

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

**DECLARATION OF DR. MARK P. MAHON IN SUPPORT OF PETITION
FOR INTER PARTES REVIEW OF U.S. PATENT NO. 8,593,358**

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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;	125
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.....	126
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EXHIBIT LIST

Ex.	Description
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. 5,962,751 (“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.)

DECLARATION OF DR. MARK MAHON, Ph.D.

I, MARK MAHON, Ph.D. hereby declare as follows:

1. My name is Mark Mahon. I have been retained to testify as an expert in this Inter Partes Petition on behalf of Samsung Electronics Co., Ltd. (“SEC”) and Samsung Electronics America, Inc. (“SEA”) (collectively, “Samsung” or “Petitioner”). I am being compensated for my time spent on this matter at a rate of \$550 per hour. My compensation is in no way dependent on the outcome of this matter or on the opinions I provide in this declaration. All of the opinions expressed in this declaration are my own.

2. I have prepared this declaration in connection with Samsung’s related petition for inter partes review (“IPR”) of U.S. Patent No. 8,593,358 (the “’358 patent,” EX1001), which I am informed is being filed concurrently with this declaration. I have been asked to provide certain opinions relating to the patentability of the ’358 Patent. Specifically, I have been asked to provide my opinion regarding whether claims 1-31 of the ’358 Patent (“the Challenged Claims”) are invalid as obvious in view of the prior art.

I. SUMMARY OF OPINIONS

3. It is my opinion that the Challenged Claims are anticipated or rendered obvious pursuant to Grounds I-VI and the reasons discussed herein.

II. MATERIALS CONSIDERED

4. In forming my opinions provided in this declaration, I have reviewed

the '358 Patent, including the abstract, figures, specification, and claims. I have also reviewed and relied on the file history of the '358 Patent, the prior art discussed in this declaration, the Exhibits cited in the Exhibit List above, and any other materials cited in this declaration. I have also relied on my relevant personal and professional experience and expertise.

III. QUALIFICATIONS

5. My qualifications are summarized here and explained in more detail in my curriculum vitae, which is attached as Appendix A to this declaration. Appendix A also includes a list of my publications and the cases in which I have testified at deposition, hearing, or trial within the past four years.

6. I am a Teaching Professor in the School of Electrical Engineering and Computer Science at Pennsylvania State University, University Park, PA ("Penn State" or "PSU"). I have worked on telecommunications and wireless networks, including Z-Wave, Bluetooth, Zigbee, Wi-Fi, NFC, AMPS, IS-95, CDMA2000, GSM, EDGE, UMTS/WCDMA, LTE, and 5G cellular systems since 1988.

7. I received my B.S. in Electronics Engineering from the University of Scranton in 1987. I received my M.S. in Electrical Engineering and Ph.D. in Acoustics from Penn State in 1991 and 2001, respectively.

8. In 1988, after I received my bachelor's degree, I joined the Central Intelligence Agency (CIA) while pursuing my M.S. degree at Penn State part-time.

My first job at the CIA involved designing and testing systems to automatically capture and characterize telecommunication signals and emissions from various wireless and computer networking devices.

9. I returned to Penn State in early 1990 to pursue graduate research full-time and complete my M.S. degree. My graduate research work focused on wideband beamforming and adaptive signal processing. After completing my M.S. degree in EE in 1991, I accepted a full-time faculty research position at the Applied Research Lab at PSU, primarily working on classified programs, and began working on diverse radio frequency and acoustic sensor systems including wireless communications and small wireless networks for acoustic tracking, source localization, and feature extraction.

10. I began pursuing my Ph.D. part-time in 1993 while continuing my faculty research position. In 1997, as part of my faculty research position, I began working on classified programs focused on mathematical analytical modeling of cellular communication networks and the development of hardware and software systems to test against cellular networks. My role was to develop the algorithms and write the code running on a specially developed embedded system. For this work, I received a letter of recognition as the “genius behind the VELA software algorithms” from the Director of National Reconnaissance Office (NRO) Systems Engineering and Technology Office. As part of this same work, I was extensively involved in

protocol and signaling analysis as well as researching model-specific performance and unique functional characteristics associated with individual mobile devices. The work involved testing dozens of handsets from many manufacturers in controlled and real-world environments against network simulators and live operational networks for each research project.

11. In 2000, my research extended into utilizing non-orthogonal wavelets for improving detection and localization of cellular handsets from high altitude sensor systems. In 2001, I completed my Ph.D. and my research focused on the utilization of advanced communication signals for wideband characterization and remote sensing of propagation channels.

12. Beginning in 1997, my cellular communications research work focused on CDMA, GSM, EDGE, UMTS, LTE, and 5G cellular systems primarily under grants sponsored principally by the Department of Defense. This classified research work required 3GPP protocol analysis and development of real-time embedded hardware and software systems capable of interacting with cellular networks and cellular handsets. A large portion of my work was directed at architectures, protocols, software, and signaling.

13. I have been working on classified projects since 1988. Before 1998, because the work was not deemed highly classified, I was able to publish eight journal and conference papers prior to 2000. Between 1999 and 2015, however, I

was allowed to publish only one article in an unclassified symposium and published and presented about a dozen articles in classified settings. This is because during this period, the vast majority of my research was highly classified. As a result, nearly all of my research results were summarized in classified reports and not available to the general public. Further, because the U.S. government owns any intellectual property resulting from the sponsored research work, I did not pursue or file patent applications.

14. Beginning in 2003, I was co-principal investigator and technical lead on a 3 year multi-million-dollar research effort for developing the Global Information Grid (GIG). This project was sponsored by the Secretary of Defense's Office with a goal of developing a real-time, multi-intelligence (multi-Int) network for collecting, processing, storing, disseminating, and managing information on demand for decision makers including the warfighter, combatant command centers, policy makers, and support personnel and was the largest network-centric warfare project in development at the time. My research team (Ubiquitous Automated Information Manager) focused on building and deploying a scalable application to perform real-time, multi-int data fusion to support every user in the system. This software application was deployed in Combat Operation Centers, Joint Interagency Task Force locations, and on various platforms (mobile and small computing environments) used by various warfighters. The fused data sources included various

content management systems, supply chain logistic reports, GPS-based reports, new feeds, backend databases, sensor system reports, and various other broad data sources.

15. Beginning in 1994, I worked on various projects that involved the implementation and design of user interfaces to support the use of the research, design, analysis tools and signal processing systems for the end user. The user platforms included a broad array of footprints including, small handheld devices with screens or visual displays and those limited to audio-only inputs, medium sized laptops and small desktop systems, and also large, heavy devices, such as servers and clusters in operational environments (including combat operations centers and 3D immersive environments).

16. Specifically, for the GIG research effort, I led a team of software engineers to deploy our inferencing tool for a disparate range of end users, from dismounted combat soldiers with only a microphone as an interface to soldiers in mules with smart devices (tablets and laptops with multiple visual display interaction capabilities) to field command centers (medium sized clients with significant video displays and processing power with touch and stylus interfaces to the) to combat operation centers with high-powered processing and complex user-interface capabilities/modalities.

17. In 2015, I transferred to the School of Electrical Engineering and

Computer Science at Penn State as a teaching faculty member. In that role, I have continued teaching graduate and undergraduate courses, guiding Ph.D. and M.S. students in communication and mobile networking (including LTE and 5G cellular networks), and pursuing research in this and related areas. Since 2015, I have been an author on nine refereed papers as listed in my curriculum vitae (CV).

18. Because of my decades of research and my continuing work at Penn State, I have intimate knowledge of telecommunication networks, including the technology involved in the patents in this case. I have been highly recognized as an expert in such systems within the research community. I was recognized twice by the National Reconnaissance Office with commendation letters for work dealing with detecting cellular signals in low signal to noise ratio environments. The U.S. government awarded me over \$12M in grants between 2003 and 2015 for projects focused on mobile communication devices and networks, in which I served as a Principal Investigator (PI), Co- PI, and/or technical lead.

19. Additionally, during my research career, I interacted extensively with computer scientists and engineers responsible for the design, development, and testing of telephony and data networking systems and testbeds. As a research faculty member, I oversaw engineers and computer scientists that executed many joint projects with development organizations. These interactions exposed me to a wide range of computer scientists and engineers working on telecommunication network

technologies. Since 2011, I have been teaching undergraduate and graduate classes in communication and mobile networking and am familiar with the curricula being taught to electrical engineers and computer scientists. The interactions with a wide range of computer scientists and engineers working on telecommunication network technologies and the familiarity with the classes taught to electrical engineers and computer scientists have allowed me to have a good understanding of the level of skills possessed by a person of ordinary skill in the field of cellular technology.

20. I have extensive experience with mobile networks in general and LTE and 5G specifically. While most of my research efforts between 1998 and 2015 were highly classified, I can state that they included detailed investigation of network architectures, signaling, and functional behavior. A typical research effort would involve studying 3GPP, 3GPP2, IEEE, and other protocol standards to fully comprehend all aspects of L1, L2, and L3 requirements including timing, bit-level construction of the control and user plane messages, and timing characteristics for a given standard as well as functional behavior of network components and user equipment.

21. From 2006 through 2015, my research focused specifically on LTE. My research continues to this day, although I am no longer operating in a classified environment. During this time, I investigated the performance and functional differences of many varied network and handset devices to see how differing

signaling and hardware configurations (including MIMO) and environmental factors influenced the behavior of user equipment in a given network environment. This included how diversity techniques (transmit and receive), synchronization, timing, and signal to interference plus noise ratio (SINR) for a given device would affect specific functional aspects including elements of the receiver structure, decoding and demodulation performance, calculation of parameters used by the device for making decisions and deriving parameters reported to the network.

22. As part of my research work, I built several custom CDMA, GSM, UMTS, and LTE platforms that implemented specific network-side and user equipment-side functionality including custom signal generation and processing structures, particularly the signal processing chains on both the transmit and receive sides. This equipment was developed using network simulation hardware in a laboratory environment and was later tested with corresponding networks in both controlled and fully operational environments. Implementing the transmit and receive chains for custom built protocol-enabled equipment required me to gain an intimate understanding of the relevant 3GPP protocol specifications and the underlying structures. Since 2015, I have been primarily focused on guiding graduate students pursuing research including using code domain non-orthogonal multiple access (NOMA) combined with MIMO sparse coding multiple access to minimize latency and maximize user density in grant free Internet of Things (IoT)

environments. Additionally, I am guiding my graduate students in pursuing research in optimized distributed processing algorithms, implementation of block chain coding techniques to improve handover security, and edge computing resource allocation in 4G (LTE)/5G (NR) networks.

23. Much of the classified research work I performed also led to similar approaches for other wireless protocols including IEEE 802.11 and 802.15 (e.g., Zigbee, Bluetooth, and UWB), HART, and other short-range standards as well as HF radio and Wi-MAX.

24. My curriculum vitae, included as an appendix to this declaration, includes a list of publications on which I am a named author. It contains further details regarding my experience, education, publications, and other qualifications to render an expert opinion in connection with this proceeding.

25. In writing this Declaration, I have considered the following: my own knowledge and experience, including my work experience in the fields of wireless communication networks, research and development of wireless signaling, protocols, transmission, and detection techniques, design and construction of wireless test equipment, prototypes, engineering models, and related areas; my experience in teaching those subjects; and my experience in working with others involved in those fields, the materials cited and/or referenced throughout this Petition.

IV. LEGAL STANDARDS

26. Counsel for Samsung has informed me of the following legal standards. I am not an attorney, and I am relying only on instructions from Samsung's attorneys for these legal standards.

A. Person of Ordinary Skill in the Art

27. I understand that issues of claim construction and invalidity are analyzed from the perspective of a person of ordinary skill in the art ("POSITA").

28. I understand that a POSITA is a hypothetical person who is used to analyzing the prior art without the benefit of hindsight. A POSITA is presumed to be one who thinks along the lines of conventional wisdom in the art.

29. I understand that the hypothetical POSITA is presumed to have knowledge of all references that are sufficiently related to one another and to the pertinent art, and to have knowledge of all arts reasonably pertinent to the particular problem that the claimed invention addresses.

30. I understand that factors considered in determining the level of ordinary skill in the art at the time of an invention include (1) the type of problems encountered in the art; (2) the prior art solutions to those problems; (3) the educational level of active workers in the field; (4) the rapidity with which innovations are made; and (5) the sophistication of the technology. I further understand that the inventors' specific levels of skill are not relevant to this inquiry.

B. Claim Construction

31. I have been informed by counsel that the Patent Trial and Appeal Board (“PTAB”) applies the same claim construction standard used in district courts, where the claims are given their ordinary meaning as understood by one skilled in the art at the time of the invention, informed by the claim language itself, the specification, and the prosecution history. I understand that claim terms can be construed in a manner deviating from their plain meaning only when: 1) there is a clear and unmistakable disclaimer by the applicant, or 2) when the inventor acts as his or her own lexicographer. I also understand that “extrinsic evidence”—*i.e.*, evidence other than the patent and prosecution history—can be relevant in determining how a POSITA would understand terms of art used in the claims. I have been informed, however, that extrinsic evidence may not be used to contradict the meaning of the claims as I described in the intrinsic evidence—*i.e.*, evidence in the claim language itself, the specification, and the prosecution history. Additionally, I understand and have been instructed that, when a claim’s recitation is purely functional and does not include any definite structure for performing the function claimed, the term is a “means-plus-function” claim. It is my understanding that means-plus-function claims are construed using a two-step process: first, determination of the claimed function, and second, identification of the corresponding structure. If the term is understood by a POSITA as referring to a particular structure, however, this two-

step process is not followed. I understand and have been instructed that, where the claim uses the word “means,” there is a presumption that it is a means-plus-function claim term. I also understand and have been instructed that an applicant for a patent must disclose adequate structure in the specification to perform the recited function, and that if adequate structure is not recited, the claim is indefinite. I am further instructed that when the corresponding structure is a general purpose computer or microprocessor, the specification must disclose the algorithm or process to be performed by the general purpose computer or microprocessor, or the claim is indefinite.

