

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TP-LINK CORPORATION LIMITED,
Petitioner

v.

NETGEAR, INC.,
Patent Owner

U.S. PATENT NO. 7,936,714 B1

Case IPR2023-TBD

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

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1001	U.S. Patent No. 7,936,714
1002	Declaration of Dr. Zhi Ding for <i>Inter Partes</i> Review of U.S. Patent No. 7,936,714
1003	<i>Curriculum Vitae</i> of Dr. Zhi Ding
1004	Certified File History of U.S. Patent No. 7,936,714
1005	U.S. Patent Application Publication No. 2002/0045459 (“Morikawa”)
1006	U.S. Patent No. 6,049,721 (“Serizawa”)
1007	<i>Millimeter Waves for Short-Range Multimedia Communication Systems</i> , Andrisano <i>et al.</i> , IEEE 1998 (“Andrisano”)
1008	<i>Fragment Adaptive Reduction: Copying with Various Interferers in Radio Unlicensed Bands</i> , Tourrilhes, IEEE 2001 (“Tourrilhes”)
1009	<i>Interference of Bluetooth and IEEE 802.11: Simulation Modeling and Performance Evaluation</i> , Golmie <i>et al.</i> , ACM 2001 (“Golmie”)
1010	<i>An Overview of Millimeter Wave Indoor Wireless Communication Systems</i> , Prasad <i>et al.</i> , IEEE 1993 (“Prasad”)
1011	U.S. Patent No. 6,470,055 (“Feher”)
1012	<i>Multirate Systems and Filter Banks</i> , Vaidyanathan, Prentice Hall (1993) (“Vaidyanathan”)
1013	Publication Declaration for Vaidyanathan
1014	IEEE 1000 The Authoritative Dictionary of IEEE Standards Terms, Seventh Edition (2000) (“IEEE Dictionary”)
1015	<i>RF Microelectronics</i> , Razavi, Prentice Hall (1998) (“Razavi”)
1016	Publication Declaration for Razavi
1017	U.S. Patent No. 5,852,767 (“Sugita”)
1018	U.S. Patent No. 6,801,519 (“Mangal”)

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1019	U.S. Patent No. 5,475,677 (“Arnold”)
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1031	IEEE 802.11-1999 (“802.11a”)

Petitioner TP-Link Corporation Limited (“TP-Link”) requests *inter partes* review (“IPR”) of claims 1-32 (the “Challenged Claims”) of U.S. Patent No. 7,936,714 (Ex.1001, “the ’714 Patent”).

I. INTRODUCTION

The ’714 Patent purports to claim a wireless communication system in which downlink communication (base station to subscriber station) and uplink communication (subscriber station to base station) take place at the same time over different frequency bands separated by at least one octave (a frequency ratio of at least two).

But such a two-way communication scheme was well-known in the art before the priority date of the ’714 patent, as illustrated in the table below which lists exemplary pairs of uplink (UL) and downlink (DL) frequency bands described in the Morikawa and Serizawa prior art references relied upon in this Petition. Ex.1005 (Morikawa), [0022], [0025], [0045], [0061]; Ex.1006 (Serizawa), 18:29-55, FIGs. 15-16, 19:47-20:5, FIGs. 19-20.

In each of these prior art references—including the embodiments highlighted in red that are discussed in detail in the grounds of unpatentability below—the downlink and uplink frequencies are separated by a frequency ratio that is significantly higher than the claimed minimum ratio of two (one octave), as shown in the “Ratio of DL/UL” column.

Prior Art	UL Freq Band	DL Freq Band	Ratio of DL/UL
Morikawa	2.4-GHz ISM	26, 38, or 42-GHz	Over 10
	2.4-GHz ISM	28-GHz	Over 10
	2.4-GHz ISM	5.3-GHz	Over 2
	5-GHz	60-GHz	12
Serizawa	2.4-GHz ISM	60-GHz	75
	800-MHz	60-GHz	25

The claims of the '714 Patent further require that the uplink frequency band is a band that is “expected to experience high interference.”¹ *See, e.g.*, Ex. 1001,

¹ Petitioner argues in the related co-pending ITC litigation (see Section IX.B for a discussed of the related proceeding) that the phrase “expected to experience high interference” is indefinite. Ex.1030, Attachment A at 2; Section V. While the '714 Patent notes that users of an unlicensed band are “not protected from possible interference” (Ex.1001, 2:66-3:8), the specification is otherwise devoid of any guidance on the scope of this claim term. However, for purposes of applying prior art in this Petition, the 2.4-GHz ISM band used in Morikawa and Serizawa is an unlicensed band, consistent with the specification’s discussion and, moreover, is the same band used in the accused products that, according to Netgear, satisfies this claim phrase. Ex.1029, 11.

claim 1, element [1b]. The embodiments of Morikawa and Serizawa that are highlighted in red in the table above use the 2.4-GHz ISM (Industrial, Scientific and Medical) frequency band for uplink. *See* Sections VII.A.1.(c), VII.B.1.(c). This band is an ***unlicensed band*** in countries like the United States and Japan that are shared by all sorts of consumer devices such as Wi-Fi, Bluetooth, microwave ovens, and garage door openers and, thus, is expected to experience high interference, as the '714 Patent recognizes. *Id.*; Ex.1001, 2:66-3:8 (“operators [in an unlicensed band] are not protected from possible interference from other [] operators ... [or] systems or devices which utilize the same frequencies.”).

The claims also require that the downlink frequency band is a band that is “expected to experience low interference.”² *See, e.g.*, Ex.1001, claim 1, element [1a].

² Petitioner argues in the co-pending ITC litigation that the phrase “expected to experience low interference” is indefinite. Ex.1030, Attachment A at 2; Section V. While the '714 Patent notes that “use of a licensed band [] affords a degree of protection from interference by other systems” (Ex.1001, 5:64-66), the specification is otherwise devoid of any guidance on the scope of this claim term. However, for purposes of applying prior art in this Petition, the 28-GHz frequency band used in Morikawa is a licensed band (known as the 28-GHz LMDS band) and is therefore expected to experience low interference as

Morikawa's 28-GHz frequency band is a licensed band (known as the 28-GHz LMDS band), as the '714 Patent recognizes. *Id.*, 2:38-47 (“**FCC licensed** and regulated bands include ... [the] Local Multipoint Distribution Services (LMDS) [] **27.5 to 29.5 GHz** and 31.0 to 31.3 GHz bands.”). A licensed band is expected to experience low interference for the reason that system deployment requires planning permissions from regulatory authorities (such as the FCC), which tend to limit competing access to the same frequency band and potential sources of interference, as the '714 Patent also recognizes. *Id.*, 5:64-66 (“use of a licensed band [] affords a degree of protection from interference by other systems.”).

In addition, the downlink frequencies used in Morikawa and Serizawa (28-GHz in Morikawa, 60-GHz in Serizawa) (highlighted in red) are millimeter-wave (MMW) frequencies that were, and still are, sparsely used. *See* Sections VII.A.1.(c), VII.B.1.(c). Moreover, MMW signals are short-range signals that do not travel far, cannot penetrate walls and other hard building materials well, and can also be significantly attenuated by rain. *Id.* Thus, distance, walls and weather conditions

described in the specification. The 60-GHz band used in Serizawa satisfies this claim term at least under the claim scope as applied by Netgear for purposes of infringement in the co-pending ITC litigation. Ex.1029, 6.

effectively shield MMW devices from one another and, for those reasons, MMW frequency bands are expected to experience low interference. *Id.*

For the reasons discussed above and detailed in this Petition, the claimed invention is unpatentable, and Petitioner respectfully requests that all claims of the '714 Patent (the "Challenged Claims") be canceled.

II. OVERVIEW OF CHALLENGE AND RELIEF REQUESTED

The '714 Patent issued on May 3, 2011, from Application No. 10/095,307, filed on March 11, 2002. Ex.1001.

Petitioner's challenge is based on the following non-cited prior art references:

- **Morikawa** – U.S. Patent Application Publication No. 2002/0045459 (Ex.1005), published on April 18, 2002, from an application filed October 12, 2001. Morikawa is a pre-AIA §102(e) reference. Morikawa is not cited art.
- **Serizawa** – U.S. Patent No. 6,049,721 (Ex.1006), issued on April 11, 2000 from an application filed April 7, 1998. Serizawa is a pre-AIA §102(b) reference. Serizawa is not cited art.
- **Razavi** – Razavi, *RF Microelectronics*, Prentice Hall 1998 (Ex.1015), published and publicly available no later than January 6, 1998. *See* Ex.1016. Razavi is a pre-AIA §102(b) reference. Razavi is not cited art.

- **Ferry** – U.S. Patent Application Publication No. 2003/0189974, (Ex.1021), published on October 9, 2003 from an application filed May 3, 2001. Ferry is a pre-AIA §102(e) reference. Ferry is not cited art.

Petitioner requests cancellation of the Challenged Claims on the grounds below:

Ground	Basis	Challenged Claims ³	Reference(s)
I	§ 103	1 , 2-5, 11-12, 13 , 14-17, 23-24, 31 , and 32	Morikawa
II	§ 103	1 , 2-5, 13 , 14-17, 31 , and 32	Serizawa
III	§ 103	6-10, 18-22, 25 , and 26-30	Serizawa, Razavi, Ferry

III. BACKGROUND OF THE '714 PATENT

A. Overview of the '714 Patent

The '714 Patent is directed to the use of “separate bands for upstream and downstream” communications in a wireless communication system. Ex.1001, 3:30-34. Upstream communication refers to data sent from a user device (subscriber station) to a base station/network hub, whereas downstream communication refers to data sent in the opposite direction, from the base station/hub to the subscriber station. *Id.*, 7:3-9; Ex.1002 ¶43.

³ Independent claims are bolded.

The '714 Patent admits that the use of different frequencies for upstream and downstream wireless communication, called frequency division duplexing (FDD), was well-known. Ex.1001, 1:30-35 (discussing “prior art data communication systems” employing “frequency division duplexing (FDD)”), *id.*, 1:65-67 (“In FDD, a base station may simultaneously transmit and receive [using different frequencies], and a subscriber station may simultaneously transmit and receive.”); Ex.1015, 103 (“[An] approach to duplexing is to employ two different frequency bands for the transmit and receive paths. Called ‘frequency-division duplexing’ (FDD) [], this technique incorporates bandpass filters to isolate the two paths, allowing simultaneous transmission and reception.”); Ex.1002 ¶44.

According to the '714 Patent, prior art FDD communication systems “operate entirely within one regulated band.” Ex.1001, 1:33-35. As a result, the upstream and downstream frequencies in prior art FDD systems are “relatively closely spaced” and this “adjacency requires extensive use of filters resulting in increased size and cost for data communication systems, particularly for subscriber stations.” *Id.*, 1:35-40; Ex.1002 ¶45.

The alleged invention described and claimed in the '714 Patent purports to solve this problem by using two separate frequency bands for upstream and downstream communication. Ex.1001, 6:46-49 (“The present systems and methods for multi-band wireless RF data communications enables communication of

upstream data *on one band of operation* while downstream data is communicated *on a different band of operation.*”); Ex.1002, ¶46.⁴ The two bands are preferably “separated by at least one octave of bandwidth.” Ex.1001, 6:49-52. The specification notes that “[t]he two bands may both be licensed bands or both may be unlicensed bands. However, in one preferred embodiment, one band is a licensed band while another is an unlicensed band.” *Id.*, 6:59-62; Ex.1002, ¶47. The specification further notes that licensed bands are “relatively interference-free.” Ex.1001, 3:37-40. In contrast to that, operators in an unlicensed band “are not protected from possible interference from other [] operators transmitting in the vicinity or even other systems and devices which utilize the same frequencies.” *Id.*, 3:5-8; Ex.1002, ¶48.

B. Summary of the Prosecution History

Application No. 10/095,307 (“the ’307 Application”) was filed on March 11, 2002. Ex.1004, 1-2. The claims ultimately issued on May 3, 2011 after undergoing two appeals and overcoming several rejections on §112 and prior art grounds. Ex.1001, Cover; *see generally* Ex.1004; *see also* Ex.1002, ¶49.

Notably, Applicant overcame Examiner’s §103(a) rejection of the claims over U.S. Patent No. 6,801,519 (“Mangal”) (Ex.1018) in view of the Admitted Prior Art. Ex.1004, 452-59; *see also* Ex.1002, ¶¶50-51. According to Applicant, while Mangal

⁴ Emphasis added unless otherwise stated.

teaches both licensed and unlicensed frequency bands, only one band is used at a time to transmit and receive data. Ex.1004, 372 (“[T]he exchange of data *both* upstream and downstream ... occurs in **only the selected band at any given time** in *Mangal*.”), 376 (“[T]he queuing methods and reverse tear down of *Mangal* indicate *both* upstream and downstream data exchange ... in a given communication session **occur in only the selected frequency band.**”) (bolding added, other emphasis in file history).

Applicant argued that the claims—as amended to recite “wherein at least a portion of said receiving and at least a portion of said transmitting occur at the same time” or “wherein said transmitting and said receiving occur during the same communication session,” *Id.*, 297-301—claim using two frequency bands concurrently to transmit and receive data, and not one band at a time as disclosed in *Mangal*, and are therefore distinguishable over *Mangal*. *Id.*, 372-73 (“[T]he exchange of data *both* upstream and downstream ... occurs in only the selected band at any given time in *Mangal*. Therefore, *Mangal* does not satisfy the limitation that receiving on the low interference band and transmitting on the high interference band occur at the same time ...”), 376 (“*Mangal* does not satisfy the limitation receiving on the low interference band *and* transmitting on the high interference band occur in the same communication session.”) (emphasis in file history).

Applicant additionally overcame Examiner's §112 indefiniteness rejections directed to the limitations "low interference frequency band" and "high interference frequency band." *Id.*, 303, 315; *see also* Ex.1002, ¶52. Examiner explained that these limitations were "unclear because in any frequency band interference and noise are subject[] to constant change" such that "at some point 'low interference band' can have higher interference than 'high interference band.'" Ex.1004, 278-79. In response, Applicant amended the limitations to read "frequency band expected to experience low interference" and "frequency band expected to experience high interference" respectively, *id.*, 296-99, after which Examiner withdrew the §112 rejection, *id.*, 315.

IV. LEVEL OF ORDINARY SKILL IN THE ART

As described in the accompanying Declaration of Dr. Ding, a person of ordinary skill in the art ("POSITA") of the subject matter of the '714 Patent would have had a Bachelor's degree in electrical engineering, computer engineering, computer science, or a related field, and three years of experience in the design and analysis of wireless communication systems or equivalent work experience. Ex.1002, ¶¶53-56. Additional education might compensate for less experience, and vice-versa. *Id.*

V. CLAIM CONSTRUCTION

Claims only need to be construed to the extent necessary to resolve a controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017). The table below lists the parties’ disputed constructions in the parallel ITC litigation. Ex.1030, Attachment A at 2. The parties agreed that the term “frequency band” should be accorded plain meaning and is a “generally contiguous portion of the electromagnetic spectrum which is regulated by a governmental entity, such as the Federal Communications Commission (FCC) for the United States.” *Id.*, Attachment A at 1. As shown in Section VII, the Challenged Claims are unpatentable under either side’s construction. Thus, Petitioner submits that the Board does not need to construe any claim term for purposes of resolving the issues presented in this Petition. Ex.1002 ¶57.

Claim Term	TP-Link’s Proposed Construction	Netgear’s Proposed Construction
“receiving ... in a frequency band expected to experience [low/high] interference” / “transmitting ... in a frequency band expected to experience [high/low] interference” (claims 1, 13, 31, 32)	The claims require separate bands for receiving and transmitting	Plain and ordinary meaning
“frequency band expected to experience	Indefinite	Not indefinite. Plain and ordinary meaning, where

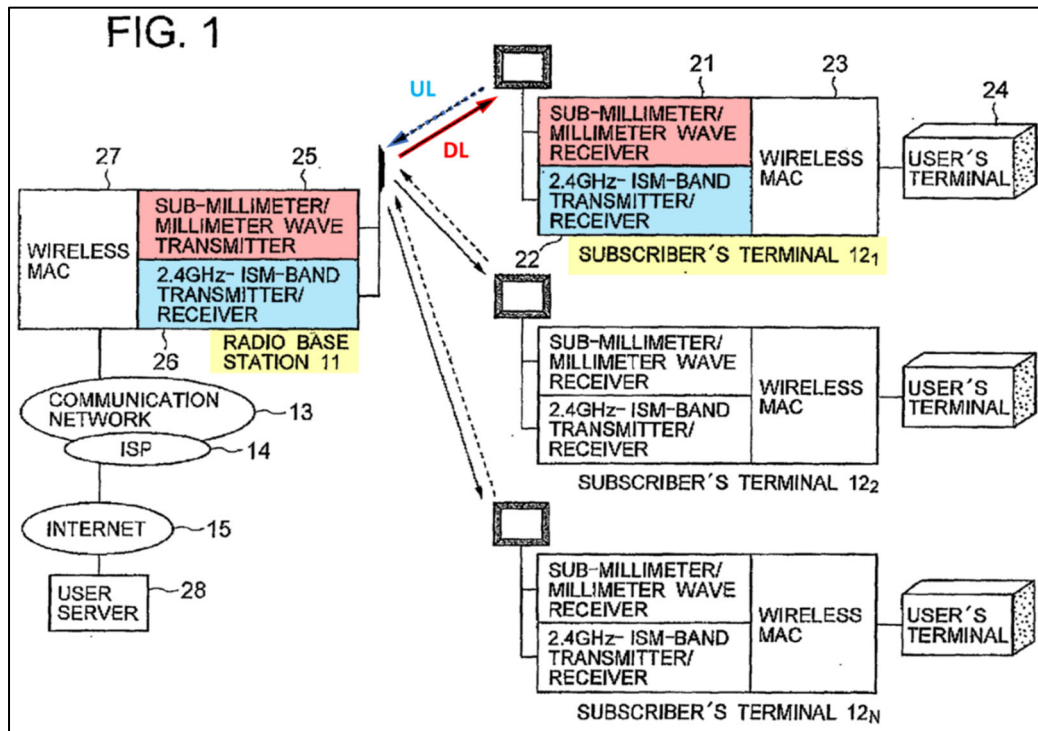
low interference” / “frequency band expected to experience high interference” (claims 1, 13, 31, 32)		a “frequency band expected to experience low interference” is relative to “a frequency band expected to experience high interference”
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VI. OVERVIEW OF THE PRIOR ART

A. Overview of Morikawa

Like the '714 Patent, Morikawa teaches a wireless communication system that uses widely separated frequency bands for uplink and downlink communications. Ex.1002 ¶¶59-61; Ex.1005 (Morikawa), [0017]-[0019]. This is illustrated in Morikawa Figure 1, in which “the down-link channels [(red)] for the subscriber’s terminals use a frequency band corresponding to a sub-millimeter waveband or a millimeter waveband, such as **26-GHz, 28-GHz, 38-GHz or 42-GHz** band, and the up-link channels [(blue)] for the subscriber’s terminals use a **2.4-GHz ISM** band.” Ex.1005, [0021]-[0022], [0027]. Morikawa explains that the 2.4-GHz ISM up-link band is an unlicensed band, while the millimeter/sub-millimeter down-link band(s) proposed for use in its system requires a license. *Id.*, [0044] (“[U]sing a 2.4-GHz ISM band [for] the up-link channel while a sub-millimeter or millimeter waveband [is used for] the down-link channel ... [helps] achieve a low-cost user’s terminal. The 2.4-GHz ISM band is a ***non-licensed*** waveband, [therefore] a ***single license***

only on the down-link channel can be sufficient for the service operation, saving the running cost for the service.”).

