

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. IPR2025-01594

U.S. Patent No. 10,224,999

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 10,224,999**

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EXHIBIT LIST

Exhibit	Description
EX1001	U.S. Patent 10,224,999 (“’999 Patent”)
EX1002	Declaration of Mark Mahon, Ph.D.
EX1003	Certificate of Correction for U.S. Patent 10,224,999
EX1004	File History of U.S. Patent 10,224,999
EX1005	U.S. Patent 6,584,080 (“Ganz”)
EX1006	Intentionally Omitted
EX1007	U.S. Patent 7,209,523 (“Larrick”)
EX1008	Patent Cooperation Treaty Patent Application WO 03/058850 (“Engels”)
EX1009	U.S. Patent Application Pub. No. 2004/0136373 (“Bareis”)
EX1010	U.S. Patent Application Pub. No. 2003/0002456 (“Soomro”)
EX1011	U.S. Provisional Application No. 60/498,324
EX1012	U.S. Provisional Application No. 60/496,913
EX1013	U.S. Patent Application Pub. No. 2005/0233709 (“Gardner”)
EX1014	Patent Owner Preliminary Infringement Contentions, Ex. 7 (September 16, 2025)
EX1015	Curriculum Vitae of Mark Mahon Ph.D.

LIST OF CHALLENGED CLAIMS

Claim	
1[pre]	A wireless network device, comprising:
1[a]	a wireless transmitter that is configured for transmitting wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz at a data rate greater than or equal to 100 megabits per second and less than or equal to 480 megabits per second;
1[b]	a wireless receiver that is configured for receiving wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz at a data rate greater than or equal to 100 megabits per second and less than or equal to 480 megabits per second;
1[c]	wherein the wireless transmitter is configured for transmitting wireless data that contains information present in or determined from wireless data that has been received by the wireless receiver, and
1[d]	wherein the wireless network device is configured for processing wireless data received by the wireless receiver, and
1[e]	wherein the wireless network device is configured for determining whether any, a portion, or all information in the processed wireless data should be transmitted by the wireless transmitter.
2	The wireless network device of claim 1 wherein the wireless network device is configured for determining whether any, a portion, or all information in the processed wireless data should be transmitted as wireless data to one or more other devices by the wireless transmitter.
3	The wireless network device of claim 1 wherein the wireless network device is a wireless router.
4	The wireless network device of claim 1 wherein the wireless network device is a wireless access point.
5	The wireless network device of claim 1 wherein the wireless network device is a repeater.
6	The wireless network device of claim 1 wherein the wireless transmitter is configured for transmitting wireless data according to an 802.11 wireless standard.

Claim	
7	The wireless network device of claim 1 wherein the wireless receiver is configured for receiving wireless data according to an 802.11 wireless standard.
8	The wireless network device of claim 1 wherein the wireless transmitter is configured for transmitting half duplex wireless data and wherein the wireless receiver is configured for receiving half duplex wireless data.
9	The wireless network device of claim 1 wherein the wireless transmitter is configured for transmitting full duplex wireless data and wherein the wireless receiver is configured for receiving full duplex wireless data.
10	The wireless network device of claim 1 wherein the wireless network device is configurable by an interface that is accessible from a computer.
11	The wireless network device of claim 1 wherein the wireless network device comprises two or more antennas.
12	The wireless network device of claim 11 wherein the wireless network device is configured for using MIMO antenna technology.
13	The wireless network device of claim 1 wherein the wireless network device is configured for performing beamforming.
14[pre]	The wireless network device of claim 1
14[a]	wherein the wireless network device comprises an adaptable antenna; and
14[b]	wherein the wireless transmitter is configured for using the adaptable antenna for transmitting wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz.
15[pre]	The wireless network device of claim 1
15[a]	wherein the wireless network device comprises a steerable antenna; and
15[b]	wherein the wireless transmitter is configured for using the steerable antenna for transmitting wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz.
16[pre]	The wireless network device of claim 1

Claim	
16[a]	wherein the wireless network device comprises an omnidirectional antenna; and
16[b]	wherein the wireless transmitter is configured for using the omnidirectional antenna for transmitting wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz.
17	The wireless network device of claim 1 wherein the wireless network device is configured for operating within a wireless mesh network.
18	The wireless network device of claim 1 wherein the wireless network device is configured for using data encryption when transmitting with the wireless transmitter.
19	The wireless network device of claim 1 wherein the wireless network device is configured for assigning priority levels to at least some wireless data that is to be transmitted by the wireless transmitter.
20[pre]	The wireless network device of claim 1 wherein the wireless network device is configured for assigning one or more priority levels to at least some wireless data that is to be transmitted by the wireless transmitter,
20[a]	wherein at least some of the one or more priority levels are related to one or more levels of a certain quality of service.
21[pre]	The wireless network device of claim 1
21[a]	wherein the wireless transmitter is configured for transmitting wireless data through electromagnetic signals in more than one frequency band, and
21[b]	wherein the wireless receiver is configured for receiving wireless data through electromagnetic signals in more than one frequency band.
22	The wireless network device of claim 1 wherein the wireless transmitter is configured for transmitting wireless data at more than one data rate.
23	The wireless network device of claim 1 wherein the wireless receiver is configured for receiving wireless data at more than one data rate.
24	The wireless network device of claim 1 wherein the wireless network device is configured to be powered through a connection to a DC power source.

Claim	
25	The wireless network device of claim 1 wherein the wireless network device is configured to be powered through a connection to an AC power source.
26	The wireless network device of claim 1 wherein the wireless network device is configured to operate in a cellular network.
27	The wireless network device of claim 1 wherein the wireless transmitter is configured for transmitting wireless data through electromagnetic signals that have a bandwidth of 100 MHz.
28	The wireless network device of claim 1 wherein the wireless transmitter is configured for transmitting wireless data through electromagnetic signals that have a bandwidth of 160 MHz.
29	The wireless network device of claim 1 wherein the wireless transmitter and the wireless receiver are both part of a transceiver.
30[pre]	A wireless network system, comprising:
30[a]	one or more wireless network devices as recited in claim 1; and
30[b]	one or more devices which receive wireless data transmitted by the wireless transmitter of at least one of the one or more wireless network devices.
31[pre]	A wireless networking method, comprising:
31[a]	transmitting wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz at a data rate greater than or equal to 100 megabits per second and less than or equal to 480 megabits per second with a wireless transmitter that is part of or in communication with a wireless network device;
31[b]	receiving wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz at a data rate greater than or equal to 100 megabits per second and less than or equal to 480 megabits per second with a wireless receiver that is part of or in communication with the wireless network device;
31[c]	processing wireless data received by the wireless receiver with a processor that is part of or in communication with the wireless network device; and
31[d]	determining whether any, a portion, or all information in the processed wireless data should be transmitted by the wireless transmitter,

Claim	
31[e]	wherein the wireless data transmitted in the transmitting step contains information present in or determined from wireless data that was received by the wireless receiver in the receiving step.
32[pre]	A wireless network device, comprising:
32[a]	a wireless transmitter that is capable of transmitting wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz;
32[b]	a wireless receiver that is capable of receiving wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz;
32[c]	wherein the wireless transmitter is configured for transmitting wireless data that contains information present in or determined from wireless data that has been received by the wireless receiver,
32[d]	wherein the wireless network device is configured for processing wireless data received by the wireless receiver,
32[e]	wherein the wireless network device is configured for determining whether any, a portion, or all information in the processed wireless data should be transmitted by the wireless transmitter, and
32[f]	wherein the wireless network device is configured for transmitting beacon frames with the wireless transmitter.
33[pre]	A wireless network device, comprising:
33[a]	a wireless transmitter that is capable of transmitting wireless data through OFDM electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz;
33[b]	a wireless receiver that is capable of receiving wireless data through OFDM electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz;
33[c]	wherein the wireless network device is configured for processing wireless data received by the wireless receiver,
33[d]	wherein the wireless network device is configured for determining whether any, a portion, or all information in the processed wireless data should be transmitted by the wireless transmitter,
33[e]	wherein the wireless network device comprises

Claim	
33[f]	a wired connection port which permits a wired internet connection wherein the wireless network device is configured for transmitting and receiving wired data through the wired connection port,
33[g]	wherein the wireless transmitter is configured for transmitting wireless data that contains information present in or determined from received wired data, and
33[h]	wherein the wireless network device is configured for transmitting via the wired connection port wired data that contains information present in or determined from wireless data that has been received by the wireless receiver.
34	The wireless network device of claim 33 wherein the wireless network device is configured for processing received wired data and determining whether any, a portion, or all information in the processed wired data should be transmitted as wireless data to one or more other devices by the wireless transmitter.
35	The wireless network device of claim 33 wherein the wireless network device is configured for providing an internet connection to one or more other devices.
36	The wireless network device of claim 33 wherein the wired internet connection is an Ethernet connection.
37	The wireless network device of claim 33 wherein the wired internet connection is a coaxial connection.
38	The wireless network device of claim 33 wherein the wired internet connection is a wired optical cable connection.
39[pre]	A wireless network device, comprising:
39[a]	a wireless transmitter configured for transmitting wireless data through OFDM electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz;
39[b]	a wireless receiver is configured for receiving wireless data through OFDM electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz;
39[c]	wherein the wireless transmitter is configured for transmitting wireless data that contains information present in or determined from wireless data that has been received by the wireless receiver,
39[d]	wherein the wireless network device is configured for processing wireless data received by the wireless receiver,

Claim	
39[e]	herein the wireless network device is configured for determining whether any, a portion, or all information in the processed wireless data should be transmitted by the wireless transmitter.

I. INTRODUCTION

Petitioners Samsung Electronics Co., Ltd. and Samsung Electronics America, LLC (“Petitioner”) request *Inter Partes* Review of claims 1-39 of U.S. Patent No. 10,224,999 (“’999 patent”) assigned to Massively Broadband LLC. (“Patent Owner”). The ’999 patent is directed to “[a]n ultrawideband radio transceiver/repeater [that] provides a low cost infrastructure solution that merges wireless and wired network devices.” (EX1001, Abstract.) As demonstrated below, transceiver/repeater devices using wide frequency bandwidths was ubiquitous in the prior art, and the ’999 patent claims no non-obvious features or implementation.

II. MANDATORY NOTICES

A. Real Party-in-Interest (37 C.F.R. § 42.8(b)(1))

The real parties-in-interest for Petitioner are Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc.

B. Related Matters (37 C.F.R. § 42.8(b)(2))

1. Related Patent Office Proceedings

The ’999 patent is in the same family as U.S. Patent Nos. 7,676,194, 8,923,754, 9,667,337, and 10,797,783. Petitioner has filed an IPR petition against U.S. Patent No. 8,923,754 (IPR2025-01595).

2. Related Litigation

Patent Owner is currently asserting the ’999 patent against Petitioner in

Massively Broadband LLC. v Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc., Case No. 2:25-cv-00608-JRG (E.D. Tex.).

C. Lead and Backup Counsel and Service Information (37 C.F.R. §§ 42.8(b)(3)-(4))

Electronic service may be made on the email addresses identified below and in the accompanying Power of Attorney. Petitioner consents to electronic service at the email addresses listed in the table below and at:

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D. Payment of Fees (37 C.F.R. § 42.15(a))

The Office is authorized to charge the fee required for this Petition (and any additional fees) to Deposit Account No. 50-5708.

E. Requirements For *Inter Partes* Review (37 C.F.R. §§ 42.101(A)-(C), 42.104(A), and 42.018)

Petitioner certifies that the '999 patent is available for *inter partes* review, that Petitioner is not barred or estopped from challenging the '999 claims on the grounds identified herein, and that the prohibitions of 35 U.S.C. §§ 315(a)-(b) are inapplicable.

III. STATEMENT OF RELIEF REQUESTED AND IDENTIFICATION OF CHALLENGE (37 C.F.R. § 42.104(B))

Petitioner respectfully requests that *inter partes* review of claims 1-39 (“Challenged Claims”) on the following grounds:

Ground	Basis	References	Claims
1	§103	Ganz in view of Larrick	1-11, 16-25, 27-31
2	§103	Ganz and Larrick in further view of Engels	12-15, 26
3	§103	Ganz and Larrick in further view of Bareis	17, 22-25
4	§103	Ganz and Larrick in further view of Soomro	32-36, 39
5	§103	Ganz, Larrick, and Soomro in further view of Bareis	37-38
6	§103	Ganz and Larrick in further view of Gardner	27-28

IV. BACKGROUND

A. '999 Patent

1. Earliest Priority Date

The '999 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. (EX1002, ¶40.)

2. Specification

The '999 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 flow control for wired and wireless connectivity of devices or networks. (EX1001, Abstract.) (EX1002, ¶41.)

The ultrawideband repeater described in the '999 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.*, 6:61-66.) (EX1002, ¶42.)

The patent describes that “[u]ltrawideband technologies are about to become mainstream, and are described in” various patent applications and publications. (*Id.*, 2:14-21.) 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.*, 2:21-25.) 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.*, 2:46-56.) (EX1002, ¶43.)