C. Burden of Proof

32. I understand that for the PTAB to institute review of a challenged patent, it is the petitioner’s burden to show that there is a reasonable likelihood of success that the petitioner will prevail in showing at least one claim is invalid. I understand that it is ultimately the petitioner’s burden to show invalidity by a preponderance of the evidence in this proceeding.

D. Invalidity

33. I understand that a patent claim is invalid if each and every element of the claim is disclosed by a single prior art reference. This is known as anticipation, and the claim is said to be “anticipated” by the prior art reference. I understand that disclosure of a limitation of a patent claim can be express or inherent. I also

understand that sometimes the disclosure of a limitation can be implicit if it involves an inference that a POSITA would reasonably be expected to draw from the express disclosure or is a clear and unambiguous consequence of what is explicitly disclosed. I understand that a patent claim is also invalid if the claimed invention would have been obvious to a POSITA at the time the application was filed. This means that even if all of the requirements of the claim cannot be found in a single prior art reference that would anticipate the claim, the claim can still be invalid. I understand that even if a patent claim is not anticipated, it is still invalid if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person of ordinary skill in the pertinent art.

34. I understand that a person of ordinary skill in the art provides a reference point from which the prior art and claimed invention should be viewed. This reference point prevents one from using his or her own insight or hindsight in deciding whether a claim is obvious.

35. I also understand that an obviousness determination includes the consideration of various factors such as (1) the scope and content of the prior art,(2) the differences between the prior art and the asserted claims, (3) the level of ordinary skill in the pertinent art, and (4) the existence of secondary considerations or objective indicia of obviousness or non-obviousness.

36. I understand that an obviousness determination can be based on a single prior art reference or a combination of multiple prior art references or the knowledge of one of ordinary skill in the art. I understand that the prior art itself may provide a suggestion, motivation, or reason to combine or modify the teachings of the prior art, or that such a reason may come from other sources, such as the knowledge of a person having ordinary skill in the art, common sense, and market forces. I understand that the following rationales may support a finding of obviousness:

- combining prior art elements according to known methods to yield predictable results;
- simple substitution of one known element for another to obtain predictable results;
- use of known technique to improve similar devices (methods, or products) in the same way;
- applying a known technique to a known device (method or product) ready for improvement to yield predictable results;
- “obvious to try” - choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;
- known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art;
- some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

37. I understand that an obviousness determination requires a reasonable

expectation of success in achieving the claimed invention.

38. I understand that secondary considerations or objective indicia of obviousness or non-obviousness may include (1) a long felt but unmet need in the prior art that was satisfied by the invention of the patent; (2) commercial success or lack of commercial success of processes covered by the patent; (3) unexpected results achieved by the invention; (4) praise of the invention by others skilled in the art; (5) the taking of licenses under the patent by others; (6) deliberate copying of the invention; (7) teaching away; and (8) the simultaneous invention of the claimed subject matter. I also understand that there must be a relationship between any such secondary considerations and the invention. I further understand that contemporaneous and independent invention by others is a secondary consideration supporting an obviousness determination.¹

39. I understand that any secondary considerations or objective indicia must bear a nexus to the claimed invention. Where the offered secondary consideration actually results from something other than what is both claimed and novel in the claim, there is no nexus to the merits of the claimed invention. I further understand that the patentee bears the burden of demonstrating that the relevant commercial success is attributable to the claimed invention, as opposed to other

¹ I am not aware of any secondary factors supporting non-obviousness of the Challenged Claims. To the extent the Patent Owner presents any such evidence, I reserve the right to respond.

economic and commercial factors unrelated to the technical quality of the patented subject matter.

40. I understand that whether a prior art reference “teaches away” from the claimed invention is a fact to be considered in determining obviousness. I understand that it is improper to combine references where the references teach away from their combination. However, I understand that the nature of the teaching is highly relevant and must be weighed in substance – a known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use. Furthermore, I understand that the prior art’s mere disclosure of more than one alternative does not constitute a teaching away from any of these alternatives because such disclosure does not criticize, discredit, or otherwise discourage the solution claimed.

V. Detailed Opinions

A. Technology Background and State of the Art

41. Since Tesla and Marconi first successfully demonstrated the transmission of wireless signals in the late nineteenth century using electromagnetic waves (electric and magnetic fields that propagate through space) at specific frequencies (typically between 3 kHz to 300 GHz), wireless communications have evolved tremendously. EX1014, 4. While other types of waves can be used to carry information, the utilization of electromagnetic energy (radio waves) for the purposes

of transmitting signals is the predominant modality in modern wireless devices due to energy efficiency, propagation speed, transmission distance, and available bandwidth.

42. Wireless devices utilize an antenna to generate the electric and magnetic fields (signals) at a given frequency which travel (propagate) out in space to eventually arrive at a receiving antenna that is used to detect the signals and the information those waves are carrying. “In other words the antenna is the transitional structure between free-space and a guiding device...The guiding device or transmission line...is used to transport electromagnetic energy from the transmitting source to the antenna, or from the antenna to the receiver. In the former case we have a transmitting antenna and in the latter a receiving antenna.” EX1015, 1.

43. Antennas are necessary to facilitate energy-efficient communication. At the transmit device, antennas convert the electrical signals encoded with data/information into electromagnetic waves that are intended to be received by a desired/target device or devices (receivers). Likewise, at the receiving device, an antenna is necessary to detect efficiently the propagating electromagnetic signals and convert them to electric signals and process them to determine the encoded data. *See, e.g.,* EX1016, 2-4; EX1017, 3. The antenna’s energy conversion efficiency (electric to electromagnetic) is related to various physical characteristics, and it will be more and less efficient at various frequencies (bands) across the spectrum.

Therefore, it is important to match the antenna's resonances (range of frequencies where it most efficiently couples the electric to electromagnetic energy) to the frequency bands used to transmit and the signals with the same necessary requirement at the receiver. "Most antennas have one resonant frequency band. For Transmission, when the antenna is excited in this frequency band by a feeder line, it supports standing electromagnetic waves. The standing waves are then coupled to electromagnetic waves radiated into space. For reception, the waves take the same forms but follow the path in the reverse order." EX 1018, [0002]. If the transmitter and receiver are not using the same frequency band, then the signals will not be detected, and the data will not be communicated/sent between the devices. A mismatch between the devices is equivalent to tuning your radio to an FM frequency/channel at which no signal is being transmitted and receiving only noise rather than music.

44. The same context is true for various wireless communication protocols used by devices such as LTE (700 MHz–2.5 GHz), 5G NR (410 MHz–52 GHz), Wi-Fi (2.4, 5, and 6 GHz), NFC (13.56 MHz), UWB (3.1–10.6 GHz), Bluetooth/Bluetooth Low Energy (2.4 GHz ISM band), etc. The table below identifies some of the bands associated with these technologies. EX 1019, 6.

Table 1.1 Wireless Communications Bands and Their Frequency Designations

<i>Band Designation</i>	<i>Alternate Description(s)</i>	<i>Transmit Frequency (Uplink) (MHz)</i>	<i>Receive Frequency (Downlink) (MHz)</i>
GSM 800 or GSM 850	AMPS DAMPS	824–849	869–894
P-GSM 900	Primary GSM 900	890–915	935–960
E-GSM 900	Extended GSM 900	880–915	925–960
GSM-R 900	Railways GSM 900	876–915	921–960
T-GSM 900	TETRA GSM 900	870.4–915	915.4–921
GPS		N/A	1,565.42–1,585.42
GSM 1800	DCS 1800	1,710–1785	1,805–1880
GSM 1900	PCS 1900	1,850–1910	1,930–1990
UMTS		1,885–2,025 1,710–1,755 (US)	2,110–2,200 2,110–2,155 (US)
802.11 b/g/n	Wi-Fi; ISM	2.4 – 2.4835 GHz ISM	
802.11 a/h/j	Wi-Fi; UNII	5.15–5.35 GHz (UNII) 5.47–5.725 GHz 5.725–5.825 GHz (ISM/UNII) 4.9–5 GHz (Japan) 5.03–5.091 GHz (Japan)	
802.15.4	Zigbee	898 MHz 915 MHz 2.4-GHz ISM	
802.15.1 1a	Bluetooth	2.4–2.4835-GHz ISM	
802.15.3	UWB	Typically > 500 MHz bands within the 3.1 – 10.6-GHz spectrum	
802.16	Wi-Max	Various bands within the 2–11-GHz spectrum. Mobile Networks: 2–6 GHz Fixed Network: < 11 GHz	

45. Given the operational frequency band associated with a specific protocol, early antennas were designed and developed to operate efficiently at that band, however they were not efficient at other bands. Thus, devices wishing to support communication using multiple wireless protocols, at the various frequency bands, required multiple antennas—one dedicated for each band/protocol. Multiple antennas require more space constraining the miniaturization and design of the wireless device. “In the past, one antenna operating at one frequency band was typically the design objective. Today, there are several frequency bands and

multiple antennas are required” *Id.*, 3.

46. The need for a single antenna with the capability to support multiple frequency bands was well known in the art prior to the priority date of the '358 Patent. “In some environments, it is necessary that the mobile device communicate with two or more cellular communication systems and another radio communication system, for example. Mobile devices in such situations typically include two or more radios with corresponding antennas in order to communicate wirelessly with the respective communication systems. Such multiple radios may operate in different frequency bands, employ different modulation techniques, or the like, which will allow the multiple radios within the mobile device to operate simultaneously.” EX1020, 1:63-2:6.

47. The recognition of advantages associated with using a single antenna to cover multiple operational bands was the driving force to overcome the technical challenges associated with the same. “In today’s environment of almost constant connectivity, wireless devices are ubiquitous. As the RF electronics technology for these wireless devices continues to decrease in size, there is a corresponding demand for a similar decrease in size for the antenna element. Unfortunately, the performance requirements for the antenna are rarely relaxed with the demand for smaller size...In addition to dealing with the challenges of designing a small antenna, antenna engineers must also deal with the challenge of designing the small

antenna to operate over multiple frequency bands.” EX1019, 5. From the mid-to-late 1990s through early 2000s, devices continued to miniaturize and researchers continued to refine both design and manufacturing processes. “The constant evolution of the mobile phone market determines more stringent constraints for terminal antenna design, as the size of the terminals shrinks rapidly, while the functionalities of the handsets are ever increased. Multiband operation, which is nowadays almost a common standard, requires the use of enhanced radiating elements. Moreover, other aspects such as small size, weight, and integration have a great relevance for the final design, while material and assembling costs must be kept as low as possible[.]...The preferred antenna solution to deal with multistranded issues is the use of radiating patches with multiple resonances covering different bands, which are easily adapted to the shape of the handset, and can therefore be integrated within the back cover.” EX1021, 384.

48. Given the need for such antennas, numerous companies in the wireless communications field developed single antennas that operated at a plurality of different frequency bands. “Unlike conventional mobile terminals, however, each mobile terminal 66 includes a single antenna 68 which is shared by each of the radios included in the mobile terminal 66.... [S]ince only a single antenna 68 is needed to handle multi-band communication, additional benefits are gained due to the space and weight savings obtained over conventional mobile terminals

employing two or more antennas.” EX1020, 5:38-49.

49. As mentioned above; in order to optimize energy coupling to free space propagation, the antenna should optimally possess a resonance at the frequency associated with the radio waves being transmitted. This is true regardless of the antenna size, but there are specific challenges associated with small antennas for mobile devices. “Typically, in the design of small antennas, the first significant challenge is mitigation the high VSWR [Voltage Standing Wave Ratio] and mismatch loss by first tuning the antenna to resonance and then impedance matching the antenna to the desired characteristic impedance...Considering again the short monopole that has increasing capacitive reactance an decreasing radiation resistance, the first objective is to make it resonant (tuning) and the second objective is to then match it to the desired characteristic impedance....” EX1019, 8. It was thus also well known in the prior art to use active and passive techniques to modify antenna resonance frequencies and the bandwidth at those resonance frequencies. “The physical size of radio communication equipment and electronic devices on which antennas are installed has been scaled down in recent years, especially in mobile communications. Therefore, there is demand for small size antennas with efficient electrical performance. In addition to the miniaturization, another desirable characteristic of modern antennas is wide-band operation, which has a single antenna to satisfy the frequency requirements of different applications.” “When varactor

diodes are used as capacitive loads for the antenna, it allows reducing the size of the antenna with an added feature of tunability. By varying the biasing voltage of the varactors, resonant frequency can be varied over a wide range.” EX1022, 10.

B. The '358 Patent

50. I understand that the '358 patent issued on November 26, 2013, and claims priority to Provisional Application No. 61/088,829, filed on August 14, 2008.

1. Disclosure

51. 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.

2. The Challenged Claims

52. Below is a table described the Challenged Claims, including claims 1-31.

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	
	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.

VI. LEVEL OF ORDINARY SKILL IN THE ART

53. In my opinion, a person of ordinary skill in the art at the time of the '358 Patent ("POSITA") 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 devices. More education can substitute for practical experience and vice versa. I meet and exceed this definition of a POSITA, and I would have met and exceeded this definition as of the priority date of the '358 Patent.

VII. CLAIM CONSTRUCTION

54. For purposes of this declaration, except as noted below, I have applied the ordinary and customary meaning of the claim terms as they would have been

understood to a POSITA as of the priority date of the '358 Patent, November 26, 2013. I have considered that meaning in the context of the patent and its prosecution history.

55. I understand that Claim 22 uses “means-plus-function” language which requires identifying the claimed function and the corresponding structure in the specification. Claim 22 in relevant part, reads, “isolation means for isolating said one or more components from more than one particular frequency band of said plurality of frequency bands.” (Claim 22).

56. The '358 Patent teaches that:

*The **key to proper operation is to** also, while providing good matching, **provide sufficient RF isolation** so that the transmitters in other bands do not overload the front end receiver of a band that is receiving. Fortunately, **RF filtering and overload protection** is improving in commercially available wireless transceivers in various popular bands, so that **overload protection may be offered within the wireless transceiver chip itself through the integrated circuitry.***

EX1001, 5:32-39; *see also id.*, 5:30-6:1, 7:9-14 (describing exemplary shielding and filtering techniques).