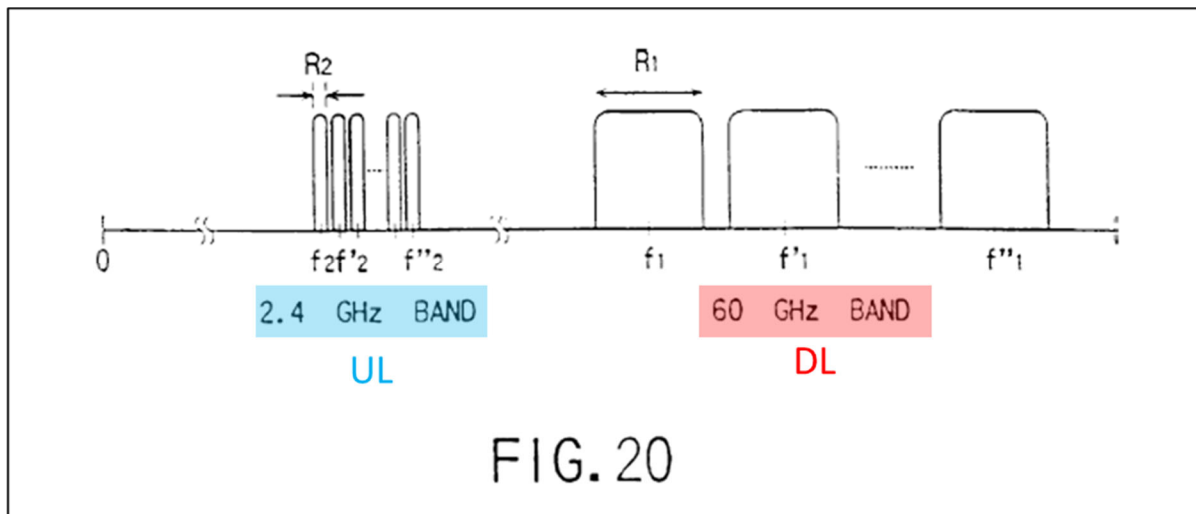
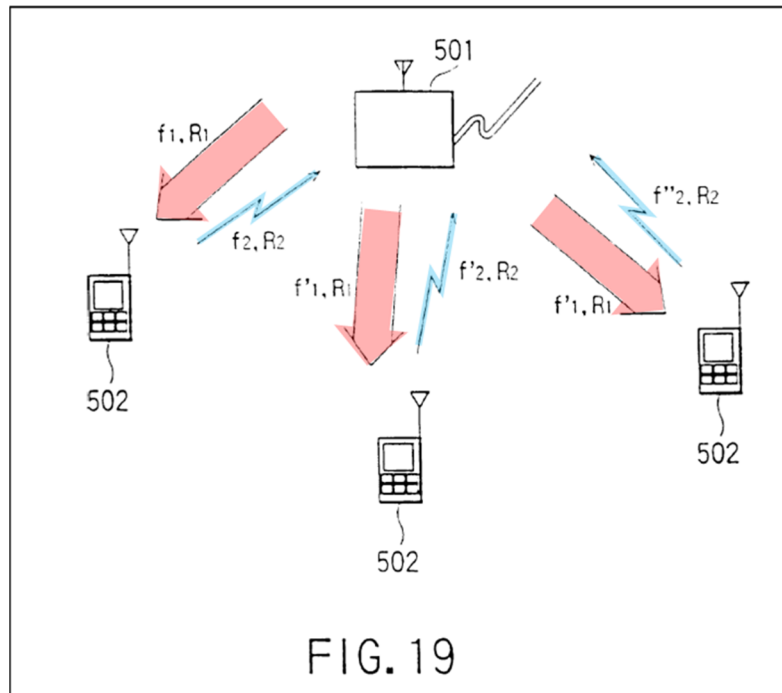


Id., Fig. 1.⁵ Morikawa’s downlink frequencies (in the range of 26-GHz to 42-GHz) are more than twice the uplink frequencies around 2.4-GHz, and thus, like the ’714 Patent, Morikawa teaches uplink and downlink frequencies that are separated by more than one octave. Ex.1002 ¶61.

⁵ All colors and colored annotations added unless otherwise noted.

B. Overview of Serizawa

Serizawa is directed to a wireless communication system having a “super highspeed downlink (abbreviated SDL ...), which has a relatively high transmission rate on the downlink, which is the radio transmission path from the base station to the terminal, in comparison with the transmission rate on the uplink, which is the radio transmission path from the terminal to the base station.” Ex.1006 (Serizawa), 1:9-17; Ex.1002, ¶¶62-64. Serizawa Figures 19 and 20 below illustrate an embodiment in which transmission “[f]rom the radio base station 501 to each of the portable terminals 502 (downlink) [(red)] transmission is made on frequencies f_1 , f_1' , f_1'' ” in the **60-GHz band** at a transmission rate of R1. From each of the portable terminals 502 to the radio base station 501 (uplink) [(blue)] transmission is made on frequencies f_2 , f_2' , and f_2'' ” in the **2.4-GHz band** at a transmission rate of R2. R1 is 100 MHz, and R2 is 2 MHz. As Serizawa explains, in such a system, “one base station and a plurality of terminals perform wideband transmission over a millimeter [wave band] downlink and relatively narrowband transmission over a 2.4-GHz-band uplink.” Ex.1006, 19:47-63; Ex.1002 ¶63. In Figure 19, the wideband downlink transmissions are illustrated by the wide arrows (red), and the narrowband uplink transmissions are illustrated by the slim arrows (blue).



Ex.1006, Figs. 19 and 20. Like the '714 Patent, Serizawa's 2.4-GHz uplink frequency band and its 60-GHz downlink frequency band are separated by more than one octave. Ex.1002 ¶64.

VII. SPECIFIC GROUNDS FOR PETITION

A. Ground I: Claims 1-5, 11-17, 23-24, 31, and 32 Are Rendered Obvious by Morikawa

1. Independent Claim 1

- (a) *Preamble: “A method for increasing capacity of a wireless data communication system, said method comprising the steps of:”*

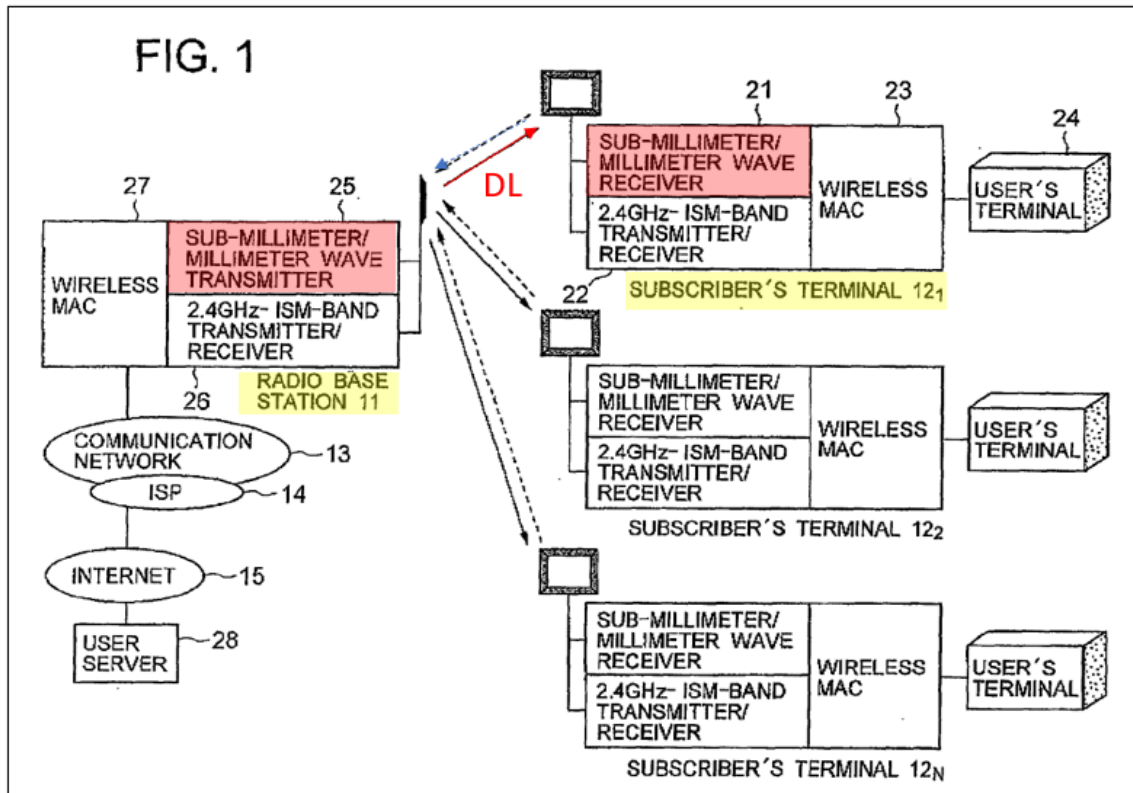
To the extent the preamble is limiting, Morikawa discloses or renders it obvious. Ex.1002, ¶¶65-67. Morikawa discloses a wireless communication system that uses “two different frequency bands for an up-link channel and a down-link channel” to transmit data between a wireless base station and wireless subscribers’ terminals in order to increase data capacity. Ex.1005, [0002], [0009]-[0010]. Specifically, “the down-link channel from the wireless base station to the subscriber’s terminal uses a frequency band corresponding to a sub-millimeter waveband or millimeter waveband, such as 26-GHz, 28-GHz, 38-GHz, and 42-GHz frequency band, and the up-link channel from the subscriber’s terminal to the wireless base station uses an 2.4-GHz ISM band that does not need a license from the authority.” *Id.*, [0025]. This dual-spectrum configuration is advantageous because of the “asymmetry of the traffic” between a base station and a subscriber station, whereby large amounts of data are transmitted from the base station to the subscriber station (downlink/downstream direction), whereas less data are typically sent in the reverse direction (uplink/upstream). Ex.1005, [0091]; Ex.1002, ¶66.

Specifically, Morikawa explains that the millimeter or sub-millimeter wave downlink bands have much larger bandwidth—and thus can transmit lots more data—compared to the 2.4-GHz uplink band. Ex.1005, ¶ [0023] (“In the above configuration, the higher-frequency band [sub-millimeter or millimeter wave band] is used for the [downlink] channel transmitting ***larger capacity data***, whereas the lower-frequency band is used for the [uplink] channel transmitting smaller capacity data.”); Ex.1007, 1385 (“the ***large spectrum*** availability of the MMW [(millimeter wave, *e.g.*, 60-GHz)] band [] is one of the main reasons for the interest in that frequency band.”). Thus, Morikawa’s wireless communication increases data capacity, per the preamble of claim 1. Ex.1002 ¶66.

In Morikawa, the downlink (*e.g.*, 28-GHz) and uplink (2.4-GHz) frequency bands are separated by more than one octave. Ex.1002, ¶67; Ex.1001, 4:22-25 (“As used herein, a frequency octave is a doubling of frequencies. In other words, an octave is an interval between two frequencies having a ratio of two-to-one.”); Ex.1014 (IEEE Dict.) (an “octave” is “the interval between two frequencies having a ratio of 2 to 1.”). The ’714 Patent recognizes that using bands separated by more than one octave “increases the efficiency and capacity of a wireless data communication system by allowing use of the full bandwidth available, in each band, to an operator.” Ex.1001, 4:18-22.

- (b) *Element [1.1]: “receiving, at a subscriber station, data on a first frequency in a frequency band expected to experience low interference”*

Morikawa discloses this element or renders it obvious. Ex.1002, ¶¶ 68-76. As shown below in Figure 1, Morikawa discloses that each wireless subscriber’s terminal (12₁ to 12_N) includes “a receiver unit 21 [(red)] for **receiving data** of sub-millimeter wave or a millimeter wave” frequency band, such as a 26-GHz, 28-GHz, 38-GHz, or 42-GHz frequency band. Ex.1005, [0030], [0027]. Morikawa explains that those millimeter/sub-millimeter downlink frequency bands are licensed. *Id.*, [0044] (“[U]sing a 2.4-GHz ISM band [for] the up-link channel while a sub-millimeter or millimeter waveband [is used for] the down-link channel ... [helps] achieve a low-cost user’s terminal. The 2.4-GHz ISM band is a non-licensed waveband, [therefore] a **single license** only on the [sub-millimeter or millimeter] **down-link channel** can be sufficient for the service operation, saving the running cost for the service.”).



Id., Fig. 1. Notably, the 28-GHz downlink frequency band discussed in Morikawa is the LMDS licensed band, as the '714 Patent recognizes. Ex.1001, 2:38-47 (“**FCC licensed** and regulated bands include ... [the] Local Multipoint Distribution Services (LMDS) [] **27.5 to 29.5 GHz** and 31.0 to 31.3 GHz bands.”); Ex.1020, 1236 (“Activity over the last several years, both within the United States and abroad, has focused on the investigation, **licensing**, and deployment of local wireless video distribution systems operating at frequencies near 28- and 42-GHz. In Europe, the 40.5-42.5-GHz band has been proposed for multipoint video distribution, while activity within the U.S. has been focused on operation within the 27.5-29.5-GHz band ... In the United States, microwave video distribution at 28-GHz has been

referred to as local multipoint distribution service (LMDS).”); *id.*, fn.1 (“In 1992, the FCC ***granted a license*** [] to CellularVision for the deployment of their **28-GHz LMDS** [(local multipoint distribution service)] system ...”).

According to the ’714 Patent, a licensed band such as the 28-GHz band is “***relatively interference-free***[.]” Ex.1001, 3:37-40, Abstract (“relatively interference free licensed bands”). This is because, unlike unlicensed bands, deployment in a licensed band requires planning permissions, which limits potential sources of interference. Ex.1008, 239; *see also* Ex.1002, ¶38.

Moreover, as Dr. Ding explains in his Declaration, each of the millimeter/sub-millimeter frequency bands discussed in Morikawa, such as the 28-GHz band, is expected to experience low interference for additional reasons, as was well-known in the art and discussed in prior art publications. Ex.1002, ¶72, citing Ex.1010 (Prasad), and Ex. 1007 (Andrisano).

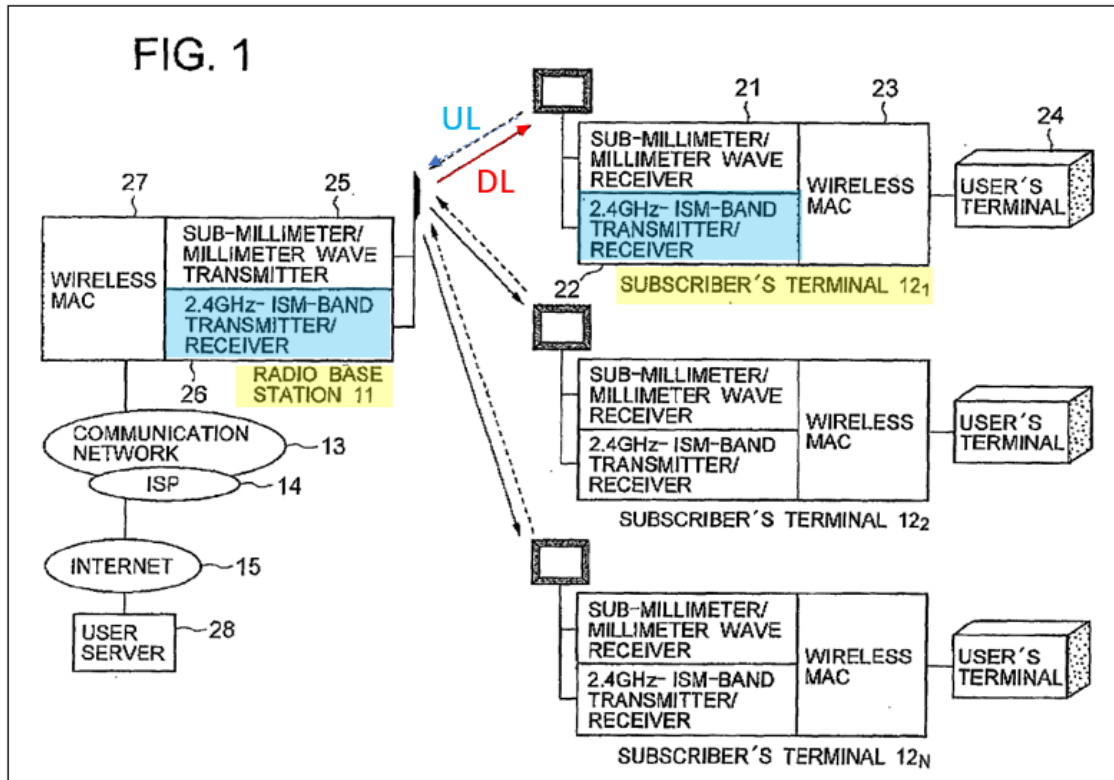
First, a POSITA would have understood that millimeter/sub-millimeter frequency bands such as the 28-GHz band disclosed in Morikawa were not (and still are not) commonly used. Ex.1010, 885 (“With the growing demand of wireless facilities in mobile, indoor and personal communications . . . , the millimeter (mm) frequency band appears to be a strong candidate ***for the future***.”); *id.* (“A system which operates at 20-60 GHz” has the advantage “that this frequency region is ***not in use by any other communications medium***, so every channel can be allocated a

large bandwidth: 100 MHz channels can be used without any bandwidth problems.”); Ex.1007, 1383 (“***Due to spectrum congestion*** ... the millimeter wave (MMW) band [is] a candidate for some of the most challenging services ***to be provided in the next decade.***”); Ex.1002, ¶¶73-74.

Second, millimeter-wave/sub-millimeter wave signals are short-range signals that do not travel far and, moreover, are significantly attenuated by hard building materials; those factors effectively shield different millimeter-wave devices from one another, resulting in less interference. Ex.1010, 885-86 (millimeter wave signals are “shielded within [a] room by the concrete or steel walls”); Ex.1007, 1384 (noting the “low number of interfering signal sources that are usually present in [a millimeter-wave] system,” due to walls in an indoor environment and the fact that the signals do not travel as far as lower frequency signals outdoors); Ex.1002, ¶¶75-76.

- (c) *Element [1.2]: “transmitting, at said subscriber station, data on a second frequency in a frequency band expected to experience high interference”*

Morikawa discloses this element or renders it obvious. Ex.1002, ¶¶ 77-81. As shown below in Figure 1, Morikawa discloses that each of the wireless subscriber’s terminals (12₁ to 12_N) includes “***a 2.4-GHz-ISM-band*** transmitter unit 22 [(blue)] for ***transmitting data*** through the down-link [(sic, up-link)] channel.” Ex.1005, [0030], [0027].