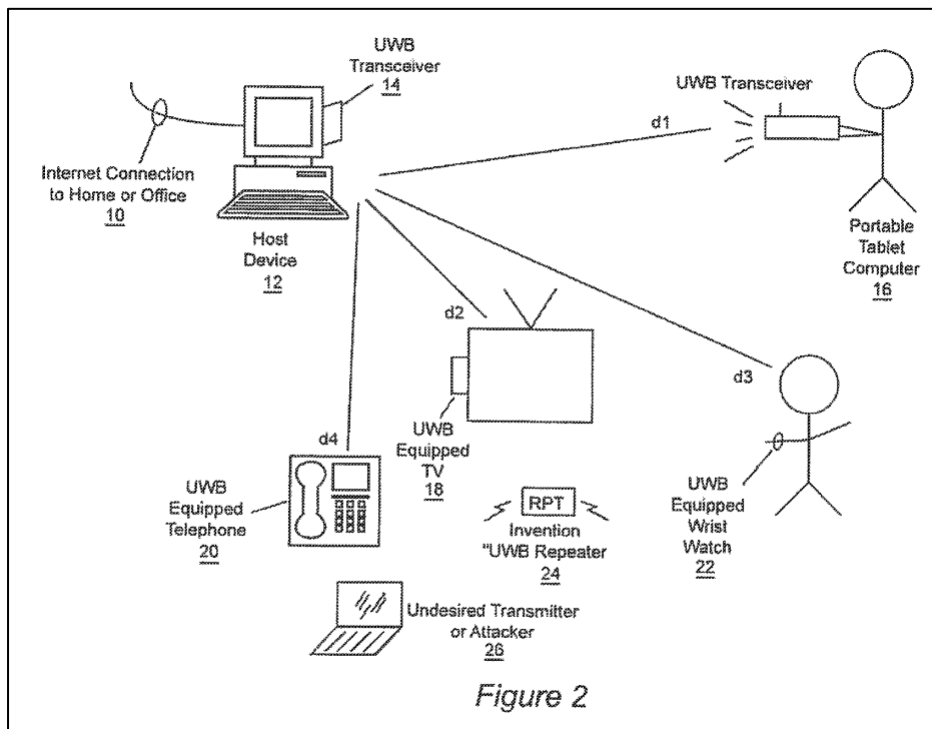
In addition, the patent describes that “IEEE 802.15.3a, the Ultrawideband Physical Layer standard committee, is working on creating a standard that may either be Multiband OFDM transmission (MBOA), with 500 MHz channels, or a Direct Sequence Spread Spectrum impulse radio standard that has broader channel bandwidths (UWB Forum).” (*Id.*, 2:57-62; emphasis added.) Moreover, ***the patent describes that UWB chips capable of 100 megabits per second were already commercially available*** (*id.*, 3:7-10; emphasis added) and that mesh networking will provide efficient network paths that allow very high data rates across the internet (*Id.*, 3:11-13). (EX1002, ¶44.)

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.” (*Id.*, 3:29-36.) (EX1002, ¶45.)

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 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.” (*Id.*, 4:4-22.) (EX1002, ¶46.)

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. (*Id.*, 9:25-29.) (EX1002, ¶47.)

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.



3. Prosecution History

The '999 patent was filed on June 20, 2017 as application 15/627,903, and claims priority to provisional applications 60/498,324 and 60/496,913. (EX1002, ¶48.)

On May 3, 2018 an office action issued rejecting pending claims 45-65, 67-71, 79-80, and 82-84 under 35 U.S.C. 103(a). Independent claim 45 was rejected as being unpatentable over Proctor U.S. Patent Application Publication 2006/0063484 (“Proctor”) in view of Kintis U.S. Patent 6,301,465 (“Kintis”). Proctor teaches a wireless network device “configured for determining whether any, a portion, or all information in the processed wireless data should be transmitted by the wireless transmitter.” (EX1004, May 3, 2018 Office Action.) Kintis “teaches *the*

electromagnetic signals that have bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz.” (Id.) (EX1002, ¶49.)

Claims 66, 72-78, and 81 were objected to as being dependent upon a rejected base claim, but would otherwise be allowable if rewritten in independent form. (EX1004, May 3, 2018 Office Action.) In response, applicant amended independent claim 45 (issued claim 1) to include the allegedly novel features of claim 81, and claim 81 was cancelled. Claim 81 included the limitation that the transmitter transmit signals having a bandwidth of 100-500 MHz and at a data speed of 100-480 mbps, and the receiver receive signals having a bandwidth of 100-500 MHz and at a data speed of 100-480 mbps. (EX1004, August 21, 2018 Response to Office Action.) (EX1002, ¶50.)

Claims 66, 72, and 78 (issued as claims 32, 33, and 39) were amended to independent form. Method claim 84 (issued as claim 31) was amended in the same manner as claim 45. (EX1004, August 21, 2018 Response to Office Action.) (EX1002, ¶51.)

The alleged novel limitation in claim 66 (issued as claim 32) is limitation 32[f] (“[32f] wherein the wireless network device is configured for transmitting beacon frames with the wireless transmitter.”). (EX1002, ¶52.)

The alleged novel limitations in claim 72 (issued as claim 33) are limitations 33[f-h] (“[33f] a wired connection port which permits a wired internet connection

wherein the wireless network device is configured for transmitting and receiving wired data through the wired connection port, [33g] wherein the wireless transmitter is configured for transmitting wireless data that contains information present in or determined from received wired data, and [33h] wherein the wireless network device is configured for transmitting via the wired connection port wired data that contains information present in or determined from wireless data that has been received by the wireless receiver.”). (EX1002, ¶53.)

The alleged novel feature in claim 78 (issued as claim 39) is that the wireless data be transmitted and received through OFDM electromagnetic signals having a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz (in issued limitations 39[a-b]). (EX1002, ¶54.)

The claims were then allowed. (EX1004, October 17, 2018 Notice of Allowance.). (EX1002, ¶55.)

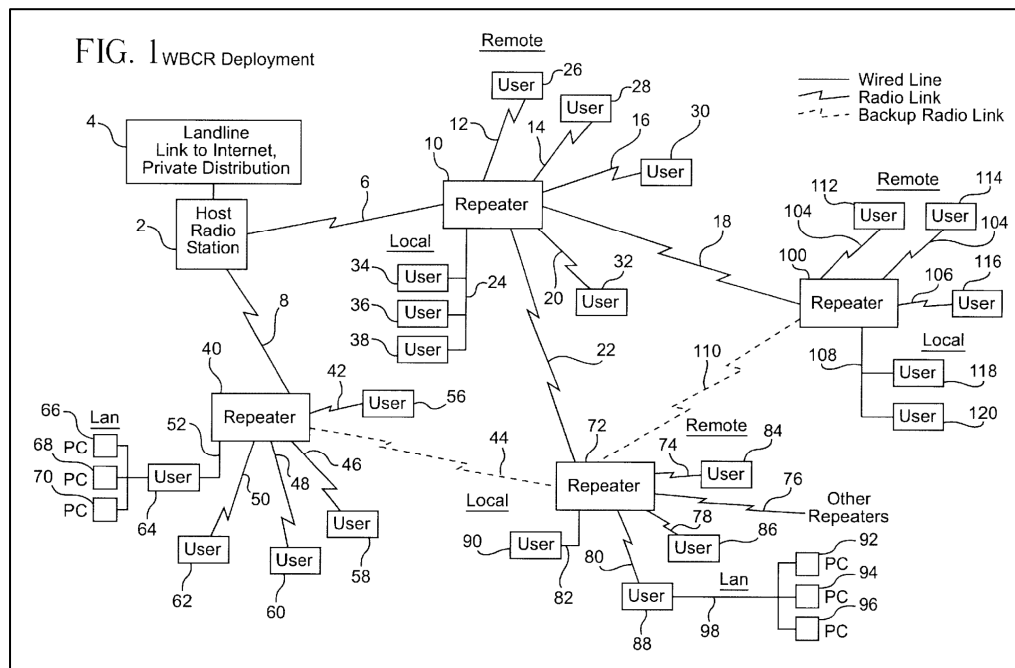
In other words, the Examiner found that the repeater functionality and the claimed bandwidth and data rates were found in the prior art. The examiner however allowed the claims because they included standard functions of wireless devices such as transmitting/receiving data at particular bandwidths and data speeds, beacon frames, a wired connection port, and OFDM. As discussed below, each of these limitations were well-known in the art and would have been obvious to combine. (EX1002, ¶56.)

B. Asserted Prior Art

1. Ganz (EX1005)

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). (EX1002, ¶57.)

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.) (EX1002, ¶58.)



2. Larrick (EX1007)

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). (EX1002, ¶60.)

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.) (EX1002, ¶61.)

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.) (EX1002, ¶62.)

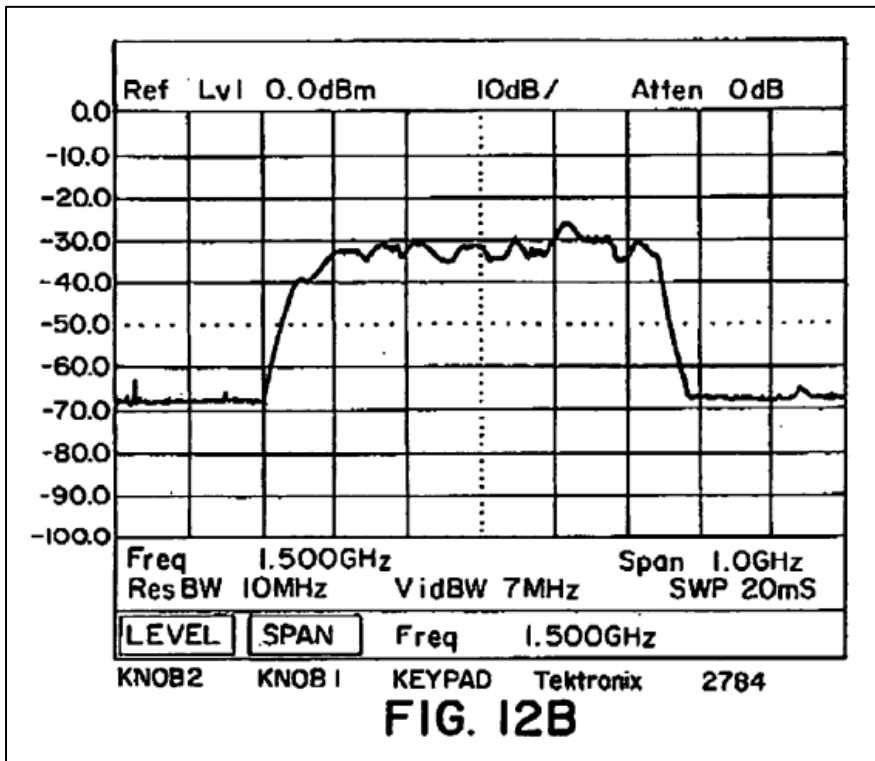
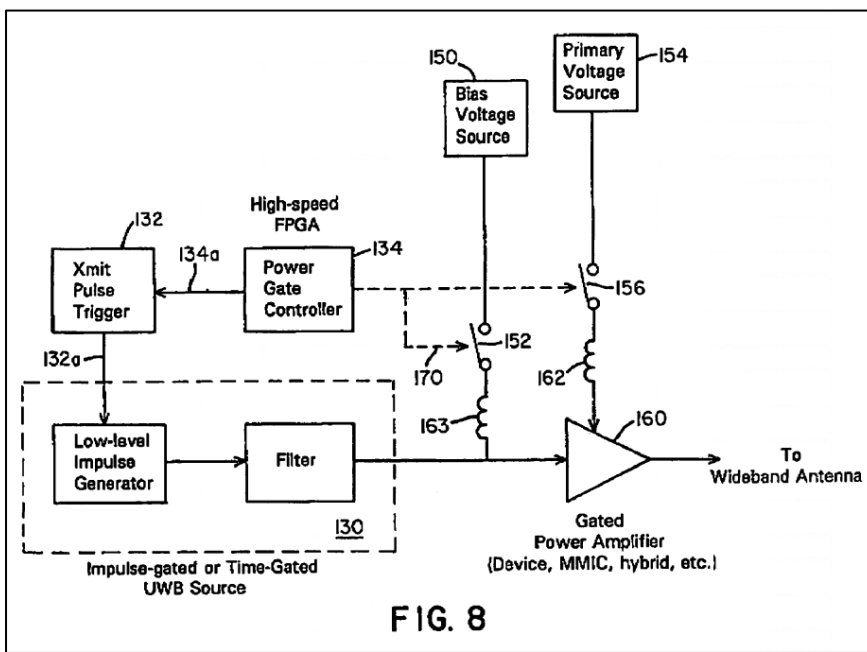


FIG. 8 shows the use of an amplifier 160 that amplifies the output of UWB source 130. (EX1007, 11:36-12:9.) (EX1002, ¶63.)



3. Engels (EX1008)

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). (EX1002, ¶65.)

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.) (EX1002, ¶66.)

4. Bareis (EX1009)

U.S. Patent Application Pub. No. 2004/0136373 (“Bareis”) was filed on January 13, 2003. It is prior art under pre-AIA § 102(e). (EX1002, ¶68.)

Bareis discloses “a broadband, packet-based wireline local network technology for connecting a local service provider or multiple service providers with one or more of a variety of electronic devices located in a user site.” (EX1009, ¶[0002].) (EX1002, ¶69.)

5. Soomro (EX1010)

U.S. Pat. App. Pub. No. 2003/0002456 to Soomro was filed on March 7, 2002 and published January 2, 2003. It is prior art under pre-AIA § 102(a) and § 102(b). (EX1002, ¶71.)

Soomro discloses the use of “beacon frames” “based on the beacon transmission rule within the IEEE 802.11-1999 standard.” (EX1010, ¶36.) These beacon frames are used to synchronize DFS count values. (*E.g., id.*) (EX1002, ¶72.)

6. Gardner (EX1013)

U.S. Pat. App. Pub. No. 2005/0233709 to Gardner was filed on April 5, 2004 and claims priority to a provisional application filed April 10, 2003. It is prior art under pre-AIA § 102(a). (EX1002, ¶74.)

Gardner discloses the simultaneous use of multiple 20 MHz channels to transmit and receive data using 802.11a. (EX1013, ¶27.) In particular, Gardner describes that MIMO techniques can be used to expand bandwidth where “multiple data streams are multiplexed spatially and/or multi-channel techniques, where an extended transmitter transmits using more than one 802.11a channel at a time.” (EX1013, Abstract.) (EX1002, ¶75.)

V. PERSON OF ORDINARY SKILL

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. (EX1002, ¶77.)

Petitioner’s expert, Dr. Mahon, met this level by the priority date. (EX1002,

¶78.)

