IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.,

SAMSUNG ELECTRONICS AMERICA, INC.

Petitioners,

v.

MASSIVELY BROADBAND LLC.

Patent Owner.

Case No. IPR2026-00033

U.S. Patent No. 9,667,337

DECLARATION OF DR. MAHON IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 9,667,337

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LIST OF CHALLENGED CLAIMS

Claim	
1[pre]	A broadband wireless repeater or relay, comprising:
1[a]	at least one receiver or transceiver for signal or data reception from one or more devices;
1[b]	at least one transmitter or transceiver for signal or data transmission to one or more devices,
1[c]	wherein the transceiver for signal or data reception and the transceiver for signal or data transmission may be the same or different; and
1[d]	a controller that is configured or configurable for operation in one or more wireless networks, said controller communicating with said at least one receiver or transceiver for signal or data reception and said at least one transmitter or transceiver for signal or data transmission,
1[e]	wherein at least one of said receiver or transceiver for signal or data reception and said transmitter or transceiver for signal or data transmission either or both transmit and receive at an instantaneous or overall occupied bandwidth of 100 MHz or more or have a data transmission rate of 100 Megabits per second or more,
1[f]	wherein said broadband wireless repeater or relay is connected or connectable to one or more network backbones for connecting said one or more wireless networks with said one or more network backbones,
1[g]	wherein said broadband wireless repeater or relay is used to support connectivity and/or position location capabilities for one or more mobile or portable devices, and
1[h]	wherein said controller is configured or configurable to perform or for performing at least one of: a) ignore or filter out at least some signal or data transmissions from one or more undesired transmitters, users, networks, data sources, or noise sources; and b) instruct one or more devices or networks to ignore or disregard at least some signal or data transmissions of one or more undesired transmitters, undesired users, undesired networks, or noise sources.

Claim	
2	The broadband wireless repeater or relay of claim 1, wherein at least one of said one or more network backbones to which said controller is connected or connectable is a wired backbone.
3	The broadband wireless repeater or relay of claim 2, wherein said wired backbone is selected from a group consisting of T1, T3, DSL, cable, cable modem, fiber, optical cable, copper lines, coax, phone, ethernet, and internet.
4	The broadband wireless repeater or relay of claim 1, wherein at least one of said one or more network backbones to which said controller is connected or connectable is a wireless backbone.
5	The broadband wireless repeater or relay of claim 4, wherein said wireless backbone is selected from a group consisting of last mile wireless service, mesh network, LMDS, MMDS, WiMax, 802.16, 802.20, 802.11a/b/g, 802.15.3.a, RF, and baseband.
6	The broadband wireless repeater or relay of claim 1, wherein said controller is configured to or configurable to perform a).
7	The broadband wireless repeater or relay of claim 1, wherein said controller is configured to or configurable to perform b).
8	The broadband wireless repeater or relay of claim 1, wherein said controller is configured to or configurable to perform network provisioning or monitoring.
9[pre]	The broadband wireless repeater or relay of claim 8, wherein the network provisioning or monitoring includes one or more of:
9[a]	i) bandwidth or delay provisioning of repeated or relayed transmissions,
9[b]	ii) application prioritization,
9[c]	iii) prioritizing, delaying or altering of data transmissions, traffic, or bandwidth, and
9[d]	iv) monitoring or measuring traffic from one or more devices, users or networks.
10[pre]	The broadband wireless repeater or relay of claim 1, wherein said controller is configured or configurable to perform or for performing all of:
10[a]	a);
10[b]	b); and
10[c]	c) network provisioning or monitoring.

Claim	
11	The broadband wireless repeater or relay of claim 1, wherein said at least one receiver or transceiver for receiving signals or data and said at least one transmitter or transceiver for transmitting signals or data operate in half duplex.
12	The broadband wireless repeater or relay of claim 1, wherein said at least one receiver or transceiver for receiving signals or data and said at least one transmitter or transceiver for transmitting signals or data operate in full duplex.
13	The broadband wireless repeater or relay of claim 1, wherein said at least one receiver or transceiver for receiving signals or data and said at least one transmitter or transceiver for transmitting signals or data operate in simplex.
14	The broadband wireless repeater or relay of claim 1, wherein said signals or data received by said receiver or transceiver for receiving signals or data, or signals or data transmitted by said transmitter or transceiver for transmitting signals or data, or signals or data controlled by said controller include modified, stored, or delayed signals or data.
15	The broadband wireless repeater or relay of claim 1, wherein said controller is configured to cause said at least one transmitter or transceiver for transmitting signals or data to transmit modified received data or transmissions to one or more devices at an instantaneous or overall occupied bandwidth of 100 MHz or more or have a data transmission rate of 100 Megabits per second or more.
16	The broadband wireless repeater or relay of claim 1, wherein said controller is configured to identify one or more devices in said one or more wireless networks.
17	The broadband wireless repeater or relay of claim 1, wherein said repeater or relay employs MIMO or adaptive antenna technology.
18	The broadband wireless repeater or relay of claim 1, wherein said controller is self-configurable.
19	The broadband wireless repeater or relay of claim 1, wherein at least one of said receiver or transceiver for signal or data reception, at least one of said transmitter or transceiver for signal or data transmission, or said controller is configured for operation in at least one of said one or more wireless networks in a moving platform environment.

Claim	
20	The broadband wireless repeater or relay of claim 1, wherein said broadband wireless repeater or relay is configured to be integrated with or in communication with a vehicle, train, aircraft, or other moving platform.
21	The broadband wireless repeater or relay of claim 1, wherein at least one of said receiver or transceiver for signal or data reception, at least one of said transmitter or transceiver for signal or data transmission, or said controller is configured for operation in at least one of said one or more wireless networks in an indoor environment.
22	The broadband wireless repeater or relay of claim 1, wherein at least one of said receiver or transceiver for signal or data reception, at least one of said transmitter or transceiver for signal or data transmission, or said controller is configured for operation in at least one of said one or more wireless networks in an outdoor environment.
23	The broadband wireless repeater or relay of claim 1, wherein at least one of said receiver or transceiver for signal or data reception, at least one of said transmitter or transceiver for signal or data transmission, or said controller is configured for operation in at least one of said one or more wireless networks selected from the group consisting of: a cellular network, an enterprise network, a wireless local area network, or a wireless personal area network.
24	The broadband wireless repeater or relay of claim 1, wherein said repeater or relay is configured to be integrated with or in communication with a device selected from the group consisting of a television, a telephone, a cellphone, a computer, a camera, a video system, a monitor, a power plug, a wall outlet, a watch, a cable modem, a vehicle or other moving platform, a game console, and an ultrawideband transceiver or device.
25	The broadband wireless repeater or relay of claim 1, wherein one or more of said receiver or transceiver for signal or data reception, said transmitter or transceiver for signal or data transmission, and said controller is embedded in one or more integrated circuit chips.
26	The broadband wireless repeater or relay of claim 1, wherein said broadband wireless repeater or relay is configured or configurable for monitoring or measuring traffic passed through, received by or transmitted by said broadband wireless repeater or relay.

Claim	
27	The broadband wireless repeater or relay of claim 1, wherein said broadband wireless repeater or relay is configured or configurable to modify at least some received signals or data from one or more devices, users or networks and transmit modified or delayed signals or data to at least one device, network or user via wireless communication.
28	The broadband wireless repeater or relay of claim 1, wherein said controller and one or more of said at least one receiver or transceiver for signal or data reception and said at least one transmitter or transceiver for signal or data transmission are integrated.
29[pre]	A broadband wireless repeater or relay, comprising:
29[a]	at least one receiver or transceiver for signal or data reception from one or more devices;
29[b]	at least one transmitter or transceiver for signal or data transmission to one or more devices,
29[c]	wherein the transceiver for signal or data reception and the transceiver for signal or data transmission may be the same or different; and
29[d]	a controller that is configured or configurable for operation in one or more wireless networks, said controller communicating with said at least one receiver or transceiver for signal or data reception and said at least one transmitter or transceiver for signal or data transmission,
29[e]	wherein at least one of said receiver or transceiver for signal or data reception and said transmitter or transceiver for signal or data transmission either or both transmit and receive at an instantaneous or overall occupied bandwidth of 100 MHz or more or have a data transmission rate of 100 Megabits per second or more,
29[f]	wherein said repeater or relay employs MIMO or adaptive antenna technology,
29[g]	wherein said broadband wireless repeater or relay is used to support connectivity and/or position location capabilities for one or more mobile or portable devices, and
29[h]	wherein said controller is configured or configurable to perform or for performing at least one of:

Claim	
29[i]	a) ignore or filter out at least some signal or data transmissions from one or more undesired transmitters, users, networks, data sources, or noise sources; and
29[j]	b) instruct one or more devices or networks to ignore or disregard at least some signal or data transmissions of one or more undesired transmitters, undesired users, undesired networks, or noise sources.
30	The broadband wireless repeater or relay of claim 29, wherein said controller is configured or configurable to perform a).
31	The broadband wireless repeater or relay of claim 29, wherein said controller is configured or configurable to perform b).
32	The broadband wireless repeater or relay of claim 29, wherein said controller is configured or configurable to perform network provisioning or monitoring.
33[pre]	The broadband wireless repeater or relay of claim 32, wherein the network provisioning or monitoring includes one or more of:
33[a]	i) bandwidth or delay provisioning of repeated or relayed transmissions,
33[b]	ii) application prioritization,
33[c]	iii) prioritizing, delaying or altering of data transmissions, traffic, or bandwidth, and
33[d]	iv) monitoring or measuring traffic from one or more devices, users or networks.
34[pre]	The broadband wireless repeater or relay of claim 29, wherein said controller is configured or configurable to perform or for performing all of:
34[a]	a);
34[b]	b); and
34[c]	c) network provisioning or monitoring.
35	The broadband wireless repeater or relay of claim 29, wherein said at least one receiver or transceiver for receiving signals or data and said at least one transmitter or transceiver for transmitting signals or data operate in half duplex.
36	The broadband wireless repeater or relay of claim 29, wherein said at least one receiver or transceiver for receiving signals or data and said at least one transmitter or transceiver for transmitting signals or data operate in full duplex.

Claim	
37	The broadband wireless repeater or relay of claim 29, wherein said at least one receiver or transceiver for receiving signals or data and said at least one transmitter or transceiver for transmitting signals or data operate in simplex.
38	The broadband wireless repeater or relay of claim 29, wherein said signals or data received by said receiver or transceiver for receiving signals or data, or signals or data transmitted by said transmitter or transceiver for transmitting signals or data, or signals or data controlled by said controller include modified, stored, or delayed signals or data.
39	The broadband wireless repeater or relay of claim 29, wherein said controller is configured to cause said at least one transmitter or transceiver for transmitting signals or data to transmit modified received data or transmissions to one or more devices at an instantaneous or overall occupied bandwidth of 100 MHz or more or have a data transmission rate of 100 Megabits per second or more.
40	The broadband wireless repeater or relay of claim 29, wherein said controller is configured to identify one or more devices in said one or more wireless networks.
41	The broadband wireless repeater or relay of claim 29, wherein said controller is self-configurable.
42	The broadband wireless repeater or relay of claim 29, wherein at least one of said receiver or transceiver for signal or data reception, at least one of said transmitter or transceiver for signal or data transmission, or said controller is configured for operation in at least one of said one or more wireless networks in a moving platform environment.
43	The broadband wireless repeater or relay of claim 29, wherein said broadband wireless repeater or relay is configured to be integrated with or in communication with a vehicle, train, aircraft, or other moving platform.
44	The broadband wireless repeater or relay of claim 29, wherein at least one of said receiver or transceiver for signal or data reception, at least one of said transmitter or transceiver for signal or data transmission, or said controller is configured for operation in at least one of said one or more wireless networks in an indoor environment.

Claim	
45	The broadband wireless repeater or relay of claim 29, wherein at least one of said receiver or transceiver for signal or data reception, at least one of said transmitter or transceiver for signal or data transmission, or said controller is configured for operation in at least one of said one or more wireless networks in an outdoor environment.
46	The broadband wireless repeater or relay of claim 29, wherein at least one of said receiver or transceiver for signal or data reception, at least one of said transmitter or transceiver for signal or data transmission, or said controller is configured for operation in at least one of said one or more wireless networks selected from the group consisting of: a cellular network, an enterprise network, a wireless local area network, or a wireless personal area network.
47	The broadband wireless repeater or relay of claim 29, wherein said repeater or relay is configured to be integrated with or in communication with a device selected from the group consisting of a television, a telephone, a cellphone, a computer, a camera, a video system, a monitor, a power plug, a wall outlet, a watch, a cable modem, a vehicle or other moving platform, a game console, and an ultrawideband transceiver or device.
48	The broadband wireless repeater or relay of claim 29, wherein one or more of said receiver or transceiver for signal or data reception, said transmitter or transceiver for signal or data transmission, and said controller is embedded in one or more integrated circuit chips.
49	The broadband wireless repeater or relay of claim 29, wherein said broadband wireless repeater or relay is configured or configurable for monitoring or measuring traffic passed through, received by or transmitted by said broadband wireless repeater or relay.
50	The broadband wireless repeater or relay of claim 29, wherein said broadband wireless repeater or relay is configured or configurable to modify at least some received signals or data from one or more devices, users or networks and transmit modified or delayed signals or data to at least one device, network or user via wireless communication.
51	The broadband wireless repeater or relay of claim 29, wherein said controller and one or more of said at least one receiver or transceiver for signal or data reception and said at least one

Claim	
	transmitter or transceiver for signal or data transmission are integrated.
52[pre]	A broadband wireless repeater or relay, comprising:
52[a]	at least one receiver or transceiver for signal or data reception from one or more devices;
52[b]	at least one transmitter or transceiver for signal or data transmission to one or more devices,
52[c]	wherein the transceiver for signal or data reception and the transceiver for signal or data transmission may be the same or different; and
52[d]	a controller that is configured or configurable for operation in one or more wireless networks, said controller communicating with said at least one receiver or transceiver for signal or data reception and said at least one transmitter or transceiver for signal or data transmission,
52[e]	wherein at least one of said receiver or transceiver for signal or data reception and said transmitter or transceiver for signal or data transmission either or both transmit and receive at an instantaneous or overall occupied bandwidth of 100 MHz or more or have a data transmission rate of 100 Megabits per second or more,
52[f]	wherein said broadband wireless repeater or relay is connected or connectable to one or more network backbones for connecting said one or more wireless networks with said one or more network backbones,
52[g]	wherein said broadband wireless repeater or relay is used to support connectivity and/or position location capabilities for one or more mobile or portable devices,
52[h]	wherein said repeater or relay is configured such that when in a network which includes one or more devices which can transmit or receive at an instantaneous or overall occupied bandwidth of 100 MHz or more or have a data transmission rate of 100 Megabits per second or more at least one of said one or more devices has at least one of
52[i]	a higher data rate,
5[j]	a greater coverage distance,
52[k]	higher quality of transmission or reception,

Claim	
52[l]	less interference, and
52[m]	an improved ability to control its capacity,
52[n]	than if said repeater or relay was not present in said network.
53	The broadband wireless repeater or relay of claim 52, wherein said repeater or relay is configured such that said at least one of said one or more devices has a higher data rate than if said repeater or relay was not present in said network.
54	The broadband wireless repeater or relay of claim 52, wherein said repeater or relay is configured such that said at least one of said one or more devices has a greater coverage distance than if said repeater or relay was not present in said network.
55	The broadband wireless repeater or relay of claim 52, wherein said repeater or relay is configured such that said at least one of said one or more devices has higher quality of transmission or reception than if said repeater or relay was not present in said network.
56	The broadband wireless repeater or relay of claim 52, wherein said repeater or relay is configured such that said at least one of said one or more devices has less interference than if said repeater or relay was not present in said network.
57	The broadband wireless repeater or relay of claim 52, wherein said repeater or relay is configured such that said at least one of said one or more wireless networks has an improved ability to control its capacity than if said repeater or relay was not present in said one or more wireless networks.
58[pre]	A broadband wireless repeater or relay, comprising:
58[a]	at least one receiver or transceiver for signal or data reception from one or more devices;
58[b]	at least one transmitter or transceiver for signal or data transmission to one or more devices,
58[c]	wherein the transceiver for signal or data reception and the transceiver for signal or data transmission may be the same or different; and
58[d]	a controller that is configured or configurable for operation in one or more wireless networks, said controller communicating with said at least one receiver or transceiver for signal or data reception and said at least one transmitter or transceiver for signal or data transmission,

Claim	
58[e]	wherein at least one of said receiver or transceiver for signal or data reception and said transmitter or transceiver for signal or data transmission either or both transmit and receive at an instantaneous or overall occupied bandwidth of 100 MHz or more or have a data transmission rate of 100 Megabits per second or more,
[58f]	wherein said repeater or relay employs MIMO or adaptive antenna technology,
58[g]	wherein said broadband wireless repeater or relay is used to support connectivity and/or position location capabilities for one or more mobile or portable devices, and
58[h]	wherein said repeater or relay is configured such that when in a network which includes one or more devices which can transmit or receive at an instantaneous or overall occupied bandwidth of 100 MHz or more or have a data transmission rate of 100 Megabits per second or more at least one of said one or more devices has at least one of
58[i]	a higher data rate,
58[j]	a greater coverage distance,
58[k]	higher quality of transmission or reception,
58[l]	less interference, and
58[m]	an improved ability to control its capacity,
58[n]	than if said repeater or relay was not present in said network.
59	The broadband wireless repeater or relay of claim 58, wherein said repeater or relay is configured such that said at least one of said one or more devices has a higher data rate than if said repeater or relay was not present in said network.
60	The broadband wireless repeater or relay of claim 58, wherein said repeater or relay is configured such that said at least one of said one or more devices has a greater coverage distance than if said repeater or relay was not present in said network.
61	The broadband wireless repeater or relay of claim 58, wherein said repeater or relay is configured such that said at least one of said one or more devices have higher quality of transmission or reception than if said repeater or relay was not present in said network.

