

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc.,
Petitioners,

v.

Massively Broadband LLC,
Patent Owner.

Case IPR2025-01587

U.S. Patent No. 8,593,358

**PETITION FOR *INTER PARTES* REVIEW
UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. §§ 42.100 *et seq.***

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1001	U.S. Patent No. 8,593,358 (“’358 Patent”)
1002	Prosecution History of U.S. Patent No. 8,593,358
1003	Expert Declaration of Dr. Mark Mahon
1004	U.S. Pat. Pub. No. 2008/0030411 (“Wen”)
1005	Intentionally Left Blank
1006	U.S. Pat. Pub. No. 2004/0125027 (“Rubinshteyn”)
1007	U.S. Pat. No. 5,926,751 (“Vlahos”)
1008	U.S. Pat. No. 7,489,914 (“Govind”)
1009	U.S. Pat. Pub. No. 2004/0095280 (“Poilasne”)
1010	U.S. Patent No. 7,786,819 (“Ella”)
1011	IEEE 100: The Authoritative Dictionary of IEEE Standards Terms, 7th ed. (2000)
1012	Prosecution History of U.S. Pat. No. 8,350,763.
1013	Int. Pub. No. WO 2005/029720 (“Leenaerts”)
1014	U.S. Patent No. 8,583,065 (“Ben-Bassat”)
1015	Infringement Contentions, <i>Massively Broadband LLC v. Samsung Electronics Co., Ltd., AND Samsung Electronics America, Inc.</i> , Case No. 2:25-cv-00608 (E.D. Tex.)

CLAIM LISTING

Claim 1	
1[pre]	A wireless device, comprising:
1[a]	one or more antennas wherein at least one of said one or more antennas includes one or more elements or sub-elements, said one or more antennas forming an antenna array; and
1[b]	a plurality of transmitters, receivers or transceivers that operate in one or more frequency bands,
1[c]	wherein at least one antenna of said antenna array is used by said plurality of transmitters, receivers or transceivers in a plurality of different bands,
1[d]	wherein said at least one antenna is one or more of a) an actively tuned antenna, and b) is tuned by one or more passive elements which are selected or interconnected using electronic control.
Claim 2	
2	The wireless device of claim 1 wherein said passive elements are comprised of either or both lumped or distributed elements.
Claim 3	
3	The wireless device of claim 1 wherein said at least one antenna is used for transmitting, receiving, or transmitting and receiving simultaneously in said plurality of different bands.
Claim 4	
4[pre]	The wireless device of claim 1 further comprising
4[a]	one or more tuners associated with one or more transmitters, receivers or transceivers of said plurality of transmitters, receivers or transceivers; and
4[b]	a controller for controlling tuning of the tuner for said at least one antenna to operate in said plurality of different bands.
Claim 5	
5	The wireless device of claim 1 wherein said mobile device is selected from the group consisting of computers, telephones, portable computing or communication devices, games, wireless post it notes, wireless

	memory media, RFID tags, vehicles, clothing, personal data assistants and navigation assistants.
Claim 6	
6	The wireless device of claim 1 wherein said antenna array is configured for use and implemented in a multiple input multiple output (MIMO) system.
Claim 7	
7	The wireless device of claim 1 wherein said antenna array is configured for use and implemented in a beam switchable array.
Claim 8	
8[pre]	A wireless device, comprising:
8[a]	one or more antennas wherein at least one of said one or more antennas includes one or more elements or sub-elements, said one or more antennas forming an antenna array;
8[b]	at least one multiband transmitter, receiver or transceiver;
8[c]	a tuner associated with said at least one multiband transmitter, receiver, or transceiver; and
8[d]	a controller for controlling tuning of the tuner to a plurality of different bands,
8[e]	wherein at least one antenna of said antenna array is used by said at least one multiband transmitter, receiver or transceiver in a plurality of different bands,
8[f]	wherein said at least one antenna is one or more of a) an actively tuned antenna, and b) is tuned by one or more passive elements which are selected or interconnected using electronic control.
Claim 9	
9	The wireless device of claim 8 said at least one antenna is used for transmitting, receiving, or transmitting and receiving simultaneously in said plurality of different bands.
Claim 10	
10	The wireless device of claim 8 wherein said mobile device is selected from the group consisting of computers, telephones, portable computing

	or communication devices, games, wireless post it notes, wireless memory media, RFID tags, vehicles, clothing, personal data assistants and navigation assistants.
Claim 11	
11	The wireless device of claim 8 wherein said passive elements are comprised of either or both lumped or distributed elements.
Claim 12	
12	The wireless device of claim 8 wherein said antenna array is configured for use and implemented in a multiple input multiple output (MIMO) system.
Claim 13	
13	The wireless device of claim 8 wherein said antenna array is configured for use and implemented in a beam switchable array.
Claim 14	
14[pre]	A wireless device, comprising:
14[a]	at least one multiband antenna which includes one or more elements or sub-elements and which is configured to form an antenna array;
14[b]	at least one multiband transmitter, receiver or transceiver; and
14[c]	a tuner associated with said at least one multiband transmitter, receiver, or transceiver, said tuner matching said at least one multiband antenna to said at least one multiband transmitter, receiver or transceiver in a plurality of different bands simultaneously.
Claim 15	
15	The mobile device of claim 14 wherein said at least one antenna is used for transmitting, receiving, or transmitting and receiving simultaneously in said plurality of different bands.
Claim 16	
16	The wireless device of claim 14 wherein said mobile device is selected from the group consisting of computers, telephones, portable computing or communication devices, games, wireless post it notes, wireless memory media, RFID tags, vehicles, clothing, personal data assistants and navigation assistants.
Claim 17	

17	The wireless device of claim 14 wherein said antenna array is configured for use and implemented in a multiple input multiple output (MIMO) system.
Claim 18	
18	The wireless device of claim 14 wherein said antenna array is configured for use and implemented in a beam switchable array.
Claim 19	
19[pre]	A wireless portable device, comprising:
19[a]	one or more antennas wherein at least one of said one or more antennas includes one or more elements or sub-elements, said one or more antennas forming an antenna array, said one or more antennas radiating or receiving electromagnetic energy at particular frequency bands, at least one of said one or more antennas radiating or receiving electromagnetic energy at a plurality of particular frequency bands;
19[b]	one or more components selected from the group consisting of receivers, transmitters and transceivers, said one or more components connected to said at least one of said one or more antennas, whereby
19[c]	at least one of said one or more components transmits or receives electromagnetic energy simultaneously at two or more of said plurality of particular frequency bands, or two or more components transmit or receive electromagnetic energy at two or more of said plurality of particular frequency bands.
Claim 20	
20	The wireless portable device of claim 19 wherein said wireless portable device is selected from the group consisting of computers, telephones, personal data assistants, and navigation assistants.
Claim 21	
21	The wireless portable device of claim 19 further comprising one or more tuners which match electromagnetic energy at a particular frequency band to only one of said one or more components.
Claim 22	
22	The wireless portable device of claim 19 further comprising isolation means for isolating said one or more components from more than one particular frequency band of said plurality of frequency bands.

Claim 23	
23	The wireless portable device of claim 19 wherein said antenna array is configured for use and implemented in a multiple input multiple output (MIMO) system.
Claim 24	
24	The wireless portable device of claim 19 wherein said antenna array is configured for use and implemented in a beam switchable array.
Claim 25	
25[pre]	A wireless device component, comprising a tuner or a set of tuners or controller or other circuitry configurable to be coupled to at least one antenna of one or more antennas wherein at least one of said one or more antennas includes one or more elements or sub-elements, said one or more antennas forming an antenna array, and a plurality of transmitters, receivers, or transceivers that operate at one or more frequency bands, wherein said at least one antenna is used by said plurality of transmitters, receivers or transceivers in a plurality of different bands,
25[a]	wherein said at least one antenna is one or more of a) an actively tuned antenna, and b) is tuned by one or more passive elements which are selected or interconnected using electronic control.
Claim 26	
26	The wireless device component of claim 25 wherein said antenna array is configured for use and implemented in a multiple input multiple output (MIMO) system.
Claim 27	
27	The wireless device component of claim 25 wherein said antenna array is configured for use and implemented in a beam switchable array.
Claim 28	
28[pre]	A wireless communication system, comprising
28[a]	at least one wireless device, comprising:
28[a][i]	one or more antennas; and
28[a][ii]	a plurality of transmitters, receivers or transceivers that operate in one or more frequency bands,

28[a][iii]	wherein at least one antenna of said one or more antennas is used by said plurality of transmitters, receivers or transceivers in a plurality of different bands,
28[a][iv]	wherein said at least one antenna is one or more of a) an actively tuned antenna, and b) is tuned by one or more passive elements which are selected or interconnected using electronic control; and
28[b]	one or more mobile, portable, or fixed devices or platforms which communicate with said at least one wireless device.
Claim 29	
29	The wireless communication system of claim 28 wherein said at least one wireless device has at least one of said one or more antennas which includes one or more elements or sub-elements, said one or more antennas forming an antenna array.
Claim 30	
30	The wireless communication system of claim 29 wherein said antenna array of at least one wireless device is configured for use and implemented in a multiple input multiple output (MIMO) system.
Claim 31	
31	The wireless communication system of claim 29 wherein said antenna array of said at least one wireless device is configured for use and implemented in a beam switchable array.

I. INTRODUCTION

Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc., (collectively, “Samsung” or “Petitioner”) respectfully requests *inter partes* review of all claims (1-31) of U.S. Patent No. 8,593,358 (the “’358 Patent”). A reasonable likelihood exists that Petitioner will prevail on at least one challenged claim.

The claims of the ’358 patent recite a purported novel multiband antenna and antenna array combined with conventional transmitters, receivers, or transceivers, and active and/or passive antenna tuning elements. None of these elements—alone or in combination—were novel and non-obvious by the earliest possible filing date. For example, Wen (EX1004) and Rubinshteyn (EX1006) each disclose a tunable, multiband antenna, and Poilasne (EX1009) discloses a multiple-element antenna constituting an antenna array.

The ’358 Patent lacks any inventive aspect, and the Board should institute *inter partes* review.

II. STANDING

Petitioner certifies that the ’358 Patent is available for *inter partes* review and that Petitioner is not barred or estopped from requesting *inter partes* review.

III. TECHNICAL BACKGROUND

Modern wireless devices use radio waves to communicate with other devices. EX1003, ¶¶41-49. Antennas transmit and receive information on radio waves at predetermined frequencies. *Id.* In order for two devices to effectively communicate,

they must transmit and receive information at the same frequency. *Id.* To facilitate such communications, wireless communication protocols typically operate at predetermined frequency bands (*e.g.*, 700 MHz-2.5 GHz for LTE, or 2.4, 5, and 6 GHz for Wi-Fi). *Id.* Within the corresponding wireless device, a transmission line is used to communicate the signal containing the information between the antenna and other electronic components. *Id.*

Antennas are typically designed to operate at specific frequencies. *Id.* The physical characteristics of the antenna cause it to be more or less efficient at specific ranges of frequency (each referred to as a frequency “band”). *Id.* The range of frequencies where the antenna operates most efficiently is called the “resonant” frequency. *Id.* Early antennas only had one resonant frequency, and devices designed to support multiple wireless communication protocols at different frequency bands required multiple antennas. *Id.* As mobile devices became handheld and miniaturized, however, space constraints created a need for small, multiband antennas. *Id.* Well before the ’358 Patent, numerous companies in the wireless communications space had developed multiband antennas that could operate at a plurality of different frequency bands. *Id.* These companies used a variety of different tuning techniques to enable tuning the antennas to a variety of different frequencies, and to match the antennas to the desired impedance. *Id.*

IV. OVERVIEW OF THE '358 PATENT

A. Priority

The '358 Patent issued on November 26, 2013, and claims priority to Provisional Application No. 61/088,829, filed on August 14, 2008.

The prior art references relied upon in this Petition predate August 14, 2008, the earliest possible effective filing date.

B. Prosecution History

The application that issued as the '358 Patent was filed December 13, 2012. Contemporaneously, Applicant entered a preliminary amendment. EX1002, 135-42 (12/13/2012 Claims Amendment). The original claims were amended to add elements directed to an antenna array, active and passive tuning, and simultaneous multiband functionality. *Id.*, 136-41. New claims were also added reciting Multiple-Input-Multiple-Output ("MIMO") and "beam switchable array" embodiments, and communications between the wireless device and a second device. *Id.*

The examiner did not issue any rejections and allowed the claims on August 1, 2013. *Id.*, 21-24.

C. Disclosure

The '358 Patent describes a wireless device with an antenna array that operates in different bands. The antenna array comprises a single antenna "implemented with other antennas or antenna elements or sub-elements." EX1001, 9:66-10:6. The antenna arrays may be part of a "MIMO system or beam switchable

array.” *Id.*, 10:2-3. The antenna array is “either actively tuned or passively tuned” and coupled to “multiple band transmitters, receivers, or transceivers.” EX1001, Abstract, 3:60-4:5, 9:66-10:19.

V. GROUNDS

Petitioner requests cancellation of Claims 1–31 on the following grounds¹:

Ground	Basis	Reference(s)	Claims
I	§103	Wen alone or in view of Poilasne	1-7, 25-31
II	§ 103	Wen in view of Poilasne and Govind	8-21, 23-24
III	§ 103	Wen in view of Poilasne, Govind, and Vlahos	22
IV	§ 103	Rubinshteyn in view of Wen and Poilasne	1-7, 25-31
V	§ 103	Rubinshteyn in view of Poilasne	8-21, 23
VI	§ 103	Rubinshteyn in view of Poilasne and Vlahos	22

VI. LEVEL OF ORDINARY SKILL

A person of ordinary skill in the art (“POSITA”) at the time of the ’358 Patent would have had at least a Bachelor’s degree in electrical engineering, computer engineering, physics, or a related field, and at least two years of experience working with design and integration of RF circuits and antennas for wireless communication

¹ Petitioners are not presently aware of any secondary considerations of non-obviousness applicable to the ’358 Patent. To the extent the Patent Owner presents any such evidence, Petitioners reserve the right to respond.

devices. EX1003, ¶53. More education can substitute for practical experience and vice versa. *Id.* Petitioner’s expert, Dr. Mark Mahon, exceeds this skill level and thus has the qualifications and experience necessary to assess the ’358 Patent from the perspective of a POSITA. *Id.*

VII. CLAIM CONSTRUCTION

Petitioner identifies one pre-AIA Section 112 Paragraph 6 means-plus-function limitation in dependent Claim 22 for construction. The remaining terms do not require construction for purposes of this proceeding and should be given their plain and ordinary meaning.

A. **“isolation means for isolating said one or more components from more than one particular frequency band of said plurality of frequency bands” (Claim 22)**

Function: “isolating said one or more components from more than one particular frequency band of said plurality of frequency bands.”

Structure: element(s) that provides overload protection, shielding, and/or filters out unwanted bands.²

The specification discloses that “proper operation” of an antenna requires “sufficient RF isolation,” which can be achieved using “filtering and overload protection” in “commercially available wireless transceivers.” EX1001, 5:32-38;

² Petitioner has identified the only structure disclosed in the specification, but does not concede that it is adequate structure under Section 112.

see also id., 5:30-6:3, 7:11-17 (describing exemplary shielding and filtering techniques). A POSITA would have understood that such elements may be used to isolate RF components from particular frequency bands. EX1003, ¶¶54-57.