57. In my opinion, a POSITA would understand that the function defined by the claims, may be used to isolate RF components from particular frequency bands. In my opinion, in light of the specification disclosure, a POSITA would understand that the claimed function is “isolating said one or more components from more than one particular frequency band of said plurality of frequency bands” and

that the corresponding structure is element(s) that “provides overload protection, shielding, and/or filters out unwanted bands,” and equivalents thereof.

VIII. GROUND I: Claims 1-7, 25-31 are RENDERED obvious by Wen alone or in view of Poilasne

58. In my opinion, 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, in my opinion, a POSITA would have been motivated to modify Wen to use antenna arrays and control elements as taught by Poilasne.

A. Wen (EX1004)

59. The cover page of European Pat. No. 1,914,835 (“Wen”) indicates it was filed on October 20, 2006, and was first published on April 23, 2008. I am informed that it is prior art to the ’358 Patent.

60. In general, 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]

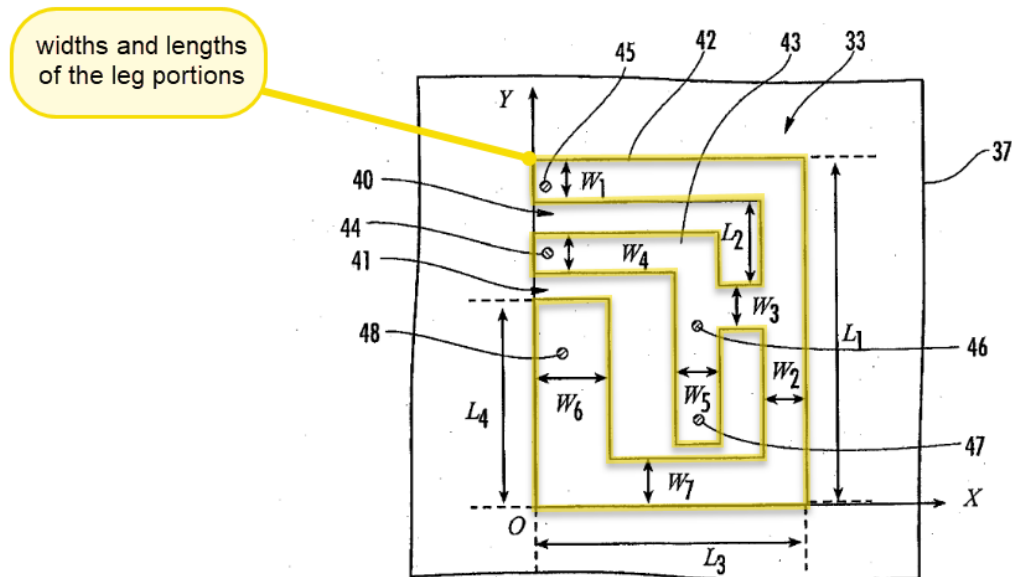
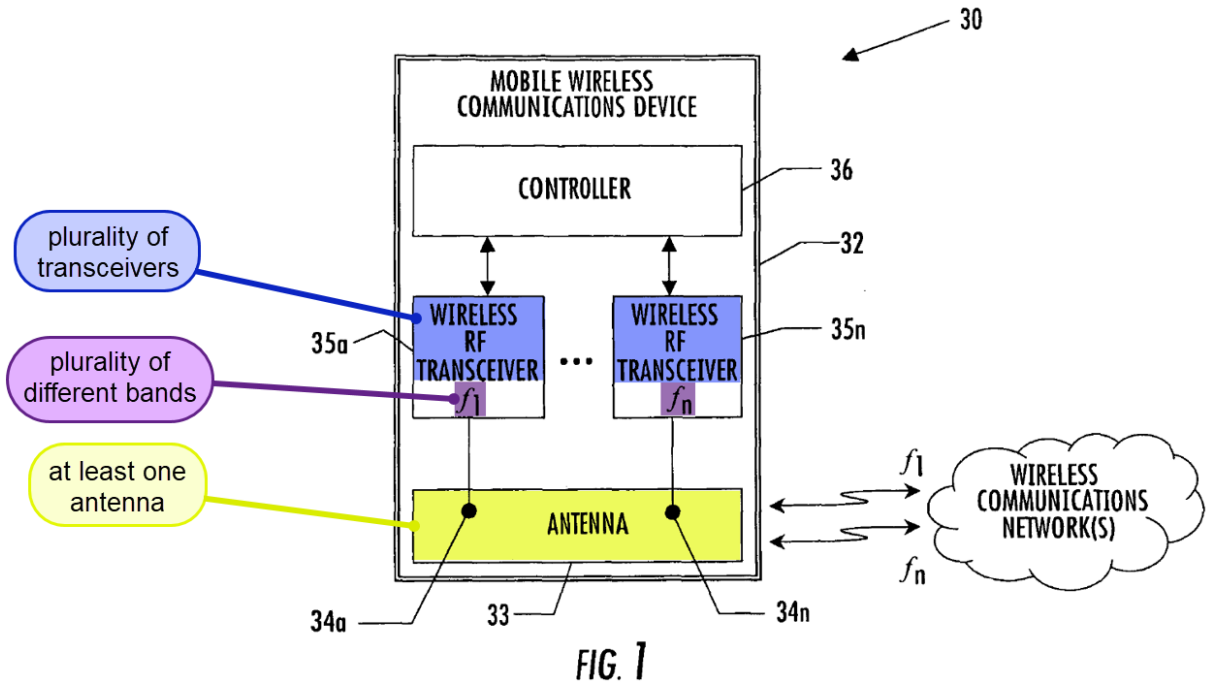


FIG. 2

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



B. Poilasne (EX1009)

62. The cover page of U.S. Pat. Pub. No. 2004/0095280 (“Poilasne”) indicates it was filed on November 18, 2002, and was published May 20, 2004. I am informed that it is prior art to the ’358 Patent.

63. In general, Poilasne discloses 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” that provides “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].

64. Poilasne's antenna array "is able to cover multiple frequency bands, either independently or at the same." EX1009, [0038]. In one embodiment the antenna is "a 3D antenna (79) comprised of multiple capacitively loaded magnetic dipole antennas" EX1009, [0067]. Such a multi-element antenna "effectuates coverage of multiple frequency bands and provides the most optimized solution in terms of input impedance, radiated power and beam direction." *Id.*

C. Motivation to combine

65. In my opinion, 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.

66. First, I note that Poilasne provides express motivations to utilize antenna arrays in wireless devices. In particular, 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.* In my opinion, a POSITA would have known that at least some of these techniques, including beam switching, are typically implemented using

antenna arrays.

67. I note that Poilasne also discloses unique advantages of its embodiments that comprise multiple antenna elements forming an antenna array. 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.” EX1009, [0060]. Poilasne teaches how to accomplish this using two or more antenna elements. *Id.*, [0060]-[0066] (embodiments with two elements), [0067] (embodiment with more than two elements).

68. Second, I note that Poilasne provides express motivations to utilize control elements to tune the antenna. In particular, Poilasne’s control elements are necessary to implement Poilasne’s antenna array because they are used to turn individual antennas on or off. EX1009, [0062]. However, Poilasne teaches that the control elements can also be used to “vary the resonant frequency of the antenna” or to “control the input impedance of the antenna.” *Id.*, [0046], [[0051]. In my opinion, both of these uses confer distinct advantages. For example, varying the resonant frequency of the antenna enables real-time switching between frequency bands used in different regions, *e.g.*, “switching from ... a 800/1900 MHz US band to a 900/1800 MHz GSM Europe and Asia band.” EX1004, [0037]. Similarly, controlling the impedance of the antenna allows real-time adjustment of “the input impedance ... to maintain the best antenna characteristics while the antenna’s

environment is changing.” *Id.*, [0051].

69. In my opinion, it was also well known in the art to use components such as tuners to perform tuning and impedance matching for an antenna. 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**” and used to “allow[] [an antenna] to operate over a wide range of frequencies” and adjust the impedance of the antenna to “minimize[] the SWR [standing wave ratio] and maximize[] power transfer through the antenna system.” EX1014, 1:51-2:9. In my opinion, a POSITA would have known that tuners are frequently used in RF systems to match the impedance at the antenna to the impedance of a transmitter, receiver, or transmitter in order to achieve well-known benefits, such as improving power transfer, minimizing distortion, and preventing overheating.

70. In addition, in my opinion, 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”).

71. In my opinion, a POSITA would have reasonably expected to be successful in modifying Wen based on Poilasne's teachings. In particular, it is my opinion that 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 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. In my opinion, 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.

D. Claim 1

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

72. I understand that the preamble to a patent claim is generally not limiting. However, to the extent the preamble is limiting, in my opinion Wen discloses "a mobile wireless communications device." EX1004, [0027]; *see also id.*, [0030], [0041], [0043].

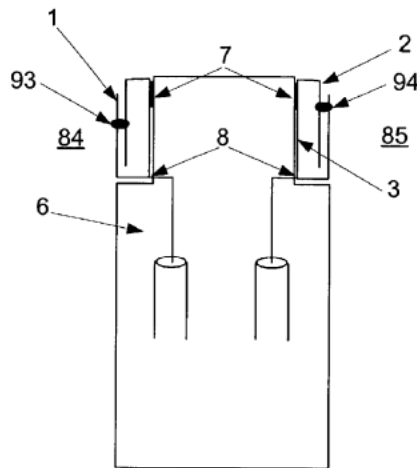
2. 1[a]: one or more antennas wherein at least one of said one or more antennas includes one or more elements or sub-elements, said one or more antennas forming an antenna array; and

73. In my opinion, it would have been obvious to a POSITA to use an

antenna array in Wen's wireless device in view of Poilasne. As I discussed above in Section VIII.C which I incorporate herein by reference, in my opinion 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.

74. First, I will address the **Poilasne's antenna design**. In particular, 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, specifically, Poilasne discloses using 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, in one embodiment, 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]. In another embodiment, Poilasne discloses a "3D antenna" comprising multiple dipole antennas that "effectuates coverage of multiple

frequency bands,” as illustrated in Figure 11 (reproduced below). *Id.*, [0067].



Top-View
Figure 9A

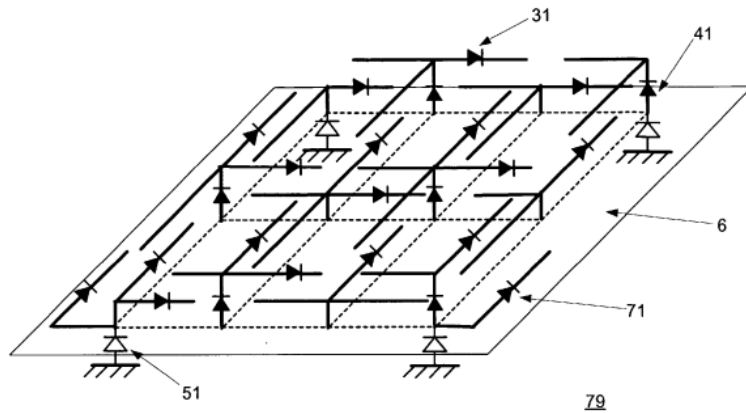


Figure 11

75. Poilasne’s antennas form an array because they work together to provide beam switching, antenna steering, or MIMO capabilities. *Id.*, [0042], [0060]. I note that PO applies the same understanding of the term “array” in its infringement contentions in the related district court case. EX1015, 3 (arguing that MIMO requires multiple antenna elements “configured and operated together as an array” and more generally that antenna elements that “operate together to provide

steerable, multi-band performance” are an “array”).

76. In my opinion, a POSITA would have understood that Poilasne’s array of dipole antennas can be used as the antenna in Wen’s system. I note that Wen expressly teaches that its multi-band antenna “may be a substantially linear antenna.” EX1004, [0033]. In my opinion, a dipole antenna is one type of linear antenna.