VI. CLAIM CONSTRUCTION

No express constructions are required to find the '999 patent claims invalid. As relevant, Petitioner addresses the plain meaning of certain terms in the analysis for the presented Grounds. The challenged claims have not been construed in other proceedings. (EX1002, ¶80.)

VII. GROUND 1: Ganz in Combination with Larrick Renders Claims 1-11, 16-25, and 27-31 Obvious²

A. Overview and Motivation to Combine

As discussed in more detail below, Ganz teaches a wireless networking device that receives wireless data, processes that wireless data, and transmits 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. (EX1002, ¶81.)

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

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

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 and with a reasonable expectation of success. (EX1002, ¶82.)

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. (EX1002, ¶803.)

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). (EX1002, ¶84.)

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 of wireless communication networks and is addressed to increasing transmitting information wirelessly. (EX1007, Abstract.) (EX1002, ¶85.)

Enhanced Modulation Techniques

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.) (EX1002, ¶86.)

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. (EX1002, ¶87.)

Multi-User Capability and Spectral Efficiency

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.) (EX1002, ¶88.)

Link Quality Assessment and Power Efficiency

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. (EX1002, ¶89.)

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. (EX1002, ¶90.)

Data Rate Advancement and Industry Trends

At the time of the '999 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.) (EX1002, ¶91.)

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.) (EX1002, ¶92.)

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. (EX1002, ¶93.)

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. (EX1002, ¶94.)

In the analysis below, the combined prior art system will be referred to as Ganz/Larrick. (EX1002, ¶95.)

B. Limitation-By-Limitation Analysis

1. Claim 1

a) 1[pre]: A wireless network device, comprising:

Ganz discloses “[a] wireless high speed data communication system having a host radio station connected to a source of data.” Ganz discloses that “[t]he 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).” (EX1005, Abstract.) (EX1002, ¶96.)

To the extent that limitation 1[pre] is not expressly disclosed in Ganz, it is expressly disclosed in Larrick, and a POSITA would have been motivated to modify Ganz' system to include Larrick's teachings. Larrick discloses “[a] waveform-adaptive ultra-wideband (UWB) transmitter and noise-tracking UWB receiver for

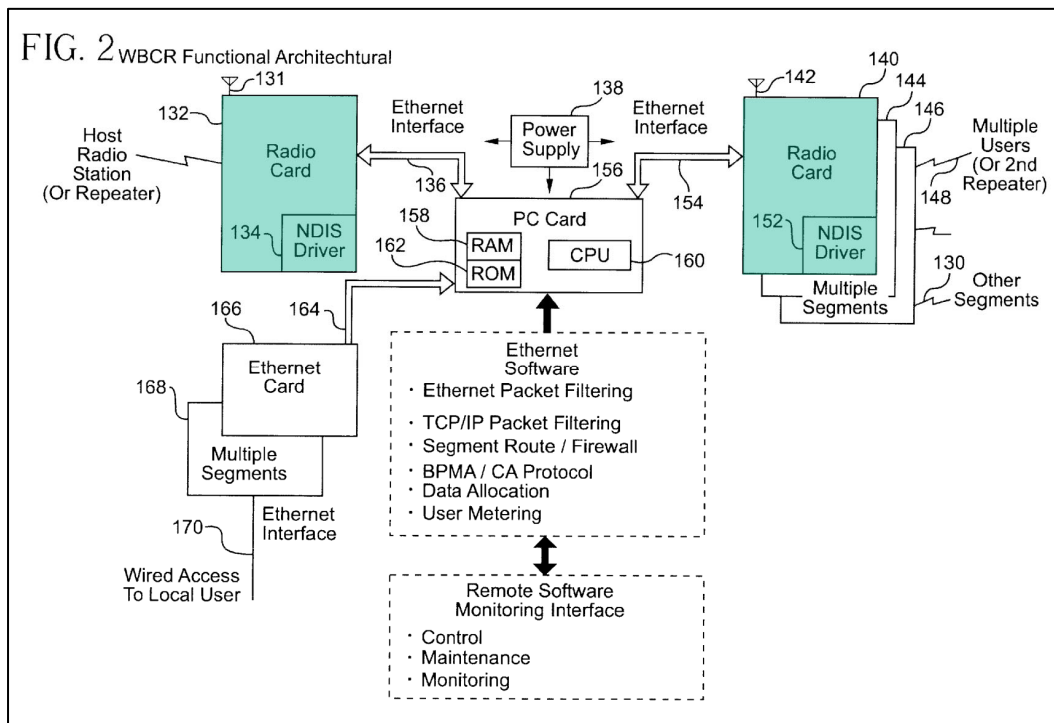
use in communications, object detection and radar applications.” Larrick also claims “[a] communication system utilizing an ultra-wideband (UWB) transmitter” (EX1007, 24:52-53) and “[a] method of communicating data by transmitting and detecting an ultra wideband UWB pulse.” (*Id.*, 27:17-18.) (EX1002, ¶97.)

Thus, as discussed in the below limitations, Ganz/Larrick discloses a wireless network device. (EX1002, ¶98.)

- b) **1[a]: a wireless transmitter that is configured for transmitting wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz at a data rate greater than or equal to 100 megabits per second and less than or equal to 480 megabits per second;**

“a wireless transmitter that is configured for transmitting wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz”

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.) (EX1002, ¶100.)



Ganz does not expressly disclose that the transmitter is configured for transmitting wireless data through signals that have a 100-500 MHz bandwidth. However, Larrick discloses a transmitter using the claimed bandwidth and as discussed above, a POSITA would have been motivated to combine Ganz and Larrick. (EX1002, ¶101.)

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.) (EX1002, ¶102.)

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.) (EX1002, ¶103.)

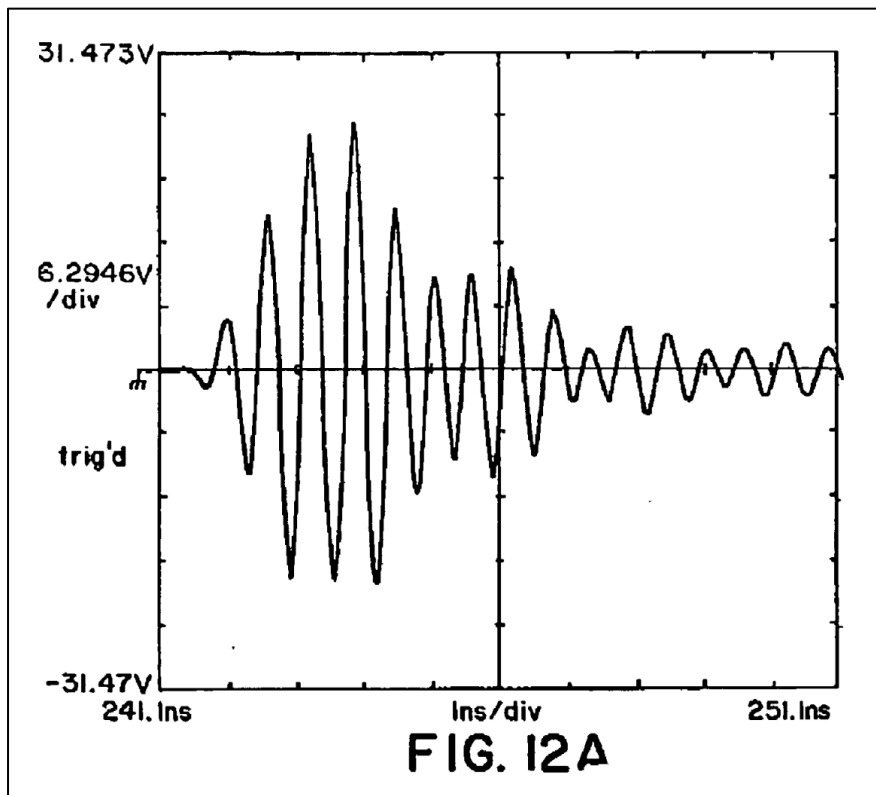


FIG. 12B shows the frequency spectrum of the UWB signal shown in

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.” (EX1007, 10:65-11:4). (EX1002, ¶104.)

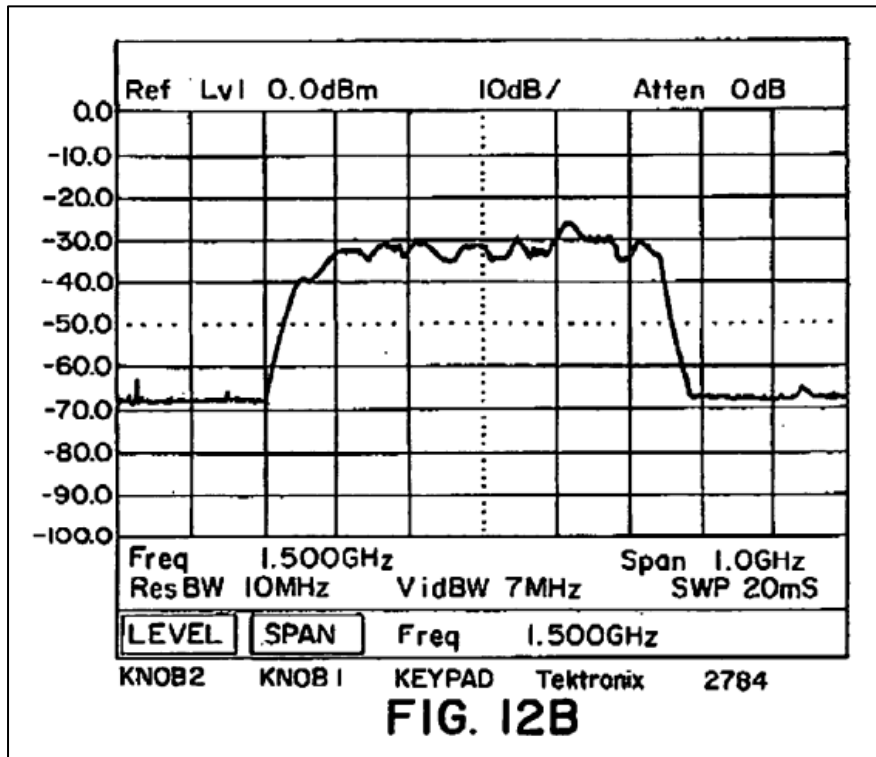
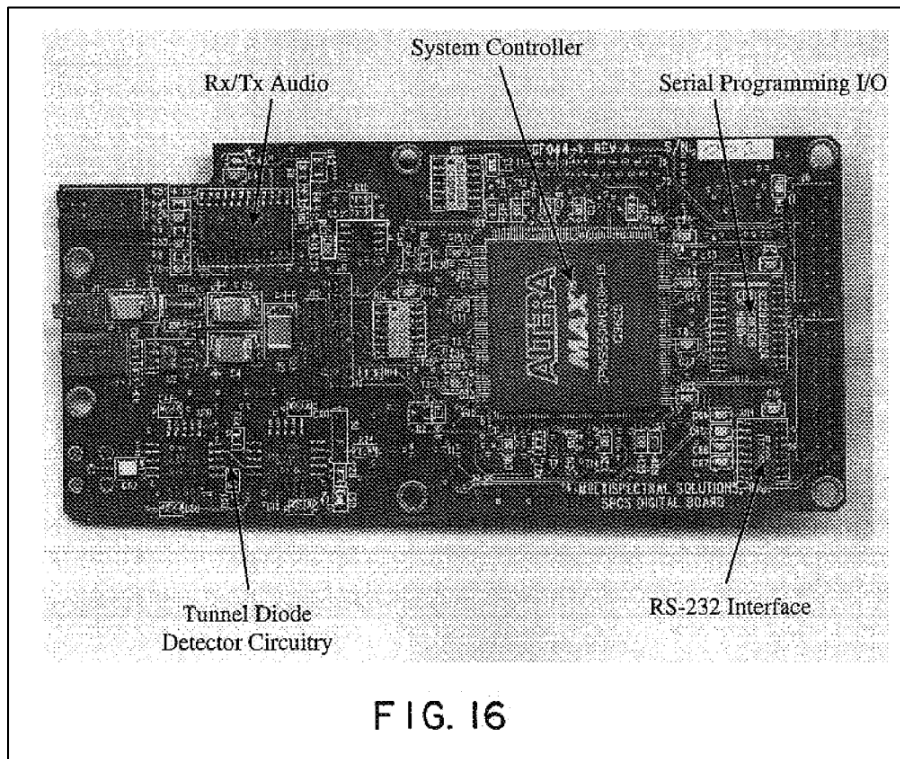


FIG. 16 “a photograph of a circuit board of a transceiver utilizing the present invention” (EX1007, 9:7-8) “shows the UWB receiver imbedded in a full duplex, voice/data ultra wideband transceiver. The RF section of this particular unit (lower left hand side) is wideband from a few MHz to beyond 4 GHz. 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.)
(EX1002, ¶105.)



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. (EX1002, ¶106.)