Claim	
62	The broadband wireless repeater or relay of claim 58, wherein said repeater or relay is configured such that said at least one of said one or more devices has less interference than if said repeater or relay was not present in said network.
63	The broadband wireless repeater or relay of claim 58, wherein said repeater or relay is configured such that said at least one of said one or more wireless networks has an improved ability to control its capacity than if said repeater or relay was not present in said one or more wireless networks.

I. INTRODUCTION

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").

2. I have prepared this declaration in connection with Samsung's related petition for inter partes review ("IPR") of U.S. Patent No. 9,667,337 (the "'337 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 '337 patent. Specifically, I have been asked to provide my opinion regarding whether claims 1-63 of the '337 patent ("the Challenged Claims") are invalid as obvious in view of the prior art.

II. QUALIFICATIONS

3. I am over the age of 18 and am competent to write this declaration. I have personal knowledge, or have developed knowledge of these technologies based upon education, training, or experience, of the matters set forth herein.

4. My qualifications are summarized here and explained in more detail in my curriculum vitae, which is attached as Appendix A to this report. 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.

5. 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.

6. 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.

7. 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.

8. 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.

9. 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.

10. 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.

11. 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.

12. 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.

13. 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.

14. 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).

15. 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.

16. 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).

17. 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.

18. 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.

19. 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.

20. 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.

21. 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.

22. 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.

23. 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.

24. 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.

III. LEGAL STANDARDS

25. 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

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

27. 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.

28. 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.

29. 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

30. 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 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.

C. Presumption of Validity

31. I understand that a granted patent is presumed to be valid. I understand that the presumption of validity can be overcome if clear and convincing evidence is presented that proves the patent is invalid.

D. Obviousness

32. 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.

33. 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.

34. 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.

35. 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.

36. I understand that an obviousness determination requires a reasonable expectation of success in achieving the claimed invention.

37. 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.

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

subject matter.

39. 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.

IV. BACKGROUND

A. '337 Patent

1. Earliest Priority Date

40. The '337 patent is a pre-AIA patent whose earliest priority date is August 22, 2003 via U.S. Provisional Application Nos. 60/498,324 and 60/496,913.

2. Specification

41. The '337 patent relates to an ultrawideband radio transceiver/repeater that merges wired and wireless network devices while providing connection to the plant, flexible repeater capabilities, network security, and traffic monitoring and

flow. (EX1001, Abstract.)

42. The ultrawideband repeater described in the ’337 patent “serves to ‘repeat’ data signals coming from one or many devices so that other devices, located farther away from the ‘source’ will be able to access the internet, Cable TV, Satellite source, phone/DSL line, or other broadband ‘plant’ source via the repeater.” (*Id.*, 6:57-62.)

43. The patent describes that “[u]ltrawideband technologies are about to become mainstream, and are described in” various patent applications and publications. (EX1001, 2:12-19.) The patent also describes that “[t]he IEEE 802.15.3 standards bodies have been developing Physical (PHY) and MAC layer standards for dynamic channel selection and repeater service for UWB, which falls under the general IEEE 802.15.3 standards body.” (*Id.*, 2:19-23.) The patent contends that “the presently proposed 802.15.3 standard[] is not adequate to provide one or more of sufficient security, proper traffic filtering, bandwidth provisioning, network management features, or flexibility of networks that can be installed or controlled easily by a consumer. That is to say, the current repeater operation contemplated by 802.15.3 and proposed UWB devices is based on the assumption that a single chip can perform necessary repeater functions, but this functionality alone will not be adequate for the rapid emergence of UWB and the onslaught of wireless data that is certain to occur.” (*Id.*, 2:44-55.)

44. In addition, the patent describes that "IEEE 802.15.3a, the Ultrawideband Physical Layer standard committee, is working on creating a standard that may either be Multiband OFDM transmission (MBOA), with 500 MHz channels, or a Direct Sequence Spread Spectrum impulse radio standard that has broader channel bandwidths (UWB Forum)." (EX1001, 2:55-60.) Moreover, ***the patent describes that UWB chips capable of 100 megabits per second were already commercially available*** (*id.*, 3:5-8; emphasis added) and that mesh networking will provide efficient network paths that allow very high data rates across the internet (*id.*, 3:8-11).

45. Repeaters are "well known in the art, and they have been manufactured for decades in the cellular and PCS industries, and more recently, … for the IEEE 802.11a/b marketplace [and] for IEEE 802.11g wireless LAN WiFi standard." (EX1001, 3:27-35.)

46. Contrary to the FCC defining ultrawideband as larger than 500 MHz,[1] the patent defines "ultrawideband" as "any type of electromagnetic signals that have an instantaneous or overall occupied bandwidth of 100 MHz or more and that are used to communicate or to position-locate between 2 or more devices. Such wide

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[1] FCC, First Report and Order 02-48. February 2002. The FCC published this formal definition in April 2002, prior to the earliest priority date of the patents.

bandwidths … generally implies a proportionally higher noise floor power level, which requires UWB devices generally to be physically closer in distant to each other in order to obtain a sufficiently strong signal to noise ratio (SNR)…. Thus, repeaters will become necessary to connect devices over greater distances than the range of a single UWB device." (EX1001, 4:2-19.)

47. In connection with FIG. 2, the ultrawideband repeater is stated to require careful signal processing that is able to null out noise and interference across the very wide bandwidth used by UWB such as noise from an undesired transmitter or attacker. (EX1001, 9:21-25.)

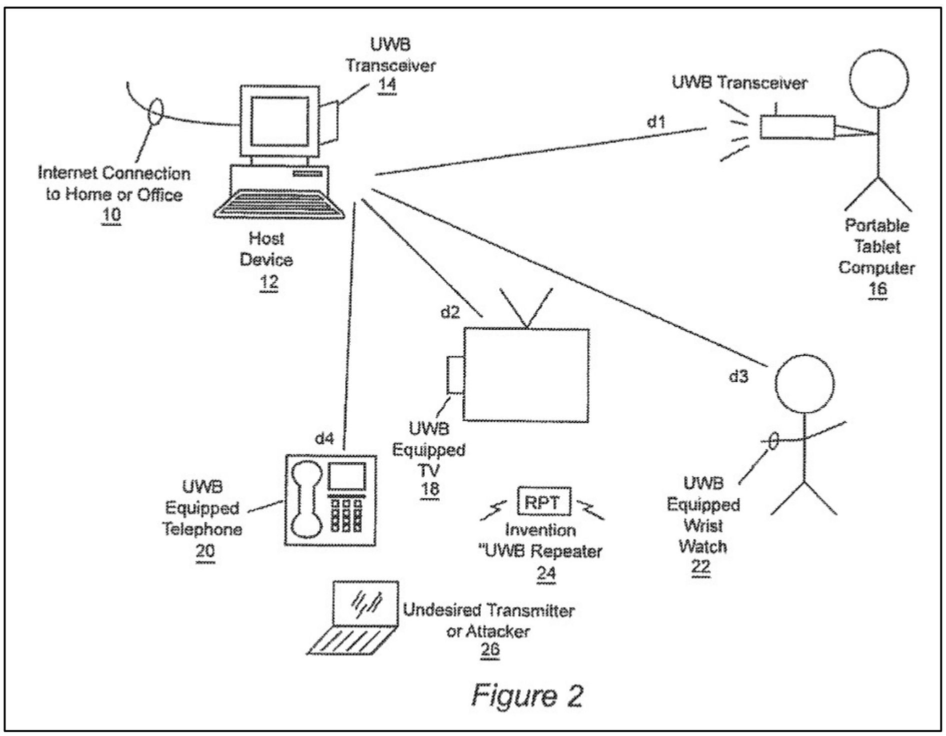


Figure 2

3. Prosecution History

48. The '337 patent was filed on November 13, 2014 as application

14/540,773, and claims priority to provisional applications 60/498,324 and 60/496,913.

49. On October 20, 2016 an Office Action issued rejecting pending claims 45-50, 53-54, 57-59, 65-81, 84-85, 88-90, and 96-109. Claims 51-52, 55-56, 60-64, 82-83, 86-87, and 91-95 were objected to as being dependent upon a rejected base claim, but would otherwise be allowable if rewritten in independent form. (EX1004, October 20, 2016 Office Action.)

50. In response, applicant amended independent claim 45 (issued claim 1) to include the features of claims 51 and 52. Independent claim 80 (issued as claim 29) was amended to include the features of claims 82 and 83. The allegedly novel limitation in issued claims 1 and 29 is limitation 1[h] and 29[h-j] ("wherein said controller is configured or configurable to perform or for performing at least one of: a) ignore or filter out at least some signal or data transmissions from one or more undesired transmitters, users, networks, data sources, or noise sources; and b) instruct one or more devices or networks to ignore or disregard at least some signal or data transmissions of one or more undesired transmitters, undesired users, undesired networks, or noise sources.") (EX1004, January 19, 2017 Response to Office Action.)

51. Claims 110 and 111 (issued as claims 52 and 58) were added as Markush claims with the features of claims 60-64 and 91-95, respectively (issued as

claims 53-56 and 59-63). (EX1004, January 19, 2017 Response to Office Action.) The allegedly novel limitations of these claims is that at least one or more of the devices in the network has "a higher data rate" (52[i], 58[i]), "a greater coverage distance (52[j], 58[j]), "higher quality of transmission or reception" (52[k], 58[k]), "less interference" (52[l], 58[l]), and "an improved ability to control its capacity" (52[m], 58[m]) "than if said repeater or relay was not present in said network."

52. The claims were then allowed. (EX1004, February 3, 2017 Notice of Allowance.).

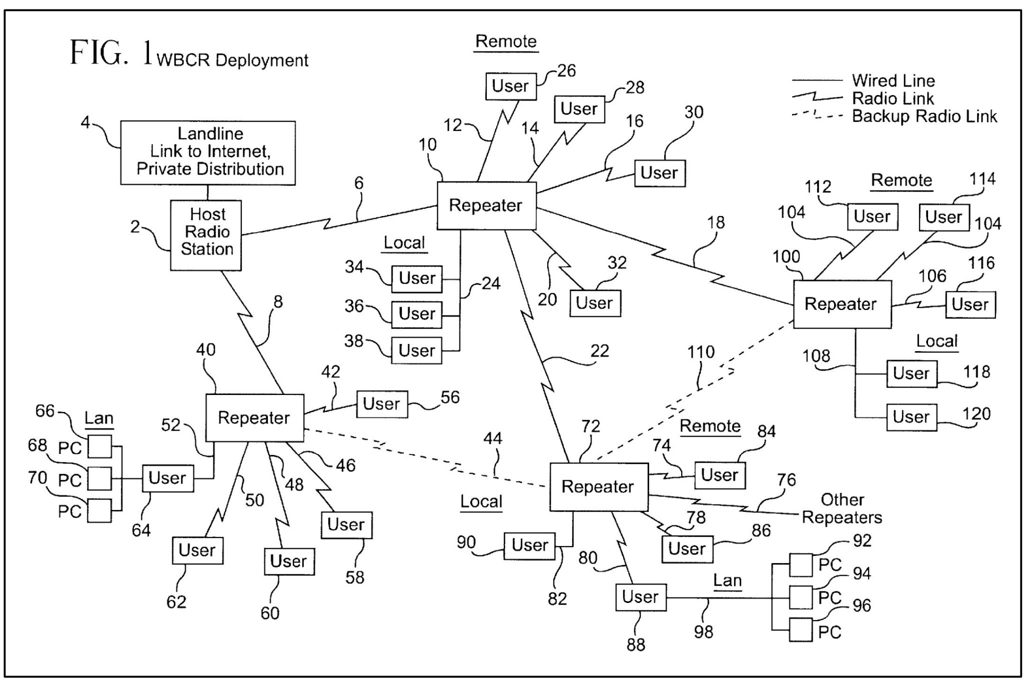
53. In other words, the Examiner found that the repeater functionality, the claimed bandwidth and data rates, the use of a controller, MIMO, and the use of the repeater to support connectivity and/or position location were found in the prior art. The examiner however allowed the claims because they included standard functions of wireless devices such as ignoring/filtering out some signal or data transmissions and instructing devices or networks to ignore/disregard some signal or data transmissions, and networks that have i) a higher data rate, ii) a greater coverage distance, iii) higher quality of transmission or reception, iv) less interference, and v) an improved ability to control its capacity than if the repeater or relay was not present in the network. As discussed below, each of these limitations were well-known in the art and would have been obvious to combine.

B. Asserted Prior Art

1. Ganz (EX1005)

54. U.S. 6,584,080 ("Ganz"), "*Wireless Burstable Communications Repeater*," was filed on January 14, 1999, and was published on June 24, 2003. It is prior art under pre-AIA § 102(a) and § 102(b).

55. Ganz discloses "[a] wireless high speed data communication system having a host radio station connected to a source of data. The host radio station transmits data to a radio repeater that is within a line of sight. The communication system may include numerous repeaters each of which is configured to communicate with each other within a line of sight." (EX1005, Abstract.)



56. Ganz was not before the examiner during prosecution of the '337 patent.

2. Larrick (EX1007)

57. U.S. 7,209,523, "*Ultra-wideband Receiver and Transmitter*," was filed on February 17, 1999, and was published on April 24, 2007. It is prior art under pre-AIA § 102(a).

58. Larrick discloses "[a] waveform-adaptive ultra-wideband (UWB) transmitter and noise-tracking UWB receiver for use in communications, object detection and radar applications…. The UWB transmitter exhibits well defined and controllable spectral characteristics. The UWB transmitter is capable of extremely high pulse repetition frequencies (PRFs) and ***data rates in the hundreds of megabits per second*** or more, frequency agility on a pulse-to-pulse basis allowing frequency hopping if desired, and extensibility from below HF to millimeter wave frequencies." (EX1007, Abstract.)

59. In one described embodiment and as shown in FIG. 12B, "[a]n UWB transmitter using a low-level impulse generator and microwave bandpass filter was constructed which generated an L-band UWB signal at a center frequency of 1.5 GHz, ***with a 3 dB down bandwidth of 400 MHz***." (EX1007, 10:61-64.)