77. Next, I will address **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, showing antenna as element 33 in yellow):

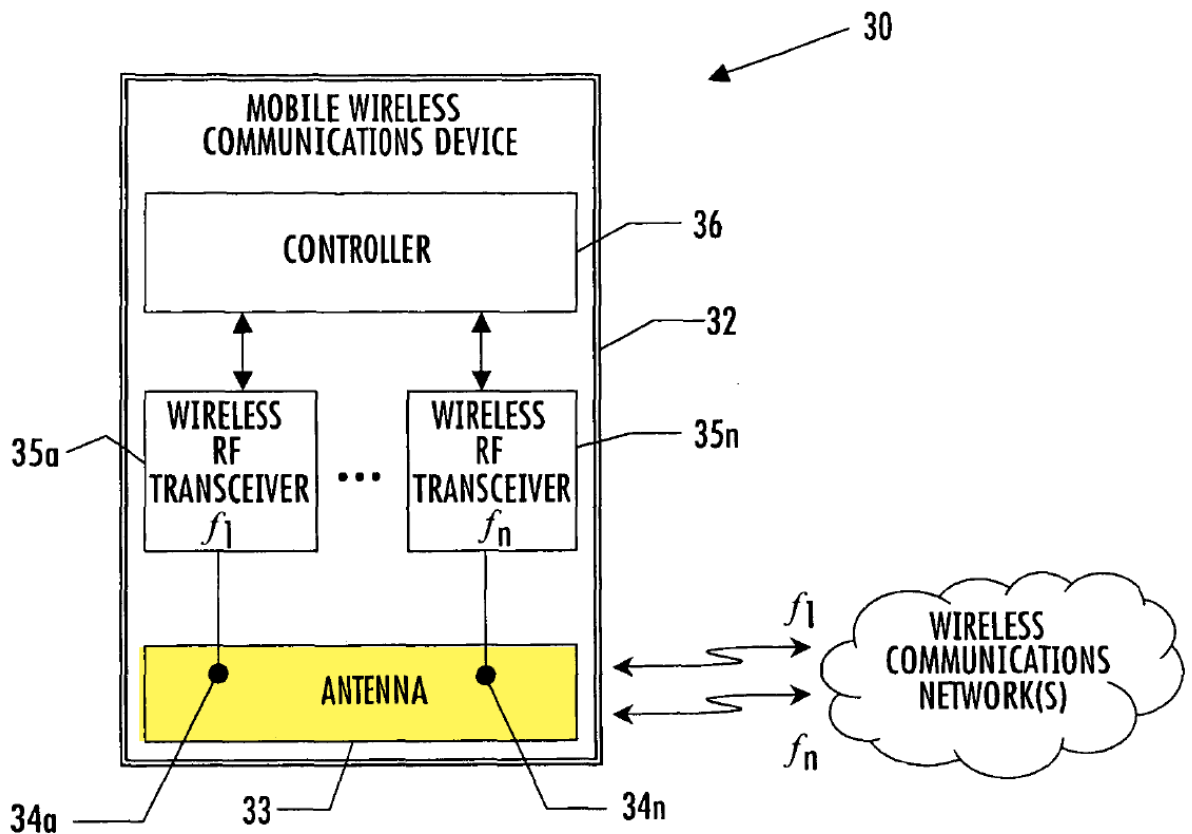


FIG. 1

78. 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 an exemplary embodiment):

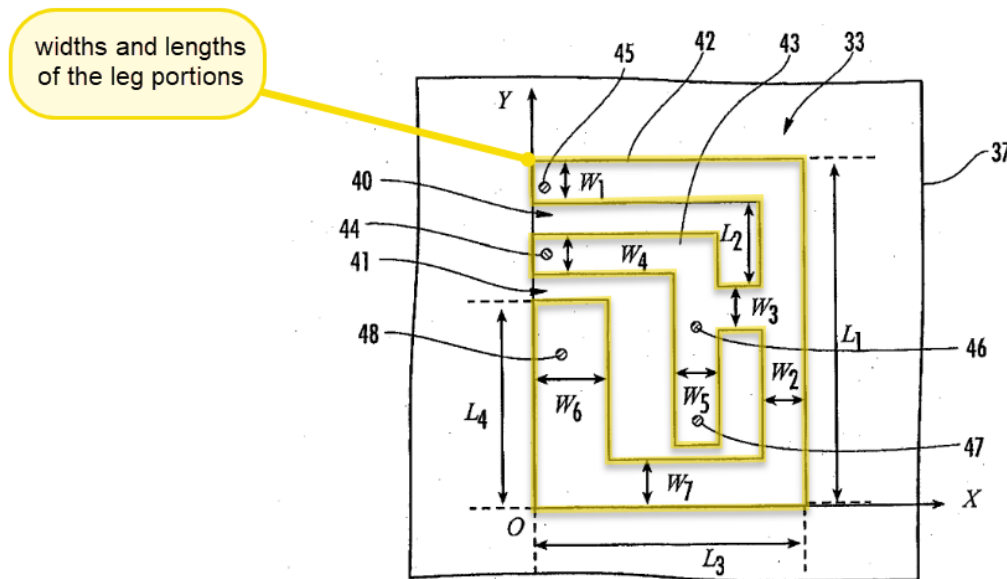


FIG. 2

79. As I 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. In my opinion, 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].

80. Accordingly, in my opinion Wen alone or in view of Poilasne renders

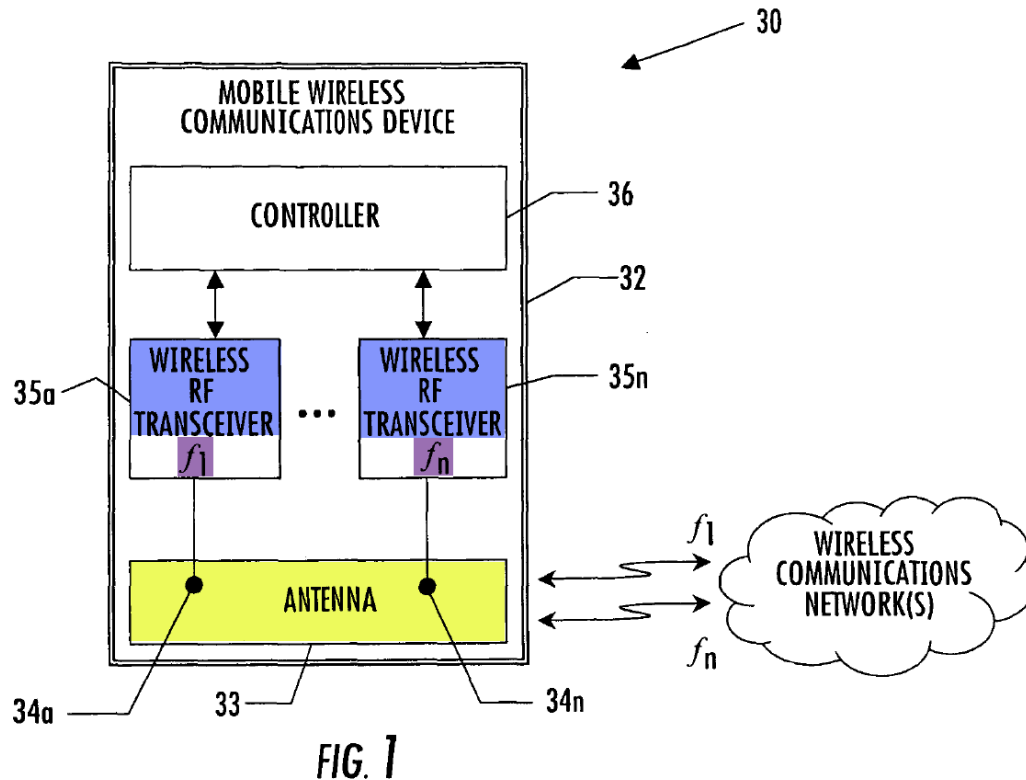
obvious Limitation 1[a] and a POSITA would have understood Wen alone or in view of Poilasne to render obvious Limitation 1[a].

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

81. In my opinion, Wen alone or in view of Poilasne renders obvious Limitation 1[b]. In particular, 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]. In my opinion, Wen’s transceivers are also useable with Poilasne’s antenna design because Poilasne’s antennas includes feed points and/or feed areas. 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 antenna embodiments with control elements coupled to an antenna feed point or feed area).

82. Each of Wen’s “wireless RF transceiver[s] preferably has a **respective different operating frequency** associated therewith.” *Id.*, [0031]; *see also id.*, [0039] (example with antenna “tuned to provide operation at 900 MHz, 1800 MHz, and 5 GHz via a selective connection of appropriate wireless RF transceivers”). Thus, it is my opinion that each transceiver operates in at least one frequency band, and the plurality of transceivers operate in multiple frequency bands (at least one per

transceiver) (*i.e., operate in one or more frequency bands*). Wen's transceivers are illustrated in Figure 1, annotated below, where the plurality of transceivers are elements 35a-35n as annotated in blue and their corresponding frequencies of operation are f_1 - f_n as annotated in purple:



83. Accordingly, in my opinion Wen alone or in view of Poilasne renders obvious Limitation 1[b] and a POSITA would have understood Wen in view of Poilasne to render obvious Limitation 1[b].

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,**

84. In my opinion, Wen alone or in view of Poilasne renders obvious

Limitation 1[c]. As I described above in connection with Limitation 1[b], Wen discloses a **plurality of transceivers** that operate in **a plurality of different bands** and connect to antenna feed points (*e.g.*, the feed points on Wen's or Poilasne's antennas). See EX1004, [0029] (example with "different operating frequencies ... within a range of about 900 MHz to 6 GHz").

85. As I described above in connection with Limitation 1[a], when Wen's antenna design is used in Poilasne's array, Wen discloses the antenna (*e.g.*, antenna 33) **is used by the plurality of transceivers in a plurality of different bands** (*e.g.*, transceivers 35a-35n operating in bands f_1 to f_n). EX1004, [0031], Fig. 1. As shown in Figure 1 that is reproduced and annotated above, the antenna is connected to and used by the plurality of transceivers. I note that Wen expressly discloses that "[t]he antenna 33 ... is **shared** by a **plurality of wireless radio frequency (RF) transceivers 35a-35n** (*e.g.*, cellular and/or wireless LAN transceivers)" and that "[e]ach wireless RF transceiver preferably has a respective **different operating frequency associated therewith.**" EX1004, [0031]; *see also id.*, [0039] (example where the antenna "provide[s] operation at 900 MHz, 1800 MHz, and 5 GHz via a selective connection of appropriate wireless RF transceivers 35"); [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 band for each of the plurality of transceivers.

86. As I described above in connection with Limitation 1[a], when Poilasne's antenna design is used, 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," 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. EX1004, [0027].

87. Accordingly, in my opinion Wen alone or in view of Poilasne renders obvious Limitation 1[c] and a POSITA would have understood Wen in view of Poilasne to render obvious Limitation 1[c].

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.**

88. In my opinion, Wen alone or in view of Poilasne renders obvious Limitation 1[d]. 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").

89. **Regarding Wen's antenna design**, in my opinion, 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. In particular, Wen

discloses **passive elements** in the form of “leg portions” that make up the antenna and “may advantageously **be selected to tune** the desired operating frequencies of the antenna 33.” EX1004, [0035]. Each leg portion “may be substantially related to a given operating frequency band” or “may influence multiple operating frequency bands.” *Id.* In my opinion, a POSITA would have understood 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]. The “plurality of leg portions” are illustrated in Figure 2, reproduced and annotated below. *Id.*, [0035], Fig. 2.

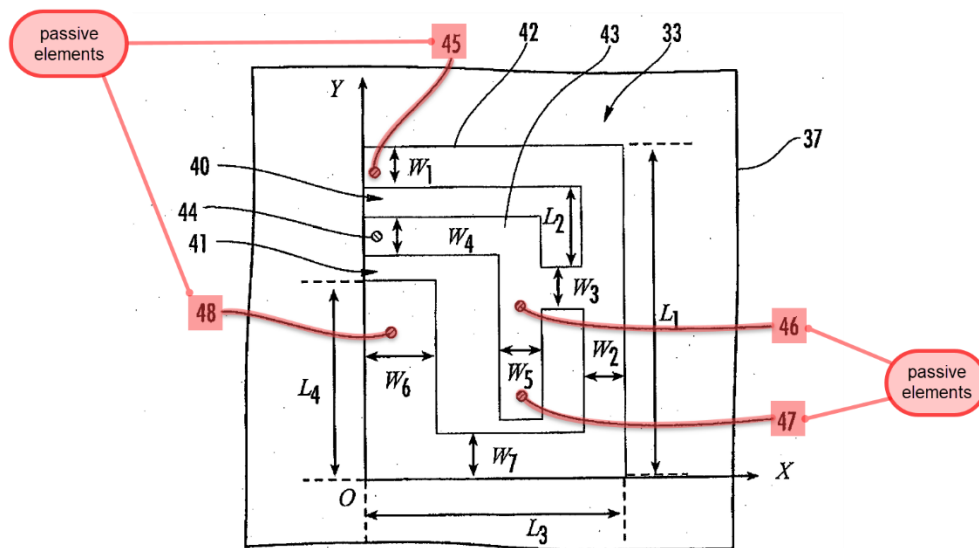
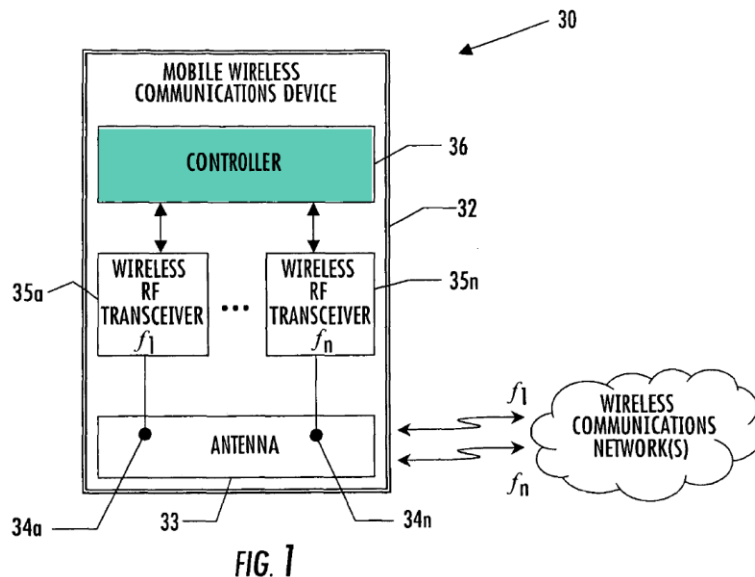


FIG. 2

90. 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). In other words, Wen’s controller tunes the antenna by selecting specific transceivers to provide a signal to a specific feed point on a leg portion, thereby selecting the corresponding leg portion and tuning the antenna to its associated operating frequency or frequencies. The controller is illustrated in Figure 1 as annotated below:



91. In my opinion, 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]. 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]. In my opinion, a POSITA would have understood that the selective operation of particular transceivers is accomplished using active circuit elements, such as switches. At a minimum, it is my opinion that 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.

92. **Regarding Poilasne’s antenna design**, Poilasne discloses both prong (a) and prong (b). In particular, 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]. Poilasne also discloses at least one “active control element” that is “electrically coupled to one or more of the portions.” EX1009, [0007].

93. 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]. 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”).

94. Accordingly, in my opinion Wen alone or in view of Poilasne renders obvious Limitation 1[d] and a POSITA would have understood Wen in view of Poilasne to render obvious Limitation 1[d]. As such, in my opinion Wen in view of Poilasne discloses and renders obvious the entirety of claim 1, and a POSITA would have understood Wen in view of Poilasne to disclose and render obvious the entirety of claim 1.

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

95. In my opinion, as I described above in connection with Limitation 1[d], Wen and Poilasne both disclose passive elements (*e.g.*, Wen’s leg portions and Poilasne’s antenna portions) that comprise ***distributed elements***. In my opinion, 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. In my opinion, 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. See EX1011, 3 (“distributed: Spread out over an electrically significant length or area.”), 4 (“lumped: effectively concentrated at a single point”).