“at a data rate greater than or equal to 100 megabits per second and less than or equal to 480 megabits per second”

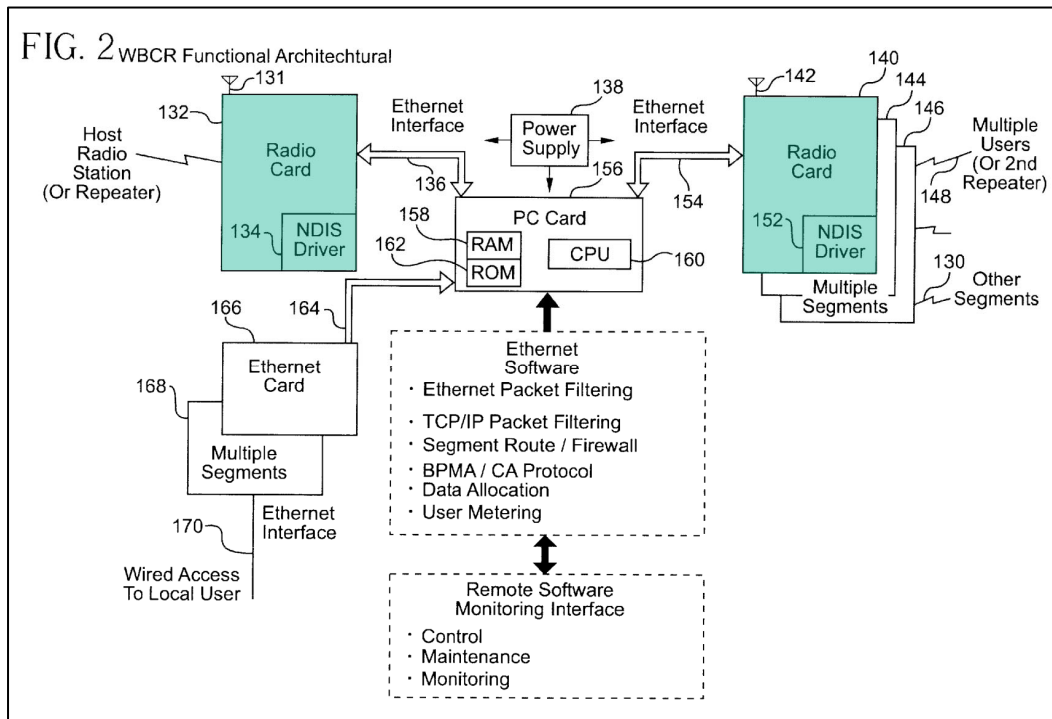
Larrick discloses a transmitter with the claimed bandwidth and data rates, and as discussed above, a POSITA would have been motivated to combine Ganz and Larrick. As discussed above, Larrick is directed to “waveform-adaptive ultra-wideband (UWB) transmitter and noise-tracking UWB receiver for use in communications.” (*Id.*, Abstract.) Thus, a POSITA would understand that Larrick’s disclosure of a UWB receiver receives any signal generated by the low-level impulse generator UWB transmitter discussed above. 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.) *See also*, limitation 1[b]. (EX1002, ¶107.)

- c) **1[b]: a wireless receiver that is configured for receiving wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz at a data rate greater than or equal to 100 megabits per second and less than or equal to 480 megabits per second;**

“a wireless receiver that is configured for receiving wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz”

As described above, 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) 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.) (EX1002, ¶109.)

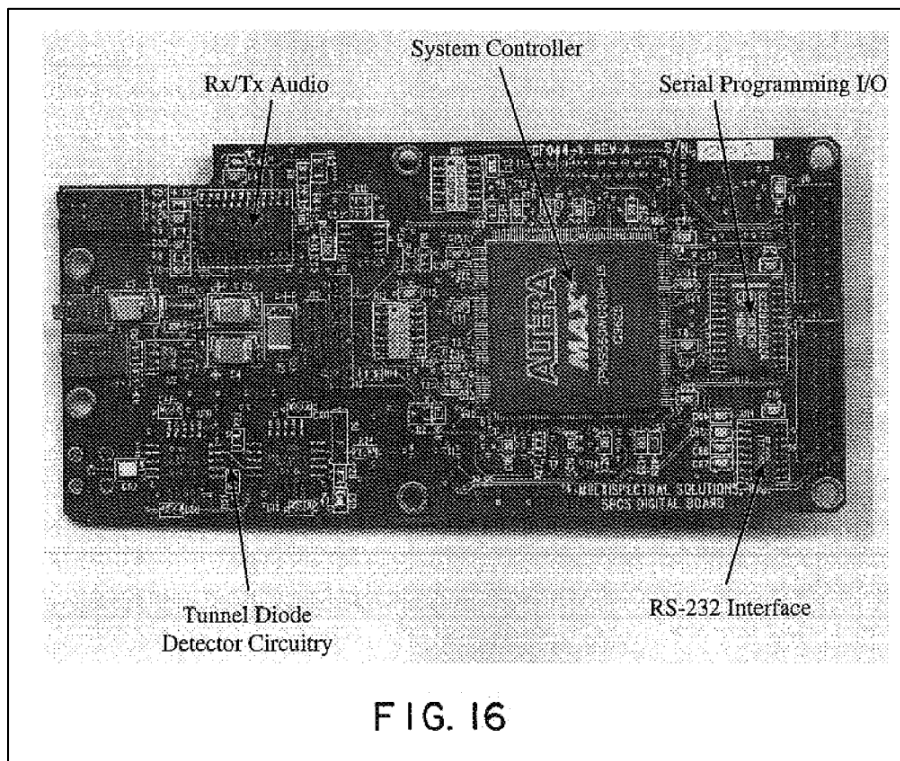


Ganz does not expressly disclose that the receiver is configured for receiving wireless data through signals that have a 100-500 MHz bandwidth. However, Larrick discloses a receiver using the claimed bandwidth and as discussed above, a POSITA would have been motivated to combine Ganz and Larrick. (EX1002, ¶110.)

As described above, 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.” (EX1007, 1:21-24) In addition, Larrick describes “[a] waveform-adaptive ultra-wideband (UWB) transmitter and noise-tracking UWB receiver for use in communications,

object detection and radar applications.” (*Id.*; Abstract.) Thus, a POSITA would understand that Larrick’s disclosure of a UWB receiver receives any signal generated by the low-level impulse generator. (EX1002, ¶111.)

FIG. 16 “a photograph of a circuit board of a transceiver utilizing the present invention” (EX1007, 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.) (EX1002, ¶112.)



Larrick claims a communication system in which a receiver detects UWB pulses generated by an UWB transmitter, and a method for detecting an UWB pulse radiated by an UWB transmitter. (EX1007, 24:52-25:5; 26:17-30.) (EX1002, ¶113.)

A POSITA would have understood that the ultra-wideband receiver on the same circuit board as the ultra-wideband transmitter would be designed or calibrated to receive transmissions from the ultra-wideband transmitter of the transceiver or an ultra-wideband transmitter of a separate device. 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 receiver have the same frequency bandwidth as the transmitter. *See also*,

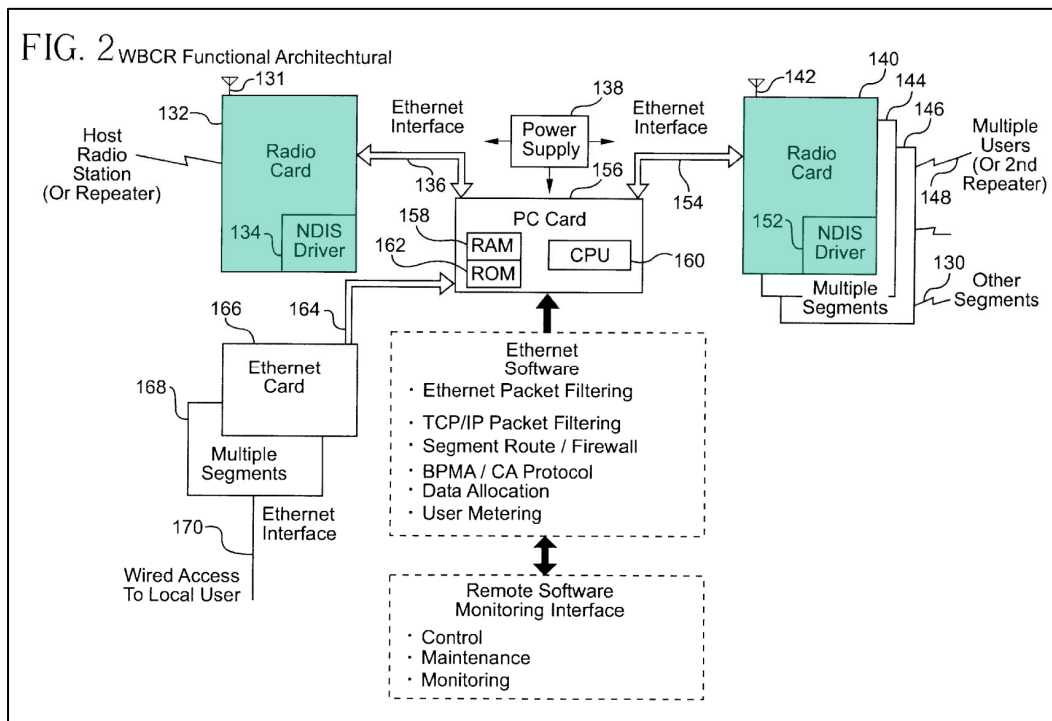
Larrick claims 10 and 16. (EX1002, ¶114.)

“at a data rate greater than or equal to 100 megabits per second and less than or equal to 480 megabits per second”

Larrick discloses a receiver with the claimed bandwidth and data rates and, as discussed above, a POSITA would have been motivated to combine Ganz and Larrick. As discussed above, Larrick is directed to “waveform-adaptive ultra-wideband (UWB) transmitter and noise-tracking UWB receiver for use in communications.” (*Id.*, Abstract.) Thus, a POSITA would understand that Larrick’s disclosure of a UWB receiver receives any signal generated by the low-level impulse generator UWB transmitter discussed above. Larrick discloses that the UWB receiver that “can operate at extremely high data rates (tens to ***hundreds of megabits per second MB/s***).” (Ex. 1007; 16:33-35). *See also*, limitation 1[a]. (EX1002, ¶115.)

d) 1[c]: wherein the wireless transmitter is configured for transmitting wireless data that contains information present in or determined from wireless data that has been received by the wireless receiver;

Ganz discloses that data packets (*i.e. data that contains information*) received by the wireless receiver are transmitted by the wireless transmitter. (EX1002, ¶117.)



In particular, Ganz discloses that user “data packets ... received by the second radio transceiver circuit 140” are “retransmitted by the radio transceiver circuit 4 to the host radio station.” (EX1005, 4:22-35.) Ganz also teaches retransmission in the other direction, from host radio station to local user. *Id.* In general, Ganz teaches that “full data stream transfer is accomplished by receiving data packets from the host radio station, temporarily buffering the data packets in the RAM circuit 158 and transferring the data packets to the second radio transceiver circuit 140 (user side), where the data packets are then transmitted to the user.” *Id.* (EX1002, ¶118.)

- e) **1[d]: wherein the wireless network device is configured for processing wireless data received by the wireless receiver; and**

For example, the above passage describes that the received data packets are

buffered in the RAM circuit or directed to a local user. (EX1005, 4:22-35.) (EX1002, ¶119.)

Ganz further discloses that the WBCR includes a “firewall circuit 222,” which “read IP addresses and protect the gates and authorize access by users,” although can 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.”)) 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. (EX1002, ¶120.)

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.) (EX1002, ¶121.)

Ganz further discloses “[t]he NCM [network control module] circuit 202 includes the processor 204, the DRAM circuit 208, and the flash memory circuit 206,” which “perform per-packet processing, examination of data packets and

maintain WBCR statistics.” (*Id.*, 6:43-47.) (EX1002, ¶122.)

- f) **1[e]: wherein the wireless network device is configured for determining whether any, a portion, or all information in the processed wireless data should be transmitted by the wireless transmitter.**

As described above, the WBCR in Ganz WBCR “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). (EX1002, ¶124.)

Ganz further discloses that the WBCR includes a “firewall circuit 222,” which “read IP addresses and protect the gates and authorize access by users,” although can 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.”)) 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. (EX1002, ¶125.)

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.) (EX1002, ¶126.)

2. Claim 2

- a) **The wireless network device of claim 1 wherein the wireless network device is configured for determining whether any, a portion, or all information in the processed wireless data should be transmitted as wireless data to one or more other devices by the wireless transmitter.**

See limitations 1[c], 1[d], and 1[e]. (EX1002, ¶127.)

3. Claim 3

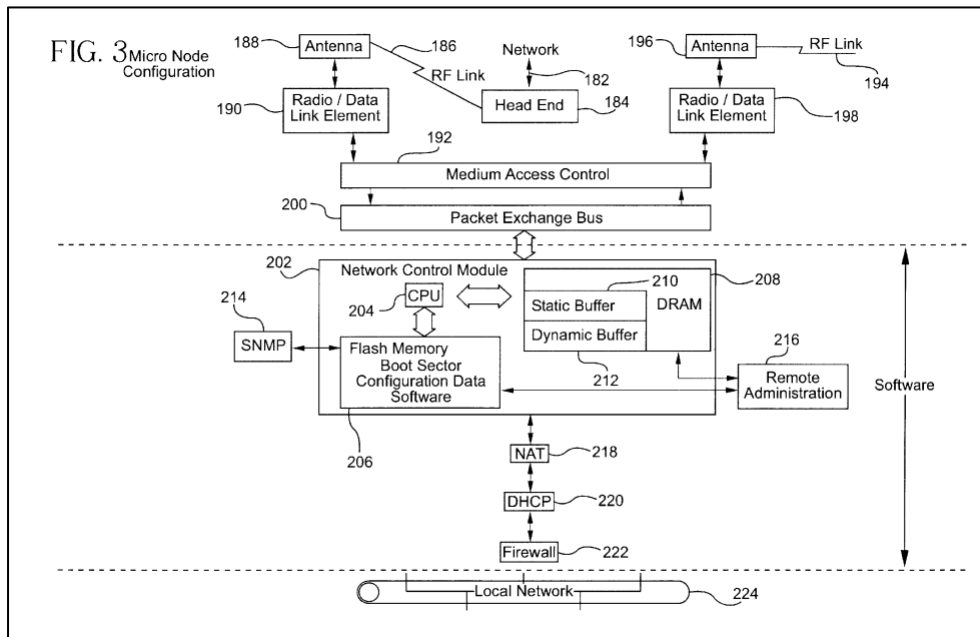
- a) **The wireless network device of claim 1 wherein the wireless network device is a wireless router.**

Ganz describes that the WBCR acts as a router: “The system also includes basic security measures to ensure that information transmitted over the network can be accessed only by the intended end user. More specifically, by access to the IP (Internet protocol) addressing within the packets, *the repeater effectively acts as a router*, allowing a firewall to be enacted for a user segment as an additional security measure, in addition to the spread spectrum coding or other noise-like coding built into the radios at the radio data link level.” (EX1005, 5:62-6:3.) (EX1002, ¶129.)