Id., Fig. 1.⁶ Because Morikawa teaches a subscriber station transmitting data in the 2.4-GHz band and receiving data in the different 28-GHz band, as detailed in Section VII.A.1.(b), Morikawa satisfies Petitioner’s construction requiring that separate bands are used for receiving and transmitting. Moreover, each frequency band is a “generally contiguous portion of the electromagnetic spectrum which is regulated by a governmental entity, such as the Federal Communications Commission (FCC)

⁶ Figure 1 illustrates an embodiment in which the subscriber’s terminal includes “a 2.4-GHz transmitter/receiver unit” instead of a 2.4-GHz transmitter *only* unit, which is the configuration relied on for claim mapping. Ex.1005, [0030].

for the United States.” Ex.1030, Attachment A at 1; Ex.1002 ¶¶77; Sections VII.A.6-7.

The 2.4-GHz ISM (Industrial, Scientific and Medical) band is an *unlicensed* band. Ex.1005, [0025] (“[T]he up-link channel from the subscriber’s terminal to the wireless base station uses an 2.4-GHZ ISM band that *does not need a license* from the authority.”), [0044] (“The 2.4-GHz ISM band is a non-licensed waveband”).

Thus, as the ’714 Patent recognizes, “a *significant amount of interference* may be present” in this band. Ex.1001, 3:23-26; *id.*, 3:5-8 (“operators are *not protected* from possible interference” in unlicensed bands), 4:10-11 (an unlicensed band is “noisier” compared to a licensed band). A POSITA would have understood that the 2.4-GHz ISM band is expected to experience high interference due to the fact that this band is shared by many types of consumer devices, such as WiFi and Bluetooth devices, cordless phones, TV redistribution systems, and microwave ovens, among others, and therefore is often congested. Ex.1002 ¶¶79-80; Ex.1008, 239; *see also* Ex.1002, ¶38. Moreover, because it is an unlicensed band, no usage permission is required, and 2.4-GHz consumer devices “may be deployed in an anarchic way and interfere[] with each other if they are within range.” Ex.1008, 239; *see also* Ex.1002, ¶38. For those reasons, it was well-known that 2.4 GHz ISM devices face “a hostile radio environment that includes . . . *abundant electromagnetic interference.*” Ex.1009, 11; Ex.1002, ¶81.

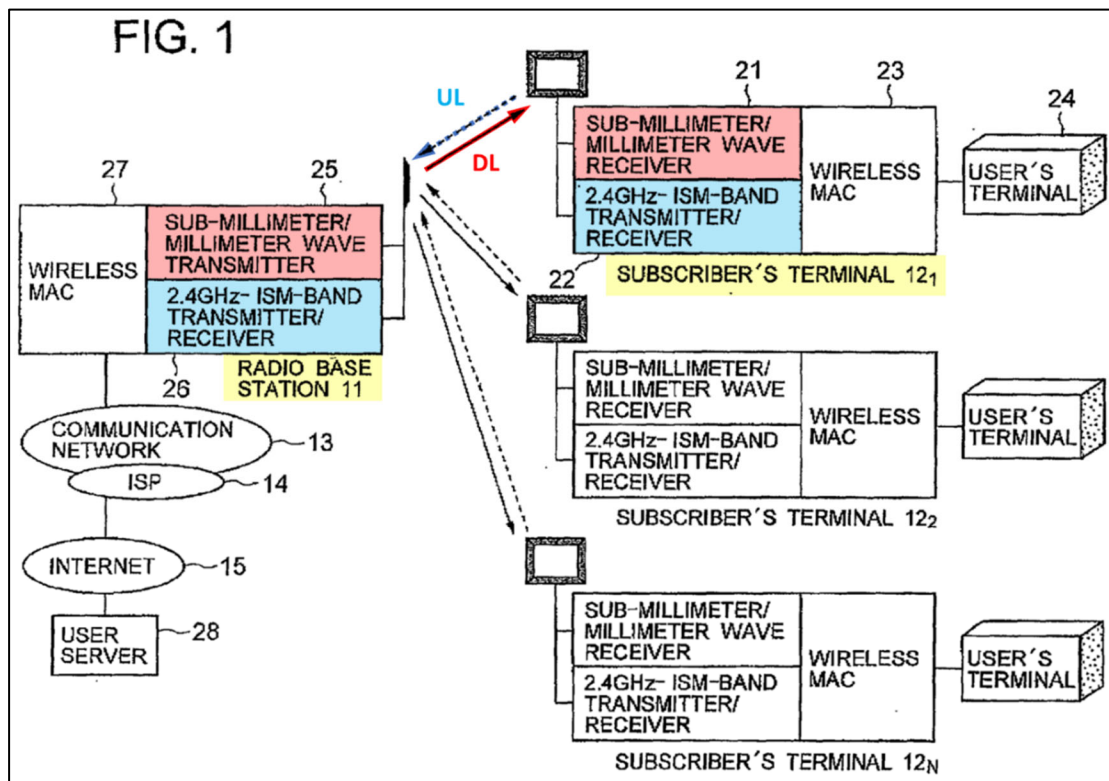
- (d) *Element [1.3]: “wherein said low interference frequency band and said high interference frequency are separated by at least one octave; and”*

Morikawa discloses this element. Ex.1002, ¶¶82-84. Each millimeter/sub-millimeter wave band used for downlink transmission in Morikawa, such as the 28-GHz LMDS band, is a low interference frequency band, as detailed above. *See* Section VII.A.1(b); Ex.1005, Fig. 1, ¶¶ [0021]-[0022], [0025]-[0027]. The 2.4-GHz ISM band used for uplink transmission in Morikawa is a high interference frequency band, as also discussed above. *See* Section VII.A.1(c); Ex.1005, Fig. 1, ¶¶ [0021]-[0022], [0025]-[0027]. Moreover, each of Morikawa’s low interference frequency bands, such as the 28-GHz LMDS band, is separated from Morikawa’s 2.4-GHz high interference frequency band by at least one octave. Ex.1014 (IEEE Dict.) (an “octave” is “the interval between two frequencies having a ratio of 2 to 1.”). For example, the ratio between Morikawa’s 28-GHz LMDS and 2.4-GHz ISM frequencies is 11.66, which is more than one octave. Ex.1002 ¶84.

- (e) *Element [1.4]: “wherein at least a portion of said receiving and at least a portion of said transmitting occur at the same time.”*

Morikawa discloses or renders obvious this element. Ex.1002, ¶¶85-87. As discussed above, Morikawa discloses that each of the subscriber’s terminals (12₁ to 12_N) uses separate uplink and downlink frequency bands to transmit and receive data. This multiple access technique, called frequency division duplexing or FDD, allows two-way communication whereby the transmission and reception of data

occur at the same time. Ex.1002, ¶85; Ex.1015, 103 (“[An] approach to duplexing is to employ *two different frequency bands* for the transmit and receive paths. Called ‘frequency-division duplexing’ (FDD) [], this technique incorporates bandpass filters to isolate the two paths, allowing *simultaneous* transmission and reception.”); Ex.1001, 1:65-67 (“In FDD, a base station may simultaneously transmit and receive, and a subscriber station may simultaneously transmit and receive.”); *see also* Ex.1002, ¶37. Morikawa Figure 1 below confirms this. The figure shows that each subscriber’s unit includes “a receiver unit 21 [(red)] for receiving data of sub-millimeter wave or a millimeter wave” that is separate from “a 2.4-GHz-ISM-band transmitter unit 22 [(blue)] for transmitting data.” Ex.1005, ¶¶ [0030], [0027].



Id., Fig. 1. As explained by Dr. Ding, a POSITA would have understood and found obvious that the separate receiver and transmitter units at each subscriber's terminal allow for concurrent, two-way, uplink and downlink transmissions over separate frequency bands. Ex.1002, ¶87; *see also* Ex.1002, ¶37. Such two-way communication is illustrated by the arrows (annotated UL and DL) in Morikawa Figure 1. *Id.* This is in contrast to the Mangal prior art distinguished during prosecution of the '714 Patent because "the exchange of data *both* upstream and downstream ... occurs **in only the selected band at any given time** in *Mangal*." Ex.1004, 372.

2. Dependent Claim 2

(a) "The method of claim 1 wherein said data is frequency division duplexed."

Morikawa discloses or renders obvious the additional element of this claim. Ex.1002, ¶¶88-90. Frequency division duplexing refers to the use of two different frequency bands (or isolated channels) for the transmit and receive paths, allowing simultaneous two-way transmission and reception. Ex.1015, 103 ("[An] approach to duplexing is to employ two different frequency bands for the transmit and receive paths. Called '*frequency-division duplexing*' (*FDD*) [], this technique incorporates bandpass filters to isolate the two paths, allowing simultaneous transmission and reception."); Ex.1001, 1:65-67; *see also* Ex.1002, ¶37. Morikawa discloses that each wireless subscriber's terminal transmits data on the 2.4-GHz ISM band and receives

data on a separate millimeter/sub-millimeter band such as the 28-GHz LMDS band, using separate transmitter and receiver circuitry. *See* Sections VII.A.1(b)-(c); Ex.1005, Fig. 1, ¶¶ [0030], [0027].

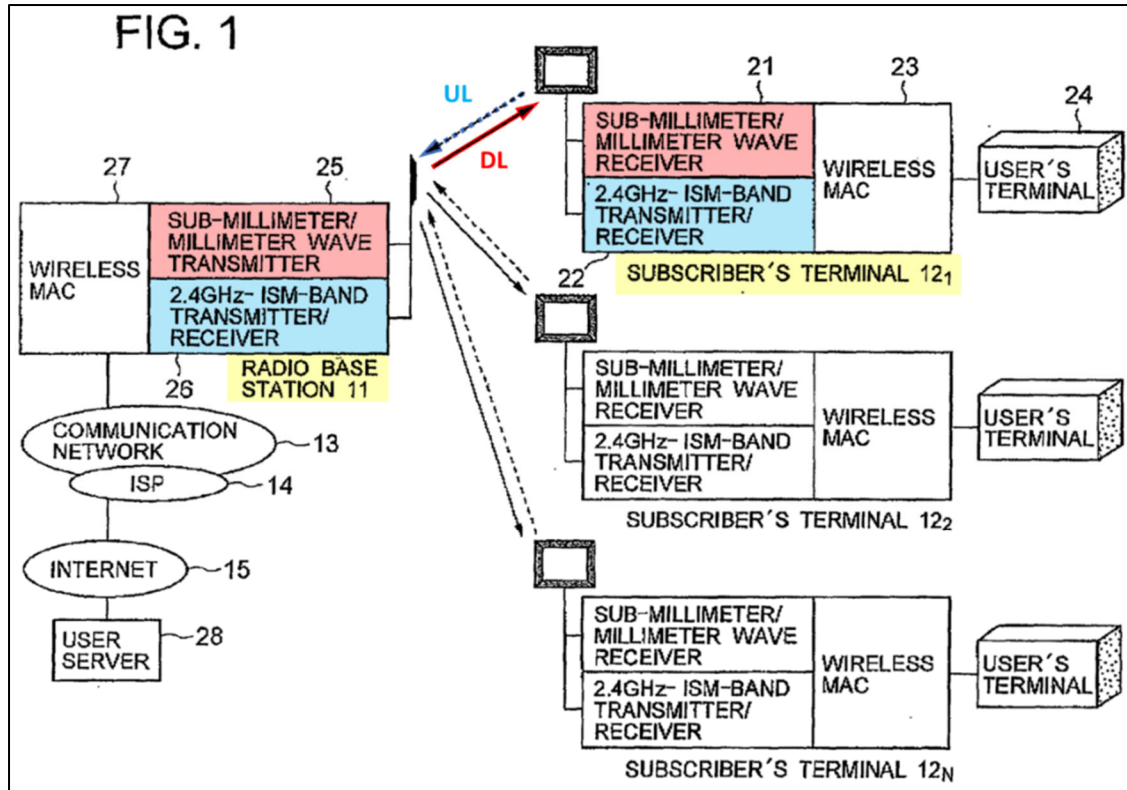
3. Dependent Claim 3

(a) *Preamble: “The method of claim 1 further comprising:”*

Morikawa at least renders obvious claim 1. *See* Section VII.A.1; Ex.1002, ¶91.

(b) *Element [3.1]: “receiving, at a base station, data on said second frequency in said interference frequency band expected to experience high interference”*

Morikawa discloses or renders obvious this element. Ex.1002, ¶¶92-93. As shown below in Figure 1, Morikawa discloses that the wireless base station 11 includes “receiver unit 26 [(blue)] for **receiving** a 2.4-GHz frequency band[.]” Ex.1005, ¶¶ [0028], [0027].

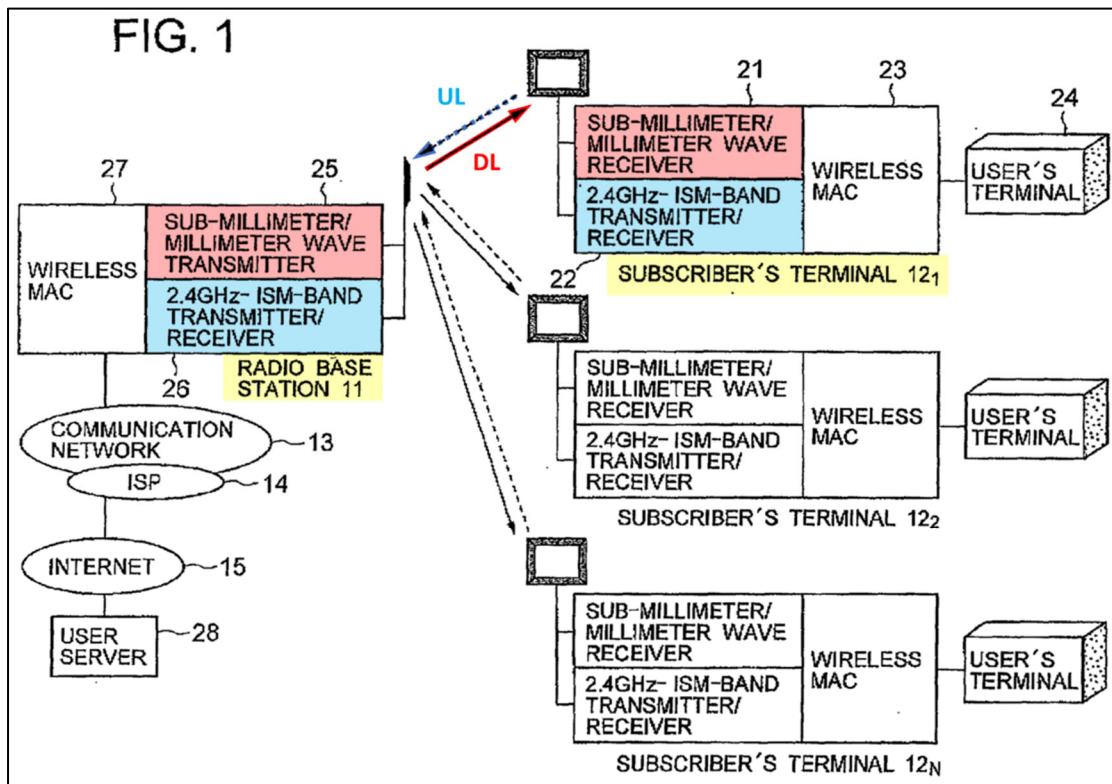


Id., Fig. 1.⁷ That frequency band is unlicensed and is expected to experience high interference, as discussed above. *Id.*, [0025] (“the up-link channel from the subscriber’s terminal to the wireless base station uses an 2.4-GHZ ISM band that **does not need a license** from the authority.”); *see also* Section VII.A.1(c); Ex.1008, 239; Ex.1009, 11; Ex.1002, ¶38.

⁷ Figure 1 illustrates an embodiment in which the base station includes “a transmitter/receiver unit 26” (illustrated in Figure 1) instead of a receiver **only** unit for receiving a 2.4-GHz ISM band, which is the configuration relied on for claim mapping. Ex.1005, ¶ [0028].

- (c) *Element [3.2]: “transmitting, at said base station, data on said first frequency in said frequency band expected to experience low interference”*

Morikawa discloses or renders obvious this element. Ex.1002, ¶¶94-95. As shown below in Figure 1, Morikawa discloses that the wireless base station 11 includes “a millimeter/sub-millimeter wave transmitter unit 25 [(red)] for **transmitting** a sub-millimeter wave or millimeter wave,” such as a 26-GHz, 28-GHz, 38-GHz, or 42-GHz band, containing data. Ex.1005, ¶¶ [0028], [0027]. Because Morikawa teaches a base station transmitting data in the 28-GHz band and receiving data in the different 2.4-GHz band, as detailed in Section VII.A.3.(b), Morikawa satisfies Petitioner’s construction requiring that separate bands are used for receiving and transmitting. Ex.1002 ¶94.



Ex.1005, Fig. 1. A millimeter/sub-millimeter band such as the 28-GHz LMDS licensed band is expected to experience low interference, as discussed above. *See* Section VII.A.1(b); Ex.1010, 885-86 (in indoor environments, millimeter wave devices tend to not interface with one another because millimeter wave signals are “shielded within [a] room by the concrete or steel walls”); Ex.1007, 1383-84 (noting the “low number of interfering signal sources that are usually present in [a millimeter-wave] system,” due to walls in an indoor environment and the fact that the signals do not travel as far as lower frequency signals outdoors); Ex.1001, 2:38-47 (“FCC licensed and regulated bands” include the 28-GHz LMDS band), 3:37-40 (discussing “relatively interference-free licensed bands”); *see also* Ex.1002, ¶38.