VIII. GROUND I: CLAIMS 1-7, 25-31 ARE RENDERED OBVIOUS BY WEN ALONE OR IN VIEW OF POILASNE

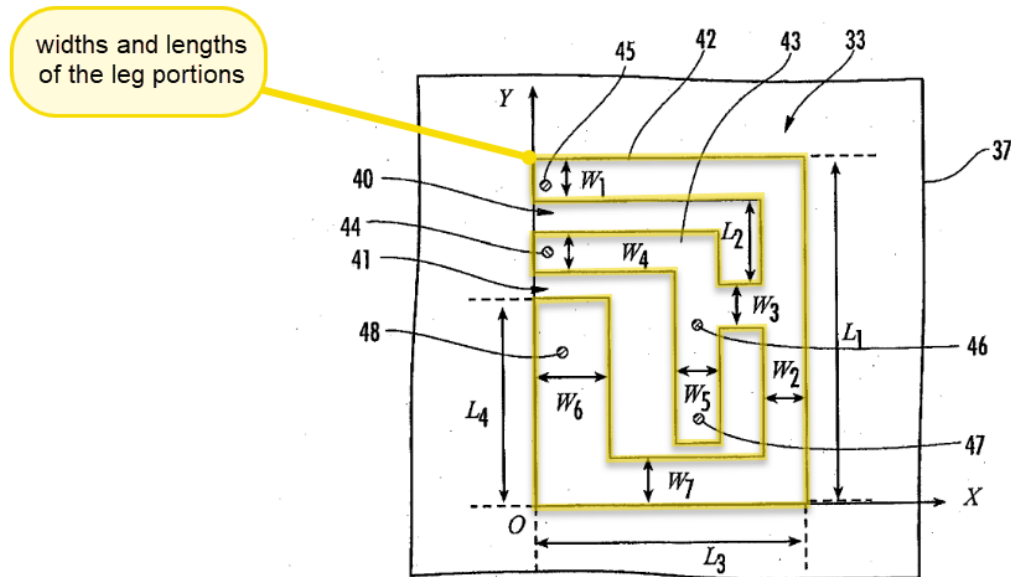
Wen discloses a multiband antenna coupled to a plurality of transceivers and passively tuned. Poilasne discloses an antenna with multiple elements, *e.g.*, in a multiple-input multiple-output (MIMO) antenna design, which is an antenna array, and control elements for tuning the antenna. As detailed below, a POSITA would have been motivated to modify Wen to use antenna arrays and control elements as taught by Poilasne.

A. Wen (EX1004)

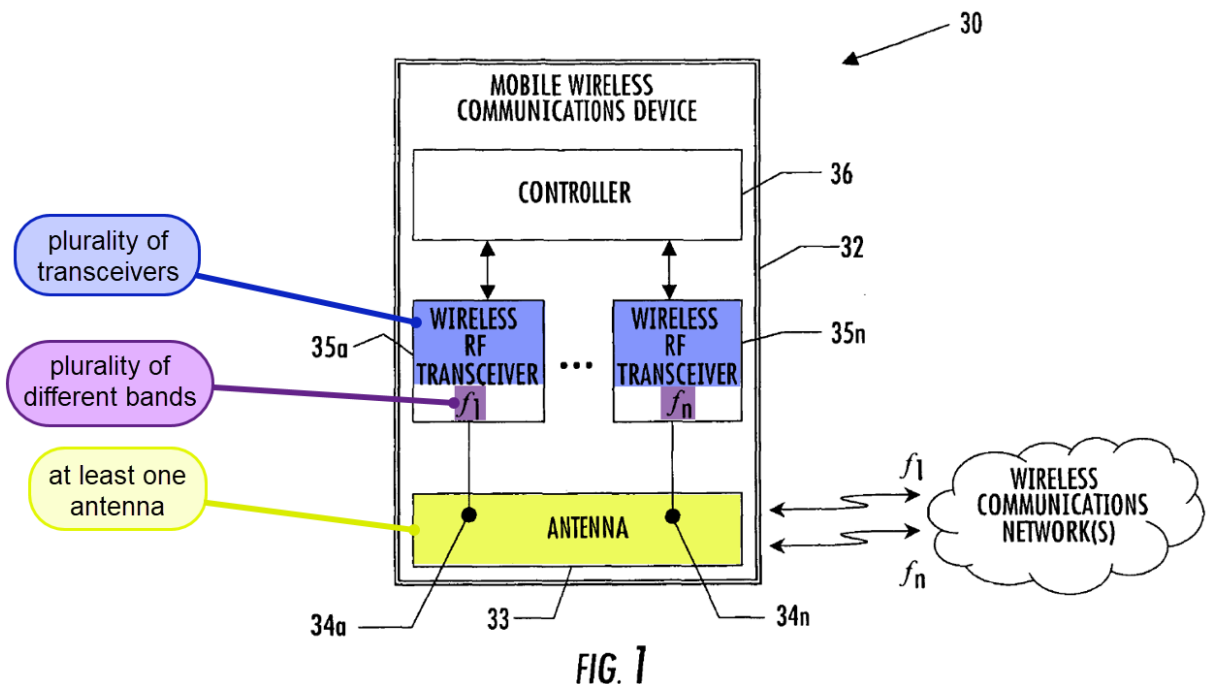
European Pat. No. 1,914,835 (“Wen”) was filed on October 20, 2006, and was first published on April 23, 2008. It is prior art under at least pre-AIA 35 U.S.C. § 102(a).

Wen discloses a mobile wireless communications device with multiple wireless RF transceivers that can “use [a] common antenna at a same time.” EX1004, [0027]. The common antenna has “a plurality of spaced apart signal feed points” to be coupled with “a plurality of wireless radio frequency (RF) transceivers” each having “a respective different operating frequency.” *Id.*, [0027]. For example, the common antenna may have a “plurality of leg portions” that are “selected to tune the

desired operating frequencies” through their geometries, as shown in Figure 2 (reproduced and annotated below). *Id.*, [0028], [0035]. A controller is employed to “selectively operat[e] at least some of the wireless RF transceivers to advantageously use the common antenna at a same time.” *Id.*, [0027]

**FIG. 2**

Wen’s Figure 1 illustrates one embodiment of a mobile wireless communications device with a multiband antenna.



B. Poilasne (EX1009)

U.S. Pat. Pub. No. 2004/0095280 (“Poilasne”) was filed on November 18, 2002, and was published May 20, 2004. It is prior art under at least pre-AIA 35 U.S.C. § 102(b).

Poilasne teaches a wireless communications device such as a cell phone with an antenna array, *i.e.*, “an antenna comprising multiple elements.” EX1009, [0042]. The antenna array may be configured in a “multiple input-multiple output [(MIMO)] antenna design” or to provide “beam switching” and “beam steering” capabilities. *Id.* One or more “control elements” may be used to turn individual antennas in the array on or off, to “vary the resonant frequency of the antenna,” or for “impedance matching of the antenna.” *Id.*, [0046], [0055], [0060], [0062]. Poilasne’s antenna

array “is able to cover multiple frequency bands, either independently or at the same.” EX1009, [0038].

C. Motivation to combine

A POSITA would have been motivated to modify Wen to use an antenna array and control elements in view of Poilasne, and would have reasonably expected the combination to succeed. EX1003, ¶65.

First, Poilasne provides express motivations to utilize antenna arrays in wireless devices. EX1003, ¶66. Poilasne teaches that “new generations” of devices that are “smaller and embedded with more and more applications” will require “new antenna designs ... to provide solutions to inherent limitations of these devices.” EX1009, [0005]. “In multi-band applications” specifically, antennas “will need to take into account beam switching, beam steering, space or polarization antenna diversity, impedance matching, frequency switching, mode switching, etc., in order to reduce the size of devices and improve their performance.” *Id.* At least some of these techniques, including beam switching, are typically implemented using antenna arrays. EX1003, ¶66.

Poilasne also discloses advantages unique to antenna arrays. *Id.*, ¶67. For example, Poilasne explains that “one way to improve the transmission quality of an antenna is to switch an antenna’s beam direction or to steer an antenna’s beam,”

which Poilasne achieves using an antenna array. EX1009, [0060]-[0066] (two elements), [0067] (more than two elements).

Second, Poilasne provides express motivations to utilize control elements to tune the antenna. EX1003, ¶68. Poilasne's control elements turn individual antennas on or off. EX1009, [0062]. However, they can also advantageously be used to "vary the resonant frequency of the antenna" or to "control the input impedance of the antenna." *Id.*, [0046], [[0051]; EX1003, ¶68. For example, varying the resonant frequency enables real-time switching for regional frequency bands, *e.g.*, "switching from ... a 800/1900 MHz US band to a 900/1800 MHz GSM Europe and Asia band." EX1004, [0037]. Similarly, adjusting "the input impedance ... maintain[s] the best antenna characteristics while the antenna's environment is changing." *Id.*, [0051].

The use of tuners for antenna tuning and impedance matching was well known in the art. EX1003, ¶69. For example, U.S. Pat. No. 8,583,065 ("Ben-Bassat"), filed in June 2007, discloses that "antenna tuning circuits are in **widespread use today**," "allow[] [an antenna] to operate over a wide range of frequencies" and "minimize[] the SWR [standing wave ratio] and maximize[] power transfer" through impedance matching. EX1014, 1:51-2:9. A POSITA would have also known that tuners are frequently used in RF systems for impedance matching with well-known benefits,

such as improving power transfer, minimizing distortion, and preventing overheating. EX1003, ¶69.

In addition, Wen, Poilasne and the '358 Patent are all analogous art because they are directed to the same technological subject matter, multiband antenna systems for wireless devices. EX1001, Abstract (“wireless devices” with antennas “for transmission and reception of many different bands”); EX1004, Abstract (“mobile wireless communications device” with “a common antenna” and multiple “transceivers” with “respective different operating frequency”); EX1009, [0038] (“a configurable antenna ... that is able to cover multiple frequency bands”).

A POSITA would have reasonably expected to be successful in modifying Wen based on Poilasne’s teachings. EX1003, ¶71. Specifically, a POSITA would have understood that Poilasne’s teachings can be beneficially applied to Wen in one of two ways: first, by modifying Wen’s antenna to operate in an array (*e.g.*, using two or more instances of Wen’s antenna that that operate together as an array, and controlled by Poilasne’s control elements, similar to the multi-element antenna embodiments shown in Figures 9-11 of Poilasne); or second, by replacing Wen’s antennas with a multi-element antenna embodiment taught by Poilasne. *Id.* Poilasne describes these embodiments and their practical implementations in sufficient detail to enable a POSITA to apply them to Wen using routine engineering skills that would be within the capacity of a POSITA. *Id.*

D. Claim 1

1. 1[pre]: A wireless device, comprising:

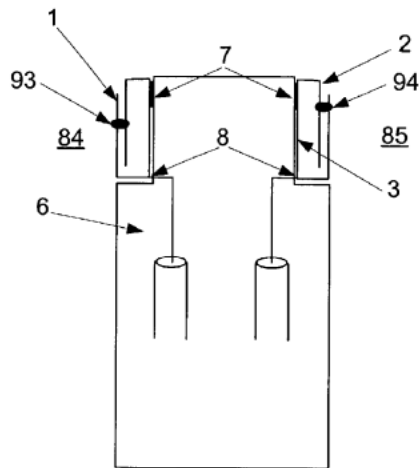
To the extent the preamble is limiting, Wen discloses “a mobile wireless communications device.” EX1004, [0027]; *see also id.*, [0030], [0041], [0043] (same); EX1003, ¶72.

2. 1[a]: one or more antennas wherein at least one of said one or more antennas includes one or more elements or sub-elements, said one or more antennas forming an antenna array; and

It would have been obvious to a POSITA to use an antenna array in Wen’s wireless device in view of Poilasne. EX1003, ¶¶73-80. As discussed in Section VIII.C, a POSITA would have been motivated to use an antenna array based on the teachings of Poilasne. Further, a POSITA would have reasonably expected to be successful in applying Poilasne’s array teachings to Wen using either of two possible approaches: (1) forming an array comprising individual antennas according to Wen’s antenna design, or (2) replacing Wen’s antenna with an antenna array embodiment taught by Poilasne and incorporating Poilasne’s antenna design. *Id.*, ¶73.

Poilasne’s antenna design: Poilasne discloses an antenna design comprising “a plurality of portions” (*i.e.*, ***sub-elements***), such as a “capacitive area,” an “inductive area,” and a “feed area”; or a “top portion,” “middle portion,” and “bottom portion.” EX1009, [0007]. To provide support for beam switching, MIMO, and antenna steering, Poilasne uses a configuration of ***two or more dipole antennas***

that “are switched ON or OFF using control elements.” EX1009, [0060]; *see also id.*, [0042] (discussing beam switching and MIMO antenna design). For example, two dipole antennas with respective control elements and feed points may form an antenna array, as illustrated in Figure 9A (reproduced below). *Id.*, [0062]-[0063]. Alternatively, a “3D antenna” may comprise multiple dipole antennas and “effectuates coverage of multiple frequency bands,” as illustrated in Figure 11 (reproduced below). *Id.*, [0067].



Top-View
Figure 9A

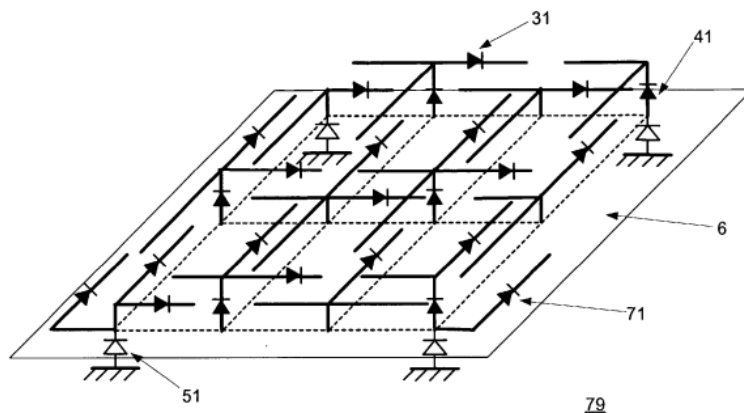


Figure 11

Poilasne’s antennas form an array because they work together to provide beam switching, antenna steering, or MIMO capabilities. *Id.*, [0042], [0060]. PO interprets the term “array” in this way in the related district court case. EX1015, 3 (arguing that MIMO requires an antenna “array” and that antenna elements that “operate together to provide steerable, multi-band performance” are an “array”).

A POSITA would have understood that Poilasne's array of dipole antennas can replace the antenna in Wen's system. Wen expressly teaches that its multi-band antenna "may be a substantially linear antenna." EX1004, [0033]. A dipole antenna is one type of linear antenna. EX1003, ¶76.