4. Claim 4

- a) **The wireless network device of claim 1 wherein the wireless network device is a wireless access point.**

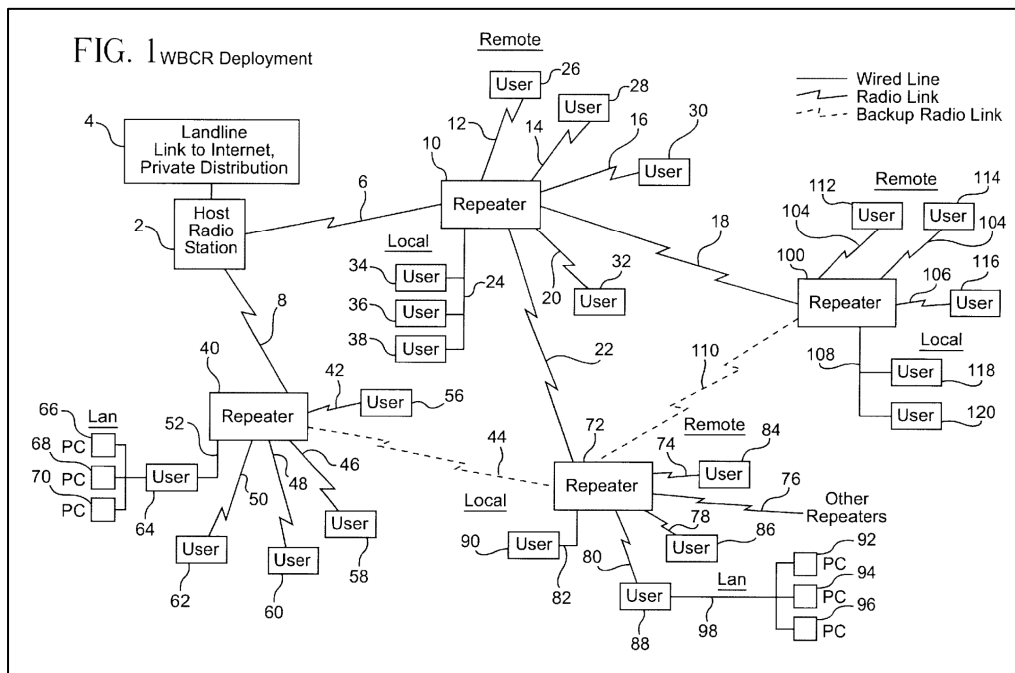
Ganz refers to a WBCR as an access point: “The firewall circuit 222, is a standard circuit which can be placed between *the WBCR access point* and the user side network.” (EX1005, 10:32-34.) (EX1002, ¶130.)



5. Claim 5

- a) The wireless network device of claim 1 wherein the wireless network device is a repeater.

Ganz is directed to a “wireless burstable communications repeater.” “The communication system may include numerous repeaters each of which is configured to communicate with each other within a line of sight. The repeaters are also configured to communicate with users by a direct electrical connection and a line of sight wireless connection.” (EX1005, Abstract.) (EX1002, ¶131.)



6. Claim 6

- a) The wireless network device of claim 1 wherein the wireless transmitter is configured for transmitting wireless data according to an 802.11 wireless standard.

Ganz discloses that wireless signals may be transmitted and received according to an 802.11 specification: “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).” (EX1005, 7:12-16.) (EX1002, ¶132.)

7. Claim 7

- a) The wireless network device of claim 1 wherein the wireless receiver is configured for receiving wireless

data according to an 802.11 wireless standard.

See Claim 6. (EX1002, ¶133.)

8. Claim 8

- a) **The wireless network device of claim 1 wherein the wireless transmitter is configured for transmitting half duplex wireless data and wherein the wireless receiver is configured for receiving half duplex wireless data.**

Ganz describes that “the present invention [] provide[s] a radio communications repeater which is capable of full data rate transfers in half-duplex systems.” To the extent that claim 8 is not expressly disclosed in Ganz, it is expressly disclosed in Larrick, and a POSITA would have been motivated to modify Ganz’ system to include Larrick’s teachings. Larrick discloses that its UWB transceivers has “high speed operation [that] enables full duplex or two-way transmission and reception of stereo quality voice, video imagery and other data rate critical applications.” (EX1007, 17:2-5.) A POSITA would understand that Larrick is describing that its UWB transceivers can operate in either full duplex or half-duplex, as “two-way transmission and reception” is contrasted with “full duplex” and therefore indicates the transmission/reception is not performed simultaneously (*i.e.* half-duplex). (EX1002, ¶123.) To the extent PO argues otherwise, a POSITA would have found that in the Ganz/Larrick combination, it would be obvious for receiving and transmitting of signals to operate in half-duplex, as disclosed in Ganz. A

POSITA would be motivated to operate in half-duplex as half-duplex requires cheaper and simpler hardware, as it does not require self-interference cancellation. This is a particular concern for full-duplex UWB transceivers where there is a potential for the transmitter to overwhelm the receiver given the large bandwidth. (EX1002, ¶134.)

9. Claim 9

- a) **The wireless network device of claim 1 wherein the wireless transmitter is configured for transmitting full duplex wireless data and wherein the wireless receiver is configured for receiving full duplex wireless data.**

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.) *See also*, claim 8. (EX1002, ¶135.)

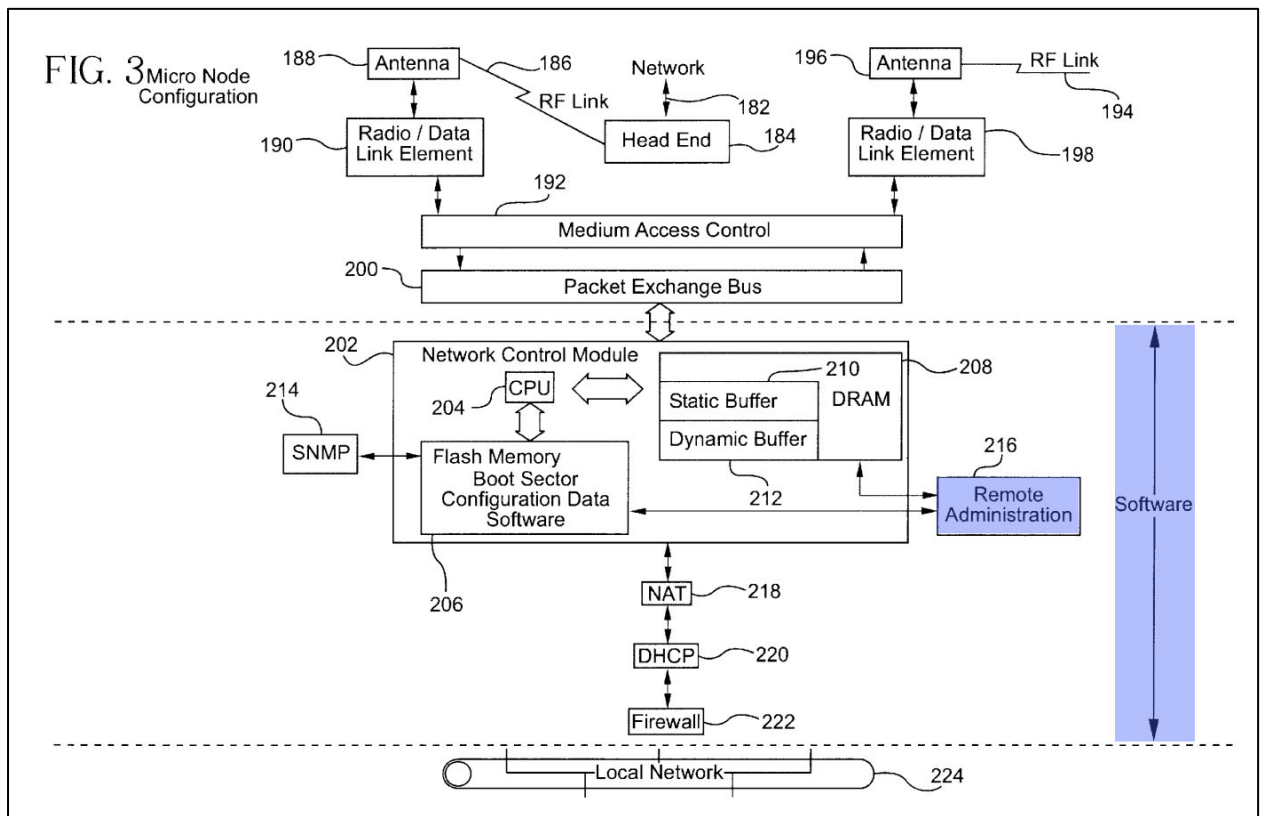
10. Claim 10

- a) **The wireless network device of claim 1 wherein the wireless network device is configurable by an interface that is accessible from a computer.**

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). (EX1002, ¶136.)

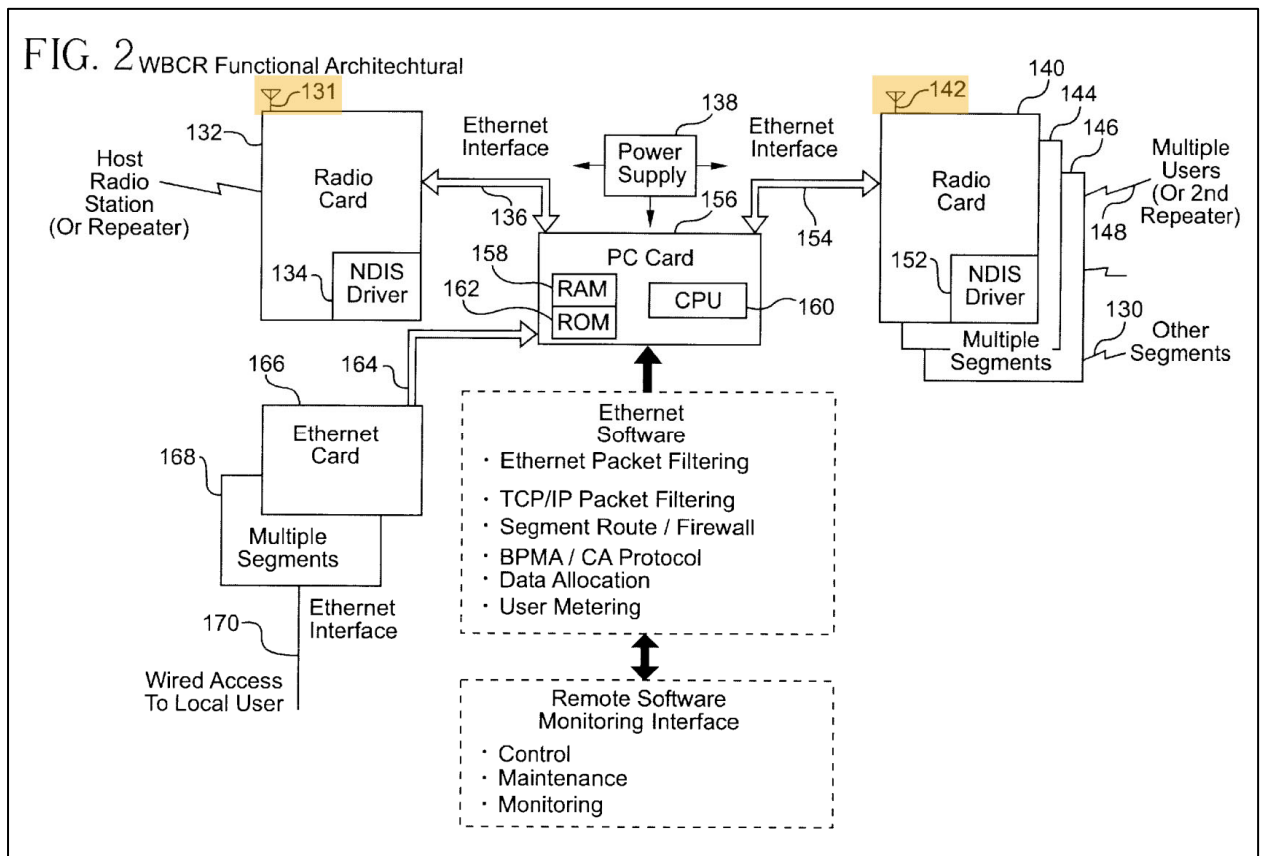
A POSITA would understand that “management software” which “provides for remote administration” would include an interface accessible from a remote computer. A POSITA would understand that in order to provide remote administration, the management software would provide an interface for the remote administrator to perform the administrative tasks. Such an interface would be accessible from a remote computer. (EX1002, ¶137.)