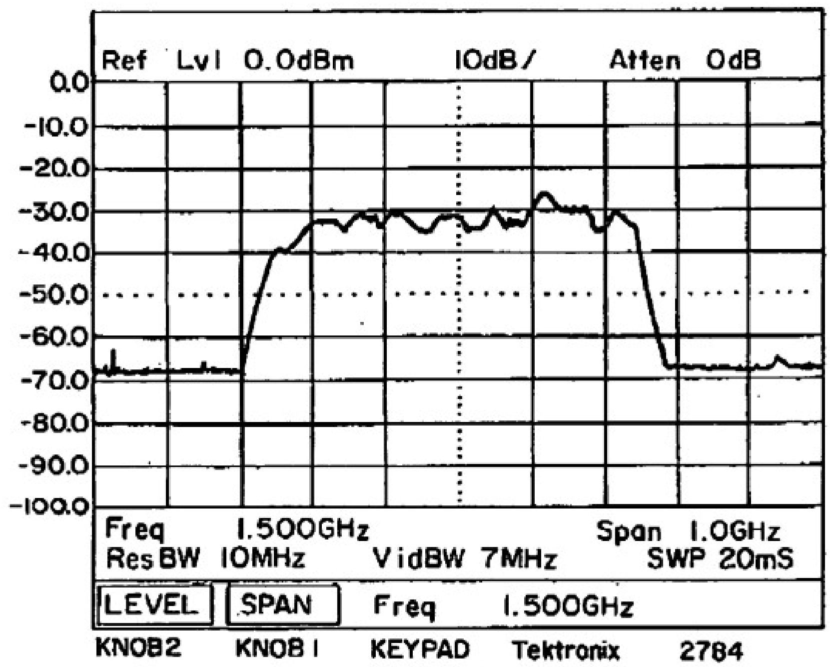


FIG. 12B

60. FIG. 8 shows the use of an amplifier 160 that amplifies the output of UWB source 130. (EX1007, 11:36-12:9.)

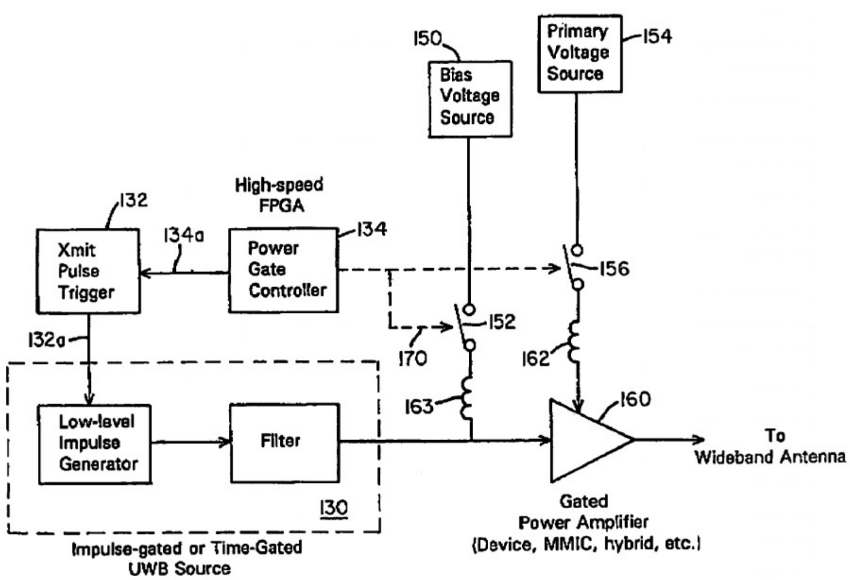


FIG. 8

61. Larrick was not before the examiner during prosecution of the '337 patent.

3. Engels (EX1008)

62. Patent Cooperation Treaty Application WO 03/058850 ("Engels") was filed on January 6, 2003 and published on July 17, 2003. It is prior art under pre-AIA § 102(a).

63. Engels discloses "a wireless radio telecommunications system, an indoor-outdoor coupling device for coupling between a telecommunications network, such as a wireless or cable network and an indoor wireless network, especially a LAN, and a method for providing improved communications between the inside and outside of a building." (EX1008, 1:5-8.)

64. Engels was not before the examiner during prosecution of the '337 patent.

4. Perlman (EX1011)

65. U.S. Patent Application Pub. No. 2004/0160928 ("Perlman") was filed on May 9, 2003. It is prior art under pre-AIA § 102(e).

66. Perlman discloses "[a] network for wireless transmission of data" which "includes a source access point, a destination device and a plurality of wireless repeaters that provide a transmission link between the source access point and the destination device." (EX1012, Abstract.)

67. Perlman was not before the examiner during prosecution of the ’337 patent.

5. Roese (EX1012)

68. U.S. Pat. No. 7,295,556 was filed on February 28, 2003. It is prior art under pre-AIA § 102(e).

69. Roese discloses a “method for location discovery in a data network” where a “router” “receiv[es] … connection information from a neighboring network device and determine[es] a physical location” of that router. (EX1012, Abstract.)

70. Roese was not before the examiner during prosecution of the ’337 patent.

V. PERSON OF ORDINARY SKILL

71. A person of ordinary skill in the art as of the asserted priority date (“POSITA”) had at least a Bachelor of Science in electrical engineering or a similar field and at least two years of practical experience in the field of wireless communication applications. More education can supplement for less practical experience, and vice versa.

72. I met this level by the priority date of the ’337 patent.

VI. CLAIM CONSTRUCTION

73. 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 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.

74. It is my understanding that no express constructions are required to find the '337 patent claims invalid. As relevant, I give my opinions under the plain meaning of certain terms in the analysis for the presented Grounds. I understand that the challenged claims have not been construed in other proceedings.

VII. GROUND 1: Ganz and Larrick in Combination with Roese Renders Claims 1-16, 20, and 24-28 Obvious[2]

A. Overview and Motivation to Combine

75. As discussed in more detail below, Ganz teaches a wireless networking device that receives wireless data, processes that wireless data, and transmits

[2] Unless noted otherwise, all emphases in quotes and annotations to figures from prior art references are added.

wireless data. Ganz uses a wireless burstable communications repeater. (EX1005, Abstract.) Larrick similarly teaches a wireless networking device that contains an ultra-wideband transmitter and receiver, with data rates of at least 100 megabits per second and bandwidth between 100 and 500 MHz.

76. A POSITA would have been motivated to incorporate the teachings of Larrick to improve the Ganz system by allowing it to transmit and receive data using wider frequency bands and at higher data speeds. Ganz teaches a wireless repeater system for wirelessly receiving and transmitting data, and Larrick provides additional detail on how to use ultra-wide band frequency bandwidths and data speeds to wirelessly transfer data. The teachings of Ganz are complementary to Larrick, and a POSITA would have recognized that Larrick's teachings could be easily implemented into Ganz without technical challenge.

77. Ganz addresses wireless burstable communications repeaters for creating network infrastructures while Larrick discloses an ultra-wideband (UWB) transmitter and receiver system with controllable spectral characteristics. Ganz, which discloses efficient spectrum utilization in a shared wireless environment, would benefit from Larrick's waveform-adaptive UWB transmitter which provides "well defined and controllable spectral characteristics." (EX1007, Abstract.) These technologies address different aspects of wireless communication that could naturally work together including Larrick's use of wider frequency bandwidths than

those disclosed in Ganz.

78. The "wireless high speed data communication system" of Ganz (EX1005, Abstract), would benefit from Larrick's UWB technology which enables even faster data speeds such as "extremely high pulse repetition frequencies (PRFs) and data rates in the hundreds of megabits per second" (EX1007, Abstract)

79. Larrick's UWB technology, which offers waveform adaptation that could improve signal propagation in challenging environments, would be beneficial to Ganz which addresses communication problems where "extended coverage areas are desired and line-of-sight conditions do not exist." (EX1005, 1:62-63.) Like Ganz, Larrick arises in the field wireless communication networks and is addressed to increasing transmitting information wirelessly. (EX1007, Abstract.)

Enhanced Modulation Techniques

80. The combination would particularly benefit from the complementary modulation approaches described in both patents. Larrick introduces sophisticated UWB signal generation methods that would significantly enhance the Ganz system:

- Larrick's "waveform-adaptive" approach provides precise control over UWB signal characteristics through an "impulse-gated oscillator" that allows "precise control of radiated frequency" governed by "the choice of oscillator which has a known stable frequency." (EX1007, 5:62-65.)
- Larrick supports advanced modulation including phase modulation where

"oscillator phase may also be controlled to generate an additional phase modulation." (EX1007, 5:67-6:1.)

- Larrick enables "frequency agility on a pulse-by-pulse basis allowing frequency hopping if desired" (EX1007, Abstract), which would enhance the frequency hopping capabilities already present in Ganz' system where "three different hopping sequence sets are established with twenty-six (26) hopping sequences per set." (EX1005, 7:21-23.)
- Larrick describes a "time-gated oscillator" approach using high-speed switches to create "a sub-nanosecond microwave burst" with controllable bandwidth. (EX1007, 15:1-9.)

81. These advanced modulation capabilities would pair effectively with Ganz' network protocols, particularly the "burstable packet multi access/collision avoidance (BPMA/CA) protocol" (EX1005, 5:16-17) that Ganz uses to improve network efficiency.

<u>Multi-User Capability and Spectral Efficiency</u>

82. Ganz identifies inefficient spectrum utilization in conventional systems due to "polling" which leads to "time slots [going] unused when a polled radio has no data to transfer." (EX1005, 1:58-60.) Combining this with Larrick's ability to control "center frequency and bandwidth" (EX1007, 6:14-15) on a "pulse-by-pulse basis" (EX1007, 5:52) would create an advanced multiple access scheme where:

- Different users could be assigned different UWB center frequencies, enhancing Ganz' ability to support "multiple segments to be installed in a common geographical area without interfering with each other." (EX1005, 8:17-18.)
- The network could dynamically allocate bandwidth based on user requirements, improving on Ganz' goal of providing "high communication speeds" in a "multi-user (access) environment." (EX1005, 2:41-42.)
- Larrick's "well defined and controllable spectral characteristics" (EX1007, Abstract) would enhance Ganz' ability to segment networks where "data bandwidth can be increased beyond 1.5 Mb/s for higher data transfer rate." (EX1005, 8:39-40.)

<u>Link Quality Assessment and Power Efficiency</u>

83. Ganz describes sophisticated link testing where "control packets" with "sequence numbers" allow the system to "know whether packets were lost either on the way to the destination, or on the way back to the source node" (EX1005, 12:28-31). This capability would pair effectively with Larrick's adaptable UWB parameters to create a system that could dynamically adjust transmission parameters based on link quality.

84. Additionally, Larrick's "gated power amplifier" with "the unique feature of high power efficiency as the power amplifier is only turned on for

approximately the duration of the UWB pulse" (EX1007, 6:42-45) would be particularly valuable in Ganz' repeater network, especially for remote installations.

Data Rate Advancement and Industry Trends

85. At the time of the '337 patent, a significant industry trend was toward higher data rates in wireless communication systems. Ganz' system specifically aims to overcome the "reduction of throughput by a factor of two" that occurs in half-duplex systems (EX1005, 1:19-20) and discusses achieving "information throughput in each segment is preferably at least 1.5 Mb/s, equal to a full dedicated T-1 line rate." (EX1005, 8:24-26.) However, Ganz acknowledges bandwidth limitations within specific frequency bands, noting that "with an 11-bit modulation sequence, a transmission is spread over a 20 MHz bandwidth." (EX1005, 8:26-27).

86. Larrick directly addresses these limitations by providing technology that enables "data rates in the hundreds of megabits per second or more" (EX1007, Abstract) and explicitly states that prior UWB systems had limitations that prevented higher data rates. (*E.g.*, EX1007, 5:41-44.) Larrick's UWB system operates with bandwidths substantially greater than those mentioned in Ganz, with examples showing bandwidths of "400 MHz" (EX1007, 10:63-64) and "over 2 GHz." (EX1007, 15:41-42.)

87. These significant improvements in data rate capabilities – from Ganz' 1.5 Mb/s to Larrick's "hundreds of megabits per second" – represent precisely the

kind of technological advancement that would motivate a POSITA to combine these references. The substantially increased bandwidth of Larrick's UWB system (400 MHz and greater compared to Ganz' 20 MHz) would directly enable these higher data rates.

88. The combination of Ganz and Larrick would have a reasonable expectation of success. Larrick provides technical details for its ultra-wideband transmitter and receivers, explaining how they can operate at higher bandwidths and data rates. It would have been well-within the skill of an ordinary artisan to implement Larrick's teachings into Ganz' repeater systems.

89. In the analysis below, the combined prior art system will be referred to as Ganz/Larrick.

90. Roese teaches various methods for locating the position of a wireless repeater using network information and using the location information within a network, such as to determine the location of user devices connected to the repeater.

91. A POSITA would have been motivated to incorporate the teachings of Roese to improve the Ganz system (along with its combination with Larrick) because of the utility of location information. As Roese itself teaches, location information "may be used in any of a variety of ways to improve configuration accuracy, control, and security," as well as "control or secure a device itself." (EX1012, 2:23-28.) Roese also teaches that "the device location can be used in any number of ways to

enhance the operation of, and services provided by, the system," for example, "anywhere user credentials are required, the location of a device can be required." (*Id.*, 2:54-61.) Location information was also useful for network administrators to optimize coverage of wireless access points as well as perform location-aware handovers. For example, by knowing the location of itself and its neighbors as well as a user device, a wireless repeater/router could more optimally hand off the user device to a neighboring wireless access point. In addition, users of user devices would have found location information to be beneficial, such as when using mapping or emergency services. The techniques of Roese would have been particularly useful at the time of the '337 patent when user devices were unlikely to have GPS.

92. A POSITA would have reasonably expected the combination to succeed. The methods described in Roese used conventional wireless network technologies and Roese provides significant detail on its implementation which was within the skill of an ordinary artisan.

B. Limitation-By-Limitation Analysis

1. Claim 1

a) 1[pre]: A broadband wireless repeater or relay, comprising:

93. Ganz's invention "relates generally to a radio communications repeater, and more particularly relates to a radio communications repeater system for high-

speed data communication which enables multiple users to access a common geographically distributed radio channel. (EX1005, 1:7-12). Ganz further explains that "[t]he radio/data link element circuits" within its wireless burstable communications repeater (WBCR) "can incorporate an IEEE 802.11 specification, the disclosure of which is incorporated herein by reference, which calls for two different physical layer implementations: frequency hopping spread spectrum (FHSS) and direct sequence spread spectrum (DSSS)." (EX1005, 7:12-16.)

94. Larrick discloses "[a] waveform-adaptive ultra-wideband (UWB) transmitter and noise-tracking UWB receiver for use in communications, object detection and radar applications." Larrick also claims "[a] communication system utilizing an ultra-wideband (UWB) transmitter" (EX1007, 24:52-53) and "[a] method of communicating data by transmitting and detecting an ultra wideband UWB pulse." (*id.*, 27:17-18).

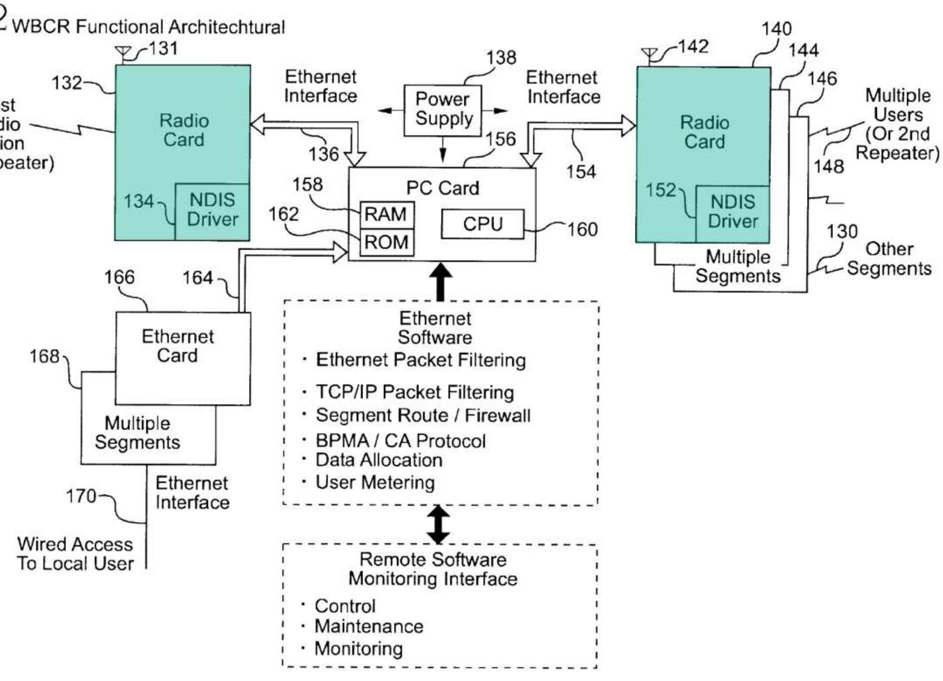
95. Thus, as further discussed in the below limitations, Ganz/Larrick discloses a broadband wireless repeater or relay.

b) 1[a]: at least one receiver or transceiver for signal or data reception from one or more devices;

96. Ganz discloses a wireless burstable communications repeater (WBCR) that includes a first transceiver circuit 132 and a second transceiver circuit 140. (EX1005, 3:64-4:21.) A block diagram of a WBCR functional architecture is

illustrated in FIG. 2 including the first and second transceiver circuits. (EX1005, 3:64-4:21.)