Wen's antenna design: Wen discloses a "common *antenna*" that is "shared by a plurality of wireless radio frequency (RF) transceivers 35a-35n." EX1004, [0027], [0031]; *see also id.*, Fig. 1 (annotated below):

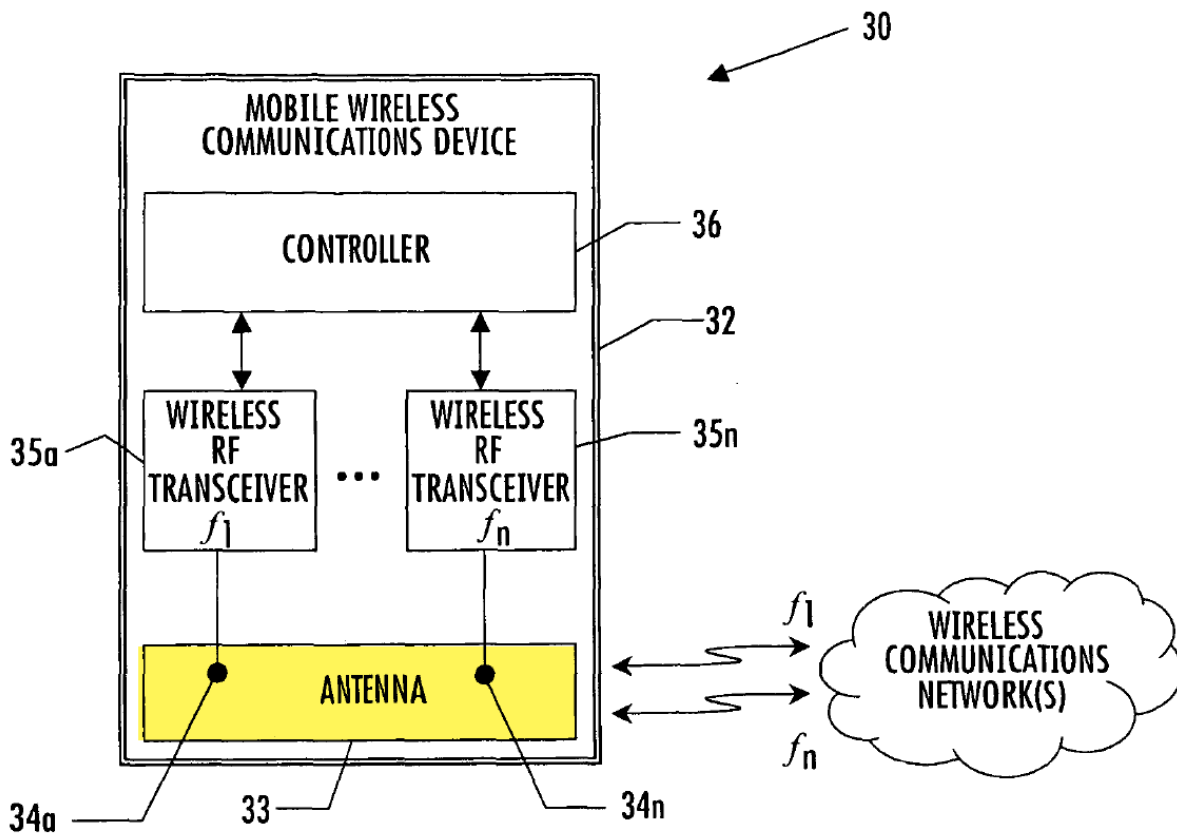


FIG. 1

Wen's antenna includes *multiple sub-elements*, e.g., "leg" portions that are used to "tune the desired operating frequencies of the antenna," each of which "may

be substantially related to a given operating frequency band” or “multiple operating frequency bands.” *Id.*, [0035]; *see also id.* Fig. 2 (showing leg portions in one embodiment):

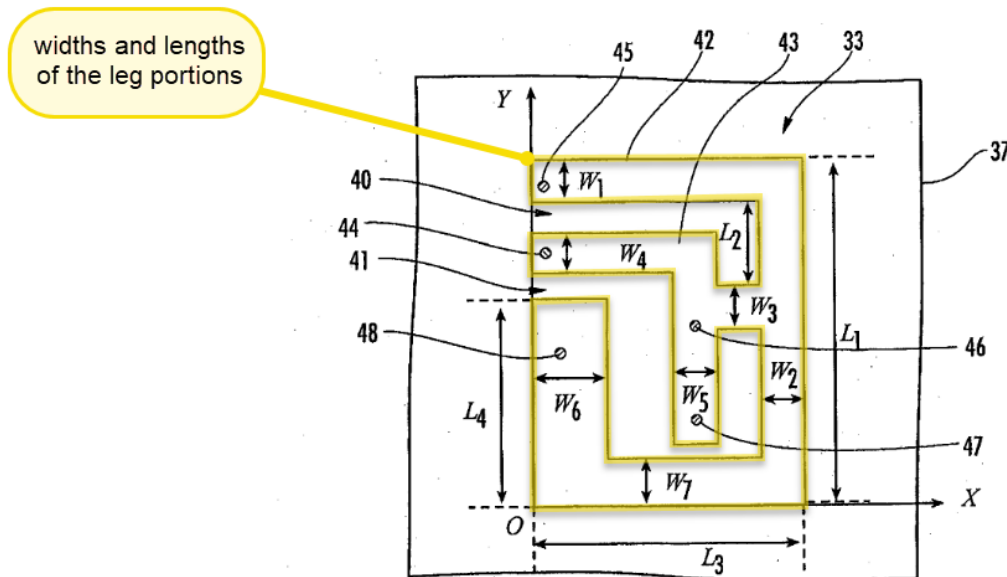


FIG. 2

As discussed above, Poilasne discloses an array of two or more dipole antennas that work together to provide beam switching, steering, or MIMO capabilities. EX1009, [0042], [0060]-[0062], [0067], Fig. 9A, Fig. 11. A POSITA would have understood that Wen’s antenna design may be used for each of the antenna elements in Poilasne’s array because Wen’s antenna may be any “substantially linear antenna,” *e.g.*, a dipole antenna. EX1004, [0033]; EX1003, ¶78.

3. **1[b]: a plurality of transmitters, receivers or transceivers that operate in one or more frequency bands;**

Wen discloses “a ***plurality*** of wireless radio frequency (RF) ***transceivers*** carried by the housing and coupled to respective ones of the signal feed points of the common antenna,” which connect the antenna to other elements in the wireless device. EX1004, [0027]. Wen’s transceivers are also useable with Poilasne’s antenna design because Poilasne’s antennas include feed points and/or feed areas. EX1003, ¶¶81-83. For example, Poilasne discloses that “[o]ne or more of the plurality of portions” (*i.e.*, antenna sub-elements) may define a feed area,” and the “wireless communication device is coupled to the antenna through the feed point.” EX1009, [0007]; *see also id.*, [0051]-[0052] (describing control elements coupled to an antenna feed point or feed area).

Each of Wen’s “wireless RF transceiver[s] preferably has a ***respective different operating frequency*** associated therewith.” *Id.*, [0031]; *see also id.*, [0039] (antenna “tuned to provide operation at 900 MHz, 1800 MHz, and 5 GHz via a selective connection of appropriate wireless RF transceivers”); Fig. 1 (annotated below). Thus, both the individual transceivers and the plurality of transceivers operate in at least one (*i.e.*, ***one or more***) frequency bands. EX1003, ¶82.

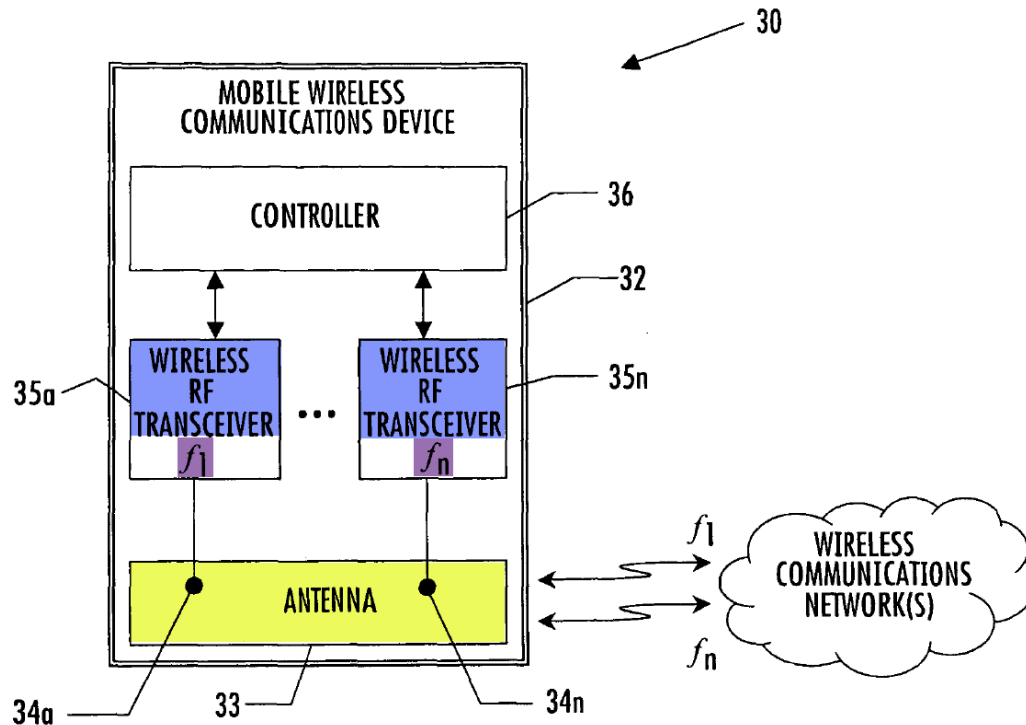


FIG. 1

4. 1[c]: wherein at least one antenna of said antenna array is used by said plurality of transmitters, receivers or transceivers in a plurality of different bands,

Wen discloses a *plurality of transceivers* in a *plurality of different bands* that connect to feed points (e.g., on Wen's or Poilasne's antennas). See Limitation 1[b]; see also EX1004, [0029] (example with "operating frequencies ... within a range of about 900 MHz to 6 GHz"); EX1003, ¶84.

When Wen's antenna design is used in Poilasne's array, see 1[a], Wen discloses the antenna (e.g., antenna 33) *is used by* the plurality of transceivers (e.g., transceivers 35a-35n operating in bands f_1 to f_n). EX1004, [0031], Fig. 1 (showing the antenna connected to and used by the transceivers). Wen also expressly discloses

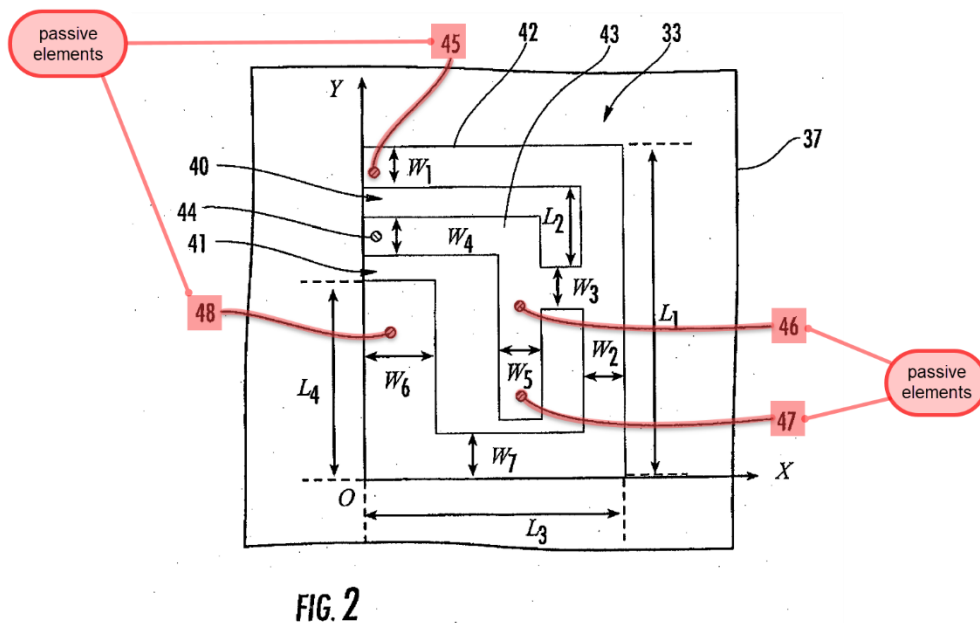
that “[t]he antenna 33 ... is *shared* by a *plurality of wireless radio frequency (RF) transceivers 35a-35n*” and that “[e]ach wireless RF transceiver preferably has a respective *different operating frequency associated therewith.*” EX1004, [0031]; *see also id.*, [0039] (example with transceivers “provid[ing] operation at 900 MHz, 1800 MHz, and 5 GHz”); [0036] (“[A] single multi-feed antenna [] may be used instead of a plurality of different antennas ... to provide multi-frequency band operation.”). Accordingly, the shared antenna is used in *a plurality of different bands*, *i.e.*, at least one for each transceiver. EX1003, ¶85.

When Poilasne’s antenna design is used, *see* 1[a], Poilasne discloses that its antenna is “able to cover multiple frequency bands, either independently or at the same time.” EX1009, [0038]; *see also id.*, [0067] (3D antenna embodiment that “effectuates coverage of multiple frequency bands”). Wen’s plurality of transceivers are “coupled to respective ones of the signal feed points of the common antenna,” EX1004, [0027], and would be coupled to the feed points and/or feed areas of Poilasne’s antennas in the combined system. EX1003, ¶86.

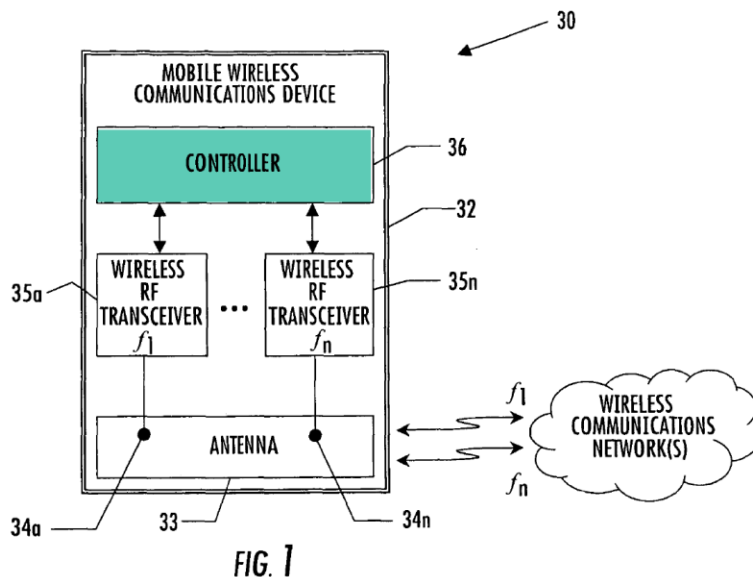
5. **1[d]: wherein said at least one antenna is one or more of, a) an actively tuned antenna, and b) is tuned by one or more passive elements which are selected or interconnected using electronic control.**

Both Wen and Poilasne disclose their respective antenna designs use at least one of prong (a) and (b) of the limitation, and thus meet this limitation. *See* EX1015, 13 (alleging infringement based on “part (b) of this claim element”).

Wen's antenna design: Wen discloses at least prong (b) because Wen's antenna is tuned by one or more passive elements which are selected or interconnected using electronic control. EX1003, ¶¶89-91. Wen's *passive elements* are "leg portions" that make up the antenna and "may advantageously *be selected to tune* the desired operating frequencies of the antenna 33." EX1004, [0035]; *see also id.*, Fig. 2 (annotated below). Each leg portion "may be substantially related to a given operating frequency band" or "may influence multiple operating frequency bands." *Id.* The leg portions are passive elements because they have fixed electrical characteristics, *e.g.*, they may be implemented as "conductive trace[s] on [a] dielectric substrate," and do not include any additional circuitry that changes their electrical characteristics during operation. EX1004, [0032]; EX1003, ¶89.



Wen further discloses a controller 36 (*i.e.*, **electronic control**) that “**selectively operat[es]** at least some of the wireless RF transceivers to ... use the common antenna at a same time.” *Id.*, [0027]. Specifically, the antenna is “**tuned** to provide operation at” specific frequency bands “via a **selective connection** of appropriate wireless RF transceivers” to different “feed point[s]” on different leg portions of the antenna. EX1004, [0039]-[0040]; *see also id.*, [0034] (describing the structure of the feed points), Fig. 1 (annotated below). When the controller selects a specific transceiver connected to a specific feed point, it effectively selects the corresponding leg portion and tunes the antenna to its associated operating frequency or frequencies. EX1003, ¶90.