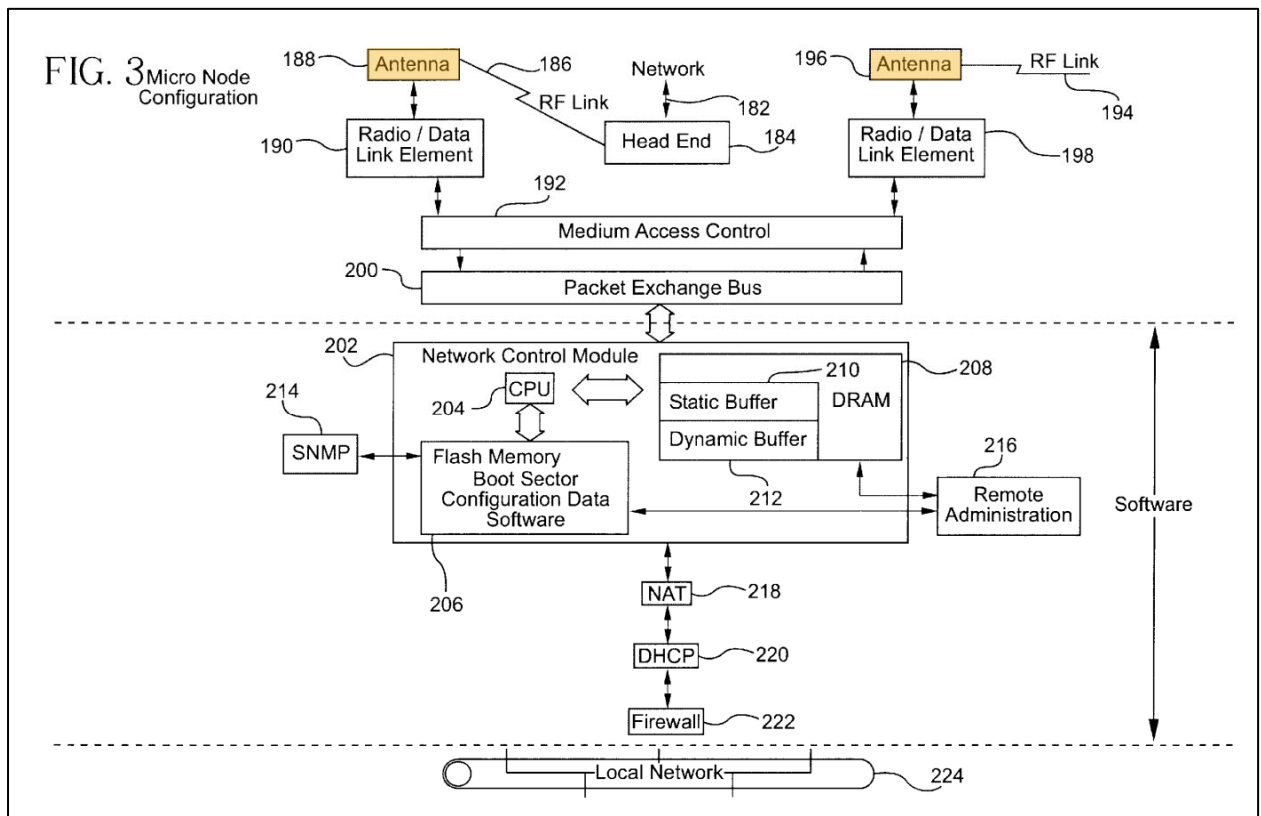
11. Claim 11

- a) The wireless network device of claim 1 wherein the wireless network device comprises two or more antennas.

The WBCR in Ganz includes at least two antennas. Ganz describes that “Multiple radio/data link element circuits 190, including multiple antennas 188, may be supported by a single WBCR.” (EX1005, 7:4-6.) A block diagram of the functional architecture of the WBCR is illustrated in FIG. 2 and shows “an antenna 131” and “a second antenna 142.” (EX1005, 4:1-4.) (EX1002, ¶138.)



“The WBCR as shown in FIG. 3 preferably includes: an antenna 188,
a second antenna 196....” (*Id.*, 6-9-10.) (EX1002, ¶139.)



12. Claim 16

a) 16[pre]: The wireless network device of claim 1

See 1[pre]. (EX1002, ¶140.)

b) 16[a]: wherein the wireless network device comprises an omnidirectional antenna; and

Ganz describes that the antennas 131, 142 and 188 (of transceiver circuits 132, 140, and 190) can be either omni or directional. (EX1005, 4:12-13, 6:62-64.) (EX1002, ¶141.)

c) 16b]: wherein the wireless transmitter is configured for using the omnidirectional antenna for transmitting wireless data through electromagnetic signals that have a bandwidth greater than or equal

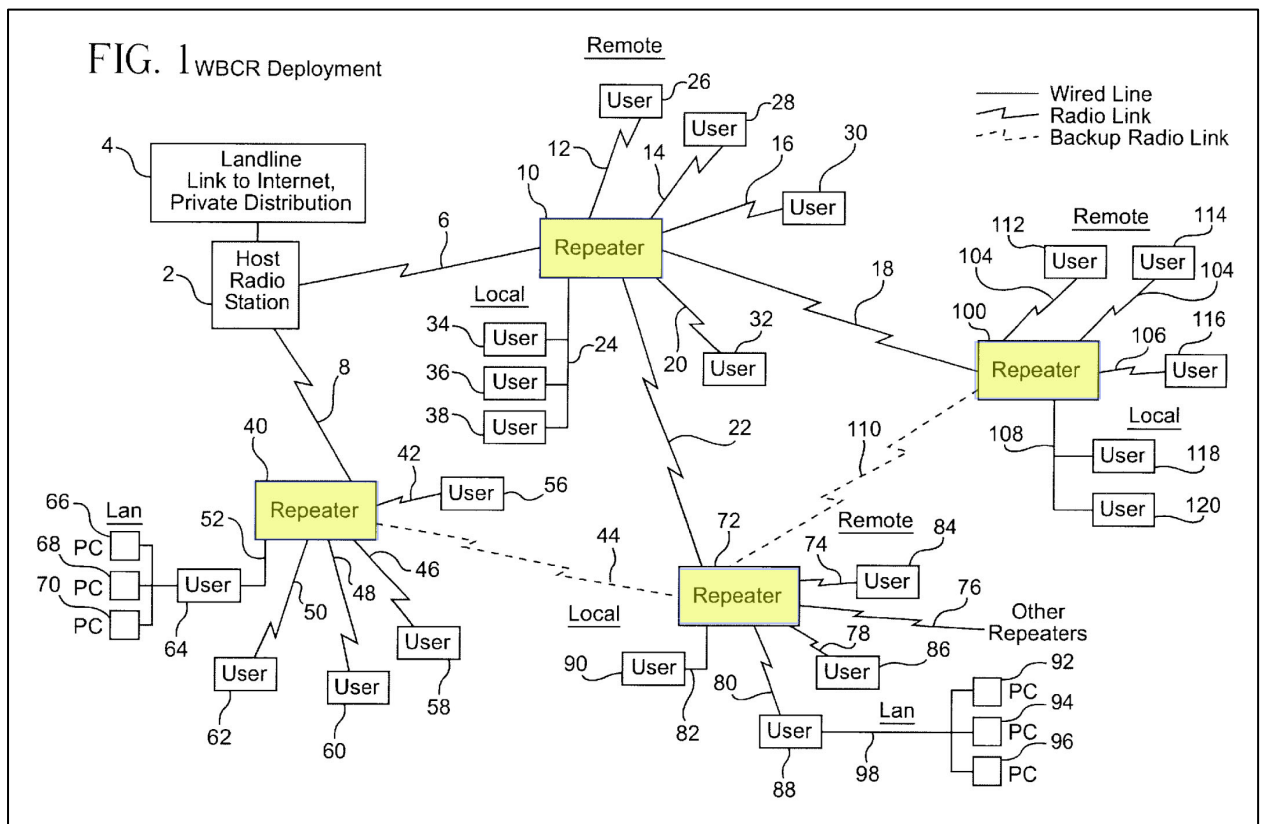
to 100 MHz and less than or equal to 500 MHz.

See limitation 1[a]. Ganz/Larrick discloses transmitting wireless data through electromagnetic signals with these bandwidths. (EX1002, ¶142.)

13. Claim 17

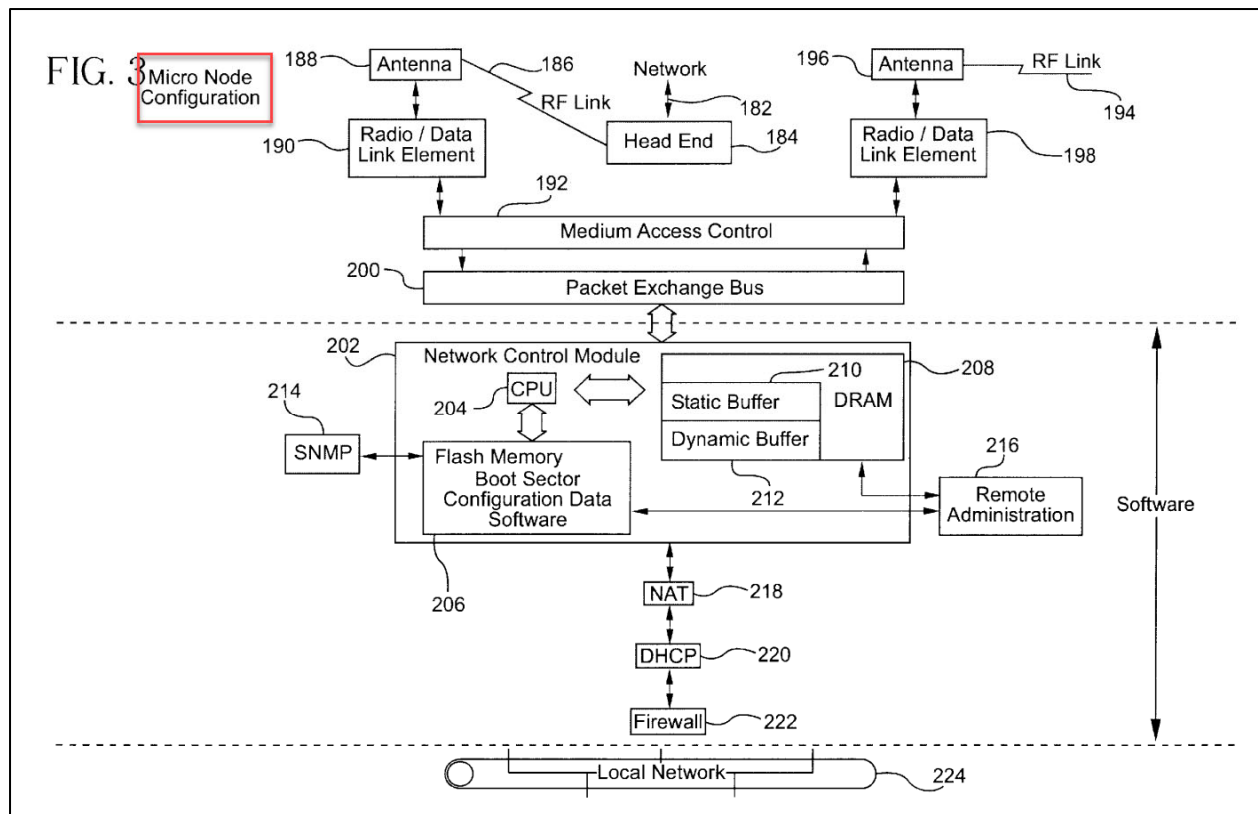
- a) **The wireless network device of claim 1 wherein the wireless network device is configured for operating within a wireless mesh network.**

Ganz shows that WBCRs are deployed as part of a network of WBCRs. (EX1005, FIG. 1). Each WBCR has “a multiple access circuit within” it, and each WBCR can transmit information to another WBCRs via primary radio links such as links 18, 22 and back-up links 44 and 110. (*Id.*, 3:56-59.) (EX1002, ¶143.)



Ganz also describes the WBCR in FIG. 3 as a “micro-node,” which is indicative of using the WBCRs as part of a mesh network. (EX1002, ¶144.)

To the extent Patent Owner argues that Ganz does not disclose a mesh network, as discussed below for Ground 3, Bareis discloses a mesh network and it would have been obvious to combine Ganz and Larrick with Bareis. (EX1002, ¶145.)



14. Claim 18

- a) The wireless network device of claim 1 wherein the wireless network device is configured for using data encryption when transmitting with the wireless transmitter.

Ganz describes that “[t]he radio/data link element circuit 190 preferably employs spread spectrum transmission, either using frequency hopping or direct sequence coding schemes. This decreases the chances of radio frequency jamming/interference, detection and interception of radio frequencies and **provides for the capability of encryption**. The radio/data link element circuits can incorporate an IEEE 802.11 specification, the disclosure of which is incorporated herein by reference.” (EX1005, 7:6-16.) IEEE 802.11 specifications published before the priority date provide for the encryption of wireless data. (EX1002, ¶146.)

15. Claim 19

- a) **The wireless network device of claim 1 wherein the wireless network device is configured for assigning priority levels to at least some wireless data that is to be transmitted by the wireless transmitter.**

Ganz describes that “Prioritization 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. Network critical traffic like topology changes are automatically assigned as an urgent priority, which takes precedence over all other traffic. After all packets in the urgent-priority queue are forwarded, the router forwards packets from the other queues in an order controlled by the WBCR. The

successful deployment of real-time applications such as voice and video may require that the WBCR provide a specific QoS for different applications. A QoS request is described by the flow specification that stipulates the maximum frame transmission rate, the long term average transmission rate, the maximum frame jitter, and the maximum end-to-end delay, along with the performance parameters. A resource reservation protocol (RSVP) is designed to support QoS flows by placing and maintaining resource reservations across the WBCR network.” (EX1005, 11:5-24.) (EX1002, ¶147.)

16. Claim 20

- a) **20[pre]: The wireless network device of claim 1 wherein the wireless network device is configured for assigning one or more priority levels to at least some wireless data that is to be transmitted by the wireless transmitter,**

See claim 19. (EX1002, ¶148.)

- b) **20[a]: wherein at least some of the one or more priority levels are related to one or more levels of a certain quality of service.**

See claim 19. (EX1002, ¶149.)

Ganz also describes a quality of service (QoS) module 244 that “includes bandwidth management functions that provide traffic control of the WBCR, allowing improved network performance while enforcing traffic flows and other network policies. The bandwidth management functions provide for control of

broadcast traffic, efficient bandwidth allocation, security within the WBCR environment, and preservation of existing open system interconnection (OSI) layer 3 structures. An additional function of the QoS 244 is dynamic bandwidth throttling technology. With this, the WBCR can maximize available bandwidth on backbone connections by throttling open network connections down to the minimum guaranteed bandwidth. While a faster interface might allow a customer to obtain bandwidth significantly higher than the guaranteed amount under some conditions (reducing the amount of time spent on the airwaves), when necessary the links can be limited to the minimum in order to handle other QoS requirements. Time-sensitive traffic (such as terminal sessions and multi-media) is combined with batch traffic (a file transfer) over the same radio segment, which could pose problems without prioritization of data.” (EX1005, 10:52-11:4.) (EX1002, ¶150.)