96. 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).

97. Accordingly, in my opinion Wen alone or in view of Poilasne also discloses the additional limitation of Claim 2 and a POSITA would have understood Wen alone or in view of Poilasne to disclose the additional limitation of Claim 2. As such, in my opinion Wen alone or in view of Poilasne discloses and renders obvious the entirety of Claim 2, and a POSITA would have understood Wen alone or in view of Poilasne to disclose and render obvious the entirety of Claim 2.

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.

98. In my opinion, both Wen’s and Poilasne’s antenna designs operate

simultaneously in a plurality of different bands. 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]. Then, in my opinion antenna will accordingly transmit and/or receive in two frequency bands simultaneously. I note that Poilasne similarly discloses that its antenna design “is able to cover multiple frequency bands ... *at the same time*.” EX1009, [0038].

99. Accordingly, in my opinion Wen alone or in view of Poilasne also discloses the additional limitation of Claim 3 and a POSITA would have understood Wen alone or in view of Poilasne to disclose the additional limitation of Claim 3. As such, in my opinion Wen alone or in view of Poilasne discloses and renders obvious the entirety of Claim 3, and a POSITA would have understood Wen alone or in view of Poilasne to disclose and render obvious the entirety of Claim 3.

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”**

100. As I described above in Section VIII.C, in my opinion, it would have been obvious to a POSITA in view of Poilasne to add control elements (*i.e.*, *tuners*) to Wen’s wireless device. In particular, 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 “provide a good impedance match for each of the transceivers.” EX1001, 5:24-32. I note that 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.

101. 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 my opinion, 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. As I described above in connection with Limitation 1[b], 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.

102. Accordingly, in my opinion Wen alone or in view of Poilasne renders obvious Limitation 4[a] and a POSITA would have understood Wen alone or in view of Poilasne to render obvious Limitation 4[a].

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”

103. 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).

104. In my opinion, a POSITA would have understood that that the control elements must thus be controlled by an external component. It is also my opinion that 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. 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]. The controller is illustrated in Figure 1, annotated below.

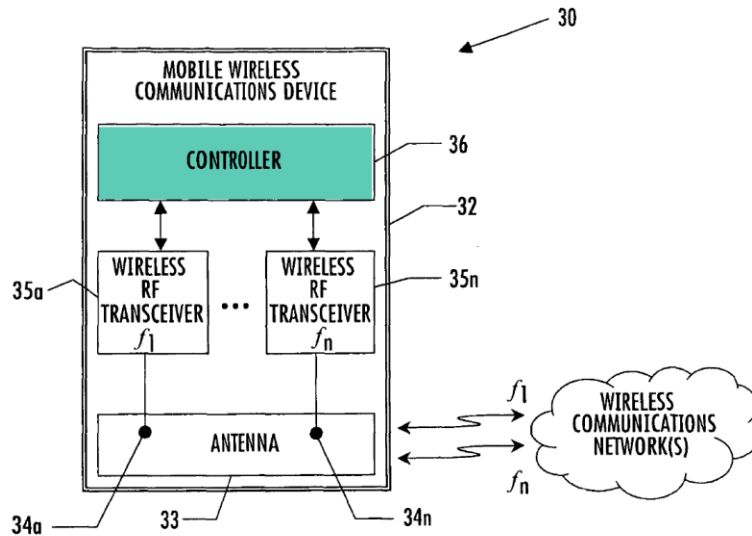


FIG. 1

105. As I 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, in my opinion, 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.

106. Accordingly, in my opinion Wen alone or in view of Poilasne renders obvious Limitation 4[b] and a POSITA would have understood WeWen alone or in view of Poilasne to render obvious Limitation 4[b]. As such, in my opinion Wen alone or in view of Poilasne discloses and renders obvious the entirety of claim 4, and a POSITA would have understood Wen alone or in view of Poilasne to disclose and render obvious the entirety of claim 4.

- 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.**

107. In my opinion, 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”). 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].

108. Accordingly, in my opinion Wen discloses the additional limitation of Claim 5 and a POSITA would have understood Wen to disclose the additional limitation of Claim 5. As such, in my opinion Wen alone or in view of Poilasne discloses and renders obvious the entirety of Claim 5, and a POSITA would have understood Wen alone or in view of Poilasne to disclose and render obvious the entirety of Claim 5.

- 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.**

109. In my opinion, 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]. It is also my opinion that Poilasne also teaches that multiple antennas can be utilized in parallel, which is consistent with MIMO operation. EX1009, [0062], [0064].

110. Accordingly, in my opinion Poilasne discloses the additional limitation of Claim 6 and a POSITA would have understood Poilasne to disclose the additional limitation of Claim 6. As such, in my opinion Wen alone or in view of Poilasne discloses and renders obvious the entirety of Claim 6, and a POSITA would have understood Wen alone or in view of Poilasne to disclose and render obvious the entirety of Claim 6.

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

111. In my opinion, 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].

112. Accordingly, in my opinion Poilasne discloses the additional limitation of Claim 7 and a POSITA would have understood Poilasne to disclose the additional limitation of Claim 7. As such, in my opinion Wen alone or in view of Poilasne discloses and renders obvious the entirety of Claim 7, and a POSITA would have understood Wen alone or in view of Poilasne to disclose and render obvious the

entirety of Claim 7.

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,**

113. I understand that the preamble to a patent claim is generally not limiting. However, to the extent the preamble is limiting, in my opinion Wen alone or in view of Poilasne discloses 25[pre]. I have broken 25[pre] into sub-parts below, and discuss each in turn with reference to Wen and Poilasne's disclosure.

114. In my opinion, Wen discloses ***"A wireless device component"*** requirement of 25[pre]. In particular, as I described above in connection with 1[pre] of Ground I, Wen discloses a wireless device. Furthermore, as I described above in connection with Limitations 1[a] and 1[b] of Ground I, the wireless device includes components such as antennas and transceivers.

115. In my opinion, Wen alone or in view of Poilasne render obvious ***"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"*** requirement of 25[pre]. In particular, as

I described above in connection with Limitations 1[b], 4[a], and 4[b] of Ground I, Wen and Poilasne render obvious tuners and a controller coupled to an antenna in an antenna array and a plurality of transceivers.

116. In my opinion, as I described above in connection with Limitation 1[a] of Ground I, Wen alone or in view of Poilasne render obvious “**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**” requirement of 25[pre].

117. In my opinion, as I described above in connection with Limitations 1[a] and 1[b] of Ground I, Wen alone or in view of Poilasne render obvious “**at least one antenna and a plurality of transmitters, receivers, or transceivers that operate at one or more frequency bands**” requirement of 25[pre].

118. In my opinion, as I described above in connection with Limitation 1[c] of Ground I, Wen alone or in view of Poilasne render obvious “**wherein said at least one antenna is used by said plurality of transmitters, receivers or transceivers in a plurality of different bands**” requirement of 25[pre].

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.

119. For at least the same reasons I explain and reference above in connection with Limitation 1[d] of Ground I, which I incorporate herein by reference, it is my opinion that Wen alone or in view of Poilasne discloses and

renders obvious Limitation 25[a]. As such, in my opinion Wen in view of Poilasne discloses and renders obvious the entirety of claim 25, and a POSITA would have understood Wen in view of Poilasne to disclose and render obvious the entirety of claim 25.

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.

120. For at least the same reasons I explain and reference above in connection with Claim 6 of Ground I, which I incorporate herein by reference, it is my opinion that Wen alone or in view of Poilasne discloses and renders obvious the additional limitations of Claim 26. As such, in my opinion Wen alone or in view of Poilasne discloses and renders obvious the entirety of Claim 26.

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.

121. For at least the same reasons I explain and reference above in connection with Claim 7 of Ground I, which I incorporate herein by reference, it is my opinion that Wen alone or in view of Poilasne discloses and renders obvious the additional limitations of Claim 27. As such, in my opinion Wen alone or in view of Poilasne discloses and renders obvious the entirety of Claim 27.

N. Claim 28

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

122. I understand that the preamble to a patent claim is generally not

limiting. However, to the extent the preamble is limiting, in my opinion 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].

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

123. For at least the same reasons I explain and reference above in connection with 1[pre] of Ground I, which I incorporate herein by reference, it is my opinion that Wen alone or in view of Poilasne discloses and renders obvious Limitation 28[a].

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

124. For at least the same reasons I explain and reference above in connection with 1[pre] of Ground I, which I incorporate herein by reference, it is my opinion that Wen alone or in view of Poilasne discloses and renders obvious Limitation 28[a][i].

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

125. For at least the same reasons I explain and reference above in connection with Limitation 1[b] of Ground I, which I incorporate herein by reference, it is my opinion that Wen alone or in view of Poilasne discloses and renders obvious Limitation 28[a][ii].

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,**

126. For at least the same reasons I explain and reference above in connection with Limitation 1[c] of Ground I, which I incorporate herein by reference, it is my opinion that Wen alone or in view of Poilasne discloses and renders obvious Limitation 28[a][iii].

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**

127. For at least the same reasons I explain and reference above in connection with Limitation 1[d] of Ground I, which I incorporate herein by reference, it is my opinion that Wen alone or in view of Poilasne discloses and renders obvious Limitation 28[a][iv].

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

128. In my opinion, Wen discloses that its wireless device communicates with a “**wireless communication network**” such as a “cellular network” or “wireless local area network.” EX1004, [0030]. In my opinion, 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). See EX1004, [0050]-[0052] (describing data, voice, and short-range communications modes for communicating with other devices). As such, in my opinion Wen in view of Poilasne discloses and renders obvious the entirety of claim 28, and a POSITA would have understood Wen in view of Poilasne to disclose and render obvious the entirety of claim 28.

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.

129. For at least the same reasons I explain and reference above in connection with Limitation 1[a] of Ground I, which I incorporate herein by reference, it is my opinion that Wen alone or in view of Poilasne discloses and renders obvious the additional limitations of Claim 29. As such, in my opinion Wen alone or in view of Poilasne discloses and renders obvious the entirety of Claim 29.

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.

130. For at least the same reasons I explain and reference above in connection with Claim 6 of Ground I, which I incorporate herein by reference, it is my opinion that Wen alone or in view of Poilasne discloses and renders obvious the additional limitations of Claim 30. As such, in my opinion Wen alone or in view of Poilasne discloses and renders obvious the entirety of Claim 30.

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.

131. For at least the same reasons I explain and reference above in connection with Claim 7 of Ground I, which I incorporate herein by reference, it is my opinion that Wen alone or in view of Poilasne discloses and renders obvious the additional limitations of Claim 31. As such, in my opinion Wen alone or in view of Poilasne discloses and renders obvious the entirety of Claim 31.

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

132. In my opinion, 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)

133. The cover page of U.S. Pat. No. 7,489,914 ("Govind") indicates it was filed on April 25, 2005 and published on November 10, 2005. I am informed that it is prior art to the '358 Patent.

134. In general, 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

135. In my opinion, as I described above in Section VIII.C, a POSITA would have been motivated to use an antenna array and control elements as taught by Poilasne in Wen’s wireless device, and would have reasonably expected the combination to succeed.

136. In my opinion, 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.

137. First, in my opinion, multiband transceivers were well known in the art and were commercially available prior to August 2008. 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, it is my opinion that 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.

138. Second, I note that Wen provides an express motivation to combine. In particular, 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.* In my opinion, 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.

139. Third, I note that Govind provides a similar express motivation to combine. In particular, Govind discloses using multiband transceivers in systems with “a multi-band antenna ... for receiving signals in various frequency ranges.”

EX1008, 17:17-31. Specifically, 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. In my opinion, 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.

140. 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].

141. Finally, in my opinion, a POSITA would have reasonably expected the combination to succeed. As noted above, multiband transceivers were well known and commercially available prior to the '358 Patent. EX1013, 1:11-15; EX1001, 6:54-57. In my opinion, 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. In addition, it is my opinion that it would have been trivial for a POSITA to integrate multiband transceivers into Wen's

system because Wen's controller and antenna are already configured to operate using multiple frequency bands.

C. Claim 8

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

142. I understand that the preamble to a patent claim is generally not limiting. However, to the extent the preamble is limiting, for at least the same reasons I explain and reference above in connection with 1[pre] of Ground I, which I incorporate herein by reference, it is my opinion that Wen discloses and renders obvious 8[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;

143. As I described above in connection with Limitation 1[a] of Ground I, which I incorporate herein by reference, it is my opinion that Wen alone or in view of Poilasne renders obvious Limitation 8[a].

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

144. In my opinion, it would have been obvious to a POSITA to use a multiband transceiver in Wen's system based on Govind.

145. In particular, 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.

146. For the reasons discussed above in Section IX.B, in my opinion, 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. Accordingly, in my opinion Wen in view of Govind renders obvious Limitation 8[b] and a POSITA would have understood Schlub to disclose Limitation 8[b].

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

147. For at least the same reasons I explain and reference above in connection with Limitation 4[a] of Ground I, which I incorporate herein by reference, it is my opinion that Wen alone or in view of Poilasne renders obvious Limitation 8[c].

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

148. For at least the same reasons I explain and reference above in connection with Limitation 4[b] of Ground I, which I incorporate herein by

reference, it is my opinion that Wen alone or in view of Poilasne renders obvious Limitation 8[d].

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,

149. For at least the same reasons I explain and reference above in connection with Limitation 1[c] of Ground I, which I incorporate herein by reference, it is my opinion that Wen alone or in view of Poilasne renders obvious Limitation 8[e]. In particular, 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"). Thus, in my opinion, a multiband transceiver connected to one feed point would use the antenna in a plurality of different bands. 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]. Thus, in my opinion, the multiband transceiver connected to the feed point would use the antenna in a plurality of different bands.

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.