A POSITA would have also understood that by selectively operating different transceivers to “tune the desired operating frequencies of the antenna,” Wen’s controller **actively** tunes the antenna. EX1004, [0035]; EX1003, ¶91. Specifically,

the controller **actively** “operates at least some (i.e., two or more) of the wireless RF transceivers 35a-35n to advantageously use the common antenna 33 at a same time.” EX1004, [0031]. A POSITA would have understood that the selective operation of particular transceivers is accomplished using active circuit elements, such as switches. EX1003, ¶91. At a minimum, it would have been obvious to a POSITA to use standard active circuit elements, which a POSITA would have been familiar with and would have been capable of incorporating into Wen’s system, to select between different transceivers and leg portions in Wen’s system. *Id.*

Poilasne’s antenna design: Poilasne discloses both prong (a) and prong (b). EX1003, ¶¶92-94. Poilasne’s antenna comprises a “a plurality of portions,” such as a “capacitive area,” an “inductive area,” and a “feed area”; or a “top portion,” “middle portion,” and “bottom portion.” EX1009, [0007]. At least some of these portions are **passive elements** because they are implemented as “conductors” with predetermined lengths and fixed electrical characteristics. *Id.*, [0008], [0044]; EX1003, ¶92. Poilasne also discloses at least one “active control element” that is “electrically coupled to one or more of the portions.” EX1009, [0007].

The control element may “exhibit active capacitive or inductive characteristics,” and “the capacitance of the control element ... may be actively changed ... to vary the resonant frequency of the antenna” (i.e., an **actively tuned antenna**). *Id.*, [0007], [0046]; *see also* EX1003, ¶93. The control element may also

operate as a “switch” that “electrically couples or decouples” two portions of the antenna, changing the effective length of the antenna “to actively change the resonant frequency of the antenna” (i.e., ***tuning the antenna by interconnecting passive elements using electronic control***). *Id.*, [0047]; *see also id.*, [0007] (disclosing control element “coupled to” two portions of the antenna and “compris[ing] a switch”); EX1003, ¶93.

E. Claim 2: The wireless device of claim 1 wherein said passive elements are comprised of either or both lumped or distributed elements.

Wen and Poilasne both disclose passive elements (e.g., Wen’s leg portions and Poilasne’s antenna portions) that comprise ***distributed elements***. *See* 1[d]. The claim terms “lumped” and “distributed” are terms of art that a POSITA would understand describe how the electrical properties of the elements may be modeled. EX1003, ¶95. Lumped element modeling assumes that electrical properties concentrate at a single discrete point in a circuit, while distributed element modeling recognizes that elements may have electrical properties spread throughout the physical dimensions of a component. *Id.* ¶¶95-97; *see also* EX1011, 3 (“distributed: Spread out over an electrically significant length or area.”), 4 (“lumped: effectively concentrated at a single point”).

Wen’s leg portions are ***distributed elements*** because their electrical characteristics depend on their lengths and widths. EX1004, [0034]-[0035]

(explaining how the widths and lengths of the leg portions are “selected to tune the desired operating frequencies of the antenna”). Similarly, Poilasne’s antenna portions are ***distributed elements*** because their electrical characteristics depend at least on their length. EX1009, [0047] (describing changing the “capacitance” and “resonant frequency” by varying the “length” of a “top portion” of the antenna).

F. Claim 3: The wireless device of claim 1 wherein said at least one antenna is used for transmitting, receiving, or transmitting and receiving simultaneously in said plurality of different bands.

Both Wen’s and Poilasne’s antenna designs operate ***simultaneously in a plurality of different bands***. EX1003, ¶¶98-99. Wen discloses that two or more transceivers each having “respective different operating frequency associated therewith” (*i.e.*, transmitting/receiving in ***different bands***), may use the common antenna “at a same time” (*i.e.*, ***simultaneously***). EX1004, [0031]. The antenna will accordingly transmit and/or receive in two frequency bands simultaneously. EX1003, ¶98. Poilasne similarly discloses that its antenna design “is able to cover multiple frequency bands ... ***at the same time.***” EX1009, [0038].

G. Claim 4:

- 1. 4[a]: “The wireless device of claim 1 further comprising: one or more tuners associated with one or more transmitters, receivers or transceivers of said plurality of transmitters, receivers or transceivers”**

It would have been obvious to a POSITA in view of Poilasne to add control elements (*i.e.*, ***tuners***) to Wen’s wireless device. EX1003, ¶¶100-102; *see* Section

VIII.C. Poilasne’s control elements are tuners because they perform tuning and impedance matching for the antenna. EX1009, [0046], [0055], [0060], [0062] (disclosing “control elements” to “vary the resonant frequency of the antenna” and for “impedance matching of the antenna”). The ’358 patent explains that tuners are used to “provide a good impedance match for each of the transceivers.” EX1001, 5:24-32. PO has similarly argued in the related district court proceeding that the “purpose” of a tuner is “to match the impedance of the transmitter, receiver, or transceiver to the antenna at a given operating frequency.” EX1015, 23.

Poilasne discloses that control elements may be “disposed generally in the feed area” and “coupled at one end generally at a feed point” of the antenna. EX1009, [0007], [0051]. The “wireless communication device is coupled to the antenna through the feed point.” *Id.*, [0007]. Thus, in the combined system, Wen’s transceivers for a given feed point are coupled to the antenna through the feed point, and thus **associated with** the control element (**tuner**) coupled between the feed point and the antenna. EX1003, ¶101. This is true regardless of whether Wen’s or Poilasne’s antenna design is used in the combined system, because both designs include feed points. See 1[b].

2. 4[b]: “a controller for controlling tuning of the tuner for said at least one antenna to operate in said plurality of different bands”

Poilasne discloses that its control elements can be “controlled,” *e.g.*, via a “control input,” to change the resonant frequency of the antenna or input impedance of the antenna (*i.e.*, to ***control tuning of the tuner*** to operate the antenna in ***different bands***). EX1009, [0008]-[0009], [0046]-[0048] (describing use of “control inputs”), [0049]-[0052] (describing “controll[ing]” the control element to vary resonant frequency or input impedance).

It would have been obvious to a POSITA to use Wen’s controller to control the control elements because Wen’s controller is already use to selectively operate the transceivers coupled to the control elements in the combined system. EX1003, ¶¶103-06. Specifically, Wen discloses “***a controller 36*** that selectively operates at least some (*i.e.*, two or more) of the wireless RF transceivers 35a-35n to advantageously use the common antenna 33 at a same time.” EX1004, [0031]; *see also id.*, Fig. 1 (annotated below).

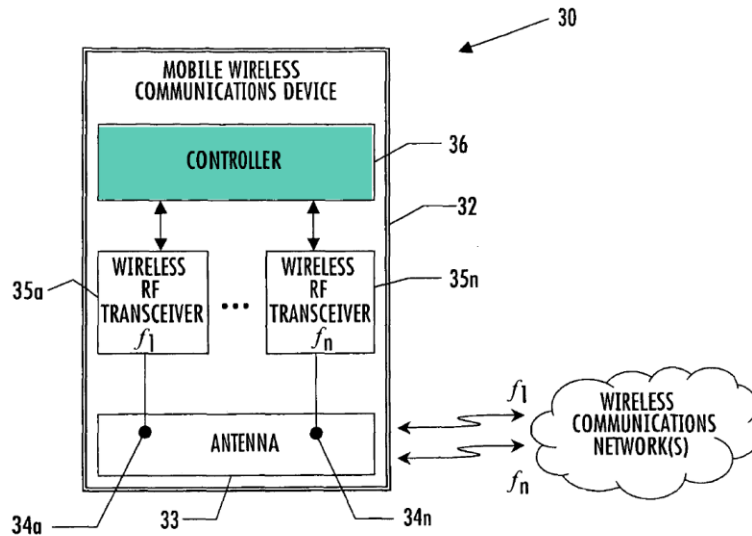


FIG. 1

As noted above, Poilasne's control elements are used to tune the antenna for operation in different frequency bands (*e.g.*, by varying the resonant frequency and/or input impedance). EX1009, [0049]-[0052]. Accordingly, a POSITA would have understood, or it would have been obvious, that controlling the transceivers to use the common antenna at different frequencies would include controlling the control elements to tune the antenna to the corresponding frequency and impedance. EX1003, ¶105.

H. Claim 5: The wireless device of claim 1 wherein said mobile device is selected from the group consisting of computers, telephones, portable computing or communication devices, games, wireless post it notes, wireless memory media, RFID tags, vehicles, clothing, personal data assistants and navigation assistants.

Wen discloses that its system relates to “*cellular telephone* technology” and other *portable communication devices*. EX1004, [0002]; *see also id.*, [0006] (discussing improvements for “handheld wireless communications devices”);

EX1003, ¶¶107-08. For example, Wen teaches configuring its antenna to support operating frequencies for “cellular phone calls,” and “for communicating with one or more communications networks.” *Id.*, [0030], [0038].

I. Claim 6: The wireless device of claim 1 wherein said antenna array is configured for use and implemented in a multiple input multiple output (MIMO) system.

Poilasne teaches that an “antenna comprising multiple elements” (*i.e.*, the antenna array) can achieve “channel optimization” using techniques such as “*multiple input-multiple output [(MIMO)] antenna design.*” EX1009, [0042]. Poilasne also teaches that multiple antennas can be utilized in parallel, which is consistent with MIMO operation. EX1009, [0062], [0064]; EX1003, ¶¶109-10.

J. Claim 7: The wireless device of claim 1 wherein said antenna array is configured for use and implemented in a beam switchable array.

Poilasne teaches that an “antenna comprising multiple elements” (*i.e.*, the antenna array) can achieve “channel optimization” using techniques such as “*beam switching.*” EX1009, [0042]. Poilasne also teaches that its antenna array embodiments with two or more antennas “improve the transmission quality of an antenna” using “*beam switching.*” EX1009, [0062]; EX1003, ¶¶111-12.

K. Claim 25:

- 1. 25[pre]: A wireless device component, comprising a tuner or a set of tuners or controller or other circuitry configurable to be coupled to at least one antenna of one or more antennas wherein at least one of said one or more antennas includes one or more elements or sub-elements, said one or more antennas forming an antenna array, and a**

plurality of transmitters, receivers, or transceivers that operate at one or more frequency bands, wherein said at least one antenna is used by said plurality of transmitters, receivers or transceivers in a plurality of different bands,

“A wireless device component”: Wen discloses a wireless device. *See* 1[pre]. The wireless device includes components such as antennas and transceivers. *See* 1[a], 1[b].

“comprising a tuner or a set of tuners or controller or other circuitry configurable to be coupled to at least one antenna of one or more antennas ... and a plurality of transmitters, receivers, or transceivers ”: Wen and Poilasne render obvious tuners and a controller coupled to an antenna in an antenna array and a plurality of transceivers. *See* 1[b], 4[b] (controller), 4[a] (tuners).

“wherein at least one of said one or more antennas includes one or more elements or sub-elements, said one or more antennas forming an antenna array”: *See* 1[a].

“at least one antenna and a plurality of transmitters, receivers, or transceivers that operate at one or more frequency bands”: *See* 1[a] (antenna), 1[b] (transceivers).

“wherein said at least one antenna is used by said plurality of transmitters, receivers or transceivers in a plurality of different bands”: *See* 1[c].

2. **25[a]: wherein said at least one antenna is one or more of a) an actively tuned antenna, and b) is tuned by one or more passive elements which are selected or interconnected using electronic control.**

See 1[d].

- L. **Claim 26: The wireless portable device of claim 25 wherein said antenna array is configured for use and implemented in a multiple input multiple output (MIMO) system.**

See Claim 6.

- M. **Claim 27: The wireless portable device of claim 25 wherein said antenna array is configured for use and implemented in a beam switchable array.**

See Claim 7.

- N. **Claim 28**

1. **28[pre]: A wireless communication system, comprising:**

To the extent the preamble is limiting, Wen discloses “mobile wireless communications device[s]” that communicate in a “*wireless communication network*” such as a “cellular network” or “wireless local area network.” EX1004, [0030]; EX1003, ¶122.

2. **28[a]: at least one wireless device, comprising:**

See 1[pre].

3. **28[a][i]: one or more antennas; and;**

See 1[a].

4. **28[a][ii]: a plurality of transmitters, receivers or transceivers that operate in one or more frequency bands,**

See 1[b].

5. **28[a][iii]: wherein at least one antenna of said one or more antennas is used by said plurality of transmitters, receivers or transceivers in a plurality of different bands,**

See 1[c].

6. **28[a][iv]: wherein said at least one antenna is one or more of a) an actively tuned antenna, and b) is tuned by one or more passive elements which are selected or interconnected using electronic control; and**

See 1[d].

7. **28[b]: one or more mobile, portable, or fixed devices or platforms which communicate with said at least one wireless device.**

Wen discloses that its wireless device communicates with a “**wireless communication network**” such as a “cellular network” or “wireless local area network.” EX1004, [0030]. A POSITA would have understood that in such networks mobile devices may communicate with a fixed device or platform, such as a base station or router, and through the fixed devices/platforms communicate with other mobile devices (*e.g.*, a cellular telephone call between two mobile devices). EX1003, ¶128; *see also* EX1004, [0050]-[0052] (describing data, voice, and short-range communications modes for communicating with other devices).

- O. **Claim 29: The wireless communication system of claim 28 wherein said at least one wireless device has at least one of said one or more antennas which includes one or more elements or**

sub-elements, said one or more antennas forming an antenna array.

See 1[a].

P. Claim 30: The wireless communication system of claim 29 wherein said antenna array of at least one wireless device is configured for use and implemented in a multiple input multiple output (MIMO) system.

See Claim 6.

Q. Claim 31: The wireless communication system of claim 29 wherein said antenna array of said at least one wireless device is configured for use and implemented in a beam switchable array.

See Claim 7.

IX. GROUND II: CLAIMS 8-21, 23-24 ARE RENDERED OBVIOUS BY WEN IN VIEW OF POILASNE AND GOVIND

Wen in view of Poilasne renders obvious a wireless device comprising a multiband antenna array with plurality of transceivers with tuners, as described in Ground I. Govind further discloses a ***multiband*** transceiver as an alternative to a plurality of transceivers. In the combined system, Wen's transceivers are substituted with one or more multiband transceivers, as taught by Govind.

A. Govind (EX1008)

U.S. Pat. No. 7,489,914 ("Govind") was filed on April 25, 2005 and published on November 10, 2005. It is prior art under at least pre-AIA 35 U.S.C. § 102(b).

Govind discloses "multi-band, multimode integrated RF transceiver topologies" that enable "a multi-band transceiver" to operate at "a first frequency

and a second frequency different from the first frequency.” EX1008, 2:8-13, 2:21-

31. Govind discloses such a multi-band transceiver may be connected to “a multi-band antenna ... for receiving signals in various frequency ranges.” *Id.*, 17:17-31.

The multi-band transceiver comprises a voltage controlled oscillator (VCO) “for simultaneously generating oscillation signals at a first frequency and a second frequency for a multi-band transceiver,” which enables concurrent operation in multiple frequency bands. *Id.*, 2:8-20, 2:32-47.

B. Motivation to Combine

Wen and Poilasne are addressed in Section VIII.C. A POSITA would have further been motivated to replace Wen’s plurality of transceivers with one or more multiband transceivers, as taught by Govind, and would have reasonably expected the combination to succeed. EX1003, ¶¶135-41.

First, multiband transceivers were well known in the art and were commercially available prior to August 2008. EX1003, ¶137. For example, Int. Pub. No. WO 2005/029720 (“Leenaerts”), published on March 31, 2005, discloses that multiband transceivers were already in use, noting that “[r]elatively recent, multi-band transceivers and accordingly multi-band receivers and multi-band transmitters have been considered,” offering the advantage of being able to “work with signals situated in different bands and being adapted to different communication protocols.” EX1013, 1:11-15. The ’358 Patent similarly

acknowledges that “it is possible to purchase multi-band transceiver chips for popular wireless standards where different antenna ports are provided for various RF output bands.” EX1001, 6:56-59. Accordingly, replacing the plurality of transceivers connected to Wen’s multiband antenna with one or more multiband transceivers would have been a simple substitution of known elements with predictable results. EX1003, ¶137.