17. Claim 21

a) 21[pre]: The wireless network device of claim 1

See 1[pre]. (EX1002, ¶151.)

b) 21[a]: wherein the wireless transmitter is configured for transmitting wireless data through electromagnetic signals in more than one frequency band, and

Ganz describes that “[t]he radio/data link element circuit 190 preferably employs spread spectrum transmission, either using frequency hopping or direct

sequence coding schemes” and that “In one embodiment, the FHSS may use a maximum of 79 channels in the hopping set. The first channel has a center frequency of 2.402 GHz, and all subsequent channels are spaced 1 MHz apart.” (EX1005, 7:46-9 and 7:17-20.) (EX1002, ¶152.)

To the extent that limitation 21[a] is not expressly disclosed in Ganz, it is expressly disclosed in Larrick, and a POSITA would have been motivated to modify Ganz’ system to include Larrick’s teachings. Larrick describes that “[t]he center frequency, as well as the instantaneous phase, of the UWB signal can be controlled via oscillator control 104. This allows for frequency agile UWB emissions by simply changing the frequency of the oscillator 106 according to a desired hopping pattern. (EX1007, 10:24-28.) Larrick describes “frequency agile” as an example of “frequency hopping.” (*Id.*, 7:36-39.) (EX1002, ¶153.)

c) 21[b]: wherein the wireless receiver is configured for receiving wireless data through electromagnetic signals in more than one frequency band.

As described above in limitation 21[a], both Ganz and Larrick describe transmitting electromagnetic signals in more than one frequency band. Fundamental to FHSS, the transmitter and receiver share a predetermined sequence of frequencies and synchronize their hop. That is, for this frequency hopping system to function properly, both the transmitter and receiver must follow the same hopping pattern. The receiver must be able to receive across the same set of frequencies that the

transmitter uses. Otherwise, the communication would fail, as the receiver wouldn't know which frequency to tune to for the next hop. (EX1002, ¶154.)

18. Claim 22

- a) **The wireless network device of claim 1 wherein the wireless transmitter is configured for transmitting wireless data at more than one data rate.**

Ganz discloses that the WBCR can transmit data on more than one data rate. For example, Ganz discloses a “basic access rate of 1 Mb/s” and an “enhanced access rate of 2 Mb/s.” (EX1005, 7:32-37.) (EX1002, ¶155.)

To the extent Patent Owner argues that the multiple data rates must all be between the claimed 100 and 480 Mb/s, as discussed below in Ground 3, Bareis discloses this limitation and a POSITA would have been motivated to combine Ganz and Larrick with Bareis. (EX1002, ¶156.)

19. Claim 23

- a) **The wireless network device of claim 1 wherein the wireless receiver is configured for receiving wireless data at more than one data rate.**

Ganz/Larrick discloses this limitation for the same reasons discussed for claim 22. (EX1002, ¶157.)

20. Claim 24:

- a) **The wireless network device of claim 1 wherein the wireless network device is configured to be powered through a connection to a DC power source.**

21. Claim 25:

- a) **The wireless network device of claim 1 wherein the wireless network device is configured to be powered through a connection to an AC power source.**

Ganz/Larrick discloses these limitations. Ganz focuses primarily on the communications architecture and functionality of the repeater system. A POSITA would understand that Ganz' WBCR, being an electronic device, would necessarily include a power source. A POSITA would further understand that a device's power source would either be AC or DC, either one being a conventional design choice. (EX1002, ¶158.)

22. Claim 27

- a) **The wireless network device of claim 1 wherein the wireless transmitter is configured for transmitting wireless data through electromagnetic signals that have a bandwidth of 100 MHz.**

As described above in connection with limitation 1[a], Larrick "relates to the **controlled transmission** and reception of ultra-wideband electromagnetic pulses." (Ex. 1007, 1:21-24.) Specifically, Larrick teaches the use of "wideband from a few MHz to beyond 4 GHz." (EX1007, 21:55-56.) Consistent with these teachings, Larrick discloses "UWB transmitters which generate UWB signals having **controllable spectral characteristics**." (*Id.*, 9:21-23) Larrick also describes that "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.) A POSITA would understand that Larrick teaches that its UWB transceivers can operate on a wide range of bandwidths, including 100 MHz and 160 MHz, which were well-known at the time. (EX1002, ¶156.) And to the extent Patent Owner argues this limitation is not expressly disclosed by Larrick, it would have been obvious to a POSITA that the wireless transmitter be configured for transmitting wireless data through electromagnetic signals that have a bandwidth of 100 MHz. (EX1002, ¶160.)

In addition, under Patent Owner’s apparent interpretation of “have a bandwidth,” any bandwidth that exceeds 100 MHz “ha[s] a bandwidth of 100 MHz.” In particular, in the litigation, Patent Owner has accused devices that use Wi-Fi 5, Wi-Fi 6 and Wi-Fi 6E, which as Patent Owner admits, “all provide **160 MHz** channel widths.” (EX1014, 21.) As discussed above for limitation 1[a], Larrick discloses the use of bandwidth that exceeds 100 MHz. (EX1002, ¶161.)

In the alternative, as discussed below in Ground 6 and under Patent Owner’s apparent interpretation, Gardner discloses a bandwidth of 100 MHz for 802.11a and a POSITA would have found it obvious to combine Ganz-Larrick with Gardner. (EX1002, ¶162.)

23. Claim 28

- a) **The wireless network device of claim 1 wherein the wireless transmitter is configured for transmitting wireless data through electromagnetic signals that have a bandwidth of 160 MHz.**

As described above in connection with claim 27, Larrick provides complete control over all aspects of the spectral emissions of the UWB transmitter. To the extent not explicitly disclosed by Larrick, it would have been obvious to a POSITA that the wireless transmitter be configured for transmitting wireless data through electromagnetic signals that have a bandwidth of 160 MHz. And, as discussed below in Ground 6, it would have been obvious to combine Ganz-Larrick with Gardner. (EX1002, ¶164.)

24. Claim 29

- a) **The wireless network device of claim 1 wherein the wireless transmitter and the wireless receiver are both part of a transceiver.**

As described above in connection with limitation 1[b], Larrick describes “[a] waveform-adaptive ultra-wideband (UWB) transmitter and noise-tracking UWB receiver for use in communications, object detection and radar applications.” (EX1007; Abstract.) A photograph of a circuit board of transceiver utilizing the invention of Larrick “show[ing] the UWB receiver imbedded in a full duplex, voice/data ultra wideband transceiver” is depicted in FIG. 16. (*Id.*, 21:54-61.) (EX1002, ¶165.)

25. Claim 30

- a) **30[pre]: A wireless network system, comprising:**

See 1[pre]. (EX1002, ¶166.)

- b) **30[a]: one or more wireless network devices as recited in claim 1; and**

See 1[pre]. (EX1002, ¶167.)

- c) **30[b]: one or more devices which receive wireless data transmitted by the wireless transmitter of at least one of the one or more wireless network devices.**

See 1[b]. (EX1002, ¶168.)

26. Claim 31

- a) **31[pre]: A wireless networking method, comprising:**

See 1[pre]. (EX1002, ¶169.)

- b) **31[a]: transmitting wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz at a data rate greater than or equal to 100 megabits per second and less than or equal to 480 megabits per second with a wireless transmitter that is part of or in communication with a wireless network device;**

See limitation 1[a]. (EX1002, ¶170.)

- c) **31[b]: receiving wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz at a data rate greater than or equal to 100 megabits per second and less than or equal to 480 megabits per second with a wireless receiver that**

is part of or in communication with the wireless network device;

See 1[b]. (EX1002, ¶171.)

- d) 31[c]: processing wireless data received by the wireless receiver with a processor that is part of or in communication with the wireless network device; and**

See 1[d]. (EX1002, ¶172.)

- e) 31[d]: determining whether any, a portion, or all information in the processed wireless data should be transmitted by the wireless transmitter,**

See 1[e]. (EX1002, ¶173.)

- f) 31[e]: wherein the wireless data transmitted in the transmitting step contains information present in or determined from wireless data that was received by the wireless receiver in the receiving step.**

See 1[c]. (EX1002, ¶174.)

VIII. Ground 2: Ganz and Larrick in Combination with Engels Renders Claims 12-15 and 26 Obvious

A. Overview and Motivation to Combine

Engels teaches various conventional antenna technologies that were well-known, including MIMO, beamforming, adaptable and directional antennas, and cellular networks. (EX1002, ¶175.)

A POSITA would have been motivated to incorporate the teachings of Engels to improve the Ganz system (along with its combination with Larrick) 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 '999 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. 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. (EX1002, ¶176.)

A POSITA would have been motivated to combine Ganz/Larrick to configure the wireless network device to operate in a cellular network. As discussed above, the

'999 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, 3:29-33.) 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.) (EX1002, ¶165.) 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. (EX1002, ¶177.)

A POSITA would have had a reasonable expectation of success combining Ganz-Larrick 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. (EX1002, ¶178.)

B. Limitation-By-Limitation Analysis

1. Claim 12

- a) **The wireless network device of claim 11 wherein the wireless network device is configured for using MIMO antenna technology.**

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. (EX1002, ¶179.)

2. Claim 13

- a) **The wireless network device of claim 1 wherein the wireless network device is configured for performing beamforming.**

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 further teaches that “[t]he direction to which the second antenna means transmits and receives radio signals may be determined by various means, e.g. by means for selection between n antenna elements, pointed to different directions, by moving an antenna or by **beamforming**.” (EX1008, 3:33-4:3.) Engels therefore discloses a wireless network device that is configured for performing beamforming. (EX1002, ¶180.)

3. Claim 14

a) 14[pre]: The wireless network device of claim 1

See 1[pre]. Ganz/Larrick discloses transmitting wireless data through electromagnetic signals with these bandwidths. (EX1002, ¶181.)

b) 14[a]: wherein the wireless network device comprises an adaptable antenna; and

As discussed above for claim 13, Engels discloses beamforming, which uses an adaptable antenna. In particular, Engels teaches that “[t]he direction to which the second antenna means transmits and receives radio signals may be determined by various means, e.g. by means for selection between n antenna elements, pointed to different directions, by moving an antenna or by **beamforming**.” (EX1008, 3:33-

4:3.) Accordingly, the antenna's position and direction is adaptable. (EX1002, ¶182.)

- c) **14[b]: wherein the wireless transmitter is configured for using the adaptable antenna for transmitting wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz.**

See 1[a]. Ganz/Larrick discloses transmitting wireless data through electromagnetic signals with these bandwidths. (EX1002, ¶183.)

4. Claim 15

- a) **15[pre]: The wireless network device of claim 1**

See 1[pre]. Ganz/Larrick discloses this limitation. (EX1002, ¶184.)

- b) **15[a]: wherein the wireless network device comprises a steerable antenna; and**

As discussed above for claim 13, Engels discloses beamforming, which uses a steerable antenna. In particular, Engels teaches that “[t]he direction to which the second antenna means transmits and receives radio signals may be determined by various means, *e.g.* by means for selection between n antenna elements, ***pointed to different directions, by moving an antenna*** or by beamforming.” (EX1008, 3:33-4:3.) Accordingly, the antenna's position and direction is steerable. (EX1002, ¶185.)

- c) **15[b]: wherein the wireless transmitter is configured for using the steerable antenna for transmitting wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz.**

See 1[a]. Ganz/Larrick discloses transmitting wireless data through electromagnetic signals with these bandwidths. (EX1002, ¶186.)

5. Claim 26

- a) **The wireless network device of claim 1 wherein the wireless network device is configured to operate in a cellular network.**

Engels 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.) (EX1002, ¶187.)

IX. Ground 3: Ganz and Larrick in Combination with Bareis Renders Claims 17 and 22-25 Obvious

A. Overview and Motivation to Combine

Bareis teaches mesh networks, transmitting/receiving data on multiple data rates, and the use of AC and DC power. (EX1002, ¶188.)

A POSITA would have been motivated to incorporate the teachings of Bareis to improve the Ganz system (including when combined with Larrick) because of the utility of mesh networks, multiple data rates, and AC and DC power. (EX1002, ¶189.)

Mesh networks are communication networks where each node can connect directly, dynamically, and non-hierarchically to other nodes. Mesh networks were well-known at the time of the ’999 patent and were known to have benefits such as

extended coverage (as each node acts as a relay), reliability and redundancy via multiple paths between nodes, scalability by adding more nodes, better performance in challenging environments as signals can find alternate routes around blockages, and load balancing as traffic can be distributed across multiple paths. (EX1002, ¶190.)

A wireless device, especially a base station, was known to be advantageous when offering different data rates, and in particular, adaptive data rate selection. This allows the base station to adjust transmission rates based on signal quality, distance, and interference conditions. For example, devices that are further in distance may still be able to connect at a lower data rate, which increases reliability and range. Meanwhile, nearby devices can achieve higher data rates, which is desirable for many applications, including media streaming. Certain devices can also be easily accommodated with lower data rates (such as IoT devices), the use of which increases energy efficiency. Moreover, support for older technologies that have lower data rates ensures backwards compatibility. (EX1002, ¶191.)

A POSITA would understand that AC and DC power are alternative technologies for transmission of current, and each has respective advantages. For example, AC power has more efficient long-distance transmission, and is inexpensive. The electric grid uses AC power. DC power (*e.g.* batteries) provides stable and constant voltage and mobility. (EX1002, ¶192.)

A POSITA would have had a reasonable expectation of success combining Ganz-Larrick with Bareis. Mesh networks, adaptive data rates, and AC or DC power were well-known and conventional technologies. A POSITA would have been well aware of such standard technologies and the conventional ways of implementing them. Implementation would have been well-within the skill of an ordinary artisan. (EX1002, ¶193.)