FIG. 2



97. Ganz describes that "[t]he WBCR functions, such that the data packets coming from the user side, are ***received*** by the second radio transceiver circuit 140." (EX1005, 4:22-24.) Further, the second radio transceiver circuit 140 "provides multiple radio frequency access to remotely distributed users and/or other WBCRs." (EX1005, 4:9:12.)

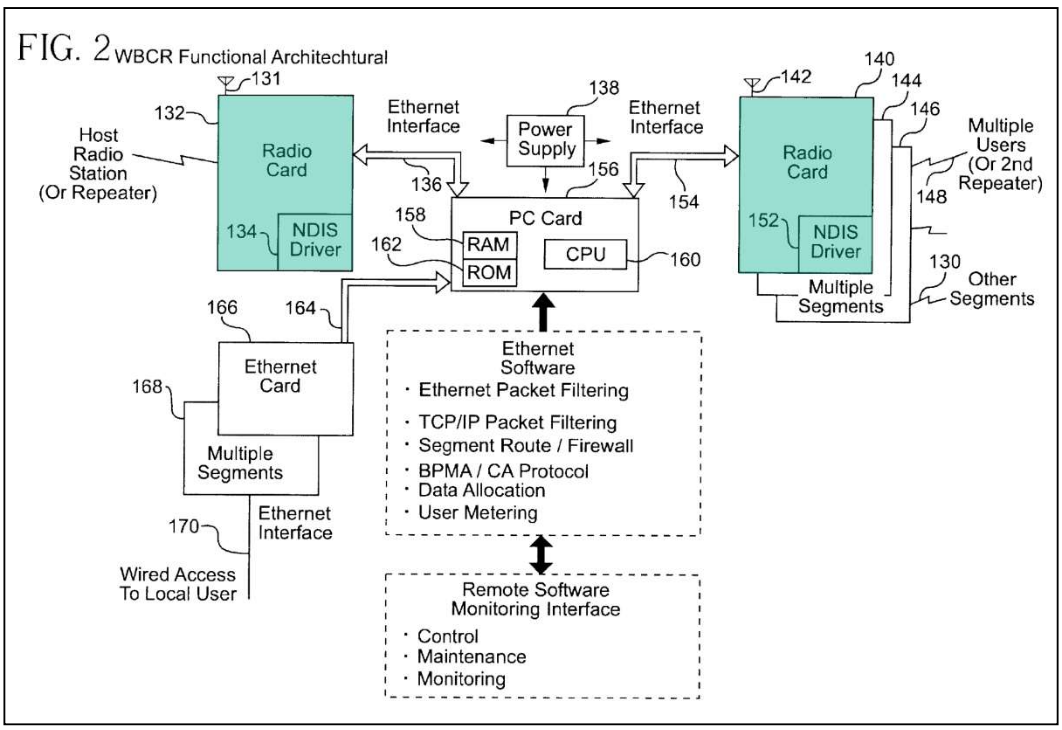
98. Additionally, Ganz explains that the first radio transceiver circuit 132 "provides the radio frequency link to a host radio station and, optionally, to one or more repeaters." (EX1005, 4:8-12.) During a full data stream transfer, data packets can be "***receiv[ed]***…from the host radio station" by the first radio transceiver circuit

132 before being "transmitted to the user" via the second radio transceiver circuit 140. (EX1005, 4:30-35.)

99. Thus, Ganz discloses at least one transceiver for signal or data reception from one or more devices.

c) 1[b]: at least one transmitter or transceiver for signal or data transmission to one or more devices,

100. As described above, Ganz discloses a wireless burstable communications repeater (WBCR) containing at least two transceivers shown in FIG. 2. (EX1005, 3:64-4:21.)



101. Ganz explains that the first radio transceiver circuit 132 "provides the radio frequency link to a host radio station and, optionally, to one or more repeaters."

(EX1005, 4:8-12.) During a full data stream transfer, data packets can be "receiv[ed]…from the host radio station" by the first radio transceiver circuit 132 before being "***transmitted*** to the user" via the second radio transceiver circuit 140. (EX1005, 4:30-35.)

102. Additionally, Ganz describes that "[t]he WBCR functions, such that the data packets coming from the user side, are received by the second radio transceiver circuit 140… before being ***retransmitted*** by the radio transceiver circuit" to the host radio station. (EX1005, 4:22-26.) Further, the second radio transceiver circuit 140 "provides multiple radio frequency access to remotely distributed users and/or other WBCRs." (EX1005, 4:9:12.)

103. Thus, Ganz discloses at least one transceiver for signal or data transmission from one or more devices.

d) 1[c]: wherein the transceiver for signal or data reception and the transceiver for signal or data transmission may be the same or different; and

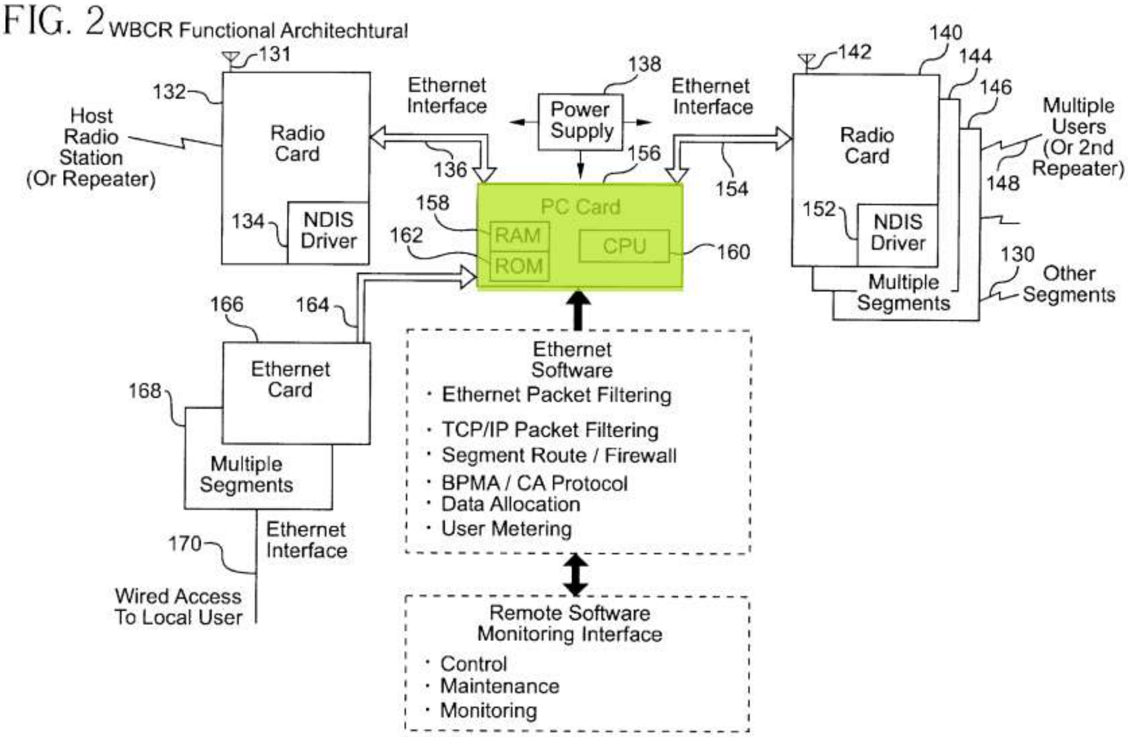
104. According to Ganz, "[t]he radio transceiver circuit 132, provides the radio frequency link to a host radio station and, optionally, to one or more repeaters. The second radio transceiver circuit 140, provides multiple radio frequency access to remotely distributed users and/or other WBCRs." (EX1005, 4:8-21.) Thus Ganz discloses multiple transceivers that may perform both signal or data transmission and reception, and thereby discloses wherein the transceiver for signal or data

reception and the transceiver for signal or data transmission may be different or the same.

e) 1[d]: a controller that is configured or configurable for operation in one or more wireless networks, said controller communicating with said at least one receiver or transceiver for signal or data reception and said at least one transmitter or transceiver for signal or data transmission,

105. Ganz discloses a wireless burstable communications repeater (WBCR) containing a "computer circuit 156" that "***performs the controlling functions*** within the WBCR and includes the processor 160 (e.g., 486 CPU or equivalent), the RAM circuit 158 and the ROM circuit 162." (EX1005, 4:15-21.)

FIG. 2

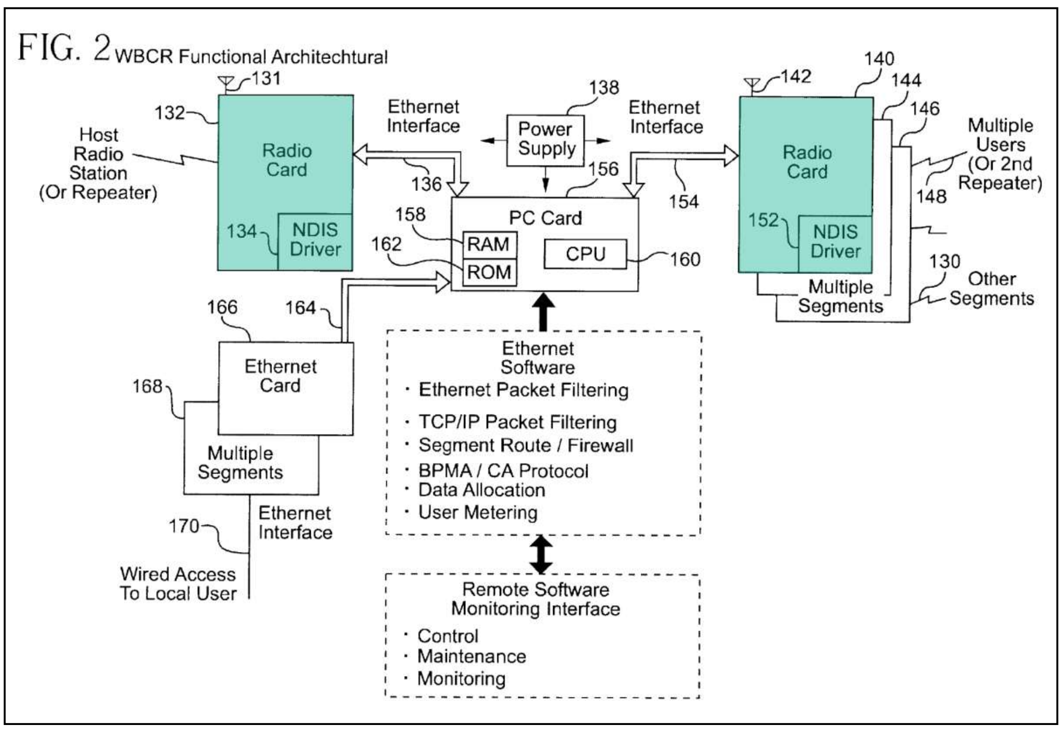


106. As is evident in FIG. 2 above, the computer circuit communicates with

each transceiver circuit 132 and 140.

f) 1[e]: wherein at least one of said receiver or transceiver for signal or data reception and said transmitter or transceiver for signal or data transmission either or both transmit and receive at an instantaneous or overall occupied bandwidth of 100 MHz or more or have a data transmission rate of 100 Megabits per second or more,

107. Ganz discloses a wireless burstable communications repeater (WBCR). A block diagram of a WBCR functional architecture is illustrated in FIG. 2 including a radio transceiver circuit 132 and a second radio transceiver circuit 140. (EX1005, 3:64-4:21.)



108. Ganz does not expressly disclose that the transmitter is configured for transmitting and receiving at an instantaneous or overall occupied bandwidth of 100

MHz. However, Larrick discloses a transmitter using the claimed bandwidth and as discussed above, a POSITA would have been motivated to combine Ganz and Larrick.

109. Larrick "relates to the field of ultra-wideband communication systems. More particularly, [Larrick] relates to the controlled transmission and reception of ultra-wideband electromagnetic pulses." (Ex. 1007, 1:21-24) Larrick discloses "UWB transmitters which generate UWB signals having controllable spectral characteristics." (*Id.*, 9:21-23) "[U]nlike direct high-power impulse excitation of an antenna as in conventional UWB transmitters, low-level impulse excitation of bandpass filter 102 provides complete control over all aspects of the spectral emissions of the UWB transmitter. This is because the spectral emissions are determined exactly by the characteristics of bandpass filter 102, for instance by the center frequency, bandwidth, out of band rejection and skirt responses." (*Id.*, 11:26-35.)

110. In one described embodiment and as shown in FIG. 12A, "[a]n UWB transmitter using a low-level impulse generator and microwave bandpass filter was constructed which generated an L-band UWB signal at a center frequency of 1.5 GHz, ***with a 3 dB bandwidth of 400 MHz***." (EX1007, 10:61-64.)

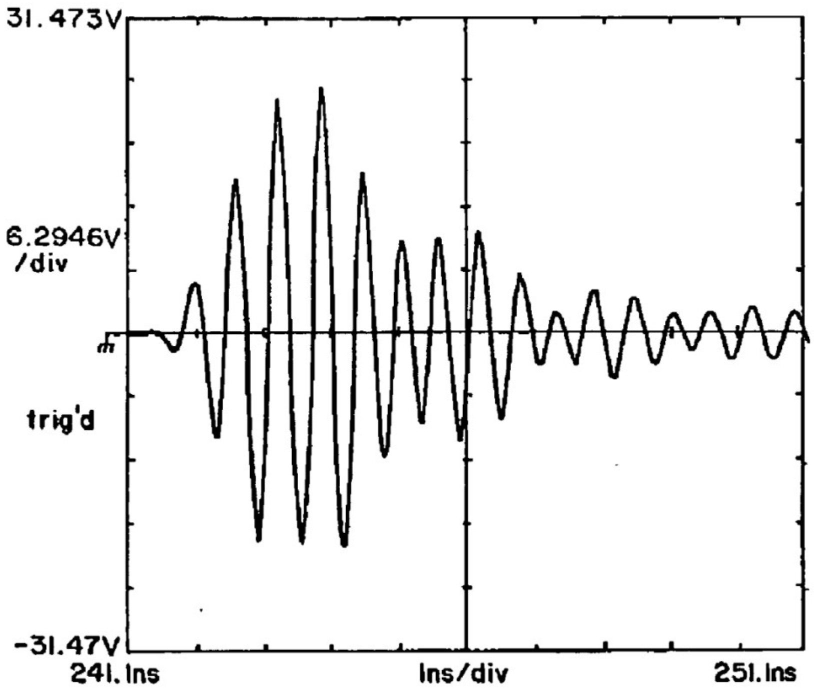


FIG. 12A

111. FIG. 12B shows the frequency spectrum of the UWB signal shown in FIG. 12A. "The particular filters used were L-band bandpass filters, with a center frequency of 1.5 GHz, ***a 1 dB bandwidth of 400 MHz, a 3 dB bandwidth of 500 MHz***, rejection at 1 GHz of greater than 30 dB down." (*Id.*, 10:65-11:4.)