Second, Wen provides an express motivation to combine. *Id.*, ¶138. Wen teaches that “as the functionality of cellular communications devices continues to increase, so too does the demand for ***smaller devices which are easier and more convenient for users to carry.***” EX1004, [0003]. One “challenge” in reducing device size is “the relatively limited amount of space available for the antenna,” particularly “where multi-frequency band operation is required.” *Id.* A POSITA would have thus been motivated to look to multiband transceivers to reduce the number and size of transceiver components necessary to support multiple frequency bands. EX1003, ¶138.

Third, Govind provides a similar express motivation to combine. *Id.*, ¶139. For example, Govind discloses using multiband transceivers in systems with “a multi-band antenna ... for receiving signals in various frequency ranges.” EX1008, 17:17-31. In particular, Govind’s multiband transceivers “can be reused at different frequency ranges, thereby reducing the number of components required.” *Id.*, 2:8-

13. Govind’s approach allows for “optimization of space and power requirements,” “reduced power consumption,” and “lower costs,” among other advantages. *Id.*, 21:48-57. A POSITA would have understood that these improvements are particularly beneficial for mobile devices, where size, power consumption (*i.e.*, battery life), and cost are all important design factors. EX1003, ¶139.

In addition, Wen, Poilasne, Govind, and the ’358 Patent are all analogous art because they are directed to the same technological subject matter, multiband antenna systems for wireless devices. EX1001, Abstract; EX1004, Abstract; EX1008, 1:23-27 (invention relates to “RF single-band and multi-band transceivers ... for use in radio frequency (RF) applications”), 17:18-36 (multiband antenna embodiment); EX1009, [0038].

Finally, a POSITA would have reasonably expected the combination to succeed. EX1003, ¶141. As noted above, multiband transceivers were well known and commercially available prior to the ’358 Patent. EX1013, 1:11-15; EX1001, 6:54-57. A POSITA would have been capable of replacing Wen’s plurality of transceivers with one or more multiband transceivers using routine engineering to achieve predictable results. EX1003, ¶141. In addition, because Wen’s controller and antenna are already configured to operate using multiple frequency bands, it would have been trivial for a POSITA to integrate multiband transceivers into Wen’s system. *Id.*

C. Claim 8

1. 8[pre]: A wireless device, comprising:

See Ground I, 1[pre].

2. 8[a]: one or more antennas wherein at least one of said one or more antennas includes one or more elements or sub-elements, said one or more antennas forming an antenna array;

See Ground I, 1[a].

3. 8[b]: at least one multiband transmitter, receiver or transceiver;

It would have been obvious to a POSITA to use a multiband transceiver in Wen's system based on Govind. EX1003, ¶¶144-46.

Govind discloses "multi-band, multimode integrated RF transceiver topologies" that enable a "a ***multi-band transceiver***" to operate at "a first frequency and a second frequency different from the first frequency." EX1008, 2:8-13, 2:21-31. Govind's multi-band transceiver comprises voltage controlled oscillators (VCOs) "for simultaneously generating oscillation signals at a first frequency and a second frequency for a multi-band transceiver." *Id.*, 2:8-20, 2:32-47. The multi-band transceiver may be connected to "a multi-band antenna ... for receiving signals in various frequency ranges." *Id.*, 17:17-31.

For the reasons discussed above in Section IX.B., a POSITA would have been motivated to apply Govind's teachings regarding multi-band transceivers to Wen's wireless device, and would have reasonably expected the combination to succeed.

4. **8[c]: a tuner associated with said at least one multiband transmitter, receiver, or transceiver; and.**

See Ground I, 4[a].

5. **8[d]: a controller for controlling tuning of the tuner to a plurality of different bands,**

See Ground I, 4[b].

6. **8[e]: wherein at least one antenna of said one or more antennas is used by said at least one multiband transmitter, receiver or transceiver in a plurality of different bands,**

See Ground I, 1[c]. In Wen's antenna design, each transceiver is connected to a feed point on one of the leg portions of the antenna. EX1004, [0034]-[0035], [0039]-[0040]. A feed point/leg portion may operate at a plurality of frequency bands. *Id.*, [0039]-[0040] (first feed point "provide[s] operation at 900 MHz, 1800 MHz, and 5 GHz"). In Poilasne's antenna design, the feed point similarly provides a connection to an antenna that can "cover multiple frequency bands ... at the same time." EX1009, [0038]. In both instances, a multiband transceiver connected to a feed point uses the antenna in a plurality of different bands. EX1003, ¶149.

7. **8[f]: wherein said at least one antenna is one or more of an actively tuned antenna, and; is tuned by one or more passive elements which are selected or interconnected using electronic control.**

See Ground I, 1[d].

- D. Claim 9: The wireless device of claim 8 said at least one antenna is used for transmitting, receiving, or transmitting and receiving simultaneously in said plurality of different bands.**

See Ground I, Claim 3.

- E. Claim 10: The wireless device of claim 8 wherein said mobile device is selected from the group consisting of computers, telephones, portable computing or communication devices, games, wireless post it notes, wireless memory media, RFID tags, vehicles, clothing, personal data assistants and navigation assistants.**

See Ground I, Claim 5.

- F. Claim 11: The wireless device of claim 8 wherein said passive elements are comprised of either or both lumped or distributed elements.**

See Ground I, Claim 2.

- G. Claim 12: The wireless device of claim 8 wherein said antenna array is configured for use and implemented in a multiple input multiple output (MIMO) system.**

See Ground I, Claim 6.

- H. Claim 13: The wireless device of claim 8 wherein said antenna array is configured for use and implemented in a beam switchable array.**

See Ground I, Claim 7.

- I. Claim 14:**

- 1. 14[pre]: A wireless device, comprising:**

See 8[pre].

2. **14[a]: at least one multiband antenna which includes one or more elements or sub-elements and which is configured to form an antenna array;**

See 8[a].

3. **14[b]: at least one multiband transmitter, receiver or transceiver;**

See 8[b].

4. **14[c]: a tuner associated with said at least one multiband transmitter, receiver, or transceiver, said tuner matching said at least one multiband antenna to said at least one multiband transmitter, receiver or transceiver in a plurality of different bands simultaneously.**

“a tuner associated with said at least one multiband transmitter, receiver, or transceiver”: See 8[c].

“said tuner matching said at least one multiband antenna to said at least one multiband transmitter, receiver or transceiver in a plurality of different bands simultaneously”: Wen in view of Poilasne and Govind renders this limitation obvious. EX1003, ¶¶159-62. As discussed above, it would have been obvious to a POSITA to substitute multiband transceivers for Wen’s transceivers in view of Govind. See 8[b]. It would further have been obvious to a POSITA to use a tuner to match the impedance of the antenna and an associated transceiver in view of Poilasne. See 8[c]. Poilasne expressly teaches that its control elements “effectuate[] coverage of multiple frequency bands and provides the most optimized solution in terms of input impedance.” EX1009, [0067]. Poilasne further teaches that its

solution “is able to cover multiple frequency bands ... ***at the same time.***” *Id.*, [0038].

A POSITA would have understood from these disclosures that the control element (***tuner***) matches the antenna and transceivers in multiple bands simultaneously.

EX1003, ¶161.

- J. Claim 15: The wireless device of claim 14 said at least one antenna is used for transmitting, receiving, or transmitting and receiving simultaneously in said plurality of different bands.**

See Claim 9.

- K. Claim 16: The wireless device of claim 14 wherein said mobile device is selected from the group consisting of computers, telephones, portable computing or communication devices, games, wireless post it notes, wireless memory media, RFID tags, vehicles, clothing, personal data assistants and navigation assistants.**

See Claim 10.

- L. Claim 17: The wireless device of claim 14 wherein said antenna array is configured for use and implemented in a multiple input multiple output (MIMO) system.**

See Claim 12.

- M. Claim 18: The wireless device of claim 14 wherein said antenna array is configured for use and implemented in a beam switchable array.**

See Claim 13.

- N. Claim 19:**

- 1. 19[pre]: A wireless portable device, comprising:**

See 8[pre] (wireless device), Claim 10 (portable devices specifically).

2. **19[a]: one or more antennas wherein at least one of said one or more antennas includes one or more elements or sub-elements, said one or more antennas forming an antenna array, said one or more antennas radiating or receiving electromagnetic energy at particular frequency bands, at least one of said one or more antennas radiating or receiving electromagnetic energy at a plurality of particular frequency bands;**

Wen and Poilasne disclose or render obvious ***one or more antennas***. See 8[a].

Wen's and Poilasne's antenna designs each send and receive signals at a ***plurality of particular frequency bands***. See 8[e] (antenna is used by transceivers in a plurality of different bands); EX1004, [0039]-[0040] (Wen's antenna providing operation at, *e.g.*, "900 MHz, 1800 MHz, and 5 GHz"), [0048] (mobile device "may send and receive communication signals" via the antennas); EX1009, [0038] (Poilasne's antenna "cover[ing] multiple frequency bands ... at the same time"). A POSITA would have understood that antennas receive communication signals by ***receiving electromagnetic energy*** at particular frequency bands, and that antennas transmit communication signals ***by radiating electromagnetic energy*** at particular frequency bands. EX1003, ¶168.

3. **19[b]: one or more components selected from the group consisting of receivers, transmitters and transceivers, said one or more components connected to said at least one of said one or more antennas, whereby;**

Wen discloses ***one or more transceivers*** connected to ***one or more antennas***.

See Ground I, 1[b]-1[c].

4. **19[c]: at least one of said one or more components transmits or receives electromagnetic energy simultaneously at two or more of said plurality of particular frequency bands, or two or more components transmit or receive electromagnetic energy at two or more of said plurality of particular frequency bands.**

Wen discloses one or more transceivers (*i.e.*, **components**). *See* 19[b]. A POSITA would have understood that transceivers send and receive signals by *transmitting and receiving electromagnetic energy*, respectively. EX1003, ¶¶170-73.

“two or more components transmit or receive electromagnetic energy simultaneously at two or more of said plurality of particular frequency bands”:

Wen discloses the second optional prong of this limitation because it discloses a plurality (*i.e.*, **two or more**) transceivers, each operating (*i.e.*, sending or receiving) in different frequency bands. *See* Ground I, 1[b]. Wen’s transceivers collectively operate in a ***plurality of frequency bands***. EX1003, ¶171. Wen further discloses that multiple transceivers may use the antenna at different frequency bands “at the same time” (*i.e.*, ***simultaneously***). EX1004, [0031]; *see also* Ground I, Claim 3.

“at least one of said one or more components transmits or receives electromagnetic energy simultaneously at two or more of said plurality of particular frequency bands”: Wen renders obvious the first optional prong of this limitation. EX1003, ¶172. It would have been obvious to a POSITA to use a multiband transceiver in Wen’s system based on Govind. *See* 8[b]. A ***multiband***

transceiver transmits and receives in two or more frequency bands simultaneously.

EX1003, ¶172; *see also* 8[b].

- O. Claim 20: The wireless portable device of claim 19 wherein said wireless portable device is selected from the group consisting of computers, telephones, personal data assistants, and navigation assistants.**

See Claim 10.

- P. Claim 21: The wireless portable device of claim 19 further comprising one or more tuners which match electromagnetic energy at a particular frequency band to only one of said one or more components.**

It would have been obvious to a POSITA to use Poilasne's control elements (*i.e.*, **tuners**) to match the impedance and resonant frequency of the antenna and an associated transceiver. *See* 8[c]. Wen discloses that each of its transceivers has "a respective different operating frequency." EX1004, [0027]. A POSITA would have understood that in the combined system, a particular control element would match a particular frequency band only to the transceiver that operates at that frequency. EX1003, ¶175.

- Q. Claim 23: The wireless portable device of claim 19 wherein said antenna array is configured for use and implemented in a multiple input multiple output (MIMO) system.**

See Claim 12.

- R. Claim 24: The wireless portable device of claim 19 wherein said antenna array is configured for use and implemented in a beam switchable array.**

See Claim 13.

X. GROUND III: CLAIM 22 IS RENDERED OBVIOUS BY WEN IN VIEW OF POILASNE, GOVIND, AND VLAHOS

Wen, Poilasne, and Govind collectively disclose and render obvious a wireless device comprising a multiband antenna array, multiband transceivers, and tuners, as described in Ground II. Vlahos further discloses filters and similar elements to provide RF isolation for different components.

A. Vlahos (EX1007)

U.S. Pat. No. 5,926,751 (“Vlahos”) was filed on February 19, 1997 and issued on July 20, 1999. It is prior art under at least pre-AIA 35 U.S.C. § 102(b).

Vlahos discloses a “method and apparatus” that “enables a communication device ... to operate in multiple bands.” EX1007, Abstract. The device includes a “transceiver” comprising a “transmitter” that “transmits through an antenna” and a “receiver” for “[i]nformation received by the communication device’s antenna.” *Id.*, 2:25-31, Fig. 1. The receiver includes “separate path[s] ... for each band,” each comprising a “preselector filter,” a “preamplifier” that “provide[s] isolation ... from transmitter energy and other spurious frequencies,” and a “combination filter.” *Id.*, 2:51-3:2. An “LC trap circuit” is also used to “filter the input RF signals (for each band).” *Id.*, 3:29-33.

B. Motivation to Combine

Wen, Poilasne, and Govind are addressed in Sections VIII.C and IX.B.

A POSITA would have further been motivated to include filters and other RF isolation components, as taught by Vlahos, in Wen’s wireless device (as modified by Poilasne and Govind), and would have reasonably expected the combination to succeed. EX1003, ¶¶181-87.

First, the need for RF isolation in multi-band wireless communication systems would have been well understood by a POSITA. EX1003, ¶184. RF isolation and filtering for transmitters and receivers in wireless devices long predates the ’358 patent, as evidenced at least by its disclosure in Vlahos over a decade earlier. Indeed, the ’358 patent acknowledges that the “key to proper operation” of a transceiver is to “provide sufficient RF isolation,” and notes that “RF filtering and overload protection” is already available in “commercially available wireless transceivers in various popular bands.” EX1001, 5:32-38. Accordingly adding RF isolation and filtering to Wen represents the use of a known technique with predictable results. EX1003, ¶184.

Second, Vlahos provides an express motivation to combine. EX1003, ¶185. Vlahos discloses that its filters and other isolation circuitry “provide isolation ... from transmitter energy and other spurious frequencies.” EX1007, 2:59-65. A POSITA would have understood that absent such filtering and isolation, the transmitter energy and other spurious frequencies may interfere with proper operation of a receiver. EX1003, ¶185. In addition, a POSITA would have

understood that filtering and isolation circuitry is particularly important in a multiband system, where different components within the system are configured to receive or transmit signals at different frequencies, which increase the risk of interference. *Id.*

In addition, like Wen, Poilasne, Govind, and the '358 Patent, Vlahos is analogous art because it is directed to RF components for wireless devices that operate in multiple frequency bands. EX1007, Abstract (“A method and apparatus enables a communication device ... to operate in multiple bands.”).

Finally, a POSITA would have reasonably expected the combination to succeed. EX1003, ¶187. As noted above, RF isolation techniques were standard, well known, and commercially available prior to the '358 Patent. EX1001, 5:32-38. A POSITA would have been capable of adding filters and isolation circuitry to Wen's transceivers using routine engineering to achieve predictable results. EX1003, ¶187.

C. Claim 22: The wireless portable device of claim 19 further comprising isolation means for isolating said one or more components from more than one particular frequency band of said plurality of frequency bands.

This is a means-plus-function limitation. See Section VII.A.

It would have been obvious to a POSITA in view of Vlahos to use isolation circuitry to filter unwanted bands for each transceiver in Wen's system (as modified by Poilasne and Govind).