B. Limitation-By-Limitation Analysis

1. Claim 17

- a) **The wireless network device of claim 1 wherein the wireless network device is configured for operating within a wireless mesh network.**

Bareis is directed to a broadband multi-drop local network, interface, and method for multimedia access. (EX1009, Abstract.) It describes “**a network mesh 802 ...** that provides the communication path for all packets generated by any node on the network.” (EX1002, ¶¶[0079].) Network devices 804, 806, 808, and 810 are operable to “generate packets of data that are placed onto the **network mesh 802.**” (*Id.*, Fig. 8). (EX1002, ¶194.)

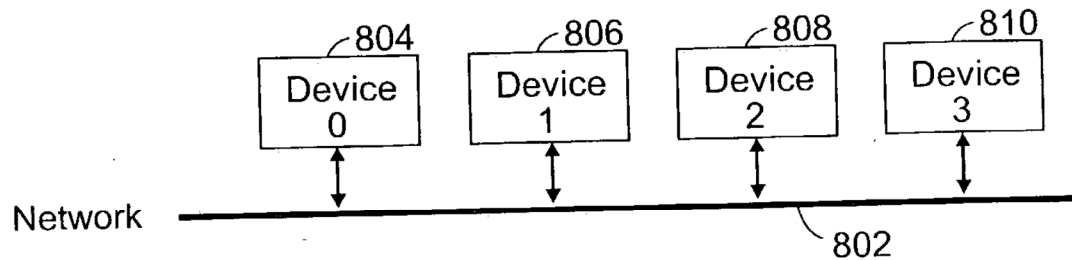


FIG. 8

2. Claim 22

- a) The wireless network device of claim 1 wherein the wireless transmitter is configured for transmitting wireless data at more than one data rate.

Bareis teaches that its method makes available data rates of “**at least 100 Mbps, and beyond to over 500 Mbps** at reasonable distances” for each local network transferring data packets at the maximum packet rate of all network devices, even when all of the network devices are transmitting. (EX1009, ¶[0097].) Bareis further discloses that shortening the distance between the network interface or transceiver and each network device can enable the technology to operate at data rates well above 100 Mbps, and at higher data rates for even shorter distances. (EX1009, ¶[0043].) Thus, Bareis discloses that its network devices can transmit wireless data at more than one data rate. (EX1002, ¶195.)

3. Claim 23

- a) The wireless network device of claim 1 wherein the wireless receiver is configured for receiving wireless

data at more than one data rate.

Bareis discloses this limitation for the same reasons discussed for claim 22.
(EX1002, ¶196.)

4. Claim 24:

- a) **The wireless network device of claim 1 wherein the wireless network device is configured to be powered through a connection to a DC power source.**

Bareis discloses that “**DC or low frequency AC power** may be coupled to the broadband multidrop local network from a localized source.” (EX1009, [0065].) Thus, a POSITA would understand that Bareis’ network devices can be powered through a connection to a DC or AC power source. (EX1002, ¶197.)

5. Claim 25:

- a) **The wireless network device of claim 1 wherein the wireless network device is configured to be powered through a connection to an AC power source.**

Bareis discloses this limitation for the same reasons discussed for claim 24.
(EX1002, ¶198.)

X. Ground 4: Ganz and Larrick in Combination with Soomro Renders Claim 32-36 and 39 Obvious

A. Overview and Motivation to Combine

Ganz in combination with Larrick and Soomro renders claims 32-36 and 39 obvious. As discussed above, a POSITA would have been motivated to combine Ganz and Larrick. In addition, a POSITA would have been motivated to combine

the teachings of Soomro to allow Ganz/Larrick to use beacon frames as to announce the presence of a LAN and provide synchronization signals to devices on the network. (*E.g.*, EX1010, ¶36.) (EX1002, ¶199.)

Soomro teaches the use of beacon frames for synchronization purposes, and specifically mentions that they are based on “the beacon transmission rule within the IEEE 802.11-1999 standard.” (EX1010, ¶36.) (EX1002, ¶200.)

A POSITA would be motivated to use Soomro’s teachings of beacon frames. Beacon frames were a conventional technology for announcing the presence and capabilities of a wireless network and devices. A POSITA would have been well-aware of the advantages of beacon frames, indeed, their necessity in wireless technologies. Beacon frames were known to allow devices to discover and automatically connect to nearby wireless networks, as they define how network information (such as the SSID, supported data rates, and security type) can be transmitted to devices. Such broadcasting reduces latency compared to each individual device requesting such information. (EX1002, ¶201.)

In addition, a POSITA would have been motivated to combine the teachings of Soomro to allow Ganz/Larrick to use OFDM to improve the data rates of Ganz/Larrick improve spectral efficiency. (EX1002, ¶202.)

For example, OFDM – as a modulation technique – allows for transmitting large amounts of data over a radio wave. A radio signal is split into multiple sub-

signals that are transmitted simultaneously over multiple frequencies from a transmitter to a receiver. OFDM combats attenuation due to, for example, narrowband interference and frequency-selective fading due to multipath. (EX1002, ¶203.)

As described above in connection in with limitation 1[pre] and claims 6-7, Ganz specifically refers to the IEEE 802.11 specification and incorporates it by reference: “[t]he radio/data link element circuits [of WBCR] can incorporate an IEEE 802.11 specification, the disclosure of which is incorporated herein by reference.” (EX1005, 7:12-14) A POSITA would have known that the IEEE 802.11 specification is a standard that is amended from time to time, and drafts of amendments to the standard are published in advance of their formal ratification by the IEEE. (EX1002, ¶204.)

The ’999 patent also identifies 802.11a and 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, 3:29-33) and refers to “802.11a/b/g” as a “wireless distribution mechanism” (*id.*, 8:29). The ’999 patent also states “today's IEEE 802.11 bridge/repeater products ... may be equipped with MAC address association control, and could easily have one or more integrated wired Ethernet port connections for use on a standard wired Ethernet connection,”

and that “[t]hese techniques are well understood by those knowledgeable in IEEE 802.11a/b/g and 802.15.3a/b standards activities, which have become widely popular in recent years.” (*Id.*, 20:65-21:6.) (EX1002, ¶205.)

IEEE 802.11a, ratified on December 30, 1999, merely adds an additional clause to the IEEE 802.11 standard. That clause is clause 17 which “specifies the PHY entity for an orthogonal frequency division multiplexing (OFDM) system and the additions that have to be made to the base standard to accommodate the OFDM PHY,” and “describes the PHY services provided to the IEEE 802.11 wireless LAN MAC by the 5 GHz (bands) OFDM system.” (EX1002, ¶206.)

Soomro also specifically references the IEEE 802.11a standard and the use of OFDM for the physical layer. (EX1008, [0004].) (EX1002, ¶207.)

A POSITA would have had a reasonable expectation of success combining Ganz-Larrick with Soomro. Beacon frames and OFDM were a well-known and conventional technology. A POSITA would have been well-aware of such methods and the conventional ways of implementing such standard technology. Implementation would have been well-within the skill of an ordinary artisan. (EX1002, ¶208.)

B. Limitation-By-Limitation Analysis

1. Claim 32

a) 32[pre]: A wireless network device, comprising:

See 1[pre]. Ganz/Larrick discloses this limitation. (EX1002, ¶209.)

- b) 32[a]: a wireless transmitter that is capable of transmitting wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz;**

See 1[a]. Ganz/Larrick discloses transmitting wireless data through electromagnetic signals with these bandwidths. (EX1002, ¶210.)

- c) 32[b]: a wireless receiver that is capable of receiving wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz;**

See 1[b]. Ganz/Larrick discloses receiving wireless data through electromagnetic signals with these bandwidths. (EX1002, ¶211.)

- d) 32[c]: wherein the wireless transmitter is configured for transmitting wireless data that contains information present in or determined from wireless data that has been received by the wireless receiver,**

See 1[c]. Ganz/Larrick discloses this limitation. (EX1002, ¶212.)

- e) 32[d]: wherein the wireless network device is configured for processing wireless data received by the wireless receiver**

See 1[d], Ganz/Larrick discloses this limitation. (EX1002, ¶213.)

- f) 32[e]: wherein the wireless network device is configured for determining whether any, a portion, or all information in the processed wireless data should be transmitted by the wireless transmitter, and**

See 1[e]. Ganz/Larrick discloses transmitting wireless data through

electromagnetic signals with these bandwidths. (EX1002, ¶214.)

- g) **32[f]: wherein the wireless network device is configured for transmitting beacon frames with the wireless transmitter.**

Soomro describes “Dynamic frequency selection for an IEEE 802.11 basic service set network is enabled by a dynamic frequency selection (DFS) element within beacon and probe response frames defining a DFS owner, a DFS interval specifying the time until channel switch in beacon intervals, a DFS count specifying a time in beacon intervals until the DFS owner initiates selection of the next channel frequency from the supported channel set, and a DFS recovery interval specifying a time after the end of the DFS interval when recovery procedures are initiated if no channel switch information was received during that DFS interval. Channel switch information is presented in beacons following the end of the channel selection process, and within beacons during the DFS recovery interval.” (EX1010, Abstract.) (EX1002, ¶216.)

2. Claim 33

- a) **33[pre]: A wireless network device, comprising**

See 1[pre]. Ganz/Larrick discloses this limitation. (EX1002, ¶217.)

- b) **33[a]: a wireless transmitter that is capable of transmitting wireless data through OFDM electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz;**

See 1[a]. Ganz/Larrick discloses transmitting wireless data through electromagnetic signals with these bandwidths. (EX1002, ¶218.)

- c) **33[b]: a wireless receiver that is capable of receiving wireless data through OFDM electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz;**

See 1[b]. Ganz/Larrick discloses receiving wireless data through electromagnetic signals with these bandwidths. For the reasons discussed above in limitation 33[a], IEEE 802.11a discloses transmitting and receiving wireless data through OFDM electromagnetic signals. (EX1002, ¶219.)

- d) **33[c]: wherein the wireless network device is configured for processing wireless data received by the wireless receiver,**

See 1[d]. Ganz/Larrick discloses this limitation. (EX1002, ¶220.)

- e) **33[d]: wherein the wireless network device is configured for determining whether any, a portion, or all information in the processed wireless data should be transmitted by the wireless transmitter,**

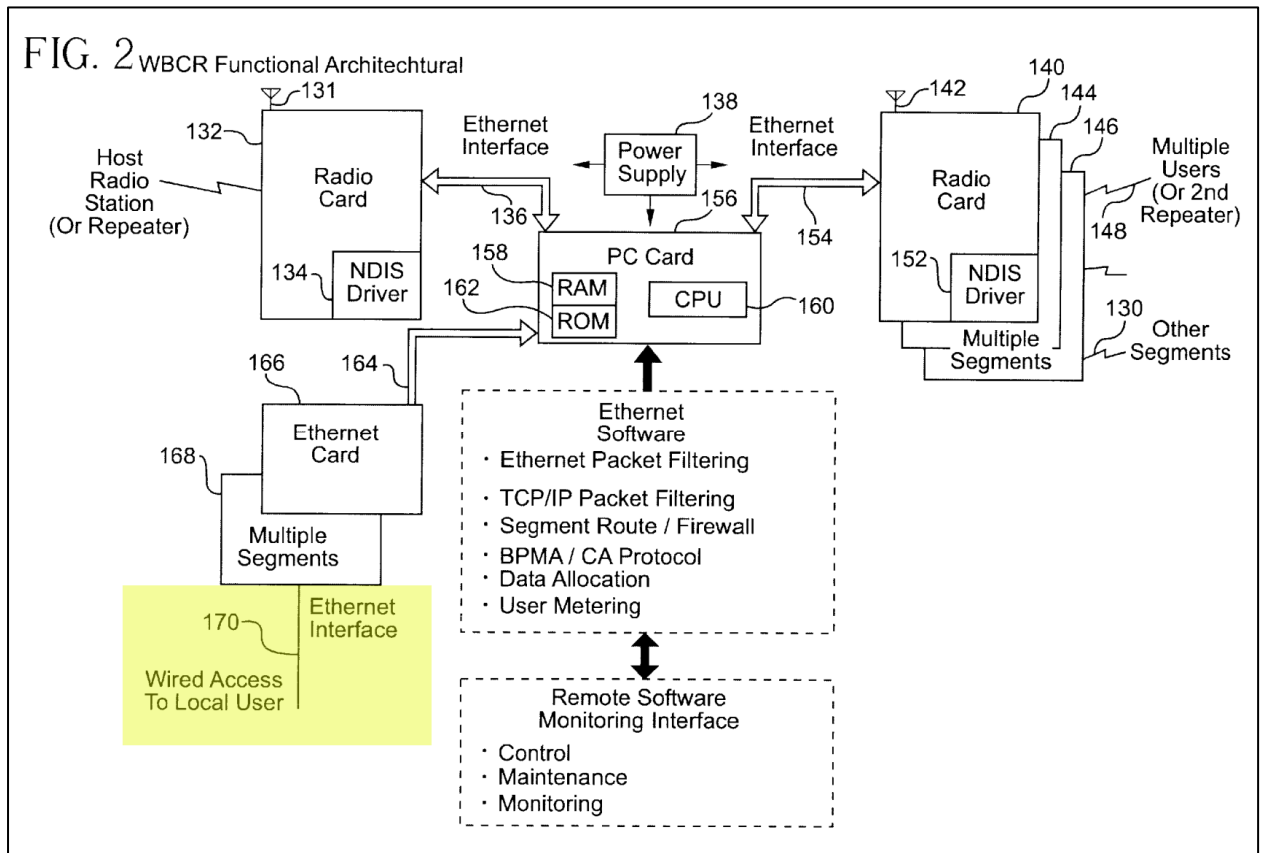
See 1[e]. Ganz/Larrick discloses this limitation. (EX1002, ¶221.)

- f) **33[e]: wherein the wireless network device comprises**

Ganz/Larrick discloses that the wireless networking device comprises the following limitations. (EX1002, ¶222.)

- g) **33[f]: a wired connection port which permits a wired internet connection wherein the wireless network device is configured for transmitting and receiving wired data through the wired connection port,**