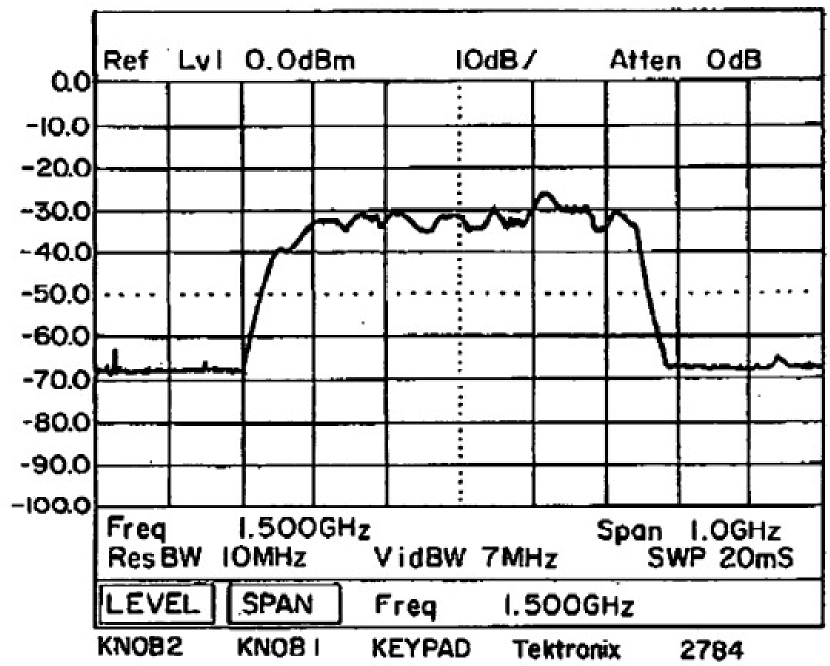


FIG. 12B

112. FIG. 16 "a photograph of a circuit board of a transceiver utilizing the present invention" (*id.*; 9:7-8) "shows the UWB receiver imbedded in a full duplex, voice/data ultra wideband transceiver. The RF section of this particular unit (lower left hand side) is wideband from a few MHz to beyond 4 GHz. Tunnel diodes with adequate response characteristics to 26 GHz and beyond are currently available, and thus **the UWB receiver can readily accommodate a wide variety of center frequencies between a few MHz upwards toward 26 GHz**." (*Id.*; 21:54-61)

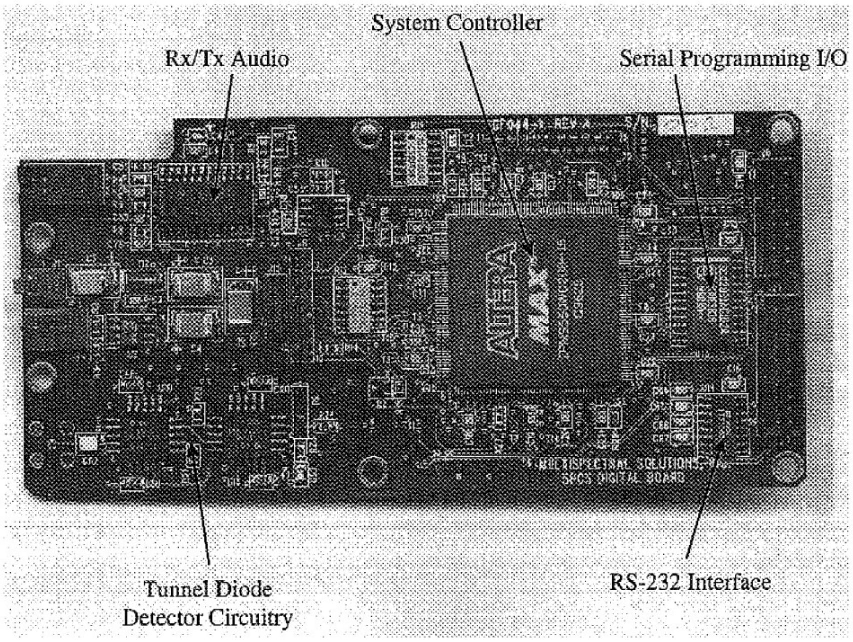


FIG. 16

113. A POSITA would have understood that the ultra-wideband transmitter on the same circuit board as the ultra-wideband receiver would be designed or calibrated to transmit transmissions to the ultra-wideband receiver of the transceiver. Larrick describes and shows the calibration of the receiver. (EX1007, FIG. 15 and 19:35-21:12.) In the object detection applications described in Larrick, it would be advantageous if not required that the transmitter have the same frequency bandwidth as the receiver. Larrick discloses a transmitter with the claimed data rates and as discussed above, a POSITA would have been motivated to combine Ganz and Larrick. In particular, Larrick discloses that its ultra-wideband transmitter is capable of "data rates in the ***hundreds of megabits per second*** or more, frequency agility on

a pulse-to-pulse basis allowing frequency hopping if desired, and extensibility from below HF to millimeter wave frequencies." (EX1007, Abstract.)

g) 1[f]: wherein said broadband wireless repeater or relay is connected or connectable to one or more network backbones for connecting said one or more wireless networks with said one or more network backbones,

114. Ganz teaches that its repeater device is connects the wireless network to a network backbone. In particular, Ganz describes that it maximize the bandwidth of network traffic of "***backbone connections***," such as by "throttling open network connections down to the minimum guaranteed bandwidth." (EX1005, 10:52-11;4.) (EX1005, 10:52-11:4.)

115. Additionally, Ganz describes the software function of "load balancing" to "ensure efficiency of data transfer in the WBCR." (EX1005, 12:12-21.) According to Ganz, "[t]he total bandwidth available to any single WBCR is limited only by the number of connections it has to other segments of the network. Since each individual link has an available bandwidth that is typically smaller than ***the backbone connectivity for the network as a whole,*** a load balancing mechanism is used for optimizing the total system throughput. This allows the creation of bandwidth on demand, by routing excess traffic through links that would otherwise be underutilized." (EX1005, 12:12-21.) Moreover, Figure 1 depicts that its repeaters connect "Local" or "Lan" networks with "Landline[s]" or a "Link to the Internet."

(EX1005, Fig. 1; *see also id.*, 3:40-42 ("land line link 4 (*i.e.*, Internet or other private distribution data sources"). A POSITA would understand that a landline or Internet connection is provided via a network backbone, especially in view of Ganz's disclosures that the WBCR is connected to a backbone. (EX1005, 12:12-21.) The internet is provided by an internet backbone. The internet backbone consists of high-capacity fiber optic cables and routers operated by major telecommunications companies that form the internet's core infrastructure. These networks connect to each other at Internet Exchange Points, where they exchange traffic through peering agreements. Regional and local Internet Service Providers connect to the backbone through a tiered system, allowing data to flow from any source to any destination on the internet and back. This creates a global network that enables communication between any two points online.

h) 1[g]: wherein said broadband wireless repeater or relay is used to support connectivity and/or position location capabilities for one or more mobile or portable devices, and

116. Ganz discloses QoS software that "includes bandwidth management functions that provide traffic control of the WBCR, allowing improved network performance while enforcing traffic flows and other network policies." (EX1005, 10:52-54.) These QoS functions include prioritization, which "provides the WBCR with the flexibility to distinguish between time-sensitive traffic and non-time

sensitive traffic and to give the former higher priority. A typical prioritization scheme assigns an administratively defined priority to each packet and then forwards the packet to a high, medium, or low priority queue." (EX1005, 11:5-9.)

117. Additionally, Ganz describes the software function of "load balancing" to "ensure efficiency of data transfer in the WBCR." (EX1005, 12:12-21.) According to Ganz, "[t]he total bandwidth available to any single WBCR is limited only by the number of connections it has to other segments of the network. Since each individual link has an available bandwidth that is typically smaller than the backbone connectivity for the network as a whole***, a load balancing mechanism is used for optimizing the total system throughput***. This allows the creation of bandwidth on demand***, by routing excess traffic through links that would otherwise be underutilized***." (EX1005, 12:12-21.)

118. Ganz teaches that its controller permits network information to be modified. For example, Ganz explains that "***[m]onitoring and control*** of the WBCR is achieved by software controlled radio/data communications, between a host radio station and the WBCR… Throughput speeds and data packet drop rates can be measured periodically and ***corrective steps taken to adjust the radio parameters remotely***." (EX1005, 5:47-61.) Further, "[t]he controlling functions implemented as part of the BPMA/CA protocol provide for ***remote dynamic load balancing among the users***, and individually enhancing or reducing the allowable user packet size

requests, thereby ensuring efficient network utilization for all users. Basic maintenance functions are performed remotely as well, such as ***adding new users and user ID's, and updating user priority codes***." (EX1005, 5:47-61.)

119. To the extent PO argues that this limitation is not disclosed by Ganz, it is likewise expressly disclosed by Roese, and a POSITA would have been motivated to modify Ganz' system to include Roese's teachings for the reasons discussed above. Roese discloses a "network entry device," such as a wireless repeater, using network information in support of position location capabilities. (EX1012, 31:36-42 ("Network entry devices 114 can include, for example, switches, routers, hubs, bridges, repeaters, wireless access points ….").) Specifically, Roese describes that a network entry device can "determine its physical location" by "receiv[ing] location information from each of its neighboring devices." (EX1012, 36:62-64; *see also id.*, 8:33-40 ("System 100 can employ a first System 100 can employ a first group of mechanisms/techniques for identifying the location of a device (e.g., 104, 114) that communicates via radio frequencies. For example, system 100 triangulates the location of a device using one or more wireless access points, such as 120a-b, associated with network entry devices 114, such as 114a and 114b, respectively, as shown in FIG. 1.") Such location information can then be ***used by a network***, such as to determine the position location of a user device. (EX1012, 9:47-50 ("System 100 also can use signal amplitude differential from the network entry

devices 114a and 114b to determine relative location of user device 104b with respect to an antenna on network device 114a or 114b.”).

i) 1[h]: wherein said controller is configured or configurable to perform or for performing at least one of: a) ignore or filter out at least some signal or data transmissions from one or more undesired transmitters, users, networks, data sources, or noise sources; and b) instruct one or more devices or networks to ignore or disregard at least some signal or data transmissions of one or more undesired transmitters, undesired users, undesired networks, or noise sources.

“a) ignore or filter out at least some signal or data transmissions from one or more undesired transmitters, users, networks, data sources, or noise sources”

120. Ganz discloses that its WBCR includes a “firewall circuit 222,” which can “read IP addresses and protect the gates and authorize access by users,” and also “be programmed to pass through what ever services are required by the user without interference.” (EX1005, 10:33-42.) As was known with firewalls, they “can also block traffic from the Internet to the internal network, but permit internal users to communicate with the Internet.” (*Id.*; *see also* 13:2-4 (“The firewall 268, drops packets that don’t meet its rules for valid traffic.”).) A POSITA would have understood that, in other words, a firewall processes received data packets by inspecting their origin (*e.g.* Internet vs. internal) or the targeted service and blocking or allowing the data packet.

121. Ganz also discloses that the WBCR performs "IP filtering," which "allows for certain data packets to be blocked, ***processed*** according to QoS policies and used to assess and sort according to traffic load on each WBCR radio segment." (*Id.*, 11:45-48.) IP filtering also "automatically drops (destroys) incorrectly formed packets or those which the system has been programmed to reject." (*Id.*, 12:70-13:2.)

122. Thus, a POSITA would understand that the controller in Ganz's WBCR is configurable to "ignore or filter out at least some signal or data transmissions," from undesired transmitters, users, networks, data sources, or noise sources.

"b) instruct one or more devices or networks to ignore or disregard at least some signal or data transmissions of one or more undesired transmitters, undesired users, undesired networks, or noise sources"

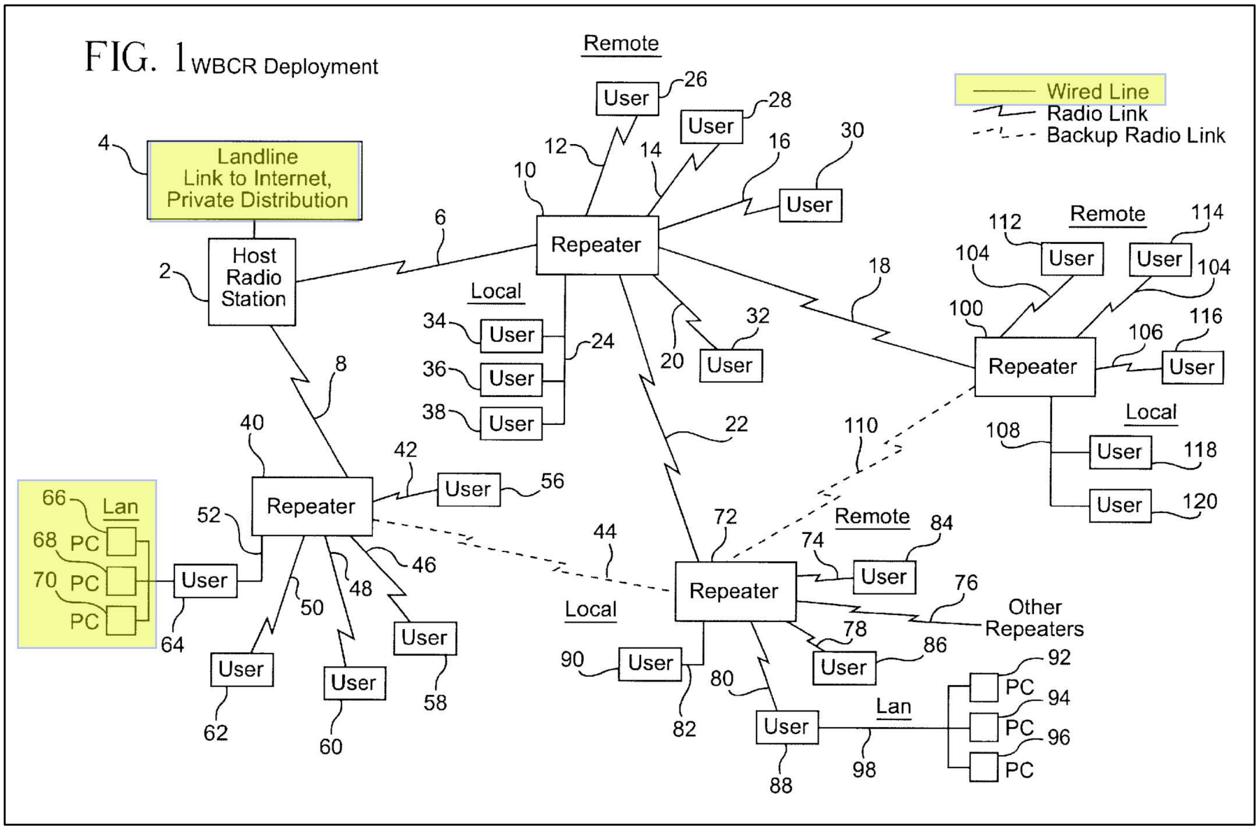
123. As discussed above, Ganz discloses ignoring or filtering out at least some signal or data transmissions of undesired transmitters, users, networks, data sources, or noise sources. Given that Ganz explains that its WBCR is configured to "***communicate with at least one end user*** by either a direct electrical connection or a wireless connection" (EX1005, 2:46-50.), it would have been obvious to a POSITA that Ganz's WBCR could also perform the function of "instruct[ing] one or more devices or networks to ignore or disregard at least some signal or data transmissions." Ganz already discloses that its WBCR has information on "undesired" signal or data transmissions, as a well as means of communicating that information. Thus, a POSITA would have known that modifying Ganz's WBCR to

communicate information on "undesired" signal or data transmissions, thereby "instructing" end user devices to ignore or disregard those signal or data transmissions, could be done without technical challenge and with a reasonable expectation of success.

2. Claim 2

a) The broadband wireless repeater or relay of claim 1, wherein at least one of said one or more network backbones to which said controller is connected or connectable is a wired backbone.

124. Ganz' WBCR deployment scheme, illustrated in FIG. 1, "includes: a host radio station 2, a land line link 4, a WBCR 10, a remote user 26, a physical data line 24, and a local user 34." "The host radio station 2, provides data communications from the land line link 4 (*i.e.*, Internet or other private distribution data sources) to users 26 remotely located from the host radio station 2, by a network of WBCRs 10, 100, 72, 40.



125. The WBCR in Ganz also "reads" each data packet in transit and directs it to the appropriate segment (i.e., out to the user radio link side, or to a user local to the repeater site via the Ethernet card). (EX1005, 4:36-39).

3. Claim 3

a) The broadband wireless repeater or relay of claim 2, wherein said wired backbone is selected from a group consisting of T1, T3, DSL, cable, cable modem, fiber, optical cable, copper lines, coax, phone, ethernet, and internet.

126. *See* claim 2

4. Claim 4

a) The broadband wireless repeater or relay of claim 1,

wherein at least one of said one or more network backbones to which said controller is connected or connectable is a wireless backbone.

127. Ganz describes that the WBCR as shown in FIG. 3 preferably includes two antennas, a radio/data link element circuit 190, a second radio/data link element circuit 198, a medium access control (MAC) circuit, a packet exchange bus, and a network control module circuit. (EX1005, 6:4-13) "The radio/data link element circuit 190 includes a radio frequency transmitter circuit and a radio frequency receiver circuit. These circuits provide the radio frequency communication between a host radio station and other repeaters." (*Id.*, 6:21-24.) "**The radio/data link element circuits can incorporate an IEEE 802.11 specification, the disclosure of which is incorporated herein by reference**, which calls for two different physical layer implementations: frequency hopping spread spectrum (FHSS) and direct sequence spread spectrum (DSSS)." (*Id.*, 7:12-16.)