- (d) *Element [3.3]: “wherein said first frequency and said second frequency are separated by at least one octave.”*

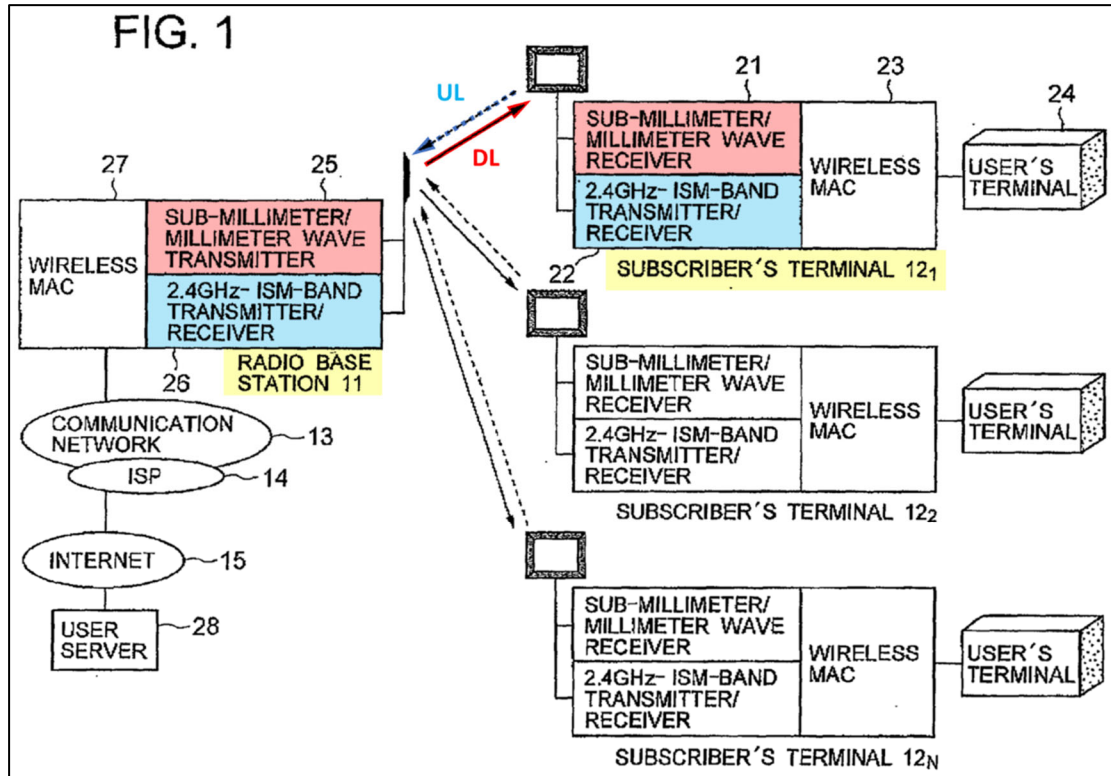
Morikawa discloses or renders obvious this element. Ex.1002, ¶96. The first frequency (*e.g.*, 28-GHz) and second frequency (2.4-GHz) are separated by at least one octave. *See* Section VII.A.1(d).

4. Dependent Claim 4

- (a) *“The method of claim 3 wherein at least a portion of said receiving at a base station and at least a portion of said transmitting at a base station occur at the same time.”*

Morikawa discloses or renders obvious this element. Ex.1002, ¶¶97-99. As discussed above, Morikawa discloses that the base station uses separate frequency bands to transmit and receive data. This technique, called frequency division

duplexing or FDD, allows simultaneous transmission and reception. Ex.1015 (Razavi), 103; Ex.1001, 1:65-67; *see also* Ex.1002, ¶37. Morikawa Figure 1 confirms this. As shown below in Figure 1, Morikawa discloses that the wireless base station 11 includes a “receiver unit 26 [(blue)] for receiving a 2.4-GHz frequency band,” and a separate “millimeter/sub-millimeter wave transmitter unit 25 [(red)] for transmitting a sub-millimeter wave or millimeter wave.” Ex.1005, ¶¶ [0028], [0027].



Id., Fig. 1. As Dr. Ding explains, a POSITA would have understood and found obvious that the separate receiver and transmitter units are used to transmit and receive data in different frequency bands at the same time (concurrently). *See*

Section VII.A.1(e); Ex.1002, ¶99; *see also* Ex.1002, ¶37. This is in contrast to the Mangal prior art distinguished during prosecution of the '714 Patent, in which “the exchange of data *both* upstream and downstream ... occurs **in only the selected band at any given time** in *Mangal*.” Ex.1004, 372.

5. Dependent Claim 5

- (a) “*The method of claim 3 wherein said data is frequency division duplexed.*”

Morikawa discloses or renders obvious this element. Ex.1002, ¶¶100-01. As discussed above, frequency division duplexing refers to the use of two different frequency bands (or isolated channels) for the transmit and receive paths, allowing simultaneous two-way transmission and reception. Ex.1015 (Razavi), 103; Ex.1001, 1:65-67; *see also* Ex.1002, ¶37. In Morikawa, the data is frequency division duplexed because each base station receives data on the 2.4-GHz ISM band and simultaneously transmits data on a separate millimeter/sub-millimeter band such as the 28-GHz LMDS band, using separate transmitter and receiver circuitry as shown in Figure 1. *See* Sections VII.A.3(b)-(c); Ex.1005, Fig. 1, ¶¶ [0028], [0027].

6. Dependent Claim 11

- (a) “*The method of claim 1 wherein said interference frequency band expected to experience low interference is determined to be low interference and said interference frequency band expected to experience high interference is determined to be high interference according to regulation of each of said frequency bands by a governmental entity.*”

Morikawa discloses or renders obvious this element. Ex.1002, ¶¶102-05. As discussed above, a POSITA would have understood and found obvious that Morikawa's 28-GHz LMDS band is expected to experience low interference because it was not commonly used and because of the short range and high attenuation characteristics of its millimeter-wave signals. *See* Section VII.A.1(b). In addition, this band is a licensed band according to FCC regulation, and a POSITA would have understood and found obvious that such regulation helps reduce congestion and potential sources of interference. Ex.1020, fn.1 ("In 1992, the FCC granted a license [] to CellularVision for the deployment of their 28-GHz LMDS system ..."); Ex.1001, 2:38-47 ("FCC licensed and regulated bands include" the 28-GHz LMDS band).

In contrast to that, as also discussed above, Morikawa's 2.4-GHz ISM band is expected to experience high interference because it is an unlicensed band according to regulation in the United States (FCC regulation) and other countries. *See* Section VII.A.1(c); Ex.1008, 239; Ex.1005, [0021] (describing the 2.4-GHz ISM band as a "***non-licensed*** frequency band" and explaining that "'non-licensed band' as used herein means that a license from the Ministry of Posts and Telecommunications is not needed"), [0025] ("the uplink channel from the subscriber's terminal to the wireless base station uses an 2.4-GHZ ISM band that does not need a license from the authority."); Ex.1031, 195 ("[T]he 2.4 GHz band [is] designated for ISM

applications as provided in the USA according to FCC 15.247, in Europe by ETS 300-328, and in other countries according to 15.4.6.2.”), 216.

A POSITA would have understood that whether a band is licensed or unlicensed according to government regulation affects interference. Ex.1002, ¶105. According to the ’714 Patent, a licensed band is expected to experience low interference, while an unlicensed band is expected to experience high interference. Ex.1001, 3:30-40 (“*relatively interference-free licensed bands* for data transmissions from a hub to subscribers”), 3:23-26 (“the *unlicensed bands* [may experience] a *significant amount of interference*”), 4:7-12 (“[T]he *less noisy licensed band frequency* is preferably used to transmit data downstream from the hub to the subscriber while the *noisier unlicensed band* frequency is preferably used to transmit upstream data from a subscriber to the hub.”). Indeed, no permission is required for operation in an unlicensed band, and thus many different industrial and consumer devices can operate over the same unlicensed band in close proximity of one another and interfere with one another. *See* Section VII.A.1(c); Ex.1002, ¶105.

7. Dependent Claim 12

(a) “*The method of claim 11 wherein said governmental entity is the FCC.*”

Morikawa discloses or renders obvious this element. Ex.1002, ¶¶106-07. Morikawa explains that the 2.4-GHz ISM band is an unlicensed band according to FCC regulation. Ex.1005, [0021], [0025] (“the uplink channel from the subscriber’s

terminal to the wireless base station uses an 2.4-GHZ ISM band that does not need a license from the authority.”), [0044], [0090] (discussing the use of “different non-licensed frequencies” according to “the FCC in the USA” such as “the combination of [the 5-GHz] U-NII band and [the 2.4-GHz] ISM band”); *see also* Ex.1001, 1:42-47 (“[A] band is a generally contiguous portion of the electromagnetic spectrum which is regulated by a governmental entity, such as the Federal Communications Commission (FCC) for the United States[.]”).

In addition, Morikawa’s 28-GHz LMDS band is a licensed band according to FCC regulation. Ex.1020, fn.1 (“In 1992, the FCC granted a license [] to CellularVision for the deployment of their 28-GHz LMDS system ...”); Ex.1001, 2:38-47 (“FCC licensed and regulated bands include” the 28-GHz LMDS band).

8. Independent Claim 13

- (a) *Preamble: “A method for increasing capacity of a wireless data communication system, said method comprising the steps of:”*

See Section VII.A.1(a); Ex.1002, ¶108.

- (b) *Element [13.1]: “transmitting, at a base station, data on a first frequency in a frequency band expected to experience low interference”*

See Section VII.A.3(c); Ex.1002, ¶109.

- (c) *Element [13.2]: “receiving, at said base station, data on a second frequency in a frequency band expected to experience high interference”*

See Section VII.A.3(b); Ex.1002, ¶110.

- (d) *Element [13.3]: “wherein said first frequency and said second frequency are separated by at least one octave; and”*

See Section VII.A.3(d); Ex.1002, ¶111.

- (e) *Element [13.4]: “wherein at least a portion of said receiving and at least a portion of said transmitting occur at the same time.”*

See Section VII.A.4; Ex.1002, ¶112.

9. Dependent Claim 14

- (a) *“The method of claim 13 wherein said data is frequency division duplexed.”*

See Section VII.A.5; Ex.1002, ¶113.

10. Dependent Claim 15

- (a) *Preamble: “The method of claim 13 further comprising:*

Morikawa at least renders obvious claim 13. See Section VII.A.8; Ex. 1002, ¶114.

- (b) *Element [15.1]: “receiving, at a subscriber station, data on said first frequency in said frequency band expected to experience low interference”*

See Section VII.A.1(b); Ex. 1002, ¶115.

- (c) *Element [15.2]: “transmitting, at said subscriber station, data on said second frequency in said frequency band expected to experience high interference”*

See Section VII.A.1(c); Ex. 1002, ¶116.

- (d) *Element [15.3]: “wherein said first frequency and said second frequency are separated by at least one octave.”*

This element is in substance the same as element [1.3]. *See* Section VII.A.1(d); Ex. 1002, ¶117.

11. Dependent Claim 16

- (a) *“The method of claim 15 wherein at least a portion of said receiving at a subscriber station and at least a portion of said transmitting at a subscriber station occur at the same time.”*

This element is in substance the same as element [1.4]. See Section VII.A.1(e); Ex.1002, ¶118.

12. Dependent Claim 17

- (a) *“The method of claim 15 wherein said data is frequency division duplexed.”*
See Section VII.A.2; Ex.1002, ¶119.

13. Dependent Claim 23

- (a) *“The method of claim 13 wherein said frequency band is determined to be low interference and said frequency band expected to experience high interference is determined to be high interference according to regulation of each of said frequency bands by a governmental entity.”*
See Section VII.A.6; Ex.1002, ¶120.

14. Dependent Claim 24

- (a) *“The method of claim 23 wherein said governmental entity is the FCC.”*
See Section VII.A.7; Ex.1002, ¶121.

15. Independent Claim 31

- (a) *Preamble: “A method for increasing capacity of a wireless data communication system, said method comprising the steps of:”*
See Section VII.A.1(a); Ex.1002, ¶122.
- (b) *Element [31.1]: “receiving, at a subscriber station, data on a first frequency in a frequency band expected to experience low interference”*
See Section VII.A.1(b); Ex.1002, ¶123.

- (c) *Element [31.2]: “transmitting, at said subscriber station, data on a second frequency in a frequency band expected to experience high interference”*

See Section VII.A.1(c); Ex.1002, ¶124.

- (d) *Element [31.3]: “wherein said low interference frequency band and said high interference frequency band are separated by at least one octave; and”*

See Section VII.A.1(d); Ex.1002, ¶125.

- (e) *Element [31.4]: “wherein said transmitting and said receiving occur during the same communication session.”*

Morikawa discloses or renders obvious this element. Ex.1002, ¶126. As discussed above, Morikawa teaches frequency division duplexing allowing concurrent, parallel transmission and reception of data over different frequency bands during the same communication session. *See* Section VII.A.1(e). This is in contrast to the Mangal prior art distinguished during prosecution of the '714 Patent. Ex.1004, 376 (“[T]he queuing methods and reverse tear down of *Mangal* indicate *both* upstream and downstream data exchange ... in a given communication session **occur in only the selected frequency band**. Therefore, *Mangal* does not satisfy the limitation receiving on the low interference band *and* transmitting on the high interference band occur in the same communication session.”) (bolding added, other emphasis in file history).

16. Independent Claim 32

- (a) *Preamble: “A method for increasing capacity of a wireless data communication system, said method comprising the steps of:”*

See Section VII.A.8(a); Ex.1002, ¶127.

- (b) *Element [32.1]: “transmitting, at a base station, data on a first frequency in a first frequency band expected to experience low interference”*

See Section VII.A.8(b); Ex.1002, ¶128.

- (c) *Element [32.2]: “receiving, at said base station, data on a second frequency in a second frequency band expected to experience high interference”*

See Section VII.A.8(c); Ex.1002, ¶129.

- (d) *Element [32.3]: “wherein said first frequency and said second frequency are separated by at least one octave; and”*

See Section VII.A.8(d); Ex.1002, ¶130.

- (e) *Element [32.4]: “wherein said transmitting and said receiving occur during the same communication session.”*

Morikawa discloses or renders obvious this element. Ex.1002, ¶131. As discussed above, Morikawa teaches frequency division duplexing allowing concurrent, parallel transmission and reception of data over different frequency bands during the same communication session. *See* Section VII.A.8(e). This is in contrast to the Mangal prior art distinguished during prosecution of the '714 Patent. Ex.1004, 376 (“[T]he queuing methods and reverse tear down of *Mangal* indicate *both* upstream and downstream data exchange ... in a given communication session **occur in only the selected frequency band**. Therefore, *Mangal* does not satisfy the limitation receiving on the low interference band *and* transmitting on the high

interference band occur in the same communication session.”) (bolding added, other emphasis in file history).

B. Ground II: Claims 1-5, 13-17, 31, and 32 Are Rendered Obvious by Serizawa

1. Independent Claim 1

- (a) *Preamble: “A method for increasing capacity of a wireless data communication system, said method comprising the steps of:”*

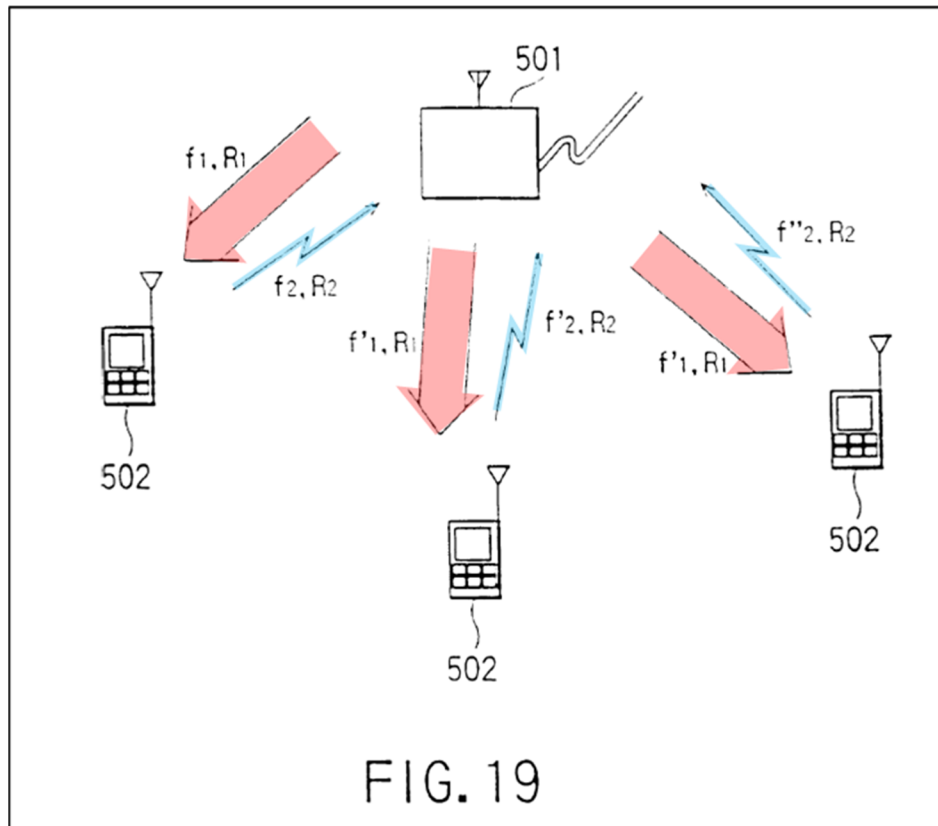
To the extent the preamble is limiting, Serizawa discloses it or renders it obvious. Ex.1002, ¶¶132-35. Serizawa is directed to a wireless communication system having a “***super highspeed downlink*** (abbreviated SDL . . .), which has a relatively high transmission rate on the downlink, which is the radio transmission path from the base station to the terminal, in comparison with the transmission rate on the uplink, which is the radio transmission path from the terminal to the base station.” Ex.1006, 1:9-17; *id.*, Abstract (“A large amount of user information is transmitted with good efficiency by means of a ***high-speed downlink*** by making transmission rates of an uplink and downlink asymmetrical.”). Serizawa discloses that an “object of the present invention is to provide radio communication system capable of an ***increase in the frequency bandwidth used*** to a bandwidth equivalent to that used in cable communication systems.” *Id.*, 3:56-59. Specifically, Serizawa’s relatively high downlink transmission rate makes it “possible to send ***a large amount of user information*** from the base station to the terminal at high speed, thereby

sufficiently meeting user requirements, while making *effective use of the frequency spectrum*.” *Id.*, 6:11-19.

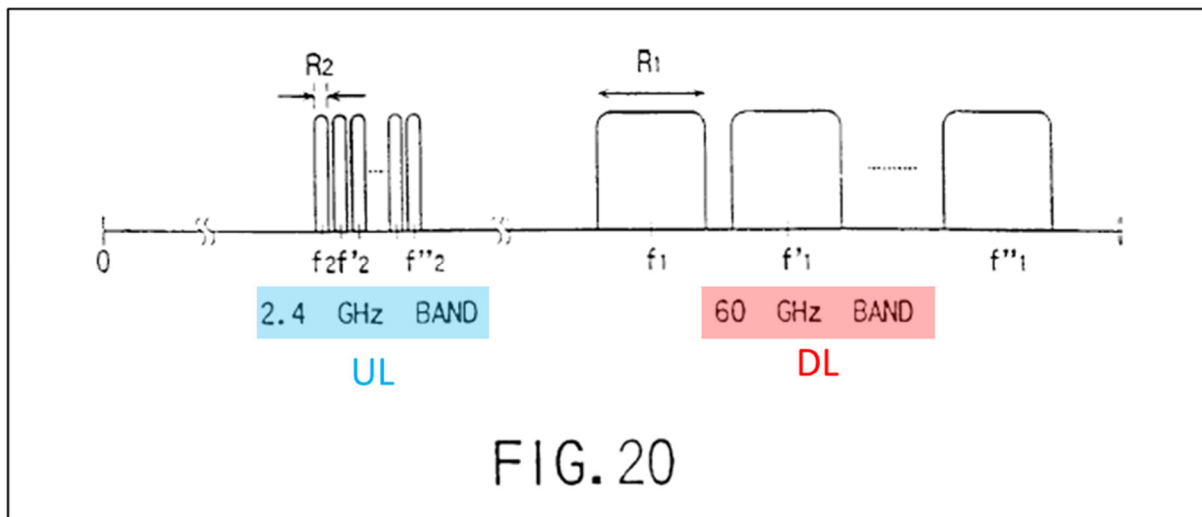
Specifically, in its fifteenth embodiment, Serizawa discloses downlink transmissions “[f]rom the radio base station 501 to each of the portable terminals 502 [] in the **60-GHz band**,” and uplink transmissions “[f]rom each of the portable terminals 502 to the radio base station 501 [] in the **2.4-GHz band**[.]” *Id.*, 19:47-63. The downlink (60-GHz) and uplink (2.4-GHz) frequency bands in Serizawa are separated by more than one octave. Ex. 1002, ¶135; Ex.1014 (IEEE Dict.) (an “octave” is “the interval between two frequencies having a ratio of 2 to 1.”). The ’714 Patent recognizes that using bands separated by more than one octave “increases the efficiency and capacity of a wireless data communication system by allowing use of the full bandwidth available, in each band, to an operator.” Ex.1001, 4:18-22.