150. As I described above in connection with Limitation 1[d] of Ground I,

which I incorporate herein by reference, it is my opinion that Wen alone or in view of Poilasne renders obvious Limitation 8[f]. As such, in my opinion Wen in view of Poilasne and Govind discloses and renders obvious the entirety of claim 28, and a POSITA would have understood Wen in view of Poilasne and Govind to disclose and render obvious the entirety of claim 28.

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.

151. For at least the same reasons I explain and reference above in connection with Claim 3 of Ground I, which I incorporate herein by reference, it is my opinion that Wen in view of Poilasne and Govind discloses and renders obvious the additional limitations of Claim 9. As such, in my opinion Wen in view of Poilasne and Govind discloses and renders obvious the entirety of Claim 9.

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.

152. For at least the same reasons I explain and reference above in connection with Claim 5 of Ground I, which I incorporate herein by reference, it is my opinion that Wen in view of Poilasne and Govind discloses and renders obvious the additional limitations of Claim 10. As such, in my opinion Wen in view of Poilasne and Govind discloses and renders obvious the entirety of Claim 10.

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

153. For at least the same reasons I explain and reference above in connection with Claim 2 of Ground I, which I incorporate herein by reference, it is my opinion that Wen in view of Poilasne and Govind discloses and renders obvious the additional limitations of Claim 11. As such, in my opinion Wen in view of Poilasne and Govind discloses and renders obvious the entirety of Claim 11.

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.

154. For at least the same reasons I explain and reference above in connection with Claim 6 of Ground I, which I incorporate herein by reference, it is my opinion that Wen in view of Poilasne and Govind discloses and renders obvious the additional limitations of Claim 12. As such, in my opinion Wen in view of Poilasne and Govind discloses and renders obvious the entirety of Claim 12.

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

155. For at least the same reasons I explain and reference above in connection with Claim 7 of Ground I, which I incorporate herein by reference, it is my opinion that Wen in view of Poilasne and Govind discloses and renders obvious the additional limitations of Claim 13. As such, in my opinion Wen in view of Poilasne and Govind discloses and renders obvious the entirety of Claim 13.

I. Claim 14:

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

156. I understand that the preamble to a patent claim is generally not limiting. However, to the extent the preamble is limiting, for at least the same reasons I explain and reference above in connection with 8[pre] of Ground II, which I incorporate herein by reference, it is my opinion that Wen discloses and renders obvious 14[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;

157. As I described above in connection with Limitation 8[a] of Ground II, which I incorporate herein by reference, it is my opinion that Wen in view of Poilasne and Govind discloses and renders obvious Limitation 14[a].

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

158. As I described above in connection with Limitation 8[b] of Ground II, which I incorporate herein by reference, it is my opinion that Wen in view of Poilasne and Govind discloses and renders obvious Limitation 14[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.

159. In my opinion, Wen in view of Poilasne and Govind renders obvious

Limitation 14[c]. I have broken this limitation into sub-parts below, and discuss each in turn with reference to Wen, Poilasne, and Govind's disclosure.

160. In my opinion, for at least the same reasons I explain and reference above in connection with Limitation 8[c] of Ground II, which I incorporate herein by reference, Wen alone or in view of Poilasne renders obvious “**a tuner associated with said at least one multiband transmitter, receiver, or transceiver**” requirement of Limitation 14[c].

161. In my opinion, Wen in view of Poilasne and Govind renders “**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**” requirement of Limitation 14[c] obvious. As I discussed above in connection with Limitation 8[b] of Ground II, it would have been obvious to a POSITA to substitute multiband transceivers for Wen's transceivers in view of Govind. In my opinion, as I discussed above in connection with Limitation 8[c] of Ground II, 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. I note that 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]. In my

opinion, a POSITA would have understood from these disclosures that the control element—a *tuner*—matches the antenna and transceivers in multiple bands simultaneously.

162. As such, in my opinion Wen in view of Poilasne and Govind discloses and renders obvious the entirety of claim 14, and a POSITA would have understood Wen in view of Poilasne and Govind to disclose and render obvious the entirety of claim 14.

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.

163. For at least the same reasons I explain and reference above in connection with Claim 9 of Ground I, which I incorporate herein by reference, it is my opinion that Wen in view of Poilasne and Govind discloses and renders obvious the additional limitations of Claim 15. As such, in my opinion Wen in view of Poilasne and Govind discloses and renders obvious the entirety of Claim 15.

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.

164. For at least the same reasons I explain and reference above in connection with Claim 10 of Ground I, which I incorporate herein by reference, it is my opinion that Wen in view of Poilasne and Govind discloses and renders obvious

the additional limitations of Claim 16. As such, in my opinion Wen in view of Poilasne and Govind discloses and renders obvious the entirety of Claim 16.

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.

165. For at least the same reasons I explain and reference above in connection with Claim 12 of Ground I, which I incorporate herein by reference, it is my opinion that Wen in view of Poilasne and Govind discloses and renders obvious the additional limitations of Claim 17. As such, in my opinion Wen in view of Poilasne and Govind discloses and renders obvious the entirety of Claim 17.

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

166. For at least the same reasons I explain and reference above in connection with Claim 13 of Ground I, which I incorporate herein by reference, it is my opinion that Wen in view of Poilasne and Govind discloses and renders obvious the additional limitations of Claim 18. As such, in my opinion Wen in view of Poilasne and Govind discloses and renders obvious the entirety of Claim 18.

N. Claim 19:

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

167. I understand that the preamble to a patent claim is generally not limiting. However, to the extent the preamble is limiting, for at least the same reasons I explain and reference above in connection with 8[pre] regarding wireless device

and Claim 10 regarding portable devices of Ground II, which I incorporate herein by reference, it is my opinion that Wen discloses and renders obvious 19[pre].

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;**

168. In my opinion, as I described above in connection with Limitation 8[a] of Ground II, Wen and Poilasne disclose or render obvious ***one or more antennas***. In particular, as I described above in connection with Limitation 8[e] of Ground II, Wen's and Poilasne's antenna designs each send and receive signals at a ***plurality of particular frequency bands***, where the 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"). In my opinion, 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. Accordingly, in my opinion Wen in view of Poilasne and Govind discloses and renders obvious Limitation 19[a].

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;**

169. For at least the same reasons I explain and reference above in connection with Limitation 1[b]-1[c] of Ground I, which I incorporate herein by reference, it is my opinion that Wen discloses ***one or more transceivers*** connected to ***one or more antennas***.

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.**

170. As I described above in connection with Limitation 19[b], Wen discloses one or more transceivers (*i.e.*, ***components***). In my opinion, a POSITA would have understood that transceivers send and receive signals by ***transmitting and receiving electromagnetic energy***, respectively.

171. In my opinion, Wen discloses “**two or more components transmit or receive electromagnetic energy simultaneously at two or more of said plurality of particular frequency bands**” requirement of Limitation 19[c]. In particular, as I described above in connection with Limitation 1[b] of Ground I, 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 a different

frequency bands. In my opinion, Wen's transceivers collectively operate in a ***plurality of frequency bands***. As I described above in connection with Claim 3 of Ground I, Wen further discloses that multiple transceivers may use the antenna at different frequency bands "at the same time" (*i.e.*, ***simultaneously***). EX1004, [0031].

172. In my opinion, Wen renders obvious "***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***" requirement of Limitation 19[c]. In particular, Wen renders obvious the first optional prong of this limitation. In my opinion, as I described above in connection with Limitation 8[b], it would have been obvious to a POSITA to use a multiband transceiver in Wen's system based on Govind. In my opinion, a *multiband* transceiver transmits and receives in two or more frequency bands simultaneously.

173. As such, in my opinion Wen in view of Poilasne and Govind discloses and renders obvious the entirety of claim 19, and a POSITA would have understood Wen in view of Poilasne and Govind to disclose and render obvious the entirety of claim 19.

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.

174. For at least the same reasons I explain and reference above in

connection with Claim 10 of Ground II, which I incorporate herein by reference, it is my opinion that Wen in view of Poilasne and Govind discloses and renders obvious the additional limitations of Claim 20. As such, in my opinion Wen in view of Poilasne and Govind discloses and renders obvious the entirety of Claim 20.

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.

175. In my opinion, as I described above in connection with Limitation 8[c], 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. In particular, Wen discloses that each of its transceivers has "a respective different operating frequency." EX1004, [0027]. In my opinion, 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.

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.

176. For at least the same reasons I explain and reference above in connection with Claim 12 of Ground II, which I incorporate herein by reference, it is my opinion that Wen in view of Poilasne and Govind discloses and renders obvious the additional limitations of Claim 23. As such, in my opinion Wen in view

of Poilasne and Govind discloses and renders obvious the entirety of Claim 23.

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.

177. For at least the same reasons I explain and reference above in connection with Claim 13 of Ground II, which I incorporate herein by reference, it is my opinion that Wen in view of Poilasne and Govind discloses and renders obvious the additional limitations of Claim 24. As such, in my opinion Wen in view of Poilasne and Govind discloses and renders obvious the entirety of Claim 24.

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

178. In my opinion, 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)

179. The cover page of U.S. Pat. No. 5,926,751 (“Vlahos”) indicates it was filed on February 19, 1997 and issued on July 20, 1999. I am informed that it is prior art under at to the ’358 Patent.

180. In general, 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

181. As I described above in Section VIII.C, in my opinion, a POSITA would have been motivated to use an antenna array and control elements as taught by Poilasne in Wen’s wireless device, and would have reasonably expected the combination to succeed. .

182. As I described above in Section IX.B, in my opinion, 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.

183. In my opinion, 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.

184. First, in my opinion, the need for RF isolation in multi-band wireless

communication systems would have been well understood by a POSITA. In my opinion, 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, in my opinion, adding RF isolation and filtering to Wen represents the use of a known technique with predictable results.

185. Second, I note that Vlahos provides an express motivation to combine. In particular, Vlahos discloses that its filters and other isolation circuitry “provide isolation ... from transmitter energy and other spurious frequencies.” EX1007, 2:59-65. In my opinion, 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. In addition, it is my opinion that 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.

186. In addition, like Wen, Poilasne, Govind, and the '358 Patent, it is my

opinion that 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.”).

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

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.

188. As I discussed above in Section VII, this is a means-plus-function limitation with the function “isolating said one or more components from more than one particular frequency band of said plurality of frequency bands” and corresponding structure “circuitry that provides overload protection, shielding, and/or filters out unwanted bands.”

189. In my opinion, 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.

190. In my opinion, Vlahos discloses several types of circuitry for filtering out unwanted frequency bands. 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).

191. For the reasons discussed above in Section X.B, in my opinion, 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. As such, in my opinion Wen in view of Poilasne, Govind, and Vlahos renders obvious the entirety of claim 22, and a POSITA would have understood Wen in view of Poilasne, Govind, and Vlahos to disclose and render obvious the entirety of claim 22.

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

192. In my opinion, 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 disclose a plurality of transmitters, receivers, or transceivers, Wen discloses connecting a plurality of transceivers to a multiband antenna. In my opinion, 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.

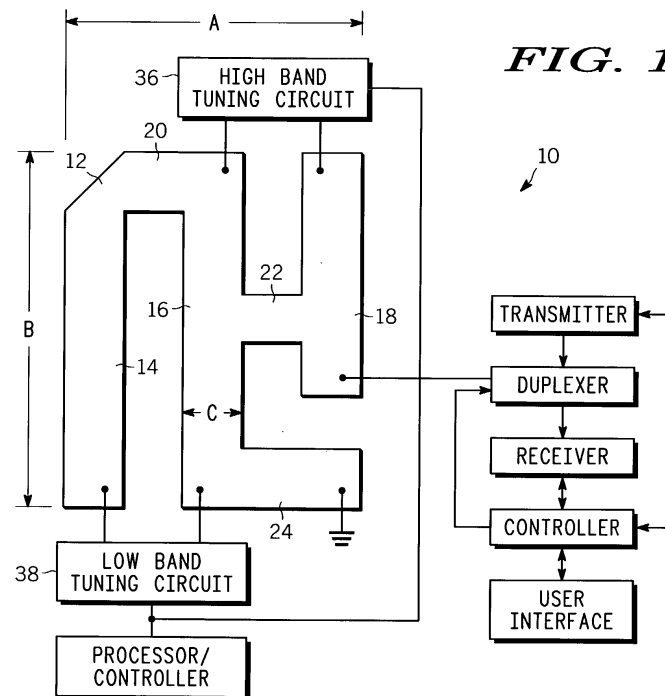
A. Rubinshteyn (EX1006)

193. The cover page of U.S. Pat. Pub. No. 2004/0125027 ("Rubinshteyn") indicates it was filed on December 27, 2002, and was published July 1, 2004. I am informed that it is prior art to the '358 Patent.

194. In general, Rubinshteyn discloses 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.*

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



B. Motivation to Combine

196. In my opinion, 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.

197. First, in my opinion, both single-band and multiband transceivers were well known in the art and were commercially available prior to August 2008. See EX1013, 1:11-15 (“A vast majority of the transceivers are built for being used in only one band, the more the bands the more transceivers. Relatively recent, multi-band transceivers and accordingly multi-band receivers and multi-band transmitters have been considered.”). I note that 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 where different antenna ports are provided for various RF output bands.”). Accordingly, using a plurality of transceivers with Rubinshteyn’s multiband antenna would have been a simple substitution of known elements with predictable results.

198. Second, in my opinion, 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. Accordingly, it is my opinion that it would have been obvious to a POSITA to try from among these two finite number of well-known and predictable solutions. Further, in my opinion, 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. 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), in my opinion, design constraints may nevertheless limit a particular device to use a plurality of single-band transceivers.

199. In my opinion, 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.

200. First, I note that Poilasne provides express motivations to utilize antenna arrays in wireless devices. In particular, Poilasne teaches 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]. As I described above in Section VIII.C, Poilasne discloses that these techniques can be achieved using antenna arrays with two or more antenna elements. EX1009, [0060]-[0067].

201. Second, I note that 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]. In my opinion, 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,” as I described in more detail above in Section VIII.C. EX1009, [0037], [0051]. In addition, it is my opinion that 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.