5. Claim 5

a) The broadband wireless repeater or relay of claim 4, wherein said wireless backbone is selected from a group consisting of last mile wireless service, mesh network, LMDS, MMDS, WiMax, 802.16, 802.20, 802.11a/b/g, 802.15.3.a, RF, and baseband.

128. *See* claim 4. To the extent Ganz does not expressly disclose IEEE 802.11a/b/g, these merely add additional clauses to the IEEE 802.11 standard and a POSITA would have readily incorporated these additions to the IEEE 802.11

standard with a reasonable expectation of success.

6. Claim 6

a) The broadband wireless repeater or relay of claim 1, wherein said controller is configured to or configurable to perform a).

129. *See* limitation 1[h].

7. Claim 7

a) The broadband wireless repeater or relay of claim 1, wherein said controller is configured to or configurable to perform b).

130. *See* limitation 1[h].

8. Claim 8

a) The broadband wireless repeater or relay of claim 1, wherein said controller is configured to or configurable to perform network provisioning or monitoring.

131. Ganz describes software controlled radio/data communications that perform ***"[m]onitoring and control of the WBCR.***" (EX1005, 5:47-48.) As such, "[t]hroughput speeds and data packet drop rates can be measured periodically and corrective steps taken to adjust the radio parameters remotely." (EX1005, 5:51-54.) "The controlling functions implemented as part of the BPMA/CA protocol provide for remote dynamic load balancing among the users, and individually enhancing or reducing the allowable user packet size requests, thereby ensuring efficient network utilization for all users." (EX1005, 5:54-58.) Additionally, "[b]asic maintenance

functions are performed remotely as well, such as adding new users and user ID's, and updating user priority codes." (EX1005, 5:58-61). Thus, a POSITA would understand that Ganz discloses that its controller performs network provisioning or monitoring.

9. Claim 9

a) 9[pre]: The broadband wireless repeater or relay of claim 8, wherein the network provisioning or monitoring includes one or more of:

b) 9[a]: i) bandwidth or delay provisioning of repeated or relayed transmissions,

c) 9[b]: ii) application prioritization,

d) 9[c]: iii) prioritizing, delaying or altering of data transmissions, traffic, or bandwidth, and

e) 9[d]: iv) monitoring or measuring traffic from one or more devices, users or networks.

132. For example, Ganz discloses QoS software that "includes bandwidth management functions that provide traffic control of the WBCR, allowing improved network performance while enforcing traffic flows and other network policies." (EX1005, 10:52-54.) These QoS functions include prioritization, which "provides the WBCR with the flexibility to distinguish between time-sensitive traffic and non-time sensitive traffic and to give the former higher priority. A typical prioritization scheme assigns an administratively defined priority to each packet and then forwards the packet to a high, medium, or low priority queue." (EX1005, 11:5-9.)

133. Additionally, Ganz describes the software function of "load balancing" to "ensure efficiency of data transfer in the WBCR." (EX1005, 12:12-21.) According to Ganz, "[t]he total bandwidth available to any single WBCR is limited only by the number of connections it has to other segments of the network. Since each individual link has an available bandwidth that is typically smaller than the backbone connectivity for the network as a whole, ***a load balancing mechanism is used for optimizing the total system throughput***. This allows the creation of bandwidth on demand, ***by routing excess traffic through links that would otherwise be underutilized***." (EX1005, 12:12-21.)

134. For example, Ganz discloses QoS software that "includes bandwidth management functions that provide traffic control of the WBCR, allowing improved network performance while enforcing traffic flows and other network policies." (EX1005, 10:52-54.) These QoS functions include prioritization, which "provides the WBCR with the flexibility to distinguish between time-sensitive traffic and non-time sensitive traffic and to give the former higher priority. A typical prioritization scheme assigns an administratively defined priority to each packet and then forwards the packet to a high, medium, or low priority queue." (EX1005, 11:5-9.)

135. Additionally, Ganz describes the software function of "load balancing" to "ensure efficiency of data transfer in the WBCR." (EX1005, 12:12-21.) According to Ganz, "[t]he total bandwidth available to any single WBCR is limited only by the

number of connections it has to other segments of the network. Since each individual link has an available bandwidth that is typically smaller than the backbone connectivity for the network as a whole**, *a load balancing mechanism is used for optimizing the total system throughput***. This allows the creation of bandwidth on demand**, *by routing excess traffic through links that would otherwise be underutilized***." (EX1005, 12:12-21.)

10. Claim 10

a) 10[pre]: The broadband wireless repeater or relay of claim 1, wherein said controller is configured or configurable to perform or for performing all of:

136. *See* limitations 1[pre] and 1[h].

b) 10[a]: a);

137. *See* limitation 1[h].

c) 10[b]: b); and

138. *See* limitation 1[h].

d) 10[c]: c) network provisioning or monitoring.

139. *See* claim 8.

11. Claim 11

a) The broadband wireless repeater or relay of claim 1, wherein said at least one receiver or transceiver for receiving signals or data and said at least one transmitter or transceiver for transmitting signals or data operate in half duplex.

140. Ganz describes that "the present invention [] provide[s] a radio communications repeater which is capable of full data rate transfers in ***half-duplex systems***." (EX1005, 2:17-19.)

12. Claim 12

a) The broadband wireless repeater or relay of claim 1, wherein said at least one receiver or transceiver for receiving signals or data and said at least one transmitter or transceiver for transmitting signals or data operate in full duplex.

141. Ganz describes a communication system comprising "a plurality of wireless communication repeaters wherein ***each repeater is adapted for two way wireless full-duplex communication*** with at least one of the host radio station and another repeater within a line-of-sight of the repeater to enable communication between the host radio station and repeaters beyond a line-of-sight of the host radio station." (EX1005, 13:15-20; *see also*, *id.*, 14:33-38 and 15:41-58.)

13. Claim 13

a) The broadband wireless repeater or relay of claim 1, wherein said at least one receiver or transceiver for receiving signals or data and said at least one transmitter or transceiver for transmitting signals or data operate in simplex.

142. Ganz discloses a transceiver operating in both half-duplex and full-duplex. *See* claims 11, 12 above. A POSITA would understand that a system containing transceivers that operate in half-duplex and full-duplex would be easily

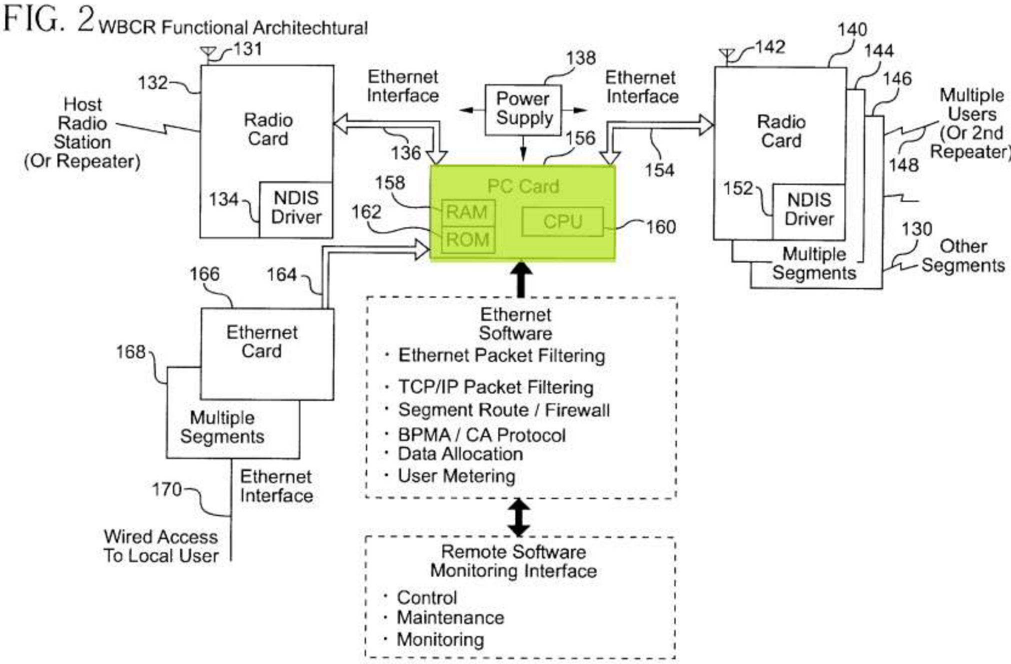
modifiable to operate in simplex, as it would require transmission of information in only a single direction rather than in two directions.

14. Claim 14

a) The broadband wireless repeater or relay of claim 1, wherein said signals or data received by said receiver or transceiver for receiving signals or data, or signals or data transmitted by said transmitter or transceiver for transmitting signals or data, or signals or data controlled by said controller include modified, stored, or delayed signals or data.

143. Ganz discloses a "computer circuit 156" that contains the "processor 160," the "RAM circuit 158," and the "ROM circuit 162." When information is received by the WBCR, "the data packets coming from the user side, are received by the second radio transceiver circuit 140 and then ***temporarily buffered in the RAM circuit 158*** before being retransmitted by the radio transceiver circuit 4 to the host radio station." (EX1005, 4:22-26, FIG. 2.)

FIG. 2 WBCR Functional Architechtural



144. Ganz further discloses a "cache" within its software modules, which keeps "popular" data locally, thereby "reduc[ing] the overall requirements for remote backbone bandwidth." (EX1005, 11:52-64.) Further, "[t]he WBCR can communicate cache information with its neighbors via the RFC 2186 internet cache protocol, thus a distributed object cache can flow throughout the local network instead of being limited to a single node." *Id.* Thus, a POSITA would understand that Ganz discloses controlling modified, stored, or delayed signals or data.

15. Claim 15

a) The broadband wireless repeater or relay of claim 1, wherein said controller is configured to cause said at least one transmitter or transceiver for transmitting signals or data to transmit modified received data or transmissions to one or more devices at an instantaneous or overall occupied bandwidth of 100

MHz or more or have a data transmission rate of 100 Megabits per second or more.

145. *See* claim limitation 1[e] and claim 14 above.

16. Claim 16

a) 16: The broadband wireless repeater or relay of claim 1, wherein said controller is configured to identify one or more devices in said one or more wireless networks.

146. Ganz describes, as part of its capacity management processes, that "[t]he WBCR may also be segregated into multiple tiers or layers when a segment on a user end approaches capacity." (EX1005, 5:33-46.) This is accomplished with the use of "additional radio transceiver circuits on the user side of the WBCR, ***each with its own unique IP address, Ethernet and radio ID code***." *Id.* Ganz further describes that basic maintenance functions for ensuring efficient network utilization can be performed remotely, such as "adding new users and ***user ID's***, and updating user priority codes." (EX1005, 5:58-60.) Thus, Ganz describes that its WBCR is able to identify one or more devices in the network.

17. Claim 20

a) The broadband wireless repeater or relay of claim 1, wherein said broadband wireless repeater or relay is configured to be integrated with or in communication with a vehicle, train, aircraft, or other moving platform.

147. Larrick describes that "[s]everal laboratory models using [early

versions of UWB impulse transmitters] were constructed for radar applications which included ship docking, pre-collision sensing for automobiles, liquid level sensing, and intrusion detection. Although these techniques proved to be reliable, the power efficiency, PRF limitations, size and complicated antenna assemblies limited performance and reproducibility." (EX1007, 2:5-11.) It was therefore an object of Larrick to "provide an UWB transmitter system that obviates pulse repetition frequency (PRF) limitations of conventional systems, thus allowing extremely high data rates on the order of hundreds of megabits per second." (*Id.*, 7:21-25.)

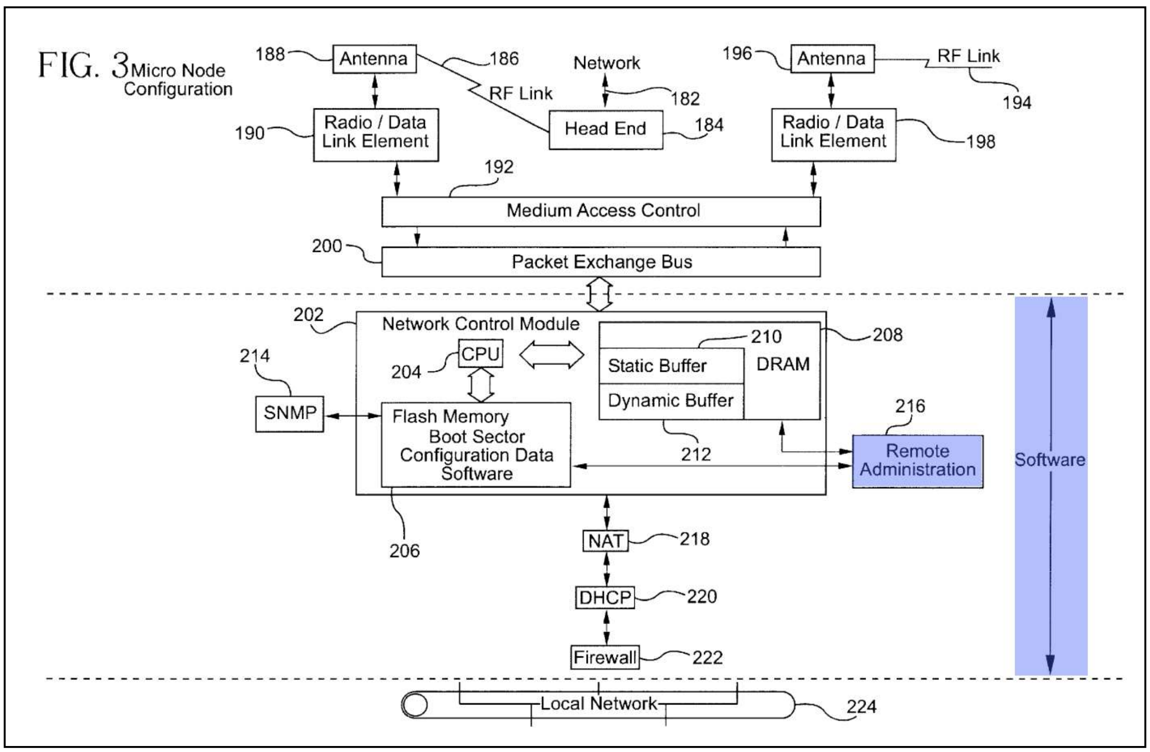
18. Claim 24:

a) The broadband wireless repeater or relay of claim 1, wherein said repeater or relay is configured to be integrated with or in communication with a device selected from the group consisting of a television, a telephone, a cellphone, a computer, a camera, a video system, a monitor, a power plug, a wall outlet, a watch, a cable modem, a vehicle or other moving platform, a game console, and an ultrawideband transceiver or device.

148. Ganz describes that "***[t]he management software 230, provides for remote administration***. Remote administration of the WBCR is possible by a high level encryption scheme and secure ports. Security keys are generated on a regular time period (e.g. every 60 minutes) to ensure that no key is active long enough to be broken. Initial keys are exchanged by an encrypted password, so that no passwords

appear in clear-text on any network." (EX1005, 11:65-12:5).

149. A POSITA would understand that "management software" which "provides for remote administration" would include an interface accessible from a remote computer. A POSITA would understand that in order to provide remote administration, the management software would provide an interface for the remote administrator to perform the administrative tasks. Such an interface would be accessible from a remote computer.



19. Claim 25:

a) **The broadband wireless repeater or relay of claim 1, wherein one or more of said receiver or transceiver for signal or data reception, said transmitter or transceiver for signal or data transmission, and said controller is embedded in one or more integrated**

circuit chips.

150. Larrick's FIG. 16 "a photograph of a circuit board of a transceiver utilizing the present invention" (*id.*; 9:7-8) "shows the UWB receiver imbedded in a full duplex, voice/data ultra wideband transceiver. The RF section of this particular unit (lower left hand side) is wideband from a few MHz to beyond 4 GHz. Tunnel diodes with adequate response characteristics to 26 GHz and beyond are currently available, and thus the UWB receiver can readily accommodate a wide variety of center frequencies between a few MHz upwards toward 26 GHz." (*Id.*; 21:54-61.)