Vlahos discloses several types of circuitry for filtering out unwanted frequency bands. EX1003, ¶¶188-91. For example, Vlahos disclose that its receiver includes “separate path[s] ... for each band.” EX1007, 2:51-54. Each path includes a “preselector filter” that only passes RF signals in a specific frequency band. *Id.*, 2:54-60. Each path also includes a “preamplifier” with an “enable line” that “controls a transistor to provide isolation ... from transmitter energy and other spurious frequencies.” *Id.*, 2:60-65. Each path also includes a “combination filter” that further filters the received signal before it is output to a mixer. *Id.*, 2:65-3:6. In addition, Vlahos discloses an “LC trap circuit” in the mixer that further “filter[s] the input RF signals (for each band).” *Id.*, 3:29-33; *see also* EX1001, 5:42-47 (describing the use of an “RF Trap” to provide isolation).

For the reasons discussed above in Section X.B, a POSITA would have been motivated to apply Vlahos’s teachings regarding filtering and isolation to Wen’s wireless device, and would have reasonably expected the combination to succeed.

XI. GROUND IV: CLAIMS 1-7, 25-31 ARE RENDERED OBVIOUS BY RUBINSHTEYN IN VIEW OF WEN AND POILASNE

Rubinshteyn discloses a wireless device comprising an antenna and a multiband transceiver that operates in multiple frequency bands. Poilasne discloses an antenna array, and control elements for tuning the antenna. To the extent PO argues that Rubinshteyn does not discloses a plurality of transmitters, receivers, or transceivers, Wen discloses connecting a plurality of transceivers to a multiband

antenna. A POSITA would have been motivated to apply Wen's teachings regarding multiple transceivers and Poilasne's teaching of an antenna array to Rubinshteyn's wireless device, as detailed below.

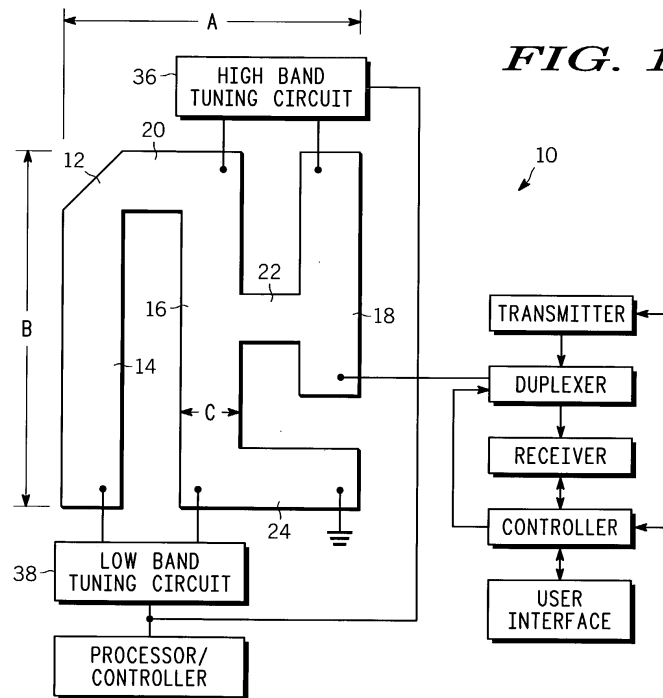
A. Rubinshteyn (EX1006)

U.S. Pat. Pub. No. 2004/0125027 ("Rubinshteyn") was filed on December 27, 2002, and was published July 1, 2004. It is prior art under at least pre-AIA 35 U.S.C. § 102(b).

Rubinshteyn teaches a wireless communication device having a planar, tunable antenna with a low band element and a high band element designed to "resonate[] at two different center frequencies simultaneously, which permits simultaneous operation of the device at two different frequencies," allowing ***"reception or transmission of RF signals...at two different frequencies simultaneously."*** EX1006, [0016]. The low band element and high band element are each connected to, respectively, a low band tuning circuit and high band tuning circuit on the antenna that "electronically alter the frequencies at which the elements...resonate" by selectively coupling a capacitive reactance or "a combination of a capacitive reactance and an inductive reactance" between predetermined points on the antenna. *Id.*, [0028]. A processor or controller is connected to both the high and low band tuning circuits to "independently control

[both] circuits to tune the antenna ... to multiple pairs of high band and low band frequencies.” *Id.*

Rubinshteyn Figure 1 illustrates one embodiment of such tunable planar antenna with connected elements such as tuning circuits and controller:



B. Motivation to Combine

A POSITA would have been motivated to include a plurality of transmitters, receivers, or transceivers, as taught by Wen, in Rubinshteyn’s wireless device, and would have reasonably expected the combination to succeed. EX1003, ¶¶196-204.

First, both single-band and multiband transceivers were well known in the art and were commercially available prior to August 2008. EX1003, ¶197; *see also*

EX1013, 1:11-15 (discussing “transceivers ... built for being used in only one band” and “multi-band transceivers”). The ’358 patent similarly acknowledges that both single-band and multi-band transceivers were known in the prior art. EX1001, 4:62-5:4 (describing prior art devices using “different band transceivers”), 6:56-59 (“[I]t is possible to purchase multi-band transceiver chips for popular wireless standards ...”). Accordingly, using a plurality of transceivers with Rubinshteyn’s multiband antenna would have been a simple substitution of known elements with predictable results. EX1003, ¶197.

Second, a POSITA would have understood that single-band transmitters, receivers, or transceivers, and multi-band transmitters, receivers, and transceivers, are the two known alternatives available to a system designer in a multiband wireless system. EX1003, ¶198. Accordingly, it would have been obvious to a POSITA to try from among these two finite number of well-known and predictable solutions. *Id.* Further, a POSITA would have understood that selecting between multiband transceivers or a plurality of single-band transceivers in a multiband wireless device may depend on design constraints. *Id.* For example, Govind discloses that multiband transceivers may present “difficulties in power consumption, compatibility, interference, and integration.” EX1008, 1:48-50. Although Govind discloses a multi-band transceiver that “may satisfy one or more of these issues,”

Id., 2:1-4, design constraints may nevertheless limit a particular device to use a plurality of single-band transceivers. EX1003, ¶198.

A POSITA would have further been motivated to modify Rubinshteyn to use an antenna array and control elements in view of Poilasne, and would have reasonably expected the combination to succeed. EX1003, ¶199.

First, Poilasne provides express motivations to utilize antenna arrays in wireless devices by teaching that “new generations” of devices will need to use antenna arrays with multiple antenna elements to provide “beam switching, beam steering,” and other advanced techniques for improving wireless performance. EX1009, [0005]; *see also* EX1003, ¶200. Poilasne discloses that these techniques can be achieved using antenna arrays with two or more antenna elements. EX1009, [0060]-[0067]; *see also* Section VIII.C.

Second, Poilasne provides express motivations to utilize control elements to tune the antenna, both for turning individual antennas in the antenna array on and off, as well as to “vary the resonant frequency of the antenna” and “control the input impedance of the antenna.” EX1009, [0046], [0051], [0062]; EX1003, ¶201. The latter uses provide additional benefits, including real-time switching between regional frequency bands and real-time adjustment of input impedance to “maintain the best antenna characteristics.” EX1009, [0037], [0051]; *see also* Section VIII.C. In addition, the use of tuners (such as Poilasne’s control elements) in antenna circuits

was widespread and well known before the '358 patent, and had well known benefits such as improving power transfer, minimizing distortion, and preventing overheating. EX1014, 1:51-2:9; EX1003, ¶201.

In addition, Rubinshteyn, Wen, Poilasne, and the '358 patent are all analogous art because they are directed to the same technological subject matter, multiband antenna systems for wireless devices. EX1001, Abstract; EX1004, Abstract; EX1006, [0016] (describing a “tunable antenna” in a “wireless communication device” that “can operate at multiple frequencies”); EX1009, [0038].

Finally, a POSITA would have reasonably expected the combination to succeed. EX1003, ¶203. Adding multiple transceivers into Rubinshteyn’s wireless device represents a simple substitution of Rubinshteyn’s individual multiband receiver and transmitter for a plurality of transmitters, receivers, or transceivers. *Id.* A POSITA would have capable of implementing this change using routine engineering to achieve predictable results. *Id.* In addition, because Rubinshteyn’s antenna is already configured to operate using multiple frequency bands, it would have been trivial for a POSITA to use a plurality of transceivers instead of a single multiband transceiver in connection with the multiband antenna. *Id.*

A POSITA would have also understood that Poilasne’s teachings can be beneficially applied to Rubinshteyn in one of two ways: first, by modifying Rubinshteyn’s antenna to operate in an array (*e.g.*, using two or more instances of

Rubinshteyn's antenna that that operate together as an array, and controlled by Poilasne's control elements, similar to the multi-element antenna embodiments shown in Figures 9A and 9B of Poilasne); or second, by replacing Rubinshteyn's antenna with a multi-element antenna embodiment taught by Poilasne. EX1003, ¶204. Poilasne describes these embodiments and their practical implementations in sufficient detail to enable a POSITA to apply them to Wen using routine engineering skills that would be within the capacity of a POSITA. *Id.*

C. Claim 1

1. 1[pre]

To the extent the preamble is limiting, Rubinshteyn discloses “tunable, multiple-frequency planar antennas ***for wireless communication devices.***” EX1006, [0001]; *see also* EX1003, ¶¶205-06.

2. 1[a]

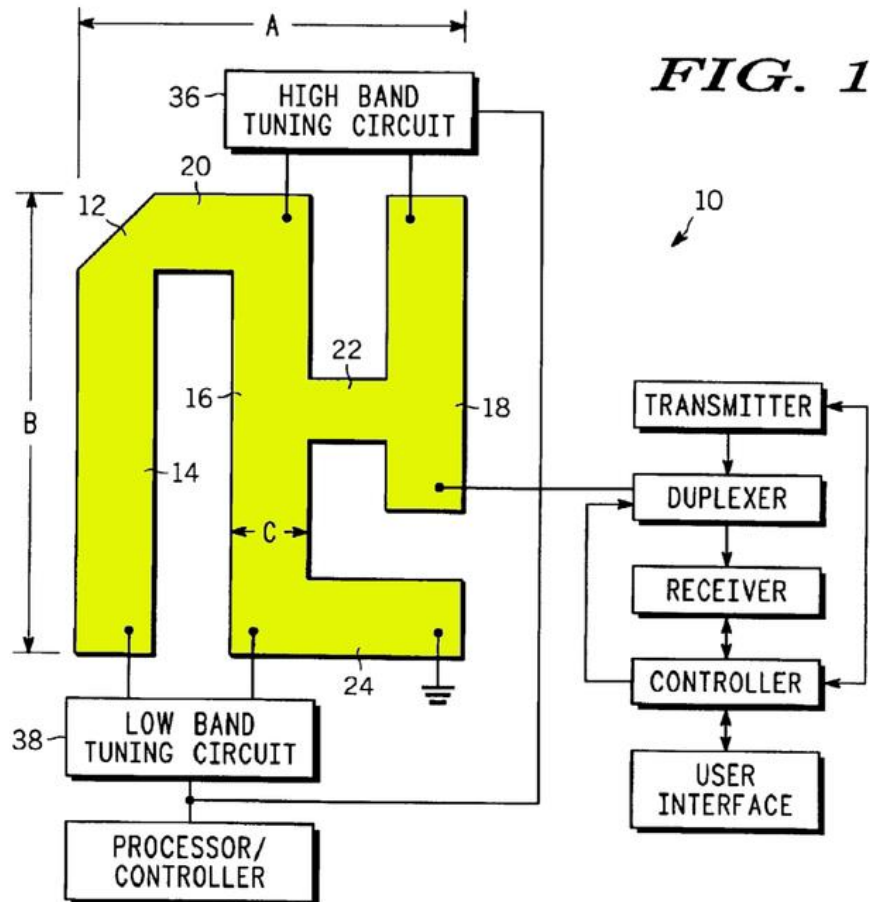
It would have been obvious to a POSITA to use an antenna array in Rubinshteyn's wireless device in view of Poilasne. EX1003, ¶¶207-11. As discussed in Section XI.B, a POSITA would have been motivated to apply Poilasne's antenna array to Rubinshteyn's device, and would have understood two ways to add an antenna array to Rubinshteyn's system: either by forming an array comprising individual antennas according to Rubinshteyn's antenna design, or by replacing Wen's antenna with an antenna array embodiment taught by Poilasne and incorporating Poilasne's antenna design. *Id.*

Poilasne’s antenna design: Poilasne discloses an antenna design comprising a dipole antenna with multiple **sub-elements** (*i.e.*, “portions”), with two or more such dipole antennas forming an **antenna array** for beam switching and MIMO. EX1009, [0007], [0042], [0060]; *see also id.*, [0062]-[0063], Fig. 9A (example with two dipole antennas); EX1003, ¶208; Ground I, 1[a].

A POSITA would have understood that Poilasne’s array of dipole antennas can be used as the antenna in Rubinshteyn’s system. Rubinshteyn expressly teaches that its antenna is a “tunable, multiple-frequency planar antenna[.]” EX1006, [0001]. A dipole antenna is one type of planar antenna. EX1003, ¶209.

Rubinshteyn’s antenna design: Rubinshteyn discloses one or more antennas. EX1003, ¶210. For example, Rubinshteyn discloses various configurations of “a multi-band antenna.” EX1006, [0002], [0041], Fig. 1. The multiband antenna, in one embodiment, is “designed such that it resonates at two different center frequencies simultaneously, which permits simultaneous operation of the device at two different frequencies.” EX1006, [0016]. In particular, Rubinshteyn’s antenna includes **at least two elements**, *e.g.*, “high band element” and a “low band element” that “is simultaneously resonant at a lower frequency than the high band element.” *Id.*, [0022]. As a result, “the antenna 12 is resonant at two different center frequencies, which allows operation in two bands simultaneously.”

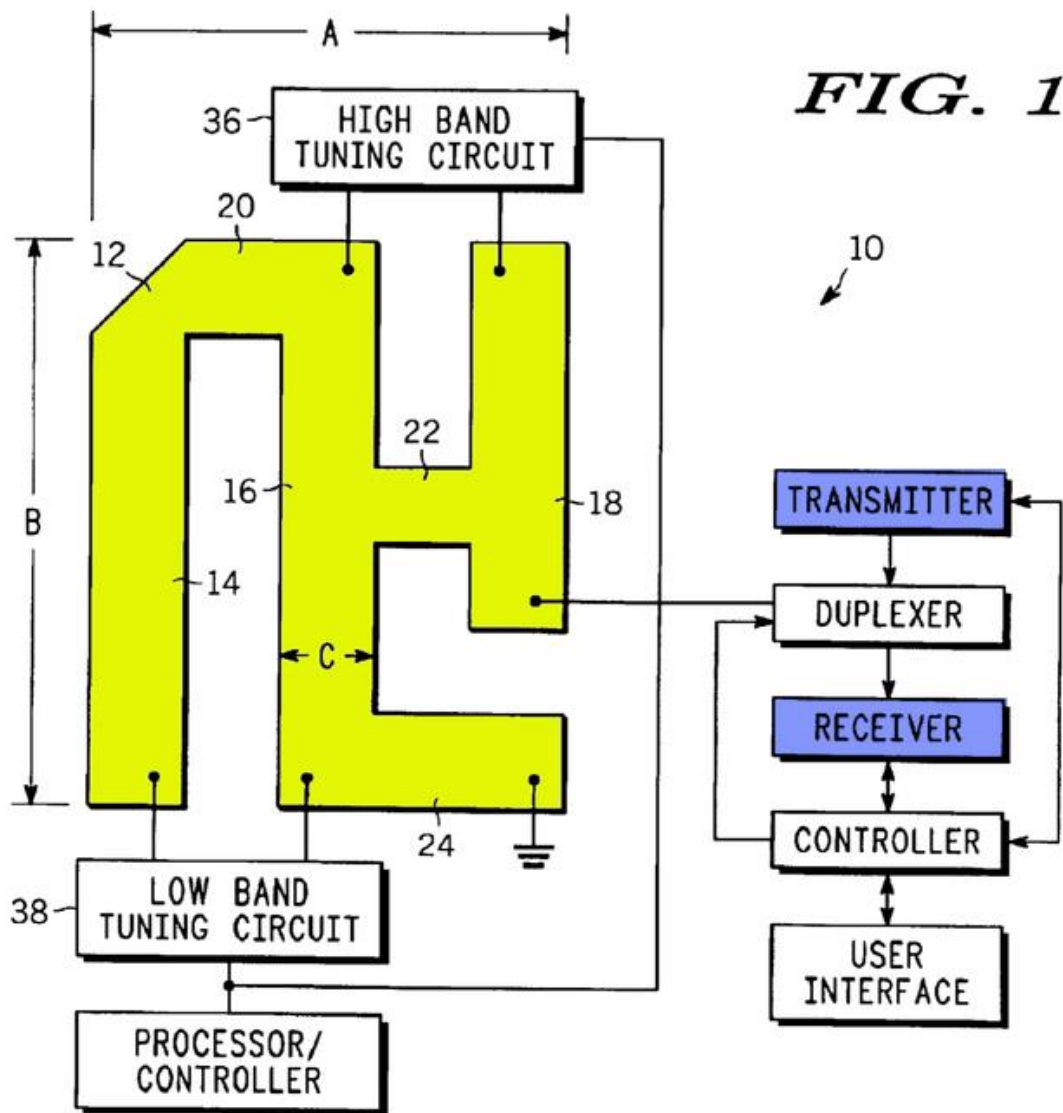
Id. The antenna (annotated in yellow) is shown in Figure 1, reproduced and annotated below.