202. In addition, in my opinion, 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].

203. Finally, in my opinion, a POSITA would have reasonably expected the combination to succeed. In particular, 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. In my opinion, a POSITA would have capable of implementing this change using routine engineering to achieve predictable results. In addition, because Rubinshteyn’s antenna is already configured to operate using

multiple frequency bands, it is my opinion that 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.

204. In my opinion, 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. In my opinion, 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.

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

205. I understand that the preamble to a patent claim is generally not limiting. However, to the extent the preamble is limiting, in my opinion, Rubinshteyn discloses "tunable, multiple-frequency planar antennas ***for wireless communication devices.***" EX1006, [0001].

206. Accordingly, in my opinion Rubinshteyn discloses 1[pre] and a POSITA would have understood Rubinshteyn to disclose 1[pre].

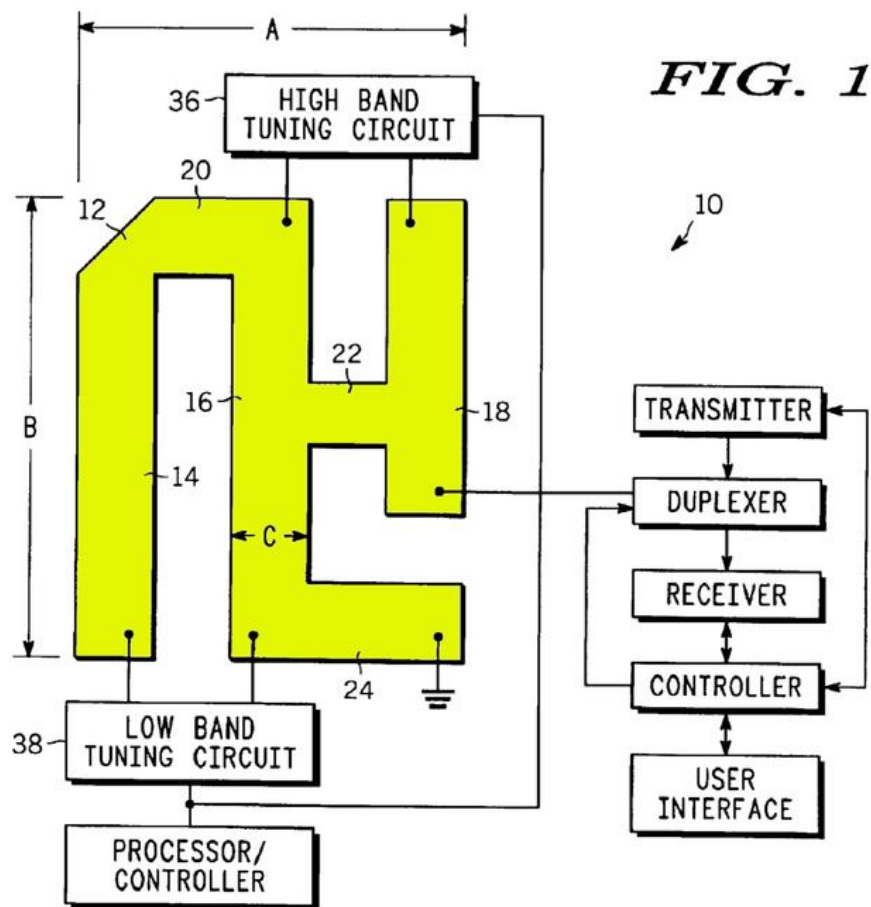
1. **1[a]: one or more antennas wherein at least one of said one or more antennas includes one or more elements or sub-elements, said one or more antennas forming an antenna array; and**

207. In my opinion, it would have been obvious to a POSITA to use an antenna array in Rubinshteyn's wireless device in view of Poilasne. As I discussed above 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.

208. **Regarding Poilasne's antenna design**, in my opinion, as I described above in connection with Limitation 1[a] of Ground I, 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).

209. In my opinion, 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.

210. **Regarding Rubinshteyn's antenna design**, in my opinion, Rubinshteyn discloses one or more antennas. 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 as annotated in yellow is shown in Figure 1 reproduced below.



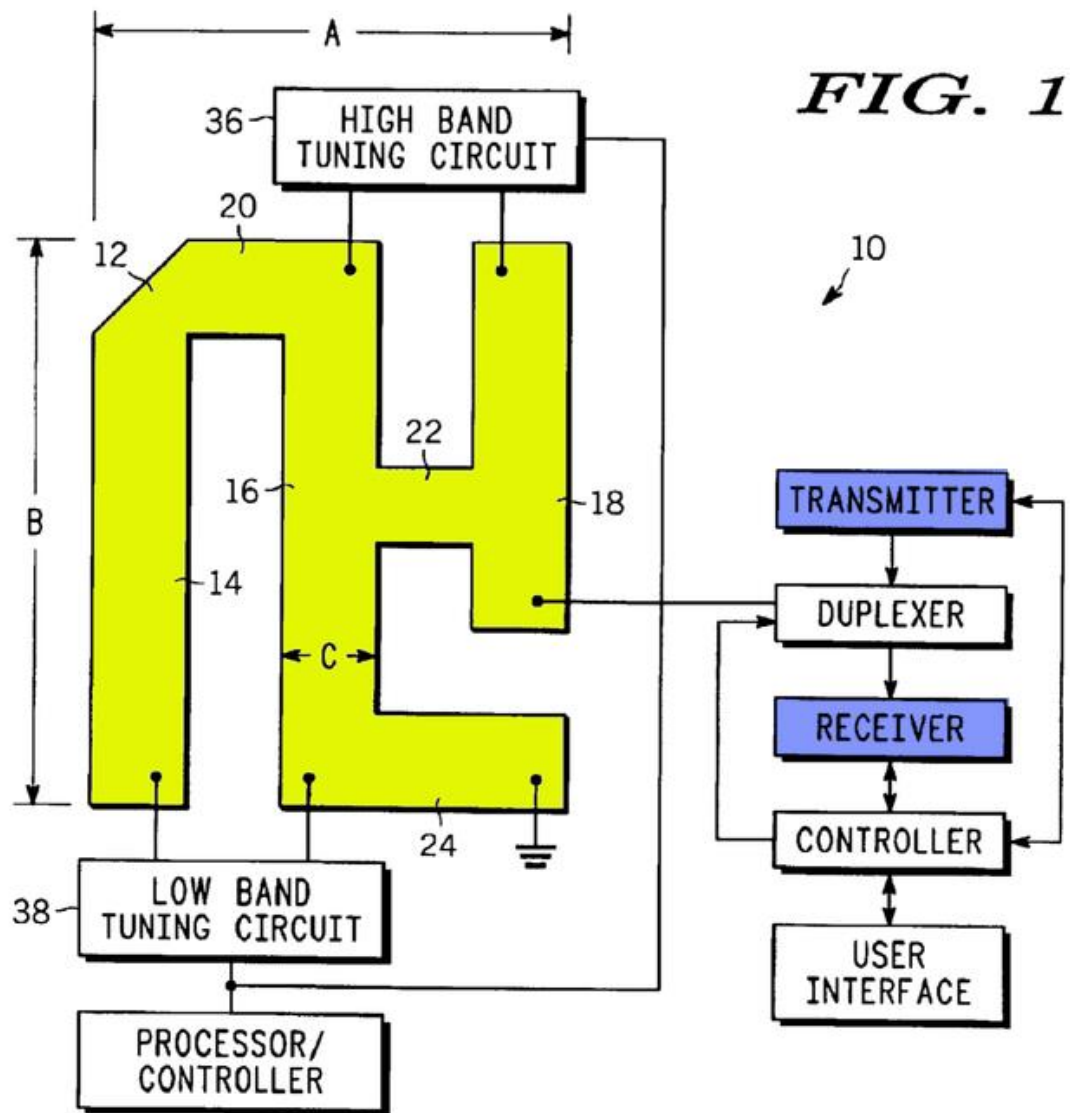
211. As I discussed above, Poilasne discloses an array of two or more dipole antennas that work together to provide beam switching, steering, or MIMO capabilities. EX1009, [0042], [0060]-[0062], [0067], Fig. 9A, Fig. 11. In my opinion, a POSITA would have understood that Rubinshteyn's antenna design 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].

212. Accordingly, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious Limitation 1[a] and a POSITA would have understood

Rubinshteyn in view of Wen and Poilasne to disclose and render obvious Limitation 1[a].

2. 1[b]: a plurality of transmitters, receivers or transceivers that operate in one or more frequency bands,

213. In my opinion, Rubinshteyn discloses at least one multiband transmitter and receiver. 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.*” In my opinion, 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***. For example, Rubinshteyn discloses that its multiband system “allows a user ... to use multiple services with the same antenna.” EX1006, [0016]. In my opinion, 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. 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’s transmitter and receiver as annotated in blue are shown in Figure 1 reproduced below.



214. In my opinion, 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. In my opinion, when Rubinshteyn's antennas are used in the antenna array of Poilasne, the transmitter and receiver would be connected to the antenna feed points.

215. To the extent PO argues this limitation requires a plurality of receivers,

a plurality of transmitters, or a plurality of transceivers, it is my opinion that 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.

216. In particular, 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, as I described above in connection with Limitation 1[b] of Ground I, each transceiver **operates in at least one frequency band**.

217. In my opinion, as I described above in connection with Limitation 1[b] of Ground I, 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].

218. For the reasons discussed above in Section XI.B, in my opinion, 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. Accordingly, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious Limitation 1[b] and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne to

disclose and render obvious Limitation 1[b].

3. **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,**

219. As I described above in connection with Limitation 1[b] of Ground IV, 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***). Alternatively, it is my opinion that 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 EX1004, [0029] (example with "different operating frequencies ... within a range of about 900 MHz to 6 GHz").

220. As I described above in connection with Limitation 1[a] of Ground IV, when Rubinshteyn's antenna design is used, 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]. I note that 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]. Alternatively, if Wen’s transceivers are used as I described above in connection with Limitation 1[b] of Ground IV, 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].

221. When Poilasne’s antenna design is used as I described above in connection with Limitation 1[a] of Ground IV, 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]. In my opinion, 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]. Alternatively, if Wen’s transceivers are used as I described above in connection with Limitation 1[b] of Ground IV, the transceivers are “coupled to respective ones of the signal feed points of the common antenna,” 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. EX1004, [0027].

222. Accordingly, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious Limitation 1[c] and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne to disclose and render obvious Limitation

1[c].

4. **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.**

223. In my opinion, 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”).

224. **Regarding Rubinshteyn’s antenna design**, in my opinion, 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. 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. See EX1006, [0035] (describing the relative capacitance of each capacitor and how to choose the capacitance).

225. 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].”

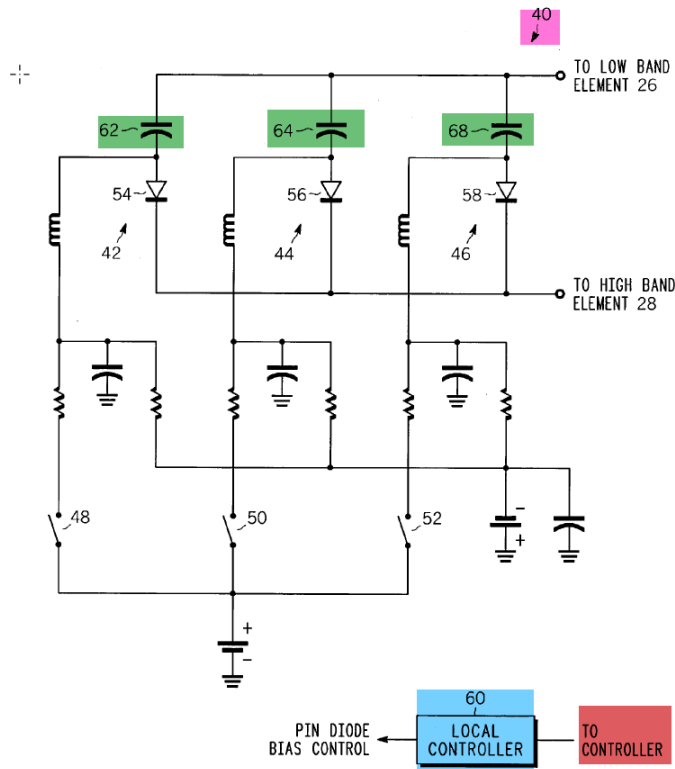


FIG. 4

226. 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.* II note that the switches are thus used to **select** the capacitors and/or inductors (*i.e.*, the **passive elements**). 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. A similar approach can be used to tune the low band element. EX1006, [0036].

227. I note that 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.”).

228. **Regarding Poilasne’s antenna design**, Poilasne discloses both prong (a) and prong (b). In particular, Poilasne’s antenna comprises a “a plurality of portions” implemented as “conductors” with fixed electrical characteristics (*i.e.*, **passive elements**). EX1009, [0007], [0008], [0044]. Poilasne also discloses at least one “active control element” that is “electrically coupled to one or more of the portions.” EX1009, [0007]. As I described above in connection with Limitation 1[b] of Ground I, 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].

229. Accordingly, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious Limitation 1[d] and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne to disclose and render obvious Limitation 1[d]. As such, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the entirety of claim 1, and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne to disclose and render obvious the entirety of claim 1.

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

230. In Rubinshteyn’s antenna design, in my opinion 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. *See* EX1011, 3-4 (defining “distributed” and “lumped” elements).

231. In Poilasne’s antenna design, as I described above in connection with

Claim 2 of Ground I, 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].

232. Accordingly, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the additional limitation of Claim 2 and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne to disclose and render obvious the additional limitation of Claim 2. As such, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the entirety of Claim 2, and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne to disclose and render obvious the entirety of Claim 2.

E. 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.

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

234. Accordingly, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the additional limitation of Claim 3 and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne to disclose and

render obvious the additional limitation of Claim 3. As such, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the entirety of Claim 3, and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne to disclose and render obvious the entirety of Claim 3.