- (b) *Element [1.1]: “receiving, at a subscriber station, data on a first frequency in a frequency band expected to experience low interference”*

Serizawa discloses or renders obvious this element. Ex.1002, ¶¶136-38. As shown below in Figures 19 and 20, Serizawa discloses that each portable radio terminal 502 (claimed subscriber station) receives downlink transmissions “on frequencies f_1, f_1', f_1'' [(red)] in the **60-GHz band**,” which is a millimeter wave band. Ex.1006, 19:47-63.



Id., Fig. 19.

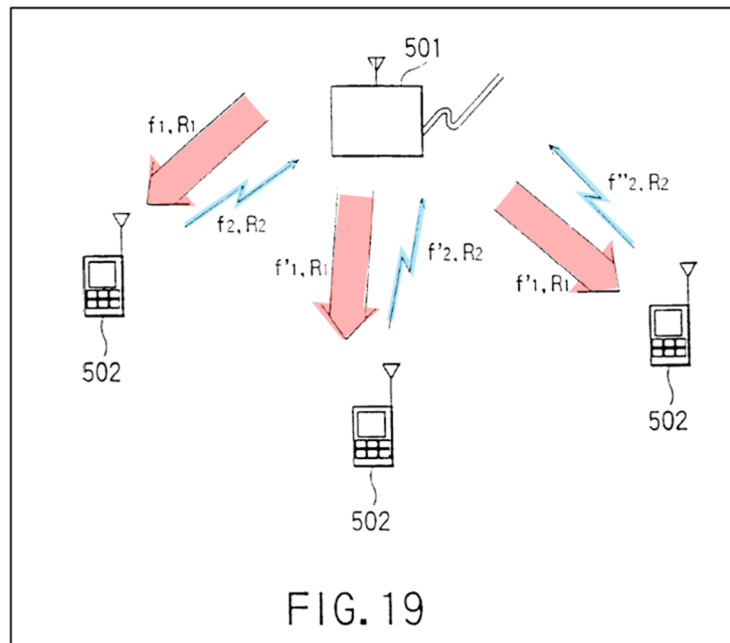


Id., Fig. 20. A millimeter wave band such as the 60-GHz band is expected to experience low interference, as discussed above. *See* Section VII.A.1(b); Ex.1010,

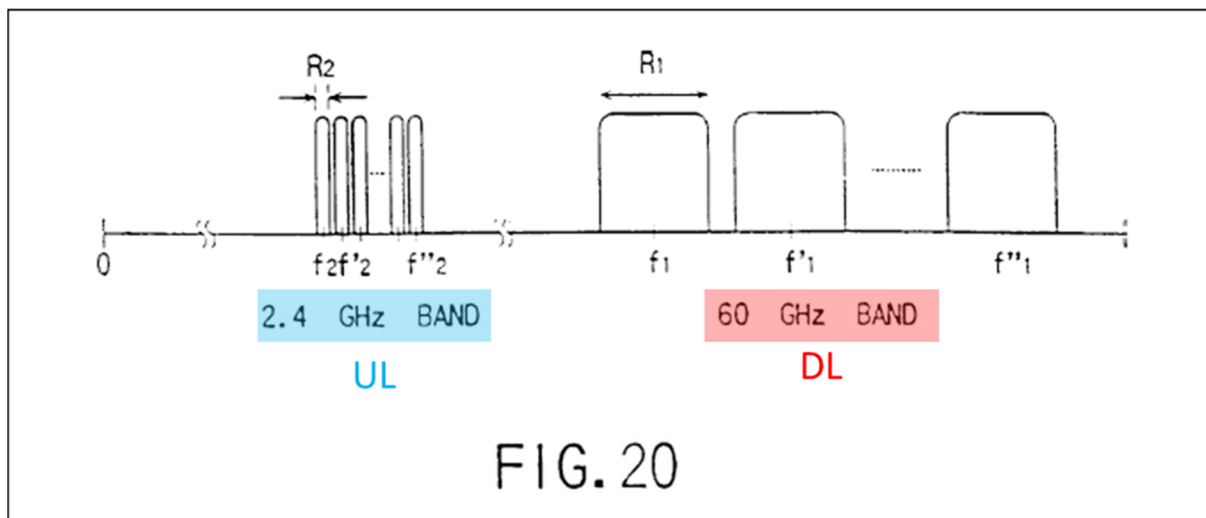
885-86 (in indoor environments, millimeter wave devices tend to not interface with one another because millimeter wave signals are “shielded within [a] room by the concrete or steel walls”); Ex.1007, 1383-84 (noting the “low number of interfering signal sources that are usually present in [a millimeter-wave] system,” due to walls in an indoor environment, the fact that millimeter-wave signals do not travel as far as lower frequency signals outdoors, and, particularly for the “60-64-GHz band,” pronounced attenuation over any substantial distance due to “oxygen and rain absorption”); Ex.1002, ¶137. The 60-GHz band is also expected to experience low interference because, as Serizawa explains, that frequency band is among “unused” millimeter/sub-millimeter bands. Ex.1006, 1:46-50 (“because the frequency spectrum resources for radio are limited, . . . it [is] desirable that higher, *unused* frequencies (such as sub-millimeter and millimeter bands) be developed.”), 22:4-7; Ex.1002, ¶138.

- (c) *Element [1.2]: “transmitting, at said subscriber station, data on a second frequency in a frequency band expected to experience high interference”*

Serizawa discloses or renders obvious this element. Ex.1002, ¶¶139-40. As shown below in Figures 19 and 20, Serizawa discloses that each portable radio terminal 502 (subscriber station) transmits uplink transmissions “on frequencies f_2 , f_2' , and f_2'' [(blue)] in the 2.4-GHz band[.]” Ex.1006, 19:47-63.



Id., Fig. 19.



Id., Fig. 20. A POSITA would have understood and found obvious that the 2.4-GHz band discussed in Serizawa is the 2.4-GHz ISM (Industrial, Scientific and Medical) band that is unlicensed in Japan and other countries and is expected to experience high interference, as discussed above. *See* Section VII.A.1(c); Ex.1031, 195 (“[T]he

2.4 GHz band [is] designated for ISM applications as provided in the USA according to FCC 15.247, in Europe by ETS 300-328, and in other countries according to 15.4.6.2.”), 216 (discussing regulation of the 2.4 GHz band by regulatory authorities in the United States, Europe and Japan); Ex.1008, 239 (“The fact that the [2.4-GHz ISM] band is unlicensed means that the deployment of such systems doesn’t require any planning permissions, so system[s] may be deployed in an anarchic way and *interfere[] with each other if they are within range.*”); Ex.1009, 11; Ex.1002, ¶140.

Because Serizawa teaches a subscriber station transmitting data in the 2.4-GHz band and receiving data in the different 60-GHz band, as detailed in Section VII.B.1.(b), Serizawa satisfies Petitioner’s construction requiring that separate bands are used for receiving and transmitting. Moreover, each frequency band is a “generally contiguous portion of the electromagnetic spectrum which is regulated by a governmental entity, such as the Federal Communications Commission (FCC) for the United States.” Ex.1030, Attachment A at 1; Ex.1002 ¶139.

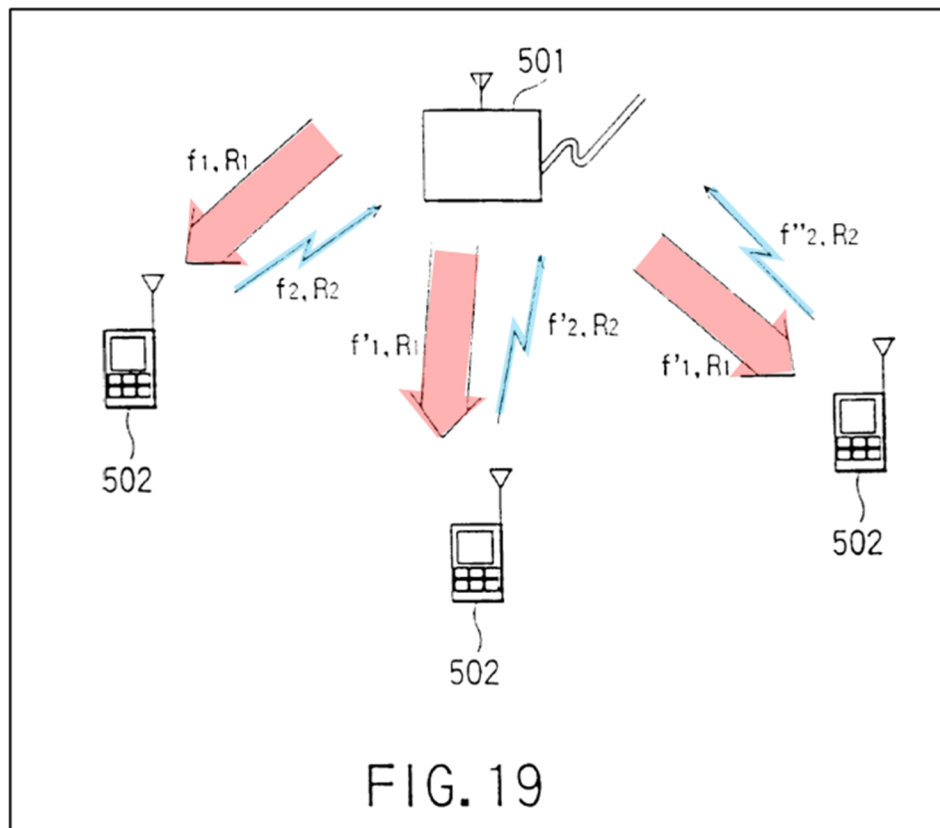
(d) *Element [1.3]: “wherein said low interference frequency band and said high interference frequency are separated by at least one octave; and”*

Serizawa discloses this element or renders it obvious. Ex.1002, ¶141. Serizawa’s 60-GHz downlink band is a low interference frequency band, as detailed above. *See* Sections VII.A.1(b), VII.B.1(b); Ex.1006, Figs. 19-20, 19:47-63. Serizawa’s 2.4-GHz uplink band is a high interference frequency band, as also

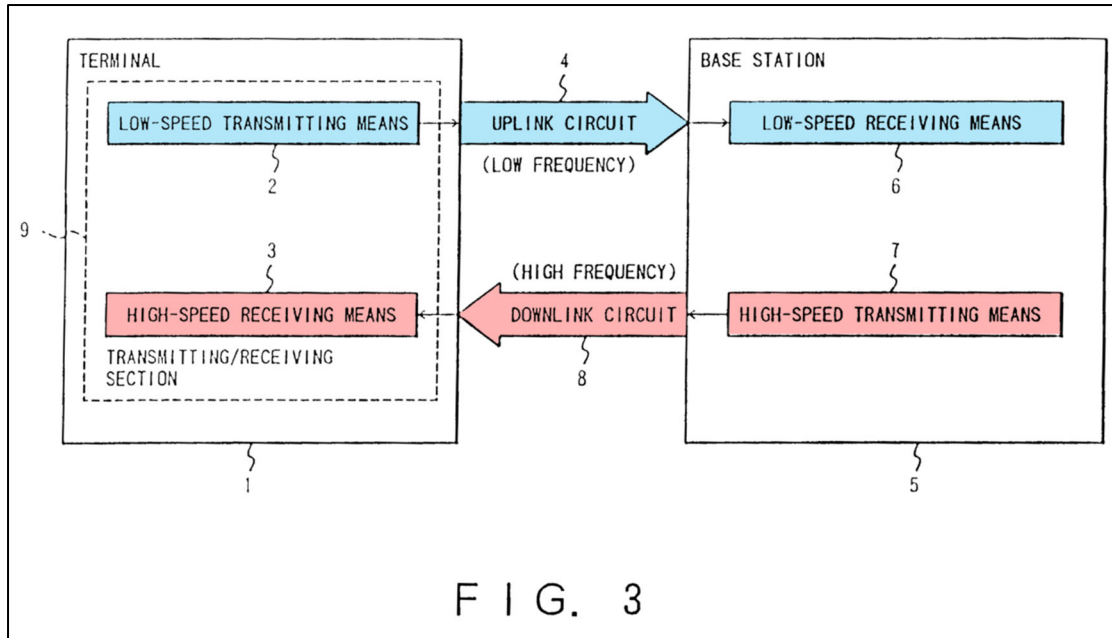
discussed above. *See* Sections VII.A.1(c), VII.B.1(c); Ex.1006, Figs. 19-20, 19:47-63. The ratio of Serizawa's 60-GHz low interference frequency band and Serizawa's 2.4-GHz high interference frequency band is 25, which is at least one octave. Ex.1014 (IEEE Dict.) (an "octave" is "the interval between two frequencies having a ratio of 2 to 1.").

- (e) *Element [1.4]: "wherein at least a portion of said receiving and at least a portion of said transmitting occur at the same time."*

Serizawa discloses or renders obvious this element. Ex.1002, ¶¶142-44. Serizawa discloses that "frequency multiplexing is used on both the uplink and the downlink[.]" Ex.1006, 19:66-20:3. Frequency multiplexing, also known as frequency division multiple access, is a technique that allows simultaneous transmission and reception over different frequencies. Ex.1002, ¶142; Ex.1015 (Razavi), 105; *see also* Ex.1002, ¶37. For example, Serizawa Figure 19 illustrates that the leftmost user radio terminal 502 (subscriber station) transmits data to a base station 501 over the uplink frequency f_2 (blue arrow) while it receives data from the base station over the different downlink frequency f_1 (red arrow) at the same time. Ex.1002, ¶142.



Ex.1006, FIG. 19. Serizawa Figure 3 below further confirms this. The figure shows two-way uplink and downlink communications taking place at the same time, as Dr. Ding explains. The uplink communication (blue) involves “low-speed” transmission of a “narrowband signal” over a “low frequency” band (the 2.4 GHz ISM band), whereas downlink communication (red) involves a different “high-speed” transmission of a “wideband signal” over a separate “high frequency” band (the 60-GHz millimeter wave band). Ex.1002, ¶143; Ex.1006, 9:43-10:22.



Id., Fig. 3. As Dr. Ding explains, a POSITA would have understood that the separate receiver and transmitter units at each terminal allow for concurrent uplink and downlink transmissions over different frequency bands. Ex.1002, ¶144; *see also* Ex.1002, ¶37. This is in contrast to the Mangal prior art distinguished during prosecution of the '714 Patent, in which “the exchange of data *both* upstream and downstream ... occurs in **only the selected band at any given time** ...”. Ex.1004, 372.

2. Dependent Claim 2

(a) “The method of claim 1 wherein said data is frequency division duplexed.”

Serizawa discloses or renders obvious the additional element of this claim. Ex.1002, ¶¶145-46. Serizawa discloses that “frequency multiplexing is used on both the uplink and the downlink[.]” Ex.1006, 19:66-20:3. Frequency multiplexing refers

to the use of different frequency bands (or isolated channels) for the transmit and receive paths, allowing simultaneous transmission and reception; it is also known as frequency division duplexing when two separate bands are used to transmit and receive data. Ex.1002, ¶145; Ex.1015 (Razavi), 103, 105. Serizawa further confirms that each terminal transmits data on the 2.4-GHz band and receives data on the 60-GHz millimeter band, using separate transmitter and receiver circuitry. *See* Sections VII.B.1(b)-(c), VII.B.1(e); Ex.1006, Fig. 3, Figs. 19-20, 19:47-63.

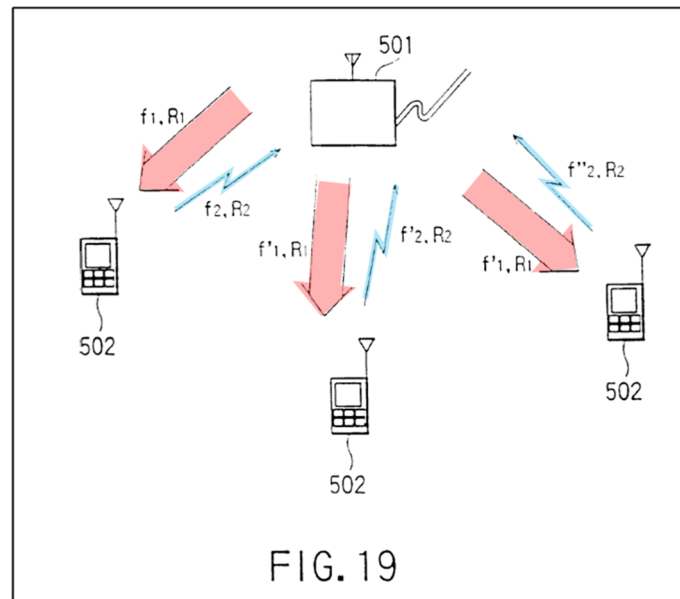
3. Dependent Claim 3

(a) *Preamble: “The method of claim 1 further comprising:”*

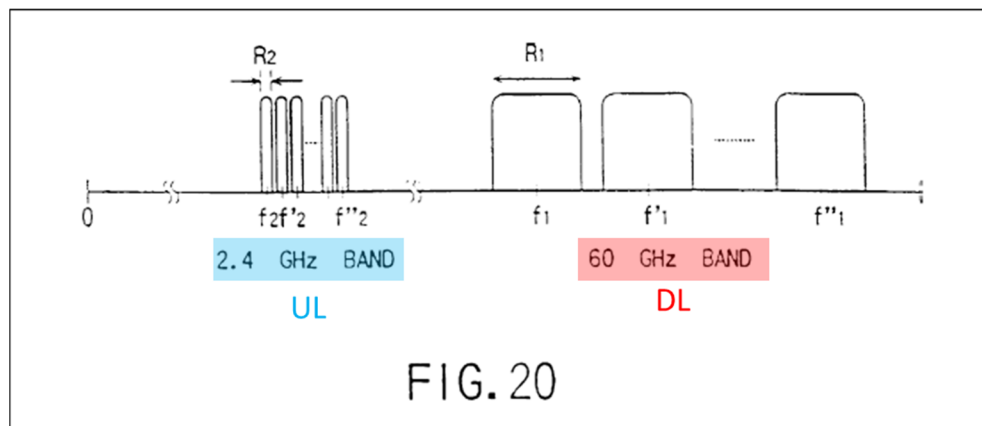
Serizawa at least renders obvious claim 1. *See* Section VII.B.1; Ex.1002, ¶147.

