 Patent similarly admits that adapting the number of MIMOs (subchannels) based on channel conditions was known in the prior art by explaining that basing the number of MIMO subchannels on channel conditions such as “propagation coefficients” was known. Ex. 1001, 2:1-3. As Thielecke demonstrates and the ’551 Patent confirms, POSAs would have been motivated to have the APs in Shpak-Ho and the APs in Bugeja-Ho select the number of MIMOs (subchannels) based on channel condition(s), including “reduc[ing] the number” of MIMOs if channel conditions are such that a particular subchannel’s potential data rate is too small to justify the processing overhead required to implement it, as Thielecke taught. Thielecke, [0031], [0126]-[0127].

245. Second, the implementation would have involved no more than using a known technique (adjusting MIMO subchannels based on channel condition(s)) to improve similar devices (802.11-based MIMO-systems) in the same way (optimizing the number of MIMO subchannels based on channel condition(s)). The ’551 Patent admits this technique was known (2:1-3), and Thielecke confirms it was well-known and “usually advantageous” to adjust the number of MIMOs

(subchannels) “[d]epending on the channel conditions” (Thielecke, [0031], [0125]-[0133]).

246. A POSA would have had a reasonable expectation of success because Ho discloses that conventional MIMO stations were able to “reconfigure themselves for different types of MIMO [e.g., 2x2 versus 3x3].” Ho, [0017]. The ’551 Patent similarly concedes POSAs knew techniques existed in September 2003 where “[t]he number of MIMOs [i.e., MIMO sub-channels] is determined in accordance with the propagation coefficients and the like” (i.e., a channel condition). Ex. 1001, 2:1-3. As discussed in Section VI.D.3, Thielecke teaches several known ways to measure channels: signal-to-noise (SNR) values, channel matrices, word error rate (WER) and bit error rates, and a so-called channel correlation matrix). Thielecke, [0059]-[0102]. It would have required only ordinary skill for the Shpak-Ho access point to reconfigure the number of MIMOs. For example, as was known in the art, the access point could measure the channel conditions and determine that one of the subchannels had a poor data rate, and thus determine that the additional processing required to make use of that subchannel would be better put to transmitting using stronger subchannels, as Thielecke taught, as I explained in Paragraphs 239-241 above.

247. In view of Thielecke, it would have required only ordinary skill for the Shpak-Ho access point or the Bugeja-Ho-Thielecke access point to reconfigure

the number of MIMOs. For example, as I discussed in Section VI.D.3, Thielecke discloses conventional techniques for performing this reconfiguration such as disabling the processing for a particular sub-channel and/or shutting off antenna(s), when channel conditions indicated the sub-channel should not be used. Thielecke, [0127], [0133].

248. As I explain in Sections VI.B.5-.6 below, the Shpak-Ho access point in view of Thielecke and Bugeja-Ho access point in view Thielecke each meet claims 4 and 8.

5. Dependent Claim 4: The wireless packet communication method according to claim 1 or 2, further comprising simultaneously transmitting wireless packets selectively using the multiple wireless channels or the MIMO in accordance with a number of pieces of data or a number of MIMOs that depends on a channel condition.

249. Claim 4 depends from claim 1, and recites that the method further comprises “simultaneously transmitting wireless packets selectively using the multiple wireless channels or the MIMO in accordance with a number of pieces of data or a number of MIMOs that depends on a channel condition.”

250. POSAs understand that “a number of MIMOs” refers to the number of MIMO subchannels used on the wireless channel. For example, in a 2x2 MIMO, the “number of MIMOs” would be two (i.e., two subchannels). This is illustrated, for example, in the ’551 Patent’s FIG. 14(1), which illustrates “three wireless channels... whe[re] the number of MIMOs of each wireless channel is two” (i.e.,

there are two subchannels per wireless channel, as illustrated by the dashed lines in FIG. 14(1)).

251. As discussed in Section VI.A.4, the Shpak-Ho access point performs the wireless packet communication method according to claim 1. As discussed in Section VI.A.4.a.(2), the Shpak-Ho access point simultaneously transmits 802.11 wireless packets using Ho's background MIMO technique. As discussed in Section VI.D.4, the Shpak-Ho access point in view of Thielecke selectively uses the MIMO in accordance with a number of MIMOs that depends on a channel condition in view of Thielecke's teachings. Accordingly, the Shpak-Ho access point in view of Thielecke meets claim 4.

252. As discussed in Section VI.C.4, the Bugeja-Ho access point performs the wireless packet communication method according to claim 1. As discussed in Section VI.C.4.a.(2), the Bugeja-Ho access point simultaneously transmits 802.11 wireless packets using Ho's background MIMO technique. As discussed in Section VI.D.4, the Bugeja-Ho access point in view of Thielecke selectively uses the MIMO in accordance with a number of MIMOs that depends on a channel condition in view of Thielecke's teachings. Accordingly, the Bugeja-Ho access point in view of Thielecke meets claim 4.

- 6. Dependent Claim 8: The wireless packet communication apparatus according to claim 5 or 6, further comprising: a unit simultaneously transmitting wireless packets selectively using the multiple wireless channels or the MIMO in accordance with a number of pieces of data or a number of MIMOs that depends on a channel condition.**

253. Claim 8 requires claim 5's "wireless packet communication apparatus," which is met by the Shpak-Ho access point for the reasons discussed above in Section VI.A.6 and is met by the Bugeja-Ho access point for the reasons discussed in Section VI.C.6.

254. Claim 8 also requires a "unit simultaneously transmitting wireless packets selectively using the multiple wireless channels or the MIMO in accordance with a number of pieces of data or a number of MIMOs that depends on a channel condition," and thus the unit performs the limitation added by Claim 4 to the method of Claim 1 or 2.

255. As discussed in Section VI.A.6.b above, the Shpak-Ho access point (apparatus) has a "message processor 72" (a unit) that controls the WLAN transceiver that transmits the wireless packets over the MIMO subchannels. Using this message processor unit to configure the number of MIMO subchannels used by the transceiver (e.g., by turning of an antenna), the Shpak-Ho access point in view of Thielecke would have transmitted the wireless packets in accordance with the number of MIMOs that depends on a channel condition, using the method

recited by Claim 4 (as discussed in Section VI.D.4 above), thereby meeting the limitation added by Claim 8.

256. As discussed in Section VI.C.6.b above, the Bugeja-Ho access point (apparatus) has a multi-channel mode/controller, configures the “power control logic,” which is part of the multi-channel controller (*see* FIG. 9), “which controls the power of the transmitted analog signal for each [sub-]channel through the respective power control signal.” Bugeja, [0054]. Using this message processor unit to configure the number of MIMO subchannels (e.g., by using the control signal to adjust the power used on each subchannel), the Bugeja-Ho access point in view of Thielecke would have transmitted the wireless packets in accordance with the number of MIMOs that depends on a channel condition, using the method recited by Claim 4 (as discussed in Section VI.D.4 above), thereby meeting the limitation added by Claim 8.

VIII. CONCLUSION AND SIGNATURE

257. In signing this declaration, I understand that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I acknowledge that I may be subject to cross-examination in this case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

258. I declare that all statements made herein of my knowledge are true, that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

259. I declare under penalty of perjury that the foregoing is true and correct.

Date: August 5, 2020

By: 
Tim A. Williams