As discussed above, Poilasne discloses an array of two or more dipole antennas that work together to provide beam switching, steering, or MIMO capabilities. EX1009, [0042], [0060]-[0062], [0067], Fig. 9A, Fig. 11. A POSITA would have understood that Rubinshteyn's antenna design may be used for each of the antenna elements in Poilasne's array because Poilasne's antenna is a "planar antenna," *e.g.*, a dipole antenna. EX1006, [0001]; EX1003, ¶211.

3. 1[b]

Rubinshteyn discloses at least one multiband transmitter and receiver. EX1003, ¶¶213-18. For example, Rubinshteyn discloses that the high band and low band elements in the antenna “share a common RF input port ... which is connected to a duplexer.” EX1006, [0022]. The duplexer in turn connects the high band and low band elements to “**a transmitter and a receiver.**” *Id.*; see also *id.*, Fig. 1 (annotated below). A POSITA would have understood that Rubinshteyn’s transmitter and receiver operate in at least the high frequency band and the low frequency band (corresponding to the high band and low band antenna elements), and thus are **multiband**. EX1003, ¶213. For example, Rubinshteyn discloses that its multiband system “allows a user ... to use multiple services with the same antenna.” EX1006, [0016]. A POSITA would have understood that this requires the device to be capable of transmitting **and** receiving at the frequency bands of the supported services. EX1003, ¶213. Rubinshteyn also expressly discloses that “reception **or** transmission of RF signals may be performed at **two different frequencies simultaneously,**” further confirming that the transmitter and receiver are multiband. EX1006, [0016].



Rubinshteyn also discloses a *plurality* of receivers, transmitters, or transceivers because it discloses one transmitter and one receiver, *i.e.*, two components from the recited set of components. EX1003, ¶214. When Rubinshteyn's antennas are used in the antenna array of Poilasne, the transmitter and receiver would be connected to the antenna feed points. *Id.*

To the extent PO argues this limitation requires a plurality of receivers, a plurality of transmitters, or a plurality of transceivers, it would have been obvious to a POSITA to use a plurality of transceivers, rather than a single multiband transmitter and receiver, as taught by Wen. EX1003, ¶¶215-18.

Wen discloses “a **plurality** of wireless radio frequency (RF) **transceivers** ... coupled to respective ones of the signal feed points of [a] common antenna,” each having “**a respective different operating frequency.**” EX1004, [0027], [0031], [0039], Fig. 1. Thus, each transceiver **operates in at least one frequency band.** EX1003, ¶175; *see also* Ground I, 1[b].

Wen’s transceivers are also useable with Poilasne’s antenna design because Poilasne’s antennas includes feed points and/or feed areas through which the wireless communication device is coupled to the antenna. EX1009, [0007], [0051]-[0052]; EX1003, ¶217; *see also* Ground I, 1[b].

For the reasons discussed above in Section XI.B, a POSITA would have been motivated to apply Wen’s teachings regarding a plurality of transceivers to Rubinshteyn’s wireless device, and would have reasonably expected the combination to succeed.

4. 1[c]

As described above, Rubinshteyn discloses a transmitter and a receiver (*i.e.*, a **plurality of transmitters, receivers, or transceivers**) that operate in at least a high

band and a low band (*i.e.*, **a plurality of different bands**). See Limitation 1[b]; EX1003, ¶¶219-22. Alternatively, Wen discloses a **plurality of transceivers** that operate in **a plurality of different bands** and connect to antenna feed points (*e.g.*, the RF input point on Rubinshteyn’s antenna or the feed points on Poilasne’s antennas). See Limitation 1[b]; *see also* EX1004, [0029] (example with “different operating frequencies ... within a range of about 900 MHz to 6 GHz”).

When Rubinshteyn’s antenna design is used, *see* 1[a], Rubinshteyn discloses the antenna (*e.g.*, antenna 12, annotated in yellow in Figure 1 above) “resonates at two different center frequencies simultaneously, which permits simultaneous operation of the device at two different frequencies [*i.e.*, **a plurality of different bands**].” EX1006, [0016]; *see also* Limitation 1[a]; EX1003, ¶220. Rubinshteyn’s antenna **is used by** Rubinshteyn’s receiver and transmitter in the plurality of different bands because “[t]he low band element 26 and the high band element 28 share a common RF input point, which ... is connected to a duplexer,” and subsequently “connected to [the] transmitter and a receiver.” EX1006, [0022]; *see also* EX1003, ¶220. Alternatively, if Wen’s transceivers are used, *see* 1[b], Wen discloses that the antenna is “**shared** by [the] plurality of wireless radio frequency (RF) transceivers 35a-35n,” and thus used in multiple bands by the different transceivers. EX1004, [0031]; EX1003, ¶220.

When Poilasne’s antenna design is used, *see* 1[a], Poilasne discloses that its antenna is “able to cover multiple frequency bands, either independently or at the same time.” EX1009, [0038]; *see also id.*, [0067]. Rubinshteyn’s transmitter and receiver are coupled to the “RF input point” of the antenna, which would be the feed points and/or feed areas in Poilasne’s antennas, and would thus use the antennas in a plurality of different bands. EX1006, [0022]; EX1003, ¶221. Alternatively, if Wen’s transceivers are used, *see* 1[b], the transceivers are “coupled to respective ones of the signal feed points of the common antenna,” EX1004, [0027], and thus would be coupled to the feed points and/or feed areas of at least one of Poilasne’s antennas in the combined system and used in a plurality of different bands. EX1003, ¶221.

5. 1[d]

Both Rubinshteyn and Poilasne disclose their respective antenna designs use at least one of prong (a) and (b) of the limitation, and thus meet this limitation. *See* EX1015, 13 (alleging infringement based on “part (b) of this claim element”).

Rubinshteyn’s antenna design: Rubinshteyn discloses at least prong (b) of Limitation 1[d] because Rubinshteyn’s antenna is tuned by one or more passive elements which are selected or interconnected using electronic control. EX1003, ¶224. Specifically, as detailed below, Rubinshteyn’s antenna is tuned by using electronic control to select one or more passive elements in the form of capacitors

and/or inductors. Rubinshteyn's capacitors and inductors are passive elements because they have fixed electrical characteristics. *Id.*; *see also* EX1006, [0035] (describing the relative capacitance of each capacitor and how to choose the capacitance).

For example, as illustrated in Figure 4, reproduced and annotated below, Rubinshteyn discloses a "high band tuning circuit" that includes "three capacitors 62, 64, 68" (annotated in green) and "PIN diode[s] 54, 56, 58." EX1006, [0030], Fig. 4. "[E]ach of the capacitors 62, 64, 68 may [also] be connected in parallel or in series with an inductor." *Id.*, [0031]. Each capacitor "effectively alters the electrical length of the high band element, in this case, thus changing the center frequency at which the high band element is resonant [*i.e.*, **tuning** the high band element of the antenna]."

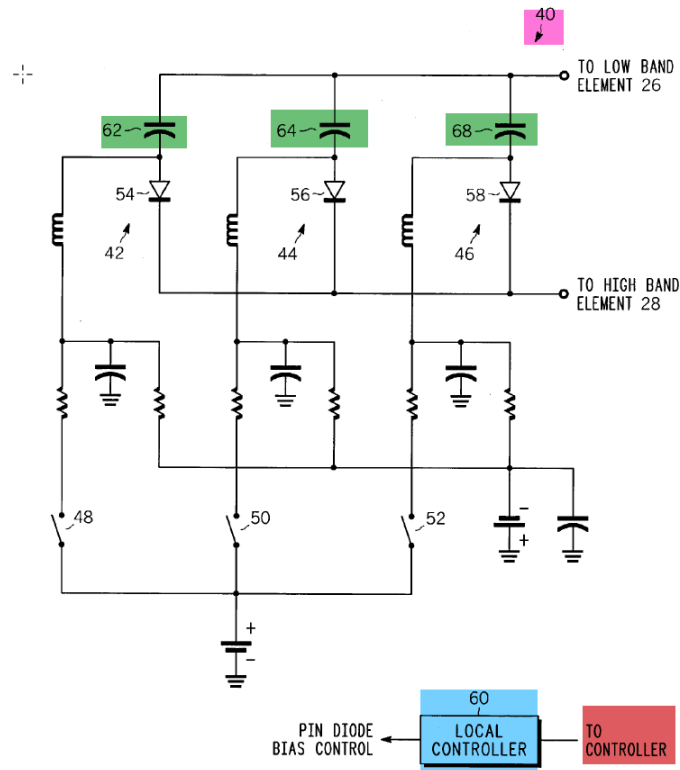


FIG. 4

The PIN diodes are controlled by switches 48, 50, and 52, so that when “one of the switches ... is closed, the corresponding PIN diode ... couples the corresponding capacitor ... between the predetermined points of the antenna.” *Id.* The switches are thus used to **select** the capacitors and/or inductors (*i.e.*, the **passive elements**). EX1003, ¶226. By activating different switches, different combinations of passive elements can be selected, such that “eight different resonant center frequencies of the high band element can be provided.” EX1006, [0035], Fig. 5. In other words, the high band element can be **tuned** to different frequency bands by selecting different combinations of passive elements. EX1003, ¶226. A similar approach can be used to tune the low band element. EX1006, [0036].

Rubinshteyn further discloses that a “controller can be connected to the high and low band tuning circuits ... to independently control the high and low band tuning circuits to tune the antenna 12 to multiple pairs of high band and low band frequencies.” EX1006, [0028]. For example, a “local controller” can “independently control[] the switches 48, 50, 52” to “[c]hang[e] the center resonant frequency of one of the band elements” (*i.e.*, using ***electronic control***). *Id.*, [0034], [0036]; *see also id.*, [0036] (“[A] single local controller 60 can control the capacitance stages of both the high band tuning circuit and the low band tuning circuit.”).

Poilasne’s antenna design: Poilasne discloses both prong (a) and prong (b). EX1003, ¶228-29. Poilasne’s antenna comprises a “a plurality of portions” implemented as “conductors” with fixed electrical characteristics (*i.e.*, ***passive elements***). EX1009, [0007], [0008], [0044]; EX1003, ¶228. Poilasne also discloses at least one “active control element” that is “electrically coupled to one or more of the portions.” EX1009, [0007]. The control element may “exhibit active capacitive or inductive characteristics” to “actively” tune the antenna, *id.*, [0007], [0046], or may operate as a “switch” that “electrically couples or decouples” two portions of the antenna, *i.e.*, tuning the antenna ***interconnecting passive elements using electronic control***, *id.*, [0007], [0047]. *See* EX1003, ¶228; Ground I, 1[d].

D. Claim 2

In Rubinshteyn’s antenna design, the antenna is tuned by using a controller to select *passive elements* in the form of capacitors and/or inductors, *see* 1[d], which are *lumped elements* because they are modeled as discrete points of capacitance or inductance, without regard to the physical dimensions of the capacitors or inductors themselves. EX1003, ¶¶230-32; *see also* EX1011, 3-4 (defining “distributed” and “lumped” elements).

In Poilasne’s antenna design, the antenna portions (*passive elements*) that may be used to tune the antenna are *distributed elements* because their electrical characteristics depend at least on their length. EX1009, [0047]; EX1003, ¶231; *see* Ground 1, Claim 2.

E. Claim 3

In Rubinshteyn’s antenna design, the antenna “resonates at *two different center frequencies simultaneously*.” EX1006, [0016]; *see also id.*, [0022] (disclosing “*operation in two bands simultaneously*”); EX1003, ¶¶233-34. Poilasne similarly discloses that its antenna design “is able to cover multiple frequency bands ... *at the same time*.” EX1009, [0038].

F. Claim 4

1. 4[a]

It would have been obvious to a POSITA in view of Poilasne to add control elements (*i.e.*, *tuners*) to Rubinshteyn’s wireless device. EX1003, ¶235; *see* Section

XI.B. Poilasne's control elements are tuners because they perform tuning and impedance matching for the antenna. EX1009, [0046], [0055], [0060], [0062]; *see also* EX1001, 5:24-32; EX1015, 23; Ground I, 4[a].

In addition, Poilasne discloses that control elements may be “disposed generally in the feed area” and “coupled at one end generally at a feed point” of the antenna. EX1009, [0007], [0051]. The “wireless communication device is coupled to the antenna through the feed point.” *Id.*, [0007]. Thus, in the combined system, either Rubinshteyn's transmitter/receiver or Wen's transceivers, which are connected to an RF input point or feed point of the antenna, would be ***associated with*** the control element (***tuner***) coupled between the feed point/RF input point and the antenna. EX1003, ¶236. This is true regardless of whether Rubinshteyn's or Poilasne's antenna design is used in the combined system, because both designs include a connection to the antenna by way of a feed point or RF input point. *See* 1[b].

2. 4[b]

Poilasne discloses that its control elements can be “controlled,” *e.g.*, via a “control input,” to change the resonant frequency of the antenna or input impedance of the antenna (*i.e.*, to ***control tuning of the tuner*** to operate the antenna in ***different bands***). EX1009, [0008]-[0009], [0046]-[0048] (describing use of “control inputs”), [0049]-[0052] (describing “controll[ing]” the control element to vary resonant

frequency or input impedance). It would have been obvious to a POSITA to use Rubinshteyn's controller to control the control elements because Rubinshteyn already discloses a controller for controlling antenna tuning. EX1003, ¶238.

Specifically, Rubinshteyn discloses a “**controller**” that can “independently control the high and low band tuning circuits to tune the antenna 12 to multiple pairs of high band and low band frequencies.” EX1008, [0028]. As noted above, Poilasne's control elements are used to tune the antenna for operation in different frequency bands (*e.g.*, by varying the resonant frequency and/or input impedance). EX1009, [0049]-[0052]. Accordingly, a POSITA would have understood, or it would have been obvious, that in the combined system, Rubinshteyn's controller would also be used to control Poilasne's control elements for antenna tuning and impedance matching. EX1003, ¶239.

G. Claim 5

Rubinshteyn discloses “[w]ireless communication devices” that “may be used in a variety of different applications, including **cellular telephone**” devices and “land-mobile” devices (*i.e.*, two-way radios, or **portable communication devices**). EX1006, [0002]; *see also* EX1003, ¶¶241-42.