(b) *Element [3.1]: “receiving, at a base station, data on said second frequency in said interference frequency band expected to experience high interference”*

Serizawa discloses or renders obvious this element. Ex.1002, ¶¶148-49. As shown below in Figures 19 and 20, Serizawa discloses that the radio base station 501 receives uplink data transmissions “on frequencies f_2 , f_2' , and f_2'' [(blue)] in the 2.4-GHz band[.]” Ex.1006, 19:47-63.



Id., Fig. 19.

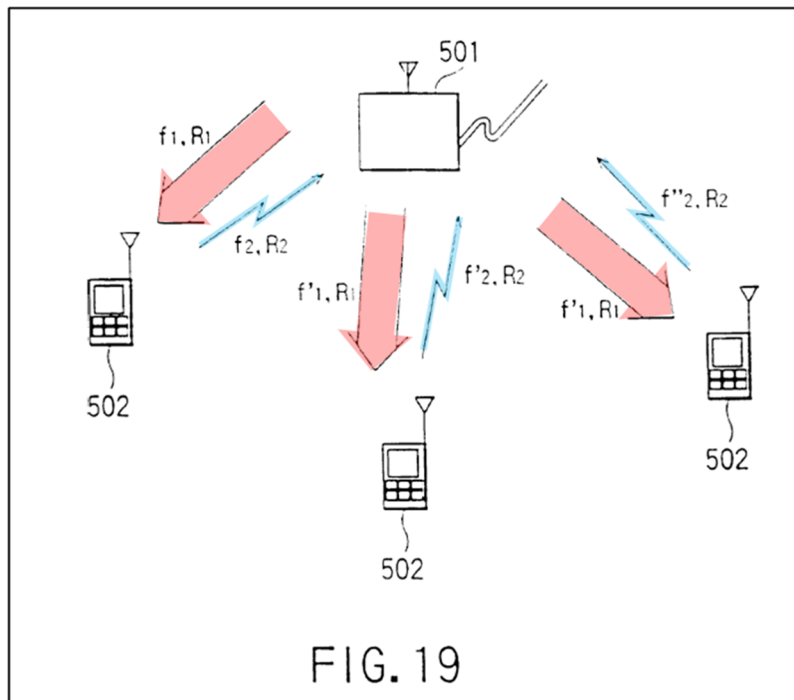


Id., Fig. 20. A POSITA would have understood that the 2.4-GHz ISM band is expected to experience high interference, as explained in the '714 patent and as discussed above. *See* Section VII.B.1(c); Ex.1008, 239 (“The fact that the [2.4-GHz ISM] band is unlicensed means that the deployment of such systems doesn’t require

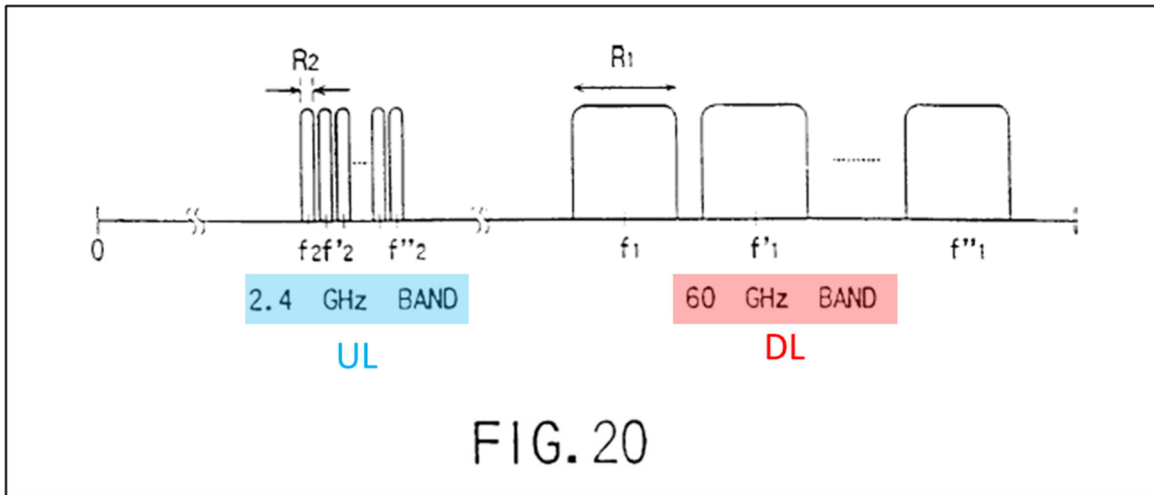
any planning permissions, so system[s] may be deployed in an anarchic way and *interfere[] with each other if they are within range.*”); Ex.1009, 11; Ex.1002, ¶149.

- (c) *Element [3.2]: “transmitting, at said base station, data on said first frequency in said frequency band expected to experience low interference”*

Serizawa discloses or renders obvious this element. Ex.1002, ¶¶150-51. As shown below in Figures 19 and 20, Serizawa discloses that the radio base station 501 transmits downlink data transmissions “on frequencies f_1 , f_1' , f_1'' [(red)] in the 60-GHz band,” which is a millimeter wave band. Ex.1006, 19:47-63.



Id., Fig. 19.



Id., Fig. 20. A millimeter wave band such as the 60-GHz band is expected to experience low interference, as discussed above. *See* Section VII.B.1(b); Ex.1010, 885-86 (in indoor environments, millimeter wave devices tend to not interface with one another because millimeter wave signals are “shielded within [a] room by the concrete or steel walls”); Ex.1007, 1383-84 (noting the “low number of interfering signal sources that are usually present in [a millimeter-wave] system,” due to walls in an indoor environment, the fact that millimeter-wave signals do not travel as far as lower frequency signals outdoors, and, particularly for the “60-64-GHz band,” pronounced attenuation over any substantial distance due to “oxygen and rain absorption”); Ex.1002, ¶151.

Because Serizawa teaches a base station transmitting in the 60-GHz band and receiving in the different 2.4-GHz band, as detailed in Section VII.B.3.(b), Serizawa

satisfies Petitioner’s construction requiring that separate bands are used for receiving and transmitting. Ex.1002, ¶150.

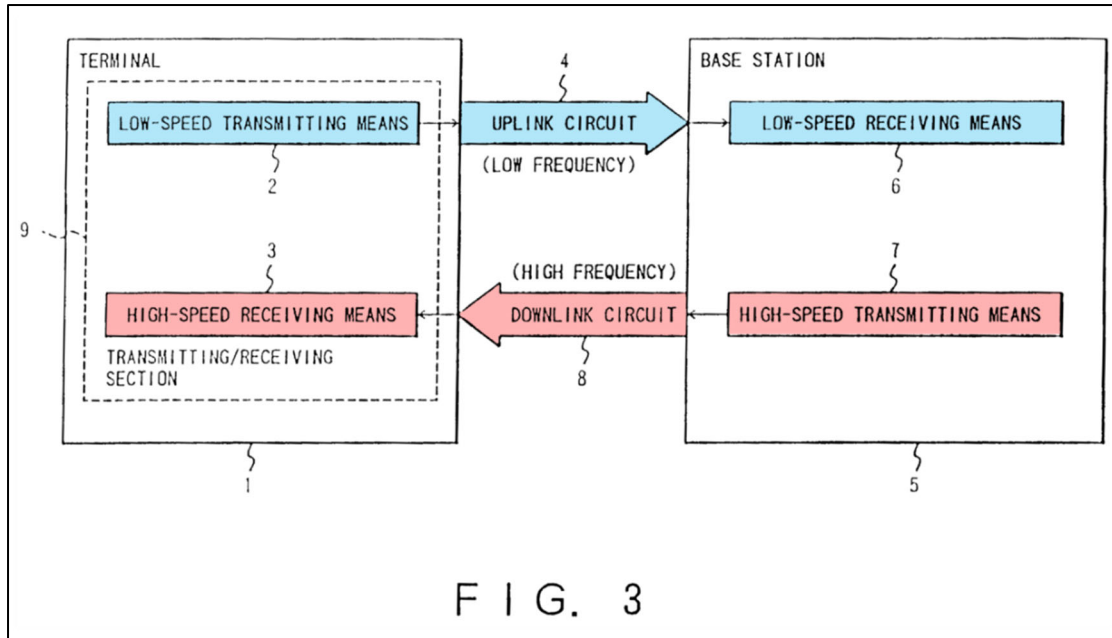
- (d) *Element [3.3]: “wherein said first frequency and said second frequency are separated by at least one octave.”*

Serizawa discloses or renders obvious this element. Ex.1002, ¶152. The first frequency (60-GHz) and second frequency (2.4-GHz) are separated by at least one octave. *See* Section VII.B.1(d).

4. Dependent Claim 4

- (a) *“The method of claim 3 wherein at least a portion of said receiving at a base station and at least a portion of said transmitting at a base station occur at the same time.”*

Serizawa discloses or renders obvious this element. Ex.1002, ¶¶153-55. As discussed above, Serizawa discloses that “frequency multiplexing is used on both the uplink and the downlink[.]” Ex.1006, 19:66-20:3. Frequency multiplexing is a technique that allows simultaneous transmission and reception over different frequencies. Ex.1015 (Razavi), 103, 105; *see also* Ex.1002, ¶37. Serizawa Figure 3 confirms this. As shown below in Figure 3, Serizawa discloses that the base station 5 has “a low-speed transmitting [(sic, receiving)] means 6 [(blue)] which **receives** a radio signal at a relatively low transmission rate” that is separate from the “high-speed receiving [(sic, transmitting)] means 7 [(red)] which **transmits** a radio signal at a relatively high transmission rate.” Ex.1006, 9:46-57, 9:65-10:7.



Id., Fig. 3. As Dr. Ding explains, a POSITA would have understood that the separate receiver and transmitter units allow for concurrent, parallel transmission and reception of data over different frequency bands. *See* Ex.1002, ¶155; Section VII.B.1(e). This is in contrast to the Mangal prior art distinguished during prosecution of the '714 Patent. Ex.1004, 372-73 (“the exchange of data *both* upstream and downstream ... occurs **in only the selected band at any given time** in *Mangal*. Therefore, *Mangal* does not satisfy the limitation that receiving on the low interference band and transmitting on the high interference band occur at the same time (emphasis added).”) (bolding added, other emphasis in file history).

5. Dependent Claim 5

(a) “*The method of claim 3 wherein said data is frequency division duplexed.*”

Serizawa discloses or renders obvious this element. Ex.1002, ¶¶156-57. Frequency division duplexing refers to the use of two different frequency bands (or isolated channels) for the transmit and receive paths, allowing simultaneous transmission and reception. Ex.1015 (Razavi), 103; *see also* Ex.1002, ¶37. Serizawa discloses that “frequency multiplexing is used on both the uplink and the downlink[.]” Ex.1006, 19:66-20:3. A POSITA would have understood that frequency multiplexing involves at least two separate frequency bands (or isolated channels) for transmission and reception, and is the same as frequency division duplexing when two separate bands are used as taught in Serizawa. Ex.1002, ¶157. Serizawa further discloses that each base station receives data on the 2.4-GHz band and transmits data on the 60-GHz millimeter band, using separate transmitter and receiver circuitry. *See* Sections VII.B.3(b)-(c), VII.B.4; Ex.1006, Fig. 3, Figs. 19-20, 19:47-63.

6. Independent Claim 13

- (a) *Preamble: “A method for increasing capacity of a wireless data communication system, said method comprising the steps of:”*

See Section VII.B.1(a); Ex.1002, ¶158.

- (b) *Element [13.1]: “transmitting, at a base station, data on a first frequency in a frequency band expected to experience low interference”*

See Section VII.B.3(c); Ex.1002, ¶159.

- (c) *Element [13.2]: “receiving, at said base station, data on a second frequency in a frequency band expected to experience high interference”*

See Section VII.B.3(b); Ex.1002, ¶160.

- (d) *Element [13.3]: “wherein said first frequency and said second frequency are separated by at least one octave; and”*

See Section VII.B.3(d); Ex.1002, ¶161.

- (e) *Element [13.4]: “wherein at least a portion of said receiving and at least a portion of said transmitting occur at the same time.”*

See Section VII.B.4; Ex.1002, ¶162.

7. Dependent Claim 14

- (a) *“The method of claim 13 wherein said data is frequency division duplexed.”*

See Section VII.B.5; Ex.1002, ¶163.

8. Dependent Claim 15

- (a) *Preamble: “The method of claim 13 further comprising:*

Serizawa renders obvious claim 13. See Section VII.B.6; Ex.1002, ¶164.

- (b) *Element [15.1]: “receiving, at a subscriber station, data on said first frequency in said frequency band expected to experience low interference”*

See Section VII.B.1(b); Ex.1002, ¶165.

- (c) *Element [15.2]: “transmitting, at said subscriber station, data on said second frequency in said frequency band expected to experience high interference”*

See Section VII.B.1(c); Ex.1002, ¶166.

- (d) *Element [15.3]: “wherein said first frequency and said second frequency are separated by at least one octave.”*

See Section VII.B.1(d); Ex.1002, ¶167.

9. Dependent Claim 16

- (a) *“The method of claim 15 wherein at least a portion of said receiving at a subscriber station and at least a portion of said transmitting at a subscriber station occur at the same time.”*

This element is in substance the same as element [1.4]. See Section VII.B.1(e); Ex.1002, ¶168.

10. Dependent Claim 17

- (a) *“The method of claim 15 wherein said data is frequency division duplexed.”*
See Section VII.B.2; Ex.1002, ¶169.

11. Independent Claim 31

- (a) *Preamble: “A method for increasing capacity of a wireless data communication system, said method comprising the steps of:”*
See Section VII.B.1(a); Ex.1002, ¶170.
- (b) *Element [31.1]: “receiving, at a subscriber station, data on a first frequency in a frequency band expected to experience low interference”*
See Section VII.B.1(b); Ex.1002, ¶171.
- (c) *Element [31.2]: “transmitting, at said subscriber station, data on a second frequency in a frequency band expected to experience high interference”*
See Section VII.B.1(c); Ex.1002, ¶172.
- (d) *Element [31.3]: “wherein said low interference frequency band and said high interference frequency band are separated by at least one octave; and”*
See Section VII.B.1(d); Ex.1002, ¶173.
- (e) *Element [31.4]: “wherein said transmitting and said receiving occur during the same communication session.”*

Serizawa discloses or renders obvious this element. Ex.1002, ¶174. As discussed above, Serizawa teaches frequency multiplexing allowing transmission and reception of data to occur over different frequency bands during the same communication session. *See* Section VII.B.1(e). This is in contrast to the Mangal prior art distinguished during prosecution of the '714 Patent. Ex.1004, 376 (“[T]he queuing methods and reverse tear down of *Mangal* indicate *both* upstream and downstream data exchange ... in a given communication session **occur in only the selected frequency band**. Therefore, *Mangal* does not satisfy the limitation receiving on the low interference band *and* transmitting on the high interference band occur in the same communication session.”) (bolding added, other emphasis in file history).

12. Independent Claim 32

- (a) *Preamble: “A method for increasing capacity of a wireless data communication system, said method comprising the steps of:”*

See Section VII.B.6(a); Ex.1002, ¶175.

- (b) *Element [32.1]: “transmitting, at a base station, data on a first frequency in a first frequency band expected to experience low interference”*

See Section VII.B.6(b); Ex.1002, ¶176.

- (c) *Element [32.2]: “receiving, at said base station, data on a second frequency in a second frequency band expected to experience high interference”*

See Section VII.B.6(c); Ex.1002, ¶177.

- (d) *Element [32.3]: “wherein said first frequency and said second frequency are separated by at least one octave; and”*

See Section VII.B.6(d); Ex.1002, ¶178.

- (e) *Element [32.4]: “wherein said transmitting and said receiving occur during the same communication session.”*

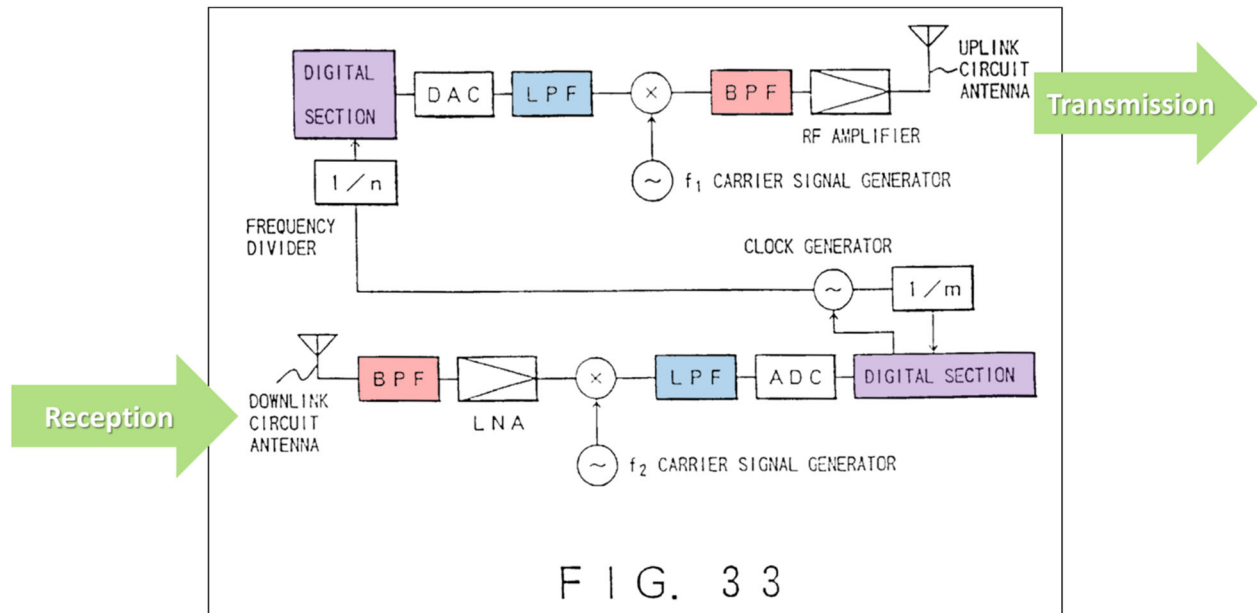
Serizawa discloses or renders obvious this element. Ex.1002, ¶179. As discussed above, Serizawa teaches frequency multiplexing allowing transmission and reception of data to occur over different frequency bands during the same communication session. *See* Section VII.B.6(e). This is in contrast to the Mangal prior art distinguished during prosecution of the '714 Patent. Ex.1004, 376 (“[T]he queuing methods and reverse tear down of *Mangal* indicate *both* upstream and downstream data exchange ... in a given communication session **occur in only the selected frequency band**. Therefore, *Mangal* does not satisfy the limitation receiving on the low interference band *and* transmitting on the high interference band occur in the same communication session.”) (bolding added, other emphasis in file history).