F. Claim 4

1. 4[a]: one or more tuners associated with one or more transmitters, receivers or transceivers of said plurality of transmitters, receivers or transceivers; and

235. In my opinion, as I described above in Section XI.B, it would have been obvious to a POSITA in view of Poilasne to add control elements (*i.e.*, **tuners**) to Rubinshteyn's wireless device. In particular, as I described above in connection with Limitation 4[a] of Ground I, 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.

236. 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 my opinion, 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. In my opinion, as I described above in connection with Limitation 1[b] of Ground IV, 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.

237. Accordingly, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious Limitation 4[a] and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne to disclose and render obvious Limitation 4[a].

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.

238. In my opinion, 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). In my opinion, 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.

239. 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, in my opinion, 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.

240. Accordingly, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious Limitation 4[b] and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne to disclose and render obvious Limitation 4[b]. As such, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the entirety of claim 4, and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne to disclose and render obvious the entirety of claim 4.

G. 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.

241. In my opinion, 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].

242. Accordingly, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the additional limitation of Claim 5 and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne to disclose and render obvious the additional limitation of Claim 5. As such, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the entirety of Claim 5, and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne to disclose and render obvious the entirety of Claim 5.

H. 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.

243. In my opinion, 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]. In my opinion, Poilasne also teaches that multiple antennas can be utilized in parallel, which is consistent with MIMO operation. EX1009, [0062], [0064].

244. Accordingly, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the additional limitation of Claim 6 and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne to disclose and

render obvious the additional limitation of Claim 6. As such, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the entirety of Claim 6, and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne to disclose and render obvious the entirety of Claim 6.

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

245. In my opinion, 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]. In my opinion, 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].

246. Accordingly, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the additional limitation of Claim 7 and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne to disclose and render obvious the additional limitation of Claim 7. As such, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the entirety of Claim 7, and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne to disclose and render obvious the entirety of Claim 7.

J. 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,**

247. I understand that the preamble to a patent claim is generally not limiting. However, to the extent the preamble is limiting, in my opinion Rubinshteyn in view of Wen and Poilasne discloses 25[pre]. I have broken 25[pre] into sub-parts below, and discuss each in turn with reference to Rubinshteyn, Wen, and Poilasne's disclosure.

248. In my opinion, Rubinshteyn discloses "***A wireless device component***" requirement of 25[pre]. In particular, as I described above in connection with 1[pre] of Ground IV, Rubinshteyn discloses a wireless device. As I described above in connection with Limitations 1[a] and 1[b] of Ground IV, the wireless device includes components such as antennas and transmitters and receivers, or transceivers (when combined with Wen).

249. In my opinion, Rubinshteyn and Poilasne, and optionally Wen, render obvious "***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” requirement of 25[pre]. In particular, as I described above in connection with Limitations 1[b], 4[a], and 4[b] of Ground IV, 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.

250. As I described above in connection with Limitation 1[a] of Ground IV, Rubinshteyn and Poilasne, and optionally Wen, render obvious “***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***” requirement of 25[pre].

251. As I described above in connection with Limitations 1[a] regarding antenna and 1[b] regarding transmitters, receivers, or transceivers of Ground IV, Rubinshteyn and Poilasne, and optionally Wen, render obvious “***at least one antenna and a plurality of transmitters, receivers, or transceivers that operate at one or more frequency bands***” requirement of 25[pre].

252. As I described above in connection with Limitation 1[c] of Ground IV, Rubinshteyn and Poilasne, and optionally Wen, render obvious “***wherein said at least one antenna is used by said plurality of transmitters, receivers or transceivers in a plurality of different bands***” requirement of 25[pre].

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.**

253. For at least the same reasons I explain and reference above in connection with Limitation 1[d] of Ground IV, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne renders obvious Limitation 25[a].

- K. **Claim 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.**

254. See Claim 6.

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

255. See Claim 7.

- M. **Claim 28**

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

256. I understand that the preamble to a patent claim is generally not limiting. However, to the extent the preamble is limiting, in my opinion Rubinshteyn discloses “*wireless communication devices*” that operate in “cellular telephone, land-mobile ..., and satellite *communications systems*.” EX1006, [0001]-[0002].

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

257. For at least the same reasons I explain and reference above in

connection with 1[pre] of Ground IV, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne renders obvious Limitation 25[a].

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

258. For at least the same reasons I explain and reference above in connection with Limitation 1[a] of Ground IV, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne renders obvious Limitation 28[a][i].

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

259. For at least the same reasons I explain and reference above in connection with Limitation 1[b] of Ground IV, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne renders obvious Limitation 28[a][ii].

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,

260. For at least the same reasons I explain and reference above in connection with Limitation 1[c] of Ground IV, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne renders obvious Limitation 28[a][iii].

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**

261. For at least the same reasons I explain and reference above in connection with Limitation 1[d] of Ground IV, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne renders obvious Limitation 28[a][iv].

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

262. In my opinion, 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]. In my opinion, 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).

263. Accordingly, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious Limitation 28[b] and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne to disclose and render obvious Limitation 28[b]. As such, in my opinion Rubinshteyn in view of Wen and Poilasne

discloses and renders obvious the entirety of claim 28, and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne to disclose and render obvious the entirety of claim 28.

N. 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.

264. For at least the same reasons I explain and reference above in connection with Limitation 1[a] of Ground IV, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the additional limitations of Claim 29. As such, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the entirety of Claim 29.

O. 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.

265. For at least the same reasons I explain and reference above in connection with Claim 6 of Ground IV, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the additional limitations of Claim 30. As such, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the entirety of Claim 30.

P. 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.

266. For at least the same reasons I explain and reference above in connection with Claim 7 of Ground IV, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the additional limitations of Claim 31. As such, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the entirety of Claim 31.

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

267. In my opinion, 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

268. In my opinion, as I described above in Section XI.B, 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.

B. Claim 8

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

269. For at least the same reasons I explain and reference above in connection with 1[pre] of Ground IV which I incorporate herein by reference, it is

my opinion that Rubinshteyn discloses and renders obvious 8[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;**

270. For at least the same reasons I explain and reference above in connection with Limitation 1[a] of Ground IV, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious Limitation 8[a].

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

271. Rubinshteyn discloses at least one multiband transmitter and receiver. For at least the same reasons I explain and reference above in connection with Limitation 1[b] of Ground IV, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious Limitation 8[b].

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

272. For at least the same reasons I explain and reference above in connection with Limitation 4[a] of Ground IV, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious Limitation 8[c].

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

273. For at least the same reasons I explain and reference above in connection with Limitation 4[b] of Ground IV, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious Limitation 8[d].

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,

274. For at least the same reasons I explain and reference above in connection with Limitation 1[c] of Ground IV, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious Limitation 8[e].

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.

275. For at least the same reasons I explain and reference above in connection with Limitation 1[d] of Ground IV, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious Limitation 8[f].

276. As such, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the entirety of claim 8, and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne, to disclose and render

obvious the entirety of claim 8.

- C. 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.**

277. For at least the same reasons I explain and reference above in connection with Claim 3 of Ground IV, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious Claim 9.

- D. 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.**

278. For at least the same reasons I explain and reference above in connection with Claim 5 of Ground IV, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious Claim 10.

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

279. For at least the same reasons I explain and reference above in connection with Claim 2 of Ground IV, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious Claim 11.

F. 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.

280. For at least the same reasons I explain and reference above in connection with Claim 6 of Ground IV, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious Claim 12.

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

281. For at least the same reasons I explain and reference above in connection with Claim 7 of Ground IV, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious Claim 13.

H. Claim 14

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

282. For at least the same reasons I explain and reference above in connection with Limitation 8[pre] of Ground V, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious 14[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;

283. For at least the same reasons I explain and reference above in

connection with Limitation 8[a] of Ground V, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious Limitation 14[a].

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

284. For at least the same reasons I explain and reference above in connection with Limitation 8[b] of Ground V, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious Limitation 14[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.

285. In my opinion, Rubinshteyn in view of Wen and Poilasne renders obvious Limitation 14[c]. I have broken this limitation into sub-parts below, and discuss each in turn with reference to Rubinshteyn, Wen, and Poilasne's disclosure.

286. In my opinion, for at least the same reasons I explain and reference above in connection with Limitation 8[c] of Ground V, which I incorporate herein by reference, Rubinshteyn in view of Wen and Poilasne renders obvious "***a tuner associated with said at least one multiband transmitter, receiver, or transceiver***" requirement of Limitation 14[c].

287. In my opinion, Rubinshteyn in view of Wen and Poilasne renders

obvious “***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***” requirement of Limitation 14[c]. In particular, as I discussed above in connection with Limitation 8[c] of Ground V, it 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. I note that 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]. In my opinion, a POSITA would have understood from these disclosures that the control element (*tuner*) matches the antenna and transceivers in multiple bands simultaneously.

288. As such, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the entirety of claim 14, and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne to disclose and render obvious the entirety of claim 14.

I. 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.

289. For at least the same reasons I explain and reference above in connection with Claim 9 of Ground V, which I incorporate herein by reference, it is

my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the additional limitations of Claim 15. As such, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the entirety of Claim 15, and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne to disclose and render obvious the entirety of Claim 15.

J. 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.

290. For at least the same reasons I explain and reference above in connection with Claim 10 of Ground V, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the additional limitations of Claim 16. As such, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the entirety of Claim 16.

K. 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.

291. For at least the same reasons I explain and reference above in connection with Claim 12 of Ground V, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the additional limitations of Claim 17. As such, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the entirety of Claim 17.

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

292. For at least the same reasons I explain and reference above in connection with Claim 13 of Ground V, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the additional limitations of Claim 18. As such, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the entirety of Claim 18.

M. Claim 19

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

293. I understand that the preamble to a patent claim is generally not limiting. However, to the extent the preamble is limiting, for at least the same reasons I explain and reference above in connection with 8[pre] regarding wireless device and Claim 10 regarding portable devices of Ground V, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious 19[pre].

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;

294. In my opinion, for at least the same reasons I explain and reference

above in connection with 8[a] of Ground V, Rubinshteyn and Poilasne disclose or render obvious **one or more antennas**. Furthermore, for at least the same reasons I explain and reference above in connection with 8[e] of Ground V, Rubinshteyn's and Poilasne's antenna designs each send and receive signals at a **plurality of particular frequency bands** as it is used by transmitters/receivers in a plurality of different bands. See 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"). In my opinion, 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.

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

295. For at least the same reasons I explain and reference above in connection with Limitations 1[b]-1[c] of Ground IV, which I incorporate herein by reference, in my opinion Rubinshteyn discloses **one or more transmitters or receivers** connected to **one or more antennas**.

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.**

296. For at least the same reasons I explain and reference above in connection with Limitation 19[b] of Ground V, which I incorporate herein by reference, Rubinshteyn discloses one or more transmitters or receivers (*i.e., components*). In my opinion, a POSITA would have understood that transmitters and receivers send and receive signals by *transmitting and receiving electromagnetic energy*, respectively.

297. In my opinion, Rubinshteyn discloses “*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*” requirement of Limitation 19[c]. In particular, as I discussed above in connection with Limitation 8[b] of Ground V, 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*).

298. In my opinion, Rubinshteyn discloses “*two or more components transmit or receive electromagnetic energy simultaneously at two or more of said plurality of particular frequency bands*” requirement of Limitation 19[c]. In

particular, as I discussed above in connection with Limitation 8[b] of Ground V, 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). Accordingly, in my opinion, Rubinshteyn’s transmitter and receiver together operate in a ***plurality of frequency bands***. In addition, Rubinshteyn discloses that transmitter and receiver may use the antenna at different frequency bands simultaneously via the duplexer. EX1006, [0022].

299. As such, in my opinion Wen in view of Poilasne and Govind discloses and renders obvious the entirety of claim 19, and a POSITA would have understood Wen in view of Poilasne and Govind to disclose and render obvious the entirety of claim 19.

N. 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.

300. For at least the same reasons I explain and reference above in connection with Claim 10 of Ground V, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the additional limitations of Claim 20. As such, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the entirety of Claim 20.

O. 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.

301. In my opinion, as I described above in connection with Limitation 8[c], 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. In my opinion, 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.

302. As such, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the entirety of Claim 21, and a POSITA would have understood Rubinshteyn in view of Wen and Poilasne to disclose and render obvious the entirety of Claim 21.

P. 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.

303. For at least the same reasons I explain and reference above in connection with Claim 12 of Ground V, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the additional limitations of Claim 23. As such, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the entirety of Claim 23.

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

304. For at least the same reasons I explain and reference above in connection with Claim 13 of Ground V, which I incorporate herein by reference, it is my opinion that Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the additional limitations of Claim 24. As such, in my opinion Rubinshteyn in view of Wen and Poilasne discloses and renders obvious the entirety of Claim 24.

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

305. In my opinion, 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

306. As I described above in Section XI.B, in my opinion, 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.

307. In my opinion, 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.

308. First, as I described above in Section X.B, in my opinion, the need for RF isolation in multi-band wireless communication systems would have been well understood by a POSITA. See EX1001, 5:30-37. It is also my opinion that adding RF isolation and filtering to Rubinshteyn represents the use of a known technique with predictable results.

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

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

311. Finally, in my opinion, a POSITA would have reasonably expected the combination to succeed. As I noted above, RF isolation techniques were standard, well known, and commercially available prior to the '358 patent. EX1001, 5:32-38. In my opinion, 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.

B. 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.

312. As I discussed above, this is a means-plus-function limitation with the function “isolating said one or more components from more than one particular frequency band of said plurality of frequency bands” and corresponding structure “circuitry that provides overload protection, shielding, and/or filters out unwanted bands.”

313. In my opinion, 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.

314. As I described above in connection with Claim 22 of Ground III, Vlahos discloses several types of circuitry for filtering out unwanted frequency bands.

315. For the reasons I discussed above in Section XIII.A, in my opinion, 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.

I, Mark Mahon, declare under penalty of perjury under the laws of the United States that the foregoing is true and correct.

Dated: October 21, 2025



Mark P. Mahon, Ph.D.