H. Claim 6

Poilasne teaches that an “antenna comprising multiple elements” (*i.e.*, the antenna array) can achieve “channel optimization” using techniques such as

“multiple input-multiple output [(MIMO)] antenna design.” EX1009, [0042].

Poilasne also teaches that multiple antennas can be utilized in parallel, which is consistent with MIMO operation. EX1009, [0062], [0064]; EX1003, ¶¶243-44.

I. Claim 7

Poilasne teaches that an “antenna comprising multiple elements” (*i.e.*, the antenna array) can achieve “channel optimization” using techniques such as ***“beam switching.”*** EX1009, [0042]. Poilasne also teaches that its antenna array embodiments with two or more antennas “improve the transmission quality of an antenna” using ***“beam switching.”*** EX1009, [0062]; EX1003, ¶¶245-46.

J. Claim 25

“A wireless device component”: Rubinshteyn discloses a wireless device. *See* 1[pre]. The wireless device includes components such as antennas and transmitters and receivers, or transceivers (when combined with Wen). *See* 1[a], 1[b].

“comprising a tuner or a set of tuners or controller or other circuitry configurable to be coupled to at least one antenna of one or more antennas ... and a plurality of transmitters, receivers, or transceivers”: Rubinshteyn and Poilasne, and optionally Wen, render obvious tuners and a controller coupled to an antenna in an antenna array and a plurality of transmitters, receivers, or transceivers. *See* 1[b], 4[b] (controller), 4[a] (tuners).

“wherein at least one of said one or more antennas includes one or more elements or sub-elements, said one or more antennas forming an antenna array”:

See 1[a].

“at least one antenna and a plurality of transmitters, receivers, or transceivers that operate at one or more frequency bands”: See 1[a] (antenna), 1[b] (transmitters, receivers, or transceivers).

“wherein said at least one antenna is used by said plurality of transmitters, receivers or transceivers in a plurality of different bands”: See 1[c].

1. 25[a]

See 1[d].

K. Claim 26

See Claim 6.

L. Claim 27

See Claim 7.

M. Claim 28

1. 28[pre]

To the extent the preamble is limiting, Rubinshteyn discloses “**wireless communication devices**” that operate in “cellular telephone, land-mobile ..., and satellite **communications systems**.” EX1006, [0001]-[0002]; see also EX1003, ¶256.

2. 28[a]

See 1[pre].

3. 28[a][i]

See 1[a].

4. 28[a][ii]

See 1[b].

5. 28[a][iii]

See 1[c].

6. 28[a][iv]

See 1[d].

7. 28[b]

Rubinshteyn discloses that its Rubinshteyn teaches that its “[w]ireless communication devices ... provide a wireless communications link to ***one or more other communications terminals***” such as “cellular handsets,” via a “communications system,” such as a “cellular telephone ... communications system.” EX1006, [0002]. A POSITA would have understood that in such networks mobile devices may communicate with a fixed device or platform, such as a base station, and through the fixed devices/platforms communicate with other mobile devices (*e.g.*, a cellular telephone call between two mobile devices). EX1003, ¶262.

N. Claim 29

See 1[a].

O. Claim 30

See Claim 6.

P. Claim 31

See Claim 7.

XII. GROUND V: CLAIMS 8-21, 23-24 ARE RENDERED OBVIOUS BY RUBINSHTEYN IN VIEW OF POILASNE

Rubinshteyn discloses a wireless device comprising an antenna and a multiband transceiver that operates in multiple frequency bands. Poilasne discloses an antenna array and control elements that operate as tuners.

A. Motivation to Combine

A POSITA would have been motivated to use an antenna array and control elements as taught by Poilasne in Rubinshteyn's wireless device, and would have reasonably expected the combination to succeed. See Section XI.B.

B. Claim 8

1. 8[pre]

See Ground IV, 1[pre].

2. 8[a]

See Ground IV, 1[a].

3. 8[b]

Rubinshteyn discloses at least one multiband transmitter and receiver. See Ground IV, 1[b].

4. 8[c]

See Ground IV, 4[a].

5. 8[d]

See Ground IV, 4[b].

6. 8[e]

See Ground IV, 1[c].

7. 8[f]

See Ground IV, 1[d].

C. Claim 9

See Ground IV, Claim 3.

D. Claim 10

See Ground IV, Claim 5.

E. Claim 11

See Ground IV, Claim 2.

F. Claim 12

See Ground IV, Claim 6.

G. Claim 13

See Ground IV, Claim 7.

H. Claim 14

1. 14[pre]

See 8[pre].

2. 14[a]

See 8[a].

3. 14[b]:

See 8[b].

4. 14[c]

“a tuner associated with said at least one multiband transmitter, receiver, or transceiver”: See 8[c].

“said tuner matching said at least one multiband antenna to said at least one multiband transmitter, receiver or transceiver in a plurality of different bands simultaneously”: Rubinshteyn in view of Poilasne renders this limitation obvious. EX1003, ¶¶287-88. As discussed above, would have been obvious to a POSITA to use a tuner to match the impedance of the antenna and an associated transceiver in view of Poilasne. See 8[c]. Poilasne expressly teaches that its control elements “effectuate[] coverage of multiple frequency bands and provides the most optimized solution in terms of input impedance.” EX1009, [0067]. Poilasne further teaches that its solution “is able to cover multiple frequency bands ... **at the same time.**” *Id.*, [0038]. A POSITA would have understood from these disclosures that the control element (**tuner**) matches the antenna and transceivers in multiple bands simultaneously. EX1003, ¶287.

5. Claim 15

See Claim 9.

I. Claim 16

See Claim 10.

J. Claim 17

See Claim 12.

K. Claim 18

See Claim 13.

L. Claim 19

1. 19[pre]

See 8[pre] (wireless device), Claim 10 (portable devices specifically).

2. 19[a]

Rubinshteyn and Poilasne disclose or render obvious ***one or more antennas***. See 8[a]. Rubinshteyn’s and Poilasne’s antenna designs each send and receive signals at a ***plurality of particular frequency bands***. See 8[e] (antenna is used by transmitters/receivers in a plurality of different bands); EX1006, [0016] (antenna “permits simultaneous operation of the device at two different frequencies”), [0022] (“low band” and “high band” elements connect to “a transmitter and a receiver”); EX1009, [0038] (Poilasne’s antenna “cover[ing] multiple frequency bands ... at the same time”). A POSITA would have understood that antennas receive communication signals by ***receiving electromagnetic energy*** at particular frequency bands, and that antennas transmit communication signals ***by radiating electromagnetic energy*** at particular frequency bands. EX1003, ¶294.

3. 19[b]

Rubinshteyn discloses ***one or more transmitters or receivers*** connected to ***one or more antennas***. See Ground IV, 1[b]-1[c].

4. 19[c]

Rubinshteyn discloses one or more transmitters or receivers (*i.e.*, ***components***). See Limitation 19[b]. A POSITA would have understood that transmitters and receivers send and receive signals by ***transmitting and receiving electromagnetic energy***, respectively. EX1003, ¶296.

“at least one of said one or more components transmits or receives electromagnetic energy simultaneously at two or more of said plurality of particular frequency bands”: Rubinshteyn discloses the first optional prong of this limitation because it discloses a multiband transmitter and a multiband receiver, which can transmit and receive (respectively) simultaneously in at least two frequency bands (*i.e.*, a high band and a low band). See 8[b].

“two or more components transmit or receive electromagnetic energy simultaneously at two or more of said plurality of particular frequency bands”: Rubinshteyn also discloses the second optional prong of this limitation because it discloses two components (a transmitter and a receiver), each operating in at least two different frequency bands (*e.g.*, a high band and a low band). See Limitation 8[b]. Accordingly, Rubinshteyn’s transmitter and receiver together operate in a

plurality of frequency bands. EX1003, ¶298. In addition, Rubinshteyn discloses that transmitter and receiver may use the antenna at different frequency bands simultaneously via the duplexer. EX1006, [0022]; EX1003, ¶¶298-99.

M. Claim 20

See Claim 10.

N. Claim 21

It would have been obvious to a POSITA to use Poilasne's control elements (*i.e.*, ***tuners***) to match the impedance and/or resonant frequency of the antenna and an associated transmitter or receiver. See 8[c]. A POSITA would have understood that in the combined system, a particular control element would match a particular frequency band only to the transmitter or receiver currently operating at that frequency. EX1003, ¶301.

O. Claim 23

See Claim 12.

P. Claim 24

See Claim 13.

XIII. GROUND VI: CLAIM 22 IS RENDERED OBVIOUS BY RUBINSHTEYN IN VIEW OF POILASNE AND VLAHOS

Rubinshteyn and Poilasne collectively disclose and render obvious a wireless device comprising a multiband antenna array, multiband transmitters and receivers,

and tuners, as described in Ground V. Vlahos further discloses filters and similar elements to provide RF isolation for different components.

A. Motivation to Combine

Rubinshteyn and Poilasne are addressed in Section XI.B.

A POSITA would have further been motivated to include filters and other RF isolation components, as taught by Vlahos, in Rubinshteyn’s wireless device, and would have reasonably expected the combination to succeed. EX1003, ¶¶306-11.

First, the need for RF isolation in multi-band wireless communication systems would have been well understood by a POSITA. EX1003, ¶308; EX1001, 5:30-37; *see also* Section X.B. Adding RF isolation and filtering to Rubinshteyn represents the use of a known technique with predictable results. EX1003, ¶308.

Second, Vlahos provides an express motivation to combine. EX1003, ¶309. Vlahos discloses using filters and other isolation circuitry to “provide isolation ... from transmitter energy and other spurious frequencies,” EX1007, 2:59-65, which would otherwise interfere with a receiver, particularly in a multiband system. EX1003, ¶309; *see also* Section X.B.

In addition, like Rubinshteyn, Poilasne, and the ’358 Patent, Vlahos is analogous art because it is directed to RF components for wireless devices that operate in multiple frequency bands. EX1007, Abstract (“A method and apparatus enables a communication device ... to operate in multiple bands.”).

Finally, a POSITA would have reasonably expected the combination to succeed. EX1003, ¶311. As noted above, RF isolation techniques were standard, well known, and commercially available prior to the '358 patent. EX1001, 5:32-38. A POSITA would have been capable of adding filters and isolation circuitry to Rubinshteyn's transmitter and/or receiver using routine engineering to achieve predictable results. EX1003, ¶311.

B. Claim 22

This is a means-plus-function limitation. See Section VII.A.

It would have been obvious to a POSITA in view of Vlahos to use isolation circuitry to filter unwanted bands at least for Rubinshteyn's receiver.

Vlahos discloses several types of circuitry for filtering out unwanted frequency bands. See Ground III, Claim 22.

For the reasons discussed above in Section XIII.A., a POSITA would have been motivated to apply Vlahos's teachings regarding filtering and isolation to Rubinshteyn's wireless device, and would have reasonably expected the combination to succeed.

XIV. MANDATORY NOTICES AND FEES

A. Real Party-In-Interest

The real party-in-interest for Petitioner is Samsung.

B. Related Matters

Patent Owner filed a patent infringement lawsuit against Petitioners asserting the '358 patent in related district court litigation captioned *Massively Broadband LLC v. Samsung Electronics Co., Ltd. et al*, 2:25-cv-00608-JRG (E.D. Tex.). Petitioners are submitting additional petitions for *inter partes* review of patents within the same family as the '358 patent, namely U.S. Patent No. 8,350,763; 11,876,548; and 11,063,625, the proceedings for which are associated with IPR Case Nos. 2025-01563, 2025-01564, 2025-01565.

C. Counsel and Service Information

Petitioner provides the following counsel and service information. Petitioner consents to electronic service the email addresses listed in the table below and at:

qe-samsung-mbl-ipr@quinnemanuel.com

Pursuant to 37 C.F.R. § 42.10(b), a Power of Attorney accompanies this Petition.

Lead Counsel	Back-Up Counsel
James M. Glass Reg. No. 46,729 jimglass@quinnemanuel.com QUINN EMANUEL URQUHART & SULLIVAN, LLP 295 5th Avenue, 9th Floor New York, New York 10016 Tel: (212) 849-7000 Fax: (212) 849-7100	John McKee Reg. No. 65,926 johnmckee@quinnemanuel.com Matthew Robson <i>pro hac vice</i> forthcoming matthewrobson@quinnemanuel.com Ron Hagiz <i>pro hac vice</i> forthcoming ronhagiz@quinnemanuel.com QUINN EMANUEL URQUHART

	& SULLIVAN, LLP 295 5th Avenue, 9th Floor New York, New York 10016 Tel: (212) 849-7000 Fax: (212) 849-7100 Quincy Lu Reg. No. 76,954 quincylu@quinnemanuel.com QUINN EMANUEL URQUHART & SULLIVAN, LLP 1109 First Avenue, Suite 210 Seattle, WA 98101 Tel: (206) 905-7000 Fax: (206) 905-7100 Benjamin Kleinman Reg. No. 66,856 benjaminkleinman@quinnemanuel.com QUINN EMANUEL URQUHART & SULLIVAN, LLP 50 California Street, 22nd Floor San Francisco, CA 94111 Tel: (415) 875-6600 Fax: (415) 875-6700
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D. Payment of Fees

The undersigned authorizes the Office to charge the fee required for this Petition for *Inter Partes* Review to Deposit Account No. 50-5708. Any additional fees that might be due are also authorized.

XV. CONCLUSION

For these reasons, Petitioner requests *inter partes* review of the '358 Patent.

Date: October 21, 2025

Respectfully submitted,

By: /s/ James M. Glass
James M. Glass

Counsel for Petitioner

**CERTIFICATE OF COMPLIANCE WITH
TYPE-VOLUME LIMITATION, TYPEFACE REQUIREMENTS,
AND TYPE STYLE REQUIREMENTS**

1. This Petition complies with the type-volume limitation of 14,000 words, comprising 13,904 words, as counted using the Microsoft Word software that was used to prepare this paper, excluding the parts exempted by 37 C.F.R. § 42.24(a).

2. This Petition complies with the general format requirements of 37 C.F.R. § 42.6(a) and has been prepared using Microsoft® Word 2016 in 14-point Times New Roman.

Date: October 21, 2025

By: /s/ James M. Glass
James M. Glass
QUINN EMANUEL URQUHART
& SULLIVAN, LLP
51 Madison Avenue, 22nd Floor
New York, NY 10010
Tel: (212) 849-7000
Fax: (212) 849-7100

Counsel for Petitioner

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6(e), 42.105(a), the undersigned hereby certifies service on the PO of a copy of this Petition and its respective exhibits at the official correspondence address for the attorneys of record for the '358 Patent as shown in USPTO PAIR via FedEx:

30743 - WC&F IP
11491 SUNSET HILLS ROAD, SUITE 340
RESTON, VA 20190
UNITED STATES

Courtesy copies were also sent via FedEx and electronic mail to Patent

Owner's counsel of record in the related district court proceeding:

Patrick J. McElhinny
K&L Gates LLP
210 Sixth Avenue
Pittsburgh, Pennsylvania 15222
Email: patrick.mcelhinny@klgates.com

Mark Knedeisen
Email: mark.knadeisen@klgates.com

Christopher Verdini
Email: christopher.verdini@klgates.com

Anna Shabalov
Email: anna.shabalov@klgates.com

Rachel Ellenberger
Email: rachel.ellenberger@klgates.com

Andrea L. Fair
MILLER FAIR HENRY PLLC
1507 Bill Owens Parkway

Longview, Texas 75604
E-mail: andrea@millerfairhenry.com

Date: October 22, 2025

By: /s/ James M. Glass
James M. Glass
QUINN EMANUEL URQUHART
& SULLIVAN, LLP
51 Madison Avenue, 22nd Floor
New York, NY 10010
Tel: (212) 849-7000
Fax: (212) 849-7100

Counsel for Petitioner