C. Ground III: Claims 6-10, 18-22, and 25-30 Are Rendered Obvious by Serizawa in View of Razavi and/or Ferry

1. Motivation to Combine

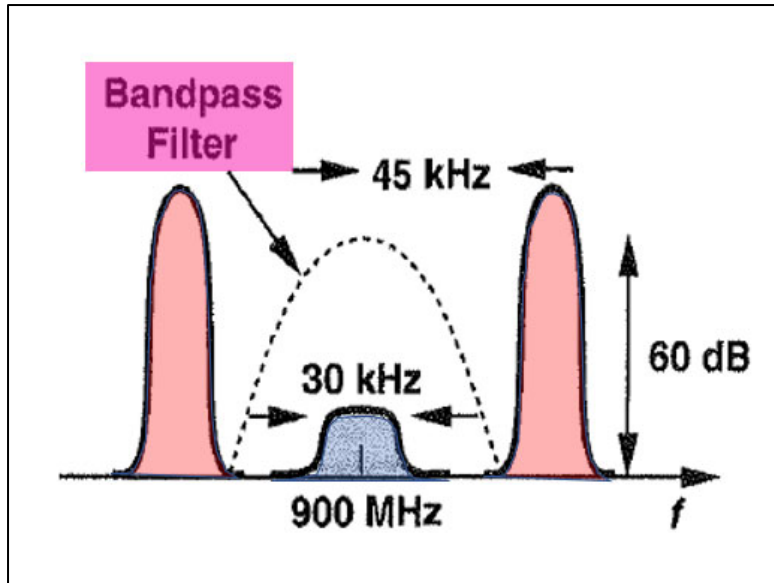
Claims 6-10, 18-22, and 25-30 are directed to filtering RF signals received at a base station or subscriber stations. Ex.1001, claims 6-10, 18-22, 25-30; Ex.1002, ¶180. The use of filters, such as bandpass filters (BPF) (red) and lowpass filters

(LPF) (blue), is depicted in Serizawa Figure 33, which illustrates the RF transmit and receive chains of a subscriber station (user device such as a cell phone). Ex.1006, 24:15-16 (“FIG. 33 shows an example of the configuration of a portable electronic apparatus used in an SDL[(super highspeed downlink)]-Net.”); Ex.1002, ¶180.



Ex.1006, Fig. 33. The top part of Figure 33 illustrates the transmit chain of a user device, whereas the bottom part of Figure 33 illustrates the device’s RF receive chain. *Id.*, 24:17-27, 24:28-38 (“The downlink signal transmitted from the base station is received by an antenna [(‘downlink circuit antenna’ in Fig. 33)] and **bandlimited by means of a bandpass filter (BPF)** [(red)], after which it is amplified by an LNA (low-noise amplifier). The output of the LNA is input to a mixer ... The output of the mixer undergoes [filtering] by means of the **LPF** [(low pass filter)

(blue)], after which an A-D converter (ADC) converts [the LPF output to a digital signal]. The ADC output (digital signal) is demodulated at the digital section [(purple)].”); Ex.1002, ¶181. As shown in Figure 33 and would be well-known to one of skill in the art, received RF signals are filtered using band pass filter(s) (BPF) (red), low pass filter(s) (LPF) (blue), and additional FIR filters in the digital domain (purple). Ex.1002, ¶182; Ex.1015 (Razavi), 119-131, 147-148, 157-162. A POSITA would understand that filters are used in the RF receive chain of a wireless communication device to attenuate (filter out) unwanted signals or interference that are out of the reception band. Ex.1002, ¶183; Ex.1015, 119-131. For example, the Razavi textbook explains that a bandpass filter (magenta) is commonly used to capture/select desired signals received in a RF channel (an exemplary 30 kHz channel centered at 900 MHz is shown here) (blue), while rejecting interference signals (red) present in frequency regions outside of the bandpass (“out-of-band-rejection”). Ex.1015, 119-120; Ex.1002, ¶183.

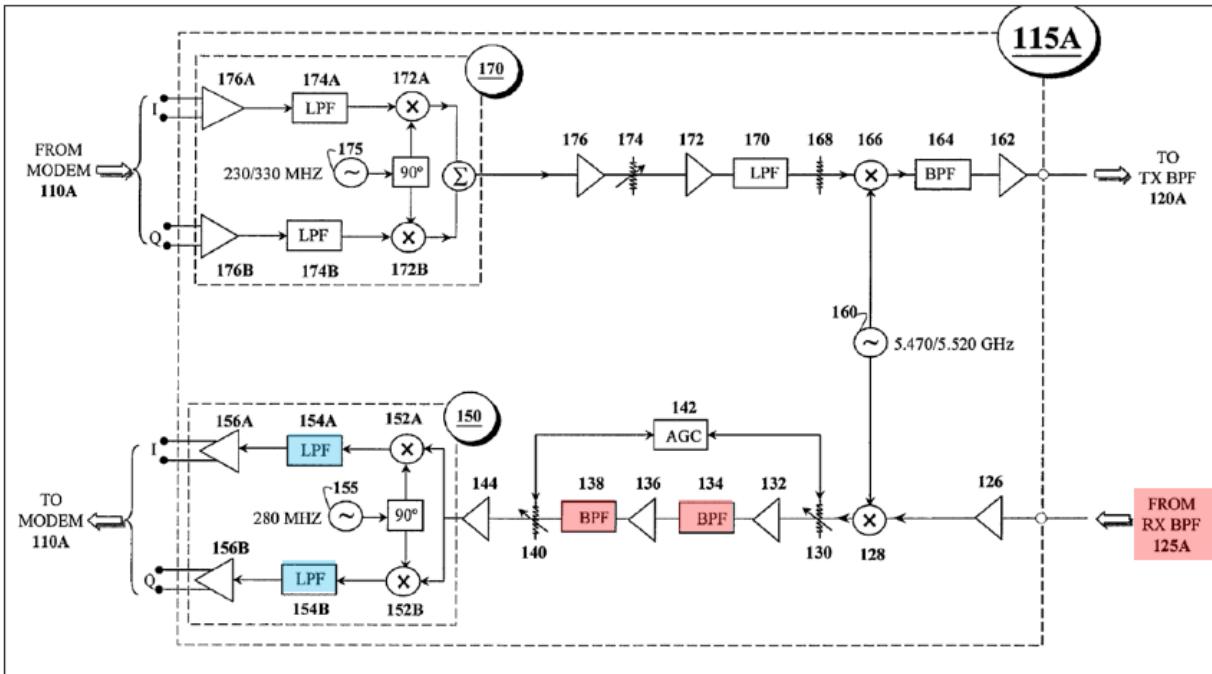


Ex.1015, Fig. 5-2; *see also id.*, 123-126 and Figs. 5.9 and 5.10 (describing “image reject” filters and “channel select” filters). A POSITA would be motivated to combine Serizawa with Razavi. Ex.1002, ¶184. Serizawa Figure 33 shows filtering of signals received in a wireless communication device using different types of filters (*e.g.*, BPF and LPF) but does not discuss filter structures because those were well-known in the art. *Id.* A POSITA would be motivated to consult Razavi, a well-known textbook that explains the architecture of the RF receive and transmit chains of wireless communication devices and the use of filters in those RF chains in detail. Ex.1002, ¶185. A POSITA would also be motivated to consult Razavi because it provides “a view of the state of the art [including] a study of five specific RF products [then] currently used in wireless systems.” Ex.1005, 118 (Chapter 5 - “Transceiver Architectures”); Ex.1002, ¶185. Significantly, Razavi describes

wireless systems that, like the '714 Patent, use separate frequency bands for simultaneous full-duplex transmission and reception. Ex.1015, 103 (“[An] approach to **duplexing** is to employ **two different bands** for the transmit and receive paths. Called ‘**frequency-division duplexing**’ (**FDD**) [] this technique incorporates bandpass filters (BPFs) to isolate the two [(transmit and receive)] paths, allowing simultaneous transmission and reception.”), 111 (use of FDD in AMPS wireless standards, one of “the earliest wireless standards”), 113 (use of FDD in GSM standards, then “the most widely used cellular standard in the world.”); Ex.1002, ¶186.

While Serizawa Figure 33 illustrates RF transmit and receive chains of a user device, a POSITA would understand that Serizawa’s wireless infrastructure devices (base stations/access points) also use filters such as bandpass filters (BPF), low-pass filters (LPF), and FIR filters in their RF transmit and receive chains. Ex.1002, ¶187; *see also id.*, ¶39. This is in fact shown in Figures 1A/1B of Ferry, which illustrate the transmit and receive chains of a wireless base station/access point, connected to a wireline network such as the Internet as shown in Figure 1A. *Id.*, ¶188; Ex.1021, Figs. 1A/1B. As illustrated in Figure 1B below, the receive chain of an access point makes extensive use of filters, such as bandpass filters (red) and lowpass filters (blue), to filter out unwanted signals or interference—just like the receive chain of a

user device shown in Serizawa Figure 33. Ex.1002, ¶188; Ex.1021 (Ferry), Figs. 1A/1B.



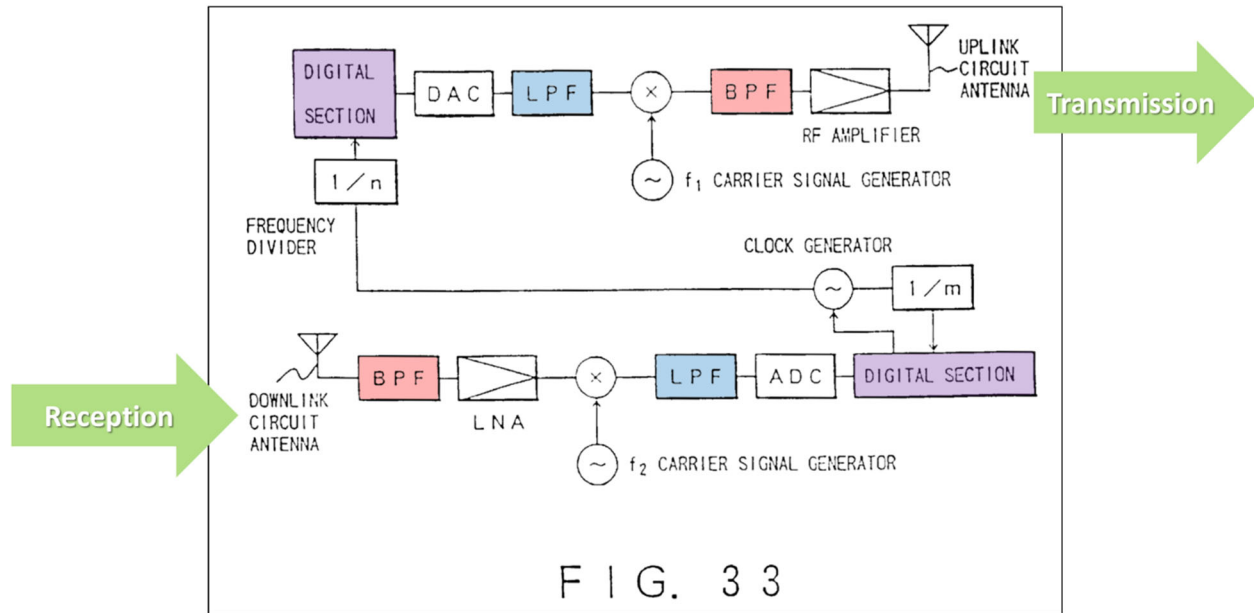
Ex.1021, Fig. 1B. A POSITA would be motivated to combine Serizawa, Razavi, and Ferry. Ex.1002, ¶189. Like Serizawa and Razavi, Ferry is directed to full duplex wireless communication systems using separate transmit and receive frequencies. *Id.*; Ex.1021, [0020], [0025], [0026]. Ferry provides additional exemplary details about the filters used in the receive chain (and transmit chain) of those systems. Ex.1002, ¶190; Ex.1021, [0037] (“The RF receive signal is then supplied to RF receive band-pass filter 125A [(in Figure 1A)] ... to filter any unwanted signals or interference. RF receive band-pass filter 125A may comprise a tuned **5- or 7-pole combline filter** to provide additional isolation and separation ...”), [0039] (“BPF

134 filters the signal *to reject any unwanted signals or interference*. The IF receive signal is ... subsequently filtered by BPF 138. BPFs 134, 138 [(in Figure 1B below)] may comprise *surface acoustic wave (SAW)* filters.”); *see also* Ex.1002, ¶39.

2. Dependent Claim 6

- (a) *“The method of claim 3 wherein said base station performs higher order filtering on signals received at said base station than said subscriber station performs on signals received at said subscriber station.”*

Serizawa, alone or in view of Razavi and/or Ferry, renders obvious the additional element of claim 6. Ex.1002, ¶¶191-97. Figure 33 of Serizawa shows that RF signals received at a subscriber station (at the “downlink circuit antenna”) are filtered by a bandpass filter (BPF) (red) to reject unwanted signals or interference. *Id.* The RF signals are down-converted to an intermediate IF frequency (“ f_2 carrier”) and the IF signals are further filtered by a low pass filter (LPF) (blue), in particular to reject undesirable down-conversion “images.” *Id.*; Ex.1006, 25:30-35 (using “a lowpass filter (LPF) for the purpose of eliminating image signals caused by the frequency [down]conversion”); Ex.1015, 123-124. Additional digital filtering using finite impulse response (FIR) filters is performed in baseband in the digital section (purple), as would be well-known to one of skill in the art. Ex.1002, ¶192; Ex.1006, 24:17-38.



Ex.1006, Fig. 33. A POSITA would understand that filters are primarily used to attenuate (filter out) unwanted signals, and that a characteristic of a filter is the filter order, reflected in the number of poles of the filters. Ex.1002, ¶193; Ex.1015, 119; Ex.1011, 18:9-18 (discussing “8th order Chebycheff filter” and “4th order Butterworth filter” designed using “conventional” filter synthesis techniques). Generally, a higher-order filter has more poles, has steeper roll-off characteristics, and provides better attenuation of unwanted out-of-band signals than a lower-order filter, but is more complex (*i.e.*, costly) to design and implement. Ex.1002, ¶193; Ex.1015, 162 (discussing “fifth-order low-pass filters” used in a GSM transceiver); Ex.1021, [0037] (“RF receive band-pass filter 125A may comprise a tuned **5- or 7-pole** combline filter to provide additional isolation and separation ...”). Thus, a POSITA would be motivated to reduce the filter order of filters implemented in a

subscriber's station (such as a cell phone) to reduce circuit area, chip size, and cost. Ex.1002, ¶194. On the other hand, a POSITA would be less constrained in designing and implementing filters in a base station and would be motivated to use higher-order filters for better performance. *Id.* For that reason, a POSITA would understand and find it obvious that a base station would perform higher order filtering on signals received at the base station than a subscriber station would perform on signals received at the subscriber station, as required by the claim. *Id.* As Dr. Ding explains, use of such high-order filtering with Serizawa as taught by Razavi and/or Ferry would be a combination of prior art elements according to known methods to yield predictable results, as well as application of a known technique to a known device ready for improvement to yield predictable results. *Id.* In addition, implementing higher order filters in the base station (and, conversely, lower order in user devices) would have been obvious to try with reasonable likelihood of success. *Id.*, ¶195. A POSITA would understand that filters used in wireless transceivers—like the LPF (blue) and BPF (red) filters in Serizawa's transceiver illustrated in Figure 33—are “implemented by *conventional* filter synthesis and design. Conventional filter designs include the design and implementation of active and passive Bessel, Butterworth, Chebycheff, Gaussian, analog and digital filters and hybrid analog/digital filters.” Ex.1011 (Feher), 17:64-18:4; Ex.1002, ¶195. As Dr. Ding

explains, a POSITA would know how to implement these conventional filter designs. *Id.*

Moreover, a POSITA would understand that the 2.4-GHz ISM signals received in a base station are much noisier signals compared to the relatively interference-free 60-GHz millimeter-wave signals received in a subscriber station, particularly due to the large number of interference sources (*e.g.*, from other WiFi and Bluetooth devices, microwave ovens, garage door openers) that operate in the same unlicensed 2.4-GHz band. Ex.1002, ¶196. Thus, a POSITA would understand and find it obvious that high-order/high-complexity filters would be required in a base station to properly filter out the unwanted noise and interference in the 2.4-GHz received signals. *Id.* ¶197. In contrast to that, a POSITA would understand that lower-order/lower-complexity filters would suffice to handle the reasonably interference-free, cleaner 60-GHz millimeter-wave signals received in a subscriber station. *Id.*

3. Dependent Claim 7

- (a) *“The method of claim 6 wherein the filtering performed at said base station is performed by a multi-pole filter.”*

Serizawa, alone or in view of Razavi and/or Ferry, renders obvious the additional limitation of claim 7. Ex.1002, ¶198. As discussed above, high-order, multi-pole filters are typically used in base stations to provide good attenuation of

unwanted signals or interference. Ex.1021, [0037] (“RF receive band-pass filter 125A may comprise a tuned **5- or 7-pole** combline filter to provide additional isolation and separation ...”); Ex.1015, 119 (discussing multi-pole “**second-order** LC filter [] to provide 60 dB of attenuation ...”), 162 (discussing multi-pole “**fifth-order** low-pass filters” used in a GSM transceiver). As Dr. Ding explains, use of a multi-pole filter with Serizawa, as taught by Razavi and/or Ferry would be a combination of prior art elements according to known methods to yield predictable results, as well as application of a known technique to a known device ready for improvement to yield predictable results. Ex.1002, ¶198. It would also be obvious to try given the known benefits of multipole filters. *Id.* A POSITA also would have a reasonable expectation of success because a multipole filter was conventional at the time. *Id.*

4. **Dependent Claim 8**

- (a) *“The method of claim 6 wherein said subscriber station performs lower order filtering on signals received at said subscriber station than said base station performs on signals received at said base station.”*

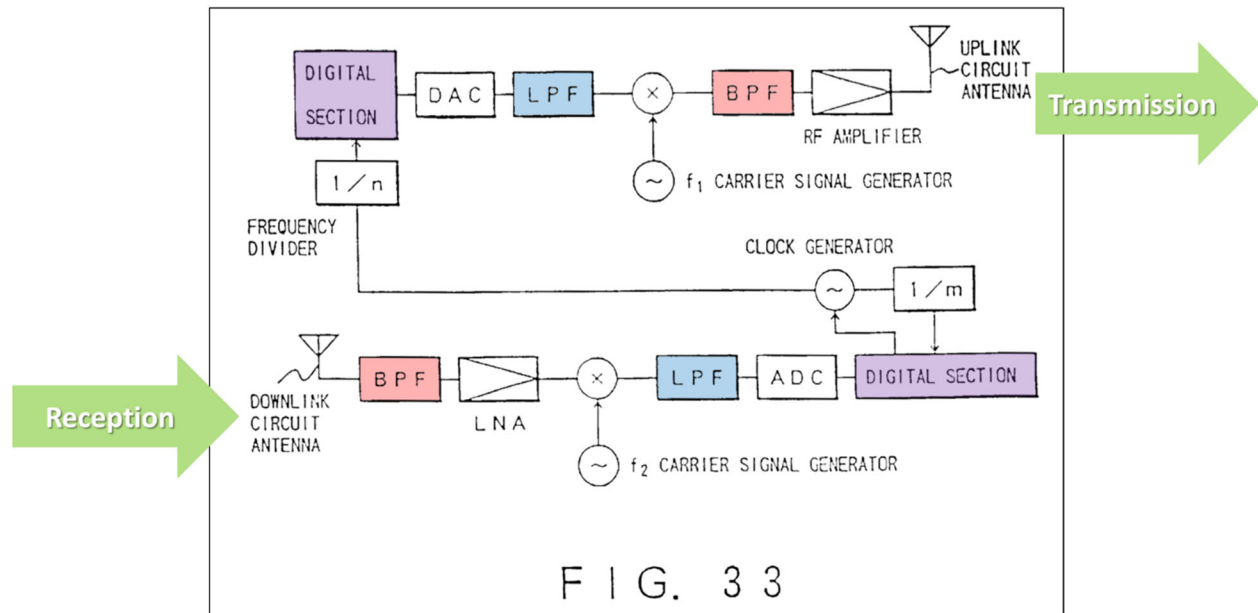
This limitation mirrors claim 6. *See* Section VII.C.2; Ex.1002, ¶199.