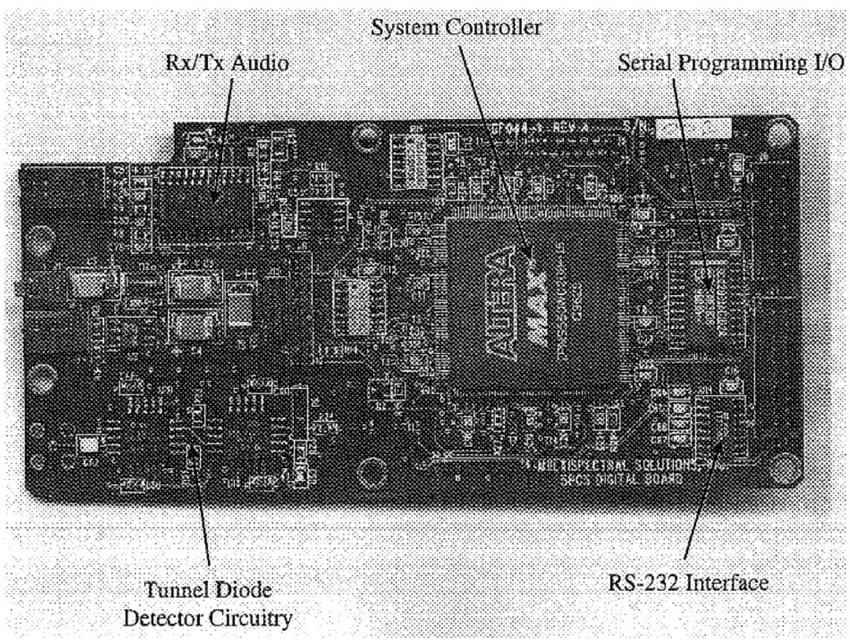


FIG. 16

151. Thus, Larrick discloses that its controller is embedded in an integrated circuit chip.

20. Claim 26:

a) The broadband wireless repeater or relay of claim 1, wherein said broadband wireless repeater or relay is configured or configurable for monitoring or measuring traffic passed through, received by or transmitted by said broadband wireless repeater or relay.

152. Ganz describes software controlled radio/data communications that perform ***"[m]onitoring and control of the WBCR.***" (EX1005, 5:47-48.) As such, "[t]hroughput speeds and data packet drop rates can be measured periodically and corrective steps taken to adjust the radio parameters remotely." (EX1005, 5:51-54.) "The controlling functions implemented as part of the BPMA/CA protocol provide for remote dynamic load balancing among the users, and individually enhancing or reducing the allowable user packet size requests, thereby ensuring efficient network utilization for all users." (EX1005, 5:54-58.) Additionally, "[b]asic maintenance functions are performed remotely as well, such as adding new users and user ID's, and updating user priority codes." (EX1005, 5:58-61). Thus, a POSITA would understand that Ganz discloses that its WBCR is configurable for monitoring or measuring traffic that passes through it.

21. Claim 27

a) The broadband wireless repeater or relay of claim 1, wherein said broadband wireless repeater or relay is configured or configurable to modify at least some received signals or data from one or more devices,

users or networks and transmit modified or delayed signals or data to at least one device, network or user via wireless communication.

153. Ganz discloses sending modified or delayed signals or data as discussed above for Claim 14.

154. Additionally, Ganz discloses that these signals can be sent wirelessly. For example, Ganz is directed to a "wireless high speed data communication system," in which a host radio station transmits data to a wireless communication repeater, which communicates with at least one end user. "The host radio station transmits and receives data to and from at least one wireless communication repeater within line of sight of the host radio station," thus communicating wirelessly, and "[t]he repeater is configured to communicate with at least one end user by ***either a direct electrical connection or a wireless connection***." (EX1005, 2:46-50.) Thus, Ganz discloses sending modified or delayed signals or data via wireless communication.

22. Claim 28

a) The broadband wireless repeater or relay of claim 1, wherein said controller and one or more of said at least one receiver or transceiver for signal or data reception and said at least one transmitter or transceiver for signal or data transmission are integrated.

155. *See* claim 25.

VIII. GROUND 2: Ganz, Larrick, and Roese in Combination with Perlman Renders Claims 18-19 and 21-22 Obvious

A. Overview and Motivation to Combine

156. Perlman teaches various conventional repeater techniques that were well-known, including using repeaters to increase the coverage distance of the network, to obtain coverage in indoor, outdoor, and moving environments, and to make a repeater self-configurable.

157. A POSITA would have been motivated to incorporate the teachings of Perlman to improve the Ganz system (along with its combination with Larrick). Both Ganz and Perlman address repeater systems that aimed to address known limitations and problems of wireless technologies at the time. A POSITA would have sought to further improve Ganz by applying the teachings of Perlman because of the utility of increasing the coverage distance of the network, obtaining coverage in indoor, outdoor, and moving environments, and making a repeater self-configurable. Such technologies were conventional and well-known by the time of the ’337 patent, and a POSITA would have known and been motivated by their utility.

158. It was a well-known problem that transmission of high-bandwidth data could be degraded by “structural obstacles,” “human traffic,” “conflicting devices,” as well as “distance between the access point and the mobile terminal or other device.” (EX1011, [0006]). The concept of using wireless repeaters to extend

coverage throughout a building similarly existed at the time. (EX1011, [0008]). Perlman applies these concepts in its teachings towards a system that utilizes wireless repeaters to solve these problems, increasing the network coverage distance and making it useful in moving, indoor, and outdoor environments. Perlman similarly applies known concepts of making its repeaters self-configurable to provide convenience to the user, negating the need to manually configure each repeater.

159. A POSITA would have had a reasonable expectation of success combining Ganz/Larrick with Perlman. Perlman utilizes a combination of known techniques to improve the performance of known repeater technologies. A POSITA would have been well aware of such methods and the conventional ways of implementing such standard technologies. Implementation would have been well-within the skill of an ordinary artisan.

B. Limitation-By-Limitation Analysis

1. Claim 18

a) The broadband wireless repeater or relay of claim 1, wherein said controller is self-configurable.

160. Perlman discloses a wireless network architecture that is self-configurable. For example, Perlman describes that "[t]he ***self-configuring feature*** of the present invention is also apparent." (EX1011, [0086].) This is done by "a

processor in the source access point" that "executes a program or algorithm that determines an optimal set of frequency channels allocated for use by each access point or repeater." (*Id.*) Optimal sets of channels are ones that "do not include over-lapping channels," "avoid[] channels used by other interfering devices in the same locality," and "maximize[] channel re-use." (*Id.*) Further, once a set of the channels has been chosen for use by the access points, "modulated power can be reduced to the minimum needed to achieve maximum bandwidth across each link so as to reduce signal reflections." (*Id.*) Further, Perlman describes that its wireless network "may also adapt to changes to the network by reconfiguring the channel assignments, such as when new repeaters are added, existing ones removed, or when the network experiences disturbances caused by other interfering devices (e.g., from a neighboring network)." (*Id.*)

161. Perlman further describes an "adaptation process" similar to the self-configuration process described above, where "all of the different possible combinations of channels may be tried until the network identifies an optimal combination that works to overcome the channel conflict without creating any new conflicts." (EX1011, [0094].) In doing so, "[t]he adaptation process may rely upon an algorithm that does not attempt to change or move channels which have already been established." (*Id.*) Thus, "regardless of the origin of a channel conflict" Perlman's disclosed network "adapts to the disturbance by ***reconfiguring itself*** to

optimize performance." (*Id.*)

2. Claim 19

a) The broadband wireless repeater or relay of claim 1, wherein at least one of said receiver or transceiver for signal or data reception, at least one of said transmitter or transceiver for signal or data transmission, or said controller is configured for operation in at least one of said one or more wireless networks in a moving platform environment.

162. Perlman describes that its invention has the ability to "provide connectivity to any user who happens to be within the range of the wireless network." (EX1011, [0106].) For example, if "a wireless repeater or access point is mounted near a window or on the rooftop of a building," a user with a laptop computer that is within range could connect to the Internet. (*Id.*) Thus, Perlman explains that its invention "provides ever greater mobility by allowing portable computer users to take media content with them." (*Id.*) A POSITA would understand that Perlman thereby allows operation of its network in a moving platform environment, whereby users on mobile or portable devices can connect to the network from different locations.

3. Claim 21

a) The broadband wireless repeater or relay of claim 1, wherein at least one of said receiver or transceiver for signal or data reception, at least one of said transmitter or transceiver for signal or data transmission, or said controller is configured for

operation in at least one of said one or more wireless networks in an indoor environment.

163. Perlman describes many applications of its network in indoor environments. For example, FIG. 19 is "a floor plan showing two simultaneous wireless networks operating ***in a building*** 84 to increase bandwidth." (EX1011, [0098].)

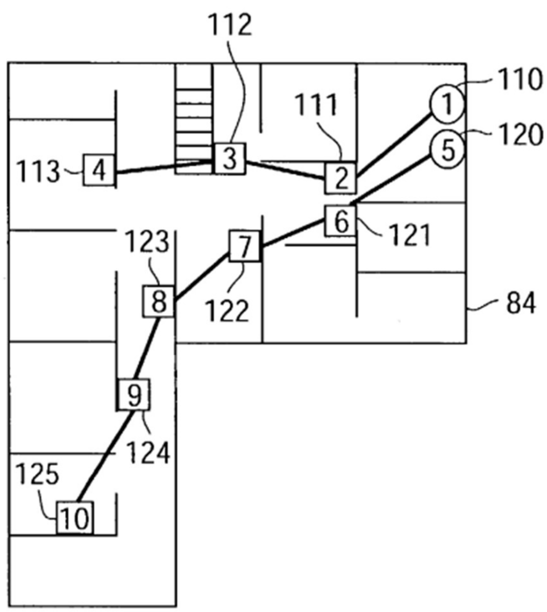


FIG. 19

4. **Claim 22**

a) **The broadband wireless repeater or relay of claim 1, wherein at least one of said receiver or transceiver for signal or data reception, at least one of said transmitter or transceiver for signal or data transmission, or said controller is configured for operation in at least one of said one or more wireless networks in an outdoor environment.**

164. Perlman describes that its invention has the ability to "provide connectivity to any user who happens to be within the range of the wireless network." (EX1011, [0106].) For example, if "a wireless repeater or access point is mounted near a window or on the rooftop of a building, ***the outdoor range of the wireless network may be extended to a nearby park or other buildings*** (*e.g.*, a café or coffeehouse). " (*Id.*) A user with a laptop computer that is within range could thereby connect to the Internet outdoors. (*Id.*)

IX. GROUND 3: Ganz, Larrick, and Roese in Combination with Engels Renders Claims 17, 23, 29-40, 43, and 46-51 Obvious

A. Overview and Motivation to Combine

165. Engels teaches various conventional antenna technologies that were well-known, including MIMO, beamforming, adaptable, and directional antennas.

166. A POSITA would have been motivated to incorporate the teachings of Engels to improve the Ganz system (along with its combination with Larrick and Roese) because of the utility of MIMO, beamforming, adaptable, and directional antennas, and cellular networks. Such technologies were conventional and well-known by the time of the '337 patent, and a POSITA would have known and been motivated by their utility. It was known that MIMO could minimize errors, optimize data speed, and improve bandwidth and capacity by allowing data to travel over multiple signals at the same time. In particular, MIMO would transmit multiple

signals along multiple paths, allowing better SNR performance in challenging conditions.

167. Beamforming is a signal processing technique used in wireless communications (Wi-Fi, 5G, radar, sonar, etc.) that focuses a signal in a specific direction instead of broadcasting it equally in all directions. Beamforming uses adaptable and steerable antennas. A POSITA would have been motivated to use beamforming as it allows for improved signal strength by directing energy to an intended receiver. This increases range and reduces dead zones, as well as allowing for higher data rates and reduction in interference. Moreover, beamforming allows multiple users to share the same frequency band simultaneously by steering beams in different directions (multi-user MIMO in 5G and Wi-Fi 6/7). Beamforming also increases energy efficiency by concentrating power where it's needed reduces overall wasted transmission energy.

168. A POSITA would have been motivated to combine Ganz/Larrick/Roese to configure the wireless network device to operate in a cellular network. As discussed above, the '337 patent states "[r]epeaters are well known in the art, and they have been manufactured for decades in the cellular and PCS industries, and more recently, a company in Melbourne Fla., WiDeFi has developed WiFi repeaters for the IEEE 802.11a/b marketplace." (EX1001, 3:27-31.) Engels references "methods of operating cellular wireless systems and the use of repeaters to extend

wireless networks," and cites "*The Cellular Radio Handbook*, third edition, N. J. Boucher, Quantum Publishing, 1995, especially, chapters 10, 11 and 12." (EX1008, 7:2-5.) Engels then discloses that its teachings "relate[] to communication between indoor and outdoor environments, especially making use of wireless radio telecommunication networks" which include known cellular technologies such as "CDMA, FDMA, TDMA …." (EX1008, 7:12-16.) One of ordinary skill in the art will recognize that access points, repeaters, stations, etc. can take various forms in wireless networks. For example, an 802.11 base station may be connected to a wired or wireless wide area network infrastructure such as a cellular modem. One of ordinary skill in the art will similarly recognize that wireless networks may be in accordance with many different protocols such as 802.11, 802.15.3.a, Bluetooth, TDS-CDMA, TDD-W-CDMA, or the like.

169. A POSITA would have had a reasonable expectation of success combining Ganz/Larrick/Roese with Engels. MIMO, beamforming, and cellular networks were well-known and conventional technologies. A POSITA would have been well aware of such methods and the conventional ways of implementing such standard technologies. Implementation would have been well-within the skill of an ordinary artisan.

B. Limitation-By-Limitation Analysis

1. Claim 17

a) The broadband wireless repeater or relay of claim 1, wherein said repeater or relay employs MIMO or adaptive antenna technology.

170. Engels teaches that "the usage of ***multiple antenna techniques*** with antenna means (10) may result in a communication with antenna's at multiple outdoor nodes located at different locations." (EX1008, 13:11-13.) These techniques, which are "particularly useful for providing redundancy in the outdoor connection," include "beamforming, spatial division multiple access (SDMA), ***multiple input multiple output (MIMO) systems***." (EX1008, 13:13-15.) Engels therefore discloses that its network device could be configured for using MIMO antenna technology.

2. Claim 23

a) The broadband wireless repeater or relay of claim 1, wherein at least one of said receiver or transceiver for signal or data reception, at least one of said transmitter or transceiver for signal or data transmission, or said controller is configured for operation in at least one of said one or more wireless networks selected from the group consisting of: a cellular network, an enterprise network, a wireless local area network, or a wireless personal area network.

171. Engels references "methods of operating cellular wireless systems and the use of repeaters to extend wireless networks," and cites "*The Cellular Radio Handbook*, third edition, N. J. Boucher, Quantum Publishing, 1995, especially,

chapters 10, 11 and 12." (EX1008, 7:2-5.) Engels then discloses that its teachings "relate[] to communication between indoor and outdoor environments, especially making use of wireless radio telecommunication networks" which include known cellular technologies such as "CDMA, FDMA, TDMA …." (EX1008, 7:12-16.)

3. Claims 29

a) 29[pre]: A broadband wireless repeater or relay, comprising:

172. *See* claim 1[pre].

b) 29[a]: at least one receiver or transceiver for signal or data reception from one or more devices;

173. *See* claim 1[a].

c) 29[b]: at least one transmitter or transceiver for signal or data transmission to one or more devices,

174. *See* claim 1[b].

d) 29[c]: wherein the transceiver for signal or data reception and the transceiver for signal or data transmission may be the same or different; and

175. *See* claim 1[c].

e) 29[d]: a controller that is configured or configurable for operation in one or more wireless networks, said controller communicating with said at least one receiver or transceiver for signal or data reception and said at least one transmitter or transceiver for signal or data transmission,

176. *See* claim 1[d].

f) **29[e]: wherein at least one of said receiver or transceiver for signal or data reception and said transmitter or transceiver for signal or data transmission either or both transmit and receive at an instantaneous or overall occupied bandwidth of 100 MHz or more or have a data transmission rate of 100 Megabits per second or more,**

177. *See* claim 1[e].

g) **29[f]: wherein said repeater or relay employs MIMO or adaptive antenna technology,**

178. *See* claim 17.

h) **29[g]: wherein said broadband wireless repeater or relay is used to support connectivity and/or position location capabilities for one or more mobile or portable devices, and**

179. *See* claim 1[g].

i) **29[h]: wherein said controller is configured or configurable to perform or for performing at least one of:**

j) **29[i]: a) ignore or filter out at least some signal or data transmissions from one or more undesired transmitters, users, networks, data sources, or noise sources; and**

k) **29[j]: b) instruct one or more devices or networks to ignore or disregard at least some signal or data transmissions of one or more undesired transmitters, undesired users, undesired networks, or noise sources.**

180. Ganz/Larrick discloses these limitations. *See* claim 1[h].

4. Claim 30

a) The broadband wireless repeater or relay of claim 29, wherein said controller is configured or configurable to perform a).