5. **Dependent Claim 9**

- (a) *“The method of claim 8 wherein the filtering performed at said subscriber station is performed by finite impulse response (FIR) filtering.”*

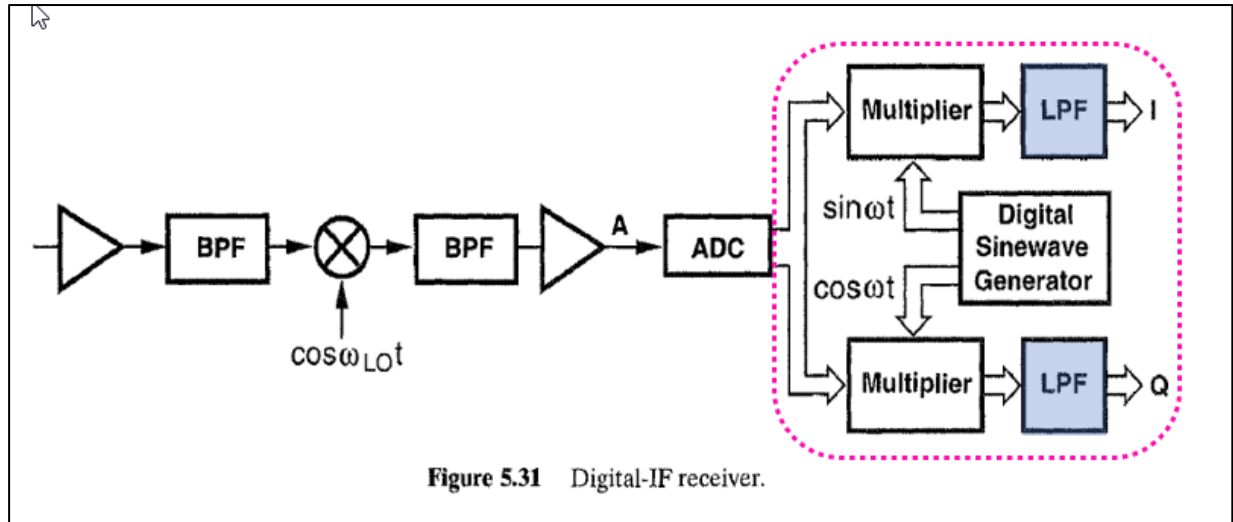
Serizawa, alone or in view of Razavi, renders obvious the additional limitation of claim 9. Ex.1002, ¶¶200-01. Serizawa Figure 33 shows digital sections (purple),

and a POSITA would understand that filtering of baseband signals is commonly done in the digital domain. *Id.*, ¶200.



Ex.1006, Fig. 33. As Razavi explains, “low-frequency [(baseband)] operations such as [] mixing and filtering can be performed more efficiently in the digital domain.”

Ex.1015, 146. This is shown in Razavi Figure 5.31. A POSITA would understand that the low pass filters (blue) in Figure 5.31 are filters implemented as FIR filters in the digital domain (magenta dotted line) downstream of the analog-to-digital converter (ADC). Ex.1002, ¶201; Ex.1012 (Vaidyanathan), 45-48 (discussing “FIR lowpass filter” design).



Ex.1015, Fig. 5.31. As Dr. Ding explains, use of FIR filters with Serizawa as taught by Razavi and/or Ferry would be a combination of prior art elements according to known methods to yield predictable results, as well as application of a known technique to a known device ready for improvement to yield predictable results. Ex.1002, ¶201. It would also be obvious to try given the known benefits of FIR filters in filtering low frequency signals in the digital domain. *Id.* A POSITA would also have a reasonable expectation of success because FIR filter was conventional at the time. *Id.*

6. Dependent Claim 10

- (a) “The method of claim 8 wherein the filtering performed at said subscriber station is performed by surface acoustical wave (SAW) filtering.”

Serizawa, alone or in view of Razavi and/or Ferry, renders obvious the additional limitation of claim 10. Ex.1002, ¶202. A POSITA would understand that SAW filters were commonly used to achieve good attenuation of unwanted signals

or interference. Ex.1002, ¶202; Ex.1015, 119, 125-126, Fig. 5.49 at 161 (SAW filter used in the receive path of a GSM transceiver); Ex.1021, [0039] (“BPFs 134, 138 may comprise surface acoustic wave (SAW) filters.”). Thus, as Dr. Ding explains, it would have been obvious to a POSITA to try a SAW filter with Serizawa, as taught by Razavi and/or Ferry, as it is one of a finite number of identified, predictable filtering solutions. Ex.1002, ¶202. A POSITA would have a reasonable expectation of success given that SAW filter was conventional at the time. *Id.*

7. Dependent Claim 18

- (a) *“The method of claim 15 wherein said base station performs higher order filtering on signals received at said base station than said subscriber station performs on signals received at said subscriber station.”*

This limitation mirrors claim 6. *See* Section VII.C.2; Ex.1002, ¶203.

8. Dependent Claim 19

- (a) *“The method of claim 18 wherein the filtering performed at said base station is performed by a multi-pole filter.”*

This limitation mirrors claim 7. *See* Section VII.C.3; Ex.1002, ¶204.

9. Dependent Claim 20

- (a) *“The method of claim 19 wherein the filtering performed at said subscriber station is performed by surface acoustical wave (SAW) filtering.”*

This limitation mirrors claim 10. *See* Section VII.C.6; Ex.1002, ¶205.

10. Dependent Claim 21

- (a) *“The method of claim 18 wherein said subscriber station performs lower order filtering on signals received at said subscriber station than said base station performs on signals received at said base station.”*

This limitation mirrors claim 8. *See* Section VII.C.4; Ex.1002, ¶206.

11. Dependent Claim 22

- (a) *“The method of claim 21 wherein the filtering performed at said subscriber station is performed by finite impulse response (FIR) filtering.”*

This limitation mirrors claim 9. *See* Section VII.C.5; Ex.1002, ¶207.

12. Independent Claim 25

- (a) *Preamble: “A method for increasing wireless communication capacity, said method comprising:”*

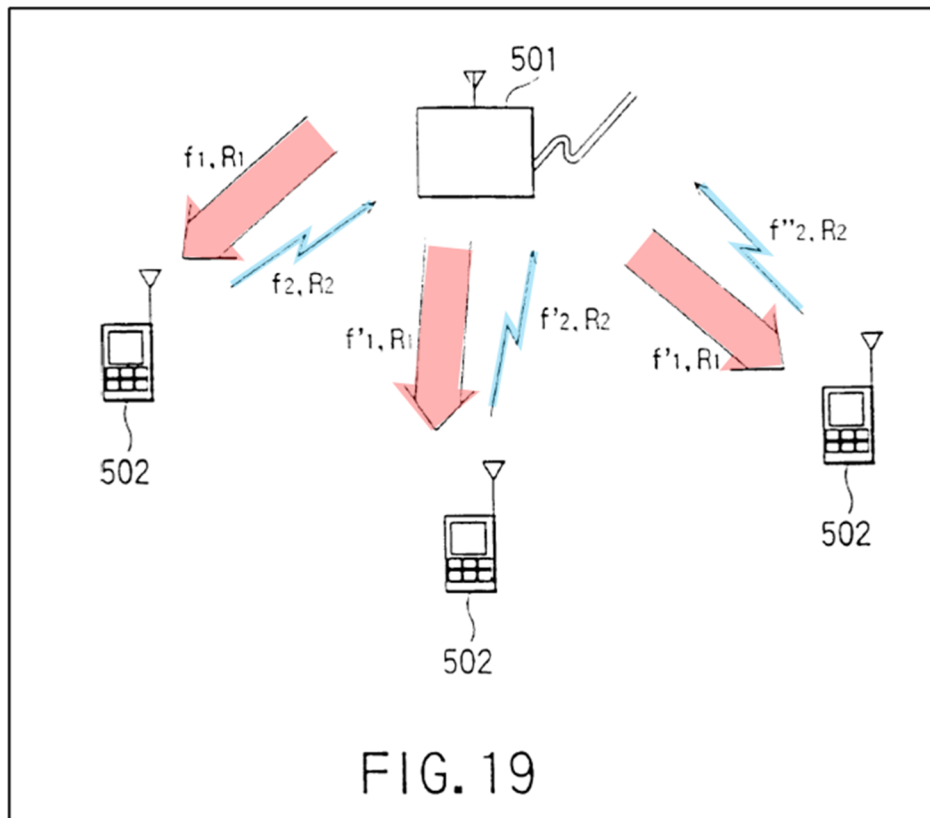
To the extent the preamble is limiting, Serizawa discloses or renders it obvious. *See* Section VII.B.1(a); Ex.1002, ¶208.

- (b) *Element [25.1]: “providing a base station, said base station adapted to transmit data in an expected low noise frequency band and to receive data in an expected high noise frequency band; and”*

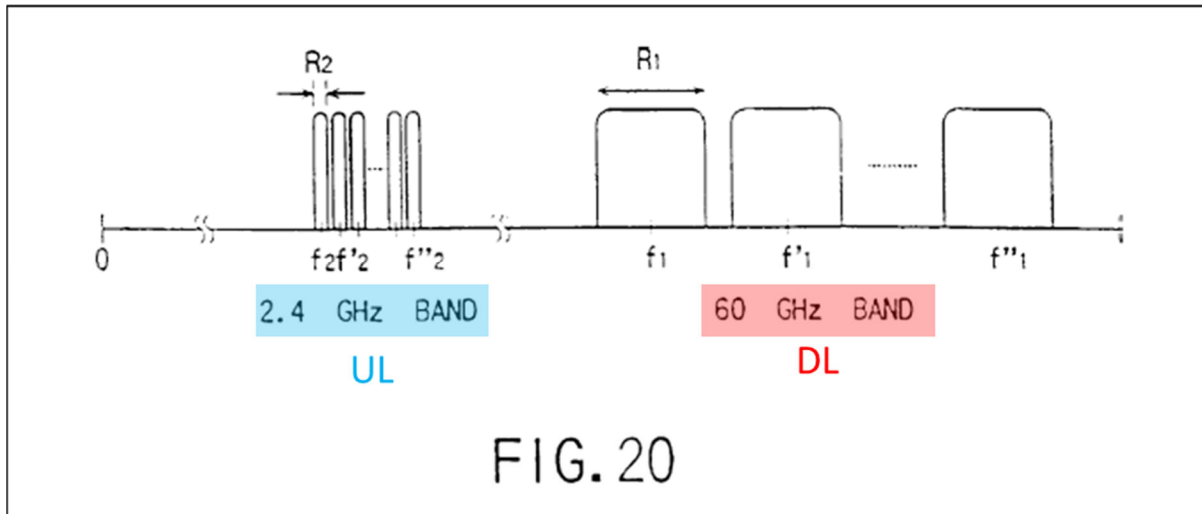
This element substantively mirrors elements [3.1] and [3.2]. *See* Section VII.B.3(b), VII.B.3(c); Ex.1002, ¶209. In particular, a POSITA would understand the phrase “expected low noise frequency band” used in this claim to mean substantially the same as “frequency band expected to experience low interference” used in claim 3. Ex.1002, ¶209. Indeed, the specification links “interference” to “induced noise.” Ex.1001, 5:12-24, 5:40-47, 4:7-12. For the same reasons, a POSITA would understand that the phrase “expected high noise frequency band” used in this claim to mean substantially the same as “frequency band expected to experience high interference” used in claim 3. Ex.1002, ¶209.

- (c) *Element [25.2]: “providing a plurality of subscriber stations, said plurality of subscriber stations adapted to transmit data in said expected high noise frequency band and to receive data in said expected low noise frequency band;”*

This element substantively mirrors elements [1.1] and [1.2]. *See* Section VII.B.1(b), VII.B.1(c); Ex.1002, ¶¶210-12. As discussed above, a POSITA would understand that the phrase “expected high noise frequency band” means substantially the same as a “frequency band expected to experience high interference” used in claim 1, and that the phrase “expected low noise frequency band” means substantially the same as “frequency band expected to experience low interference” used in claim 1. *See* Section VII.C.12(b); Ex.1002, ¶210. In addition, Serizawa Figure 19 discloses a plurality of subscriber stations (mobile phones 502) as required by the claim.



Ex.1006, Fig. 19. As shown in Figures 19 and 20, each subscriber station transmits data in the 2.4-GHz ISM uplink band (f_2) (blue) which is an unlicensed, expected high noise/high interference frequency band. *See* VII.A.1(b). Each subscriber station receives data in the 60-GHz MMW downlink band (f_1) which is an expected low noise/low interference band, as discussed above. *See* VII.A.1(a); Ex.1002, ¶212.



Ex.1006, Fig. 20.

- (d) *Element [25.3]: “wherein said base station performs higher order filtering on signals received at said base station than said plurality of subscriber station perform on signals received at said plurality of subscriber stations.”*

This element is in substance the same as the additional element of claim 6.

See Section VII.C.2; Ex.1002, ¶213. A POSITA would understand that signals can be filtered not only at a single subscriber station, but also at a plurality of subscriber stations. Ex.1002, ¶213.

13. Dependent Claim 26

- (a) *“The method of claim 25 wherein the filtering performed at said base station is performed by a multi-pole filter.”*

See Section VII.C.3; Ex.1002, ¶214.

14. Dependent Claim 27

- (a) *“The method of claim 25 wherein the filter performed at said subscriber station is performed by finite impulse response (FIR) filtering.”*

See Section VII.C.5; Ex.1002, ¶215.

15. Dependent Claim 28

- (a) *“The method of claim 25 wherein the filter performed at said subscriber station is performed by surface acoustical wave (SAW) filtering.”*

See Section VII.C.6; Ex.1002, ¶216.

16. Dependent Claim 29

- (a) *“The method of claim 25 wherein said low noise frequency and said high noise frequency band are separated by at least one octave.”*

This element is in substance the same as element [1.3] and element [3.3]. *See* Section VII.B.1(d), VII.B.3(d); Ex.1002, ¶217.

17. Dependent Claim 30

- (a) *“The method of claim 25 wherein said data is frequency division duplexed.”*

This element is in substance the same as the additional element of claim 2 and claim 5. *See* Section VII.B.2, VII.B.5; Ex.1002, ¶218.

VIII. THE BOARD SHOULD INSTITUTE IPR

The Board should decline to exercise its discretion to deny institution.

No Discretionary Denial under *Fintiv* - “The PTAB will not discretionarily deny petitions based on applying *Fintiv* to a parallel ITC proceeding.” Ex.1022, at 7. As explained below in Section IX.B, the only active parallel proceeding involving the ’714 Patent is ITC Investigation No. 337-TA-1361.

No Discretionary Denial under §325(d) - The Board has consistently “held that a reference that ‘was neither applied against the claims nor discussed by the Examiner’ does not weigh in favor of exercising [] discretion under §325(d).”

Fasteners for Retail, Inc. v. RTC Indus., Inc., IPR2019-00994, Paper 9 at 7-11 (PTAB Nov. 5, 2019). Here, none of the prior art references relied on in this Petition were cited or discussed during prosecution. Moreover, the closest art discussed during prosecution, U.S. Patent No. 6,801,519 (“Mangal”), was distinguished on the ground that it does not teach simultaneous transmit and receive over different frequency bands. Ex.1004, 454-59. As discussed in Section VII, both Morikawa and Serizawa teach transmit and receive in different frequency bands at the same time. Therefore, they are not cumulative with Mangal. Ex.1002, ¶¶ 219-20.

IX. MANDATORY NOTICES

A. Real Party-In-Interest

TP-Link Corporation Limited f/k/a/ TP-Link International Ltd., TP-Link Technologies Co., Ltd., TP-Link USA. Corp. and TP-Link Institute USA Corp. d/b/a TP-Link Research America Corp. are the real parties-in-interest.

B. Related Matters

The ’714 Patent is the subject of an investigation in the International Trade Commission, Inv. No. 337-TA-1361, filed April 3, 2023 (“ITC Investigation”).

The ’714 Patent is also subject of Civil Action No. 2:23-cv-2540 in the Central District of California (“District Court Case”), filed April 4, 2023. The District Court Case is stayed pending outcome of the ITC Investigation. Ex.1023.

C. Counsel and Service Information

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Individual attorney contact information is in the signature block below.

Petitioner concurrently submits a Power of Attorney, 37 C.F.R. § 42.10(b), and consents to electronic service directed to the following email address: TP-Link_ITC@kirkland.com.

X. PAYMENT OF FEES UNDER 37 C.F.R. § 42.103

Petitioner authorizes the Office to charge the filing fee and any other necessary fee to Deposit Account No. 506092. Review of 32 claims is requested. The undersigned further authorizes payment for any additional fees that may be due in connection with this Petition.

XI. CERTIFICATION OF GROUNDS FOR STANDING

Petitioner certifies pursuant to Rule 42.104(a) that the '714 Patent is available for IPR and that Petitioner is not barred or estopped from requesting an IPR of the Challenged Claims on the grounds identified in this Petition.

XII. CONCLUSION

Petitioner requests institution of an IPR and cancellation of the Challenged Claims.

Date: September 7, 2023

Respectfully submitted,

/s/ Todd M. Friedman

Todd M. Friedman, P.C.
Counsel for Petitioners
Reg. No. 42,559

CERTIFICATE OF COMPLIANCE

This Petition complies with the type-volume limitations as mandated in 37 C.F.R. § 42.24, totaling 13,712 words. Counsel has relied upon the word count feature provided by Microsoft Word.

/s/ Todd M. Friedman
Todd M. Friedman

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), I certify that I caused to be served on September 7, 2023, a true and correct copy of the foregoing **PETITION FOR *INTER PARTES* REVIEW UNDER 35 U.S.C. § 312 AND 37 C.F.R. § 42.104** by overnight carrier to the Patent Owner at the correspondence address of record for the Patent Owner's Attorneys as follows:

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A courtesy copy was also served via electronic mail on Patent Owner's counsel of record in the investigation before the International Trade Commission, Inv. No. 337-TA-1361.

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