181. *See* claim 29[i].

5. Claim 31

a) The broadband wireless repeater or relay of claim 29, wherein said controller is configured or configurable to perform b).

182. *See* claim 29[j].

6. Claim 32

a) The broadband wireless repeater or relay of claim 29, wherein said controller is configured or configurable to perform network provisioning or monitoring.

183. *See* claim 8.

7. Claim 33

a) 33[pre]: The broadband wireless repeater or relay of claim 32, wherein the network provisioning or monitoring includes one or more of:

b) 33[a]: i) bandwidth or delay provisioning of repeated or relayed transmissions,

c) 33[b]: ii) application prioritization,

d) 33[c]: iii) prioritizing, delaying or altering of data transmissions, traffic, or bandwidth, and

e) 33[d]: iv) monitoring or measuring traffic from one or more devices, users or networks.

184. Ganz/Larrick discloses these limitations. *See* claim 9.

8. Claim 34

a) 34[pre]: The broadband wireless repeater or relay of claim 29, wherein said controller is configured or configurable to perform or for performing all of:

b) 34[a]: a);

c) 34[b]: b); and

d) 34[c]: c) network provisioning or monitoring.

185. Ganz/Larrick discloses these limitations. *See* claim 10.

9. Claim 35

a) The broadband wireless repeater or relay of claim 29, wherein said at least one receiver or transceiver for receiving signals or data and said at least one transmitter or transceiver for transmitting signals or data operate in half duplex.

186. *See* claim 11.

10. Claim 36

a) The broadband wireless repeater or relay of claim 29, wherein said at least one receiver or transceiver for receiving signals or data and said at least one transmitter or transceiver for transmitting signals or data operate in full duplex.

187. *See* claim 12.

11. Claim 37

a) The broadband wireless repeater or relay of claim 29, wherein said at least one receiver or transceiver for

receiving signals or data and said at least one transmitter or transceiver for transmitting signals or data operate in simplex.

188. *See* claim 13.

12. Claim 38

a) The broadband wireless repeater or relay of claim 29, wherein said signals or data received by said receiver or transceiver for receiving signals or data, or signals or data transmitted by said transmitter or transceiver for transmitting signals or data, or signals or data controlled by said controller include modified, stored, or delayed signals or data.

189. *See* claim 14.

13. Claim 39

a) The broadband wireless repeater or relay of claim 29, wherein said controller is configured to cause said at least one transmitter or transceiver for transmitting signals or data to transmit modified received data or transmissions to one or more devices at an instantaneous or overall occupied bandwidth of 100 MHz or more or have a data transmission rate of 100 Megabits per second or more.

190. *See* claim 15.

14. Claim 40

a) The broadband wireless repeater or relay of claim 29, wherein said controller is configured to identify one or more devices in said one or more wireless networks.

191. *See* claim 16.

15. Claim 43

a) The broadband wireless repeater or relay of claim 29, wherein said broadband wireless repeater or relay is configured to be integrated with or in communication with a vehicle, train, aircraft, or other moving platform.

192. *See* claim 20.

16. Claim 46

a) The broadband wireless repeater or relay of claim 29, wherein at least one of said receiver or transceiver for signal or data reception, at least one of said transmitter or transceiver for signal or data transmission, or said controller is configured for operation in at least one of said one or more wireless networks selected from the group consisting of: a cellular network, an enterprise network, a wireless local area network, or a wireless personal area network.

193. *See* claim 23.

17. Claim 47

a) The broadband wireless repeater or relay of claim 29, wherein said repeater or relay is configured to be integrated with or in communication with a device selected from the group consisting of a television, a telephone, a cellphone, a computer, a camera, a video system, a monitor, a power plug, a wall outlet, a watch, a cable modem, a vehicle or other moving platform, a game console, and an ultrawideband transceiver or device.

194. *See* claim 24.

18. Claim 48

a) The broadband wireless repeater or relay of claim 29, wherein one or more of said receiver or transceiver for signal or data reception, said transmitter or transceiver for signal or data transmission, and said controller is embedded in one or more integrated circuit chips.

195. *See* claim 25.

19. Claim 49

a) The broadband wireless repeater or relay of claim 29, wherein said broadband wireless repeater or relay is configured or configurable for monitoring or measuring traffic passed through, received by or transmitted by said broadband wireless repeater or relay.

196. *See* claim 26.

20. Claim 50

a) The broadband wireless repeater or relay of claim 29, wherein said broadband wireless repeater or relay is configured or configurable to modify at least some received signals or data from one or more devices, users or networks and transmit modified or delayed signals or data to at least one device, network or user via wireless communication.

197. *See* claim 27.

21. Claim 51

a) The broadband wireless repeater or relay of claim 29, wherein said controller and one or more of said at least one receiver or transceiver for signal or data reception and said at least one transmitter or

transceiver for signal or data transmission are integrated.

198. *See* claim 28.

X. GROUND 4: Ganz, Larrick, Roese, and Perlman in Combination with Engels Renders Claims 41-42, 44-45, and 52-63 Obvious

A. Overview and Motivation to Combine

199. Section VIII.A describes that a POSITA would have been motivated to modify Ganz/Larrick/Roese to include Perlman's teachings. Section IX.A describes that a POSITA would have been motivated to modify Ganz/Larrick/Roese to include Engelman's teachings. Similarly, for the reasons discussed above, a POSITA would have been motivated to modify Ganz/Larrick/Roese/Perlman to include Engel's teachings.

200. For the reasons discussed above, a POSITA would have had a reasonable expectation of success combining Ganz/Larrick/Roese/Perlman with Engels. A POSITA would have been well aware of the conventional ways of implementing the standard technologies discussed therein. Implementation would have been well-within the skill of an ordinary artisan.

B. Limitation-By-Limitation Analysis

1. Claim 41

a) The broadband wireless repeater or relay of claim 29, wherein said controller is self-configurable.

201. *See* claim 18.

2. Claim 42

a) **The broadband wireless repeater or relay of claim 29, wherein at least one of said receiver or transceiver for signal or data reception, at least one of said transmitter or transceiver for signal or data transmission, or said controller is configured for operation in at least one of said one or more wireless networks in a moving platform environment.**

202. *See* claim 19.

3. Claim 44

a) **The broadband wireless repeater or relay of claim 29, wherein at least one of said receiver or transceiver for signal or data reception, at least one of said transmitter or transceiver for signal or data transmission, or said controller is configured for operation in at least one of said one or more wireless networks in an indoor environment.**

203. *See* claim 21.

4. Claim 45

a) **The broadband wireless repeater or relay of claim 29, wherein at least one of said receiver or transceiver for signal or data reception, at least one of said transmitter or transceiver for signal or data transmission, or said controller is configured for operation in at least one of said one or more wireless networks in an outdoor environment.**

204. *See* claim 22.

5. Claim 52

a) **52[pre]: A broadband wireless repeater or relay, comprising:**

205. *See* limitation 1[pre].

b) 52[a]: at least one receiver or transceiver for signal or data reception from one or more devices;

206. *See* limitation 1[a].

c) 52[b]: at least one transmitter or transceiver for signal or data transmission to one or more devices,

207. *See* limitation 1[b].

d) 52[c]: wherein the transceiver for signal or data reception and the transceiver for signal or data transmission may be the same or different; and

208. *See* limitation 1[c].

e) 52[d]: a controller that is configured or configurable for operation in one or more wireless networks, said controller communicating with said at least one receiver or transceiver for signal or data reception and said at least one transmitter or transceiver for signal or data transmission,

209. *See* limitation 1[d].

f) 52[e]: wherein at least one of said receiver or transceiver for signal or data reception and said transmitter or transceiver for signal or data transmission either or both transmit and receive at an instantaneous or overall occupied bandwidth of 100 MHz or more or have a data transmission rate of 100 Megabits per second or more,

210. *See* limitation 1[e].

g) 52[f]: wherein said broadband wireless repeater or relay is connected or connectable to one or more network backbones for connecting said one or more

wireless networks with said one or more network backbones,

211. *See* limitation 1[f].

h) 52[g]: wherein said broadband wireless repeater or relay is used to support connectivity and/or position location capabilities for one or more mobile or portable devices,

212. *See* limitation 1[g].

i) 52[h]: wherein said repeater or relay is configured such that when in a network which includes one or more devices which can transmit or receive at an instantaneous or overall occupied bandwidth of 100 MHz or more or have a data transmission rate of 100 Megabits per second or more at least one of said one or more devices has at least one of

213. Limitations 52[d] and 52[f] describe that devices that can transmit or receive are configured for operation in a network. Limitation 52[e] further describes that at least one of the devices has a transmitter and/or receiver that occupies the required bandwidth and transmits data at the required speed. As described below, at least one or more of the devices performs the following limitations.

j) 52[i]: a higher data rate,

214. Ganz discloses software that performs "monitoring and control" of its WBCR that periodically measures "throughput speeds and data packet drop rates" in the system. (EX1005, 5:47-54.) The software can then perform "controlling functions" that provides for "remote dynamic load balancing among the users, and

individually enhancing or reducing the allowable user packet size requests, thereby ensuring efficient network utilization for all users." (EX1005, 5:55-61.) A POSITA would understand that this "load balancing" and "efficient network utilization" results in higher data rates for one or more devices within the network than if the WBCR was not present in the network.

k) 52[j]: a greater coverage distance,

215. Perlman identifies the problem of degradation of high-bandwidth data transmissions "by the physical distance between the access point and the mobile terminal or other device." (EX100X, [0006].) To address this, Perlman's system "achieves ***full range coverage in the home without bandwidth loss*** by utilizing a different channel for each data packet hop. This feature allows repeater data packets to overlap in time...." (EX100X, [0059].) Thus, Perlman teaches use of a repeater that is configured such that when in a network at least one of said one or more devices has a greater coverage distance than if the repeater or relay was not present in said network.

l) 52[k]: higher quality of transmission or reception,

216. Ganz explains that its quality of service (QoS) software module "includes bandwidth management functions that provide traffic control of the WBCR, allowing improved network performance while enforcing traffic flows and other network policies." (EX1005, 10:52-54.) The QoS module uses "prioritization

of data," in order to "distinguish between time-sensitive traffic and non-time sensitive traffic and to give the former higher priority." (EX1005, 11:5-7.) For example, "[t]he successful deployment of real-time applications such as voice and video may require that the WBCR provide a specific QoS for different applications." (EX1005, 11:14-17.) Thus, Ganz discloses that its WBCR optimizes the quality of transmission or reception to user devices, and said devices have a higher quality of transmission or reception than if the WBCR was not present in the network.

m) 52[l]: less interference, and

217. Ganz discloses that its WCBR contains a "radio/data link element," which "preferably employs spread spectrum transmission, either using frequency hopping or direct sequence coding schemes," which "***decreases the chances of radio frequency jamming/interference, detection and interception of radio frequencies and provides for the capability of encryption***." (EX1005, 7:6-11.) Thus, Ganz teaches use of a repeater that is configured such that when in a network at least one of said one or more devices has less interference than if the repeater or relay was not present in said network.

n) 52[m]: an improved ability to control its capacity,

218. Ganz explains that "***[t]he WBCR may also be segregated into multiple tiers or layers when a segment on a user end approaches capacity***." (EX1005, 5:33-34.) Thus, "[i]f there is a high volume of users that significantly exceed a 2-5%

loading factor, separate segments may be dedicated to the users." (EX1005, 5:34-37.) Depending on the specific application, segregation can be accomplished at the radio datalink level by: "(1) assigning another spread spectrum chip code to that link, thereby providing isolation from other radios on the network; (2) operating a new segment on a different radio frequency; and (3) attaching directionally controlled antennas to the radios, thereby providing for spatial diversity." (EX1005, 5:40-46.) Thus, a POSITA would understand that a network implementing Ganz's WBCR would have an improved ability to control its capacity than if the WBCR was not present in said network.

o) 52[n]: than if said repeater or relay was not present in said network.

219. *See* limitations 52[i-m].

6. Claim 53

a) The broadband wireless repeater or relay of claim 52, wherein said repeater or relay is configured such that said at least one of said one or more devices has a higher data rate than if said repeater or relay was not present in said network.

220. *See* limitation 52[i].

7. Claim 54

a) The broadband wireless repeater or relay of claim 52, wherein said repeater or relay is configured such that said at least one of said one or more devices has a greater coverage distance than if said repeater or relay was not present in said network.

221. *See* limitation 52[j].

8. Claim 55

a) The broadband wireless repeater or relay of claim 52, wherein said repeater or relay is configured such that said at least one of said one or more devices has higher quality of transmission or reception than if said repeater or relay was not present in said network.

222. *See* limitation 52[k].

9. Claim 56

a) The broadband wireless repeater or relay of claim 52, wherein said repeater or relay is configured such that said at least one of said one or more devices has less interference than if said repeater or relay was not present in said network.

223. *See* limitation 52[l].

10. Claim 57

a) The broadband wireless repeater or relay of claim 52, wherein said repeater or relay is configured such that said at least one of said one or more wireless networks has an improved ability to control its capacity than if said repeater or relay was not present in said one or more wireless networks.

224. *See* limitation 52[m].

11. Claim 58

a) 58[pre]: A broadband wireless repeater or relay, comprising:

225. *See* limitation 1[pre].

b) 58[a]: at least one receiver or transceiver for signal or data reception from one or more devices;

226. *See* limitation 1[a].

c) 58[b]: at least one transmitter or transceiver for signal or data transmission to one or more devices,

227. *See* limitation 1[b].

d) 58[c]: wherein the transceiver for signal or data reception and the transceiver for signal or data transmission may be the same or different; and

228. *See* limitation 1[c].

e) 58[d]: a controller that is configured or configurable for operation in one or more wireless networks, said controller communicating with said at least one receiver or transceiver for signal or data reception and said at least one transmitter or transceiver for signal or data transmission,

229. *See* limitation 1[d].

f) 58[e]: wherein at least one of said receiver or transceiver for signal or data reception and said transmitter or transceiver for signal or data transmission either or both transmit and receive at an instantaneous or overall occupied bandwidth of 100 MHz or more or have a data transmission rate of 100 Megabits per second or more,

230. *See* limitation 1[e].

g) 58[f]: wherein said repeater or relay employs MIMO or adaptive antenna technology,

231. *See* claim 17.

h) 58[g]: wherein said broadband wireless repeater or relay is used to support connectivity and/or position location capabilities for one or more mobile or portable devices, and

232. *See* limitation 52[g].

i) 58[h]: wherein said repeater or relay is configured such that when in a network which includes one or more devices which can transmit or receive at an instantaneous or overall occupied bandwidth of 100 MHz or more or have a data transmission rate of 100 Megabits per second or more at least one of said one or more devices has at least one of

233. *See* limitation 52[h].

j) 58[i]: a higher data rate,

234. *See* limitation 52[i].

k) 58[j]: a greater coverage distance,

235. *See* limitation 52[j].

l) 58[k]: higher quality of transmission or reception,

236. *See* limitation 52[k].

m) 58[l]: less interference, and

237. *See* limitation 52[l].

n) 58[m]: an improved ability to control its capacity,

238. *See* limitation 52[m].

o) 58[n]: than if said repeater or relay was not present in said network.

239. *See* limitation 52[n].

12. Claim 59

a) The broadband wireless repeater or relay of claim 58, wherein said repeater or relay is configured such that said at least one of said one or more devices has a higher data rate than if said repeater or relay was not present in said network.

240. *See* claim 53.

13. Claim 60

a) The broadband wireless repeater or relay of claim 58, wherein said repeater or relay is configured such that said at least one of said one or more devices has a greater coverage distance than if said repeater or relay was not present in said network.

241. *See* claim 54.

14. Claim 61

a) The broadband wireless repeater or relay of claim 58, wherein said repeater or relay is configured such that said at least one of said one or more devices have higher quality of transmission or reception than if said repeater or relay was not present in said network.

242. *See* claim 55.

15. Claim 62

a) The broadband wireless repeater or relay of claim 58, wherein said repeater or relay is configured such that said at least one of said one or more devices has less interference than if said repeater or relay was not present in said network.

243. *See* claim 56.

16. Claim 63

a) The broadband wireless repeater or relay of 58, wherein said repeater or relay is configured such that said at least one of said one or more wireless networks has an improved ability to control its capacity than if said repeater or relay was not present in said one or more wireless networks.

244. *See* claim 57.

XI. CONCLUSION

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

* * *

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

Date: October 22, 2025

/s/ Dr. Mark Mahon

Dr. Mark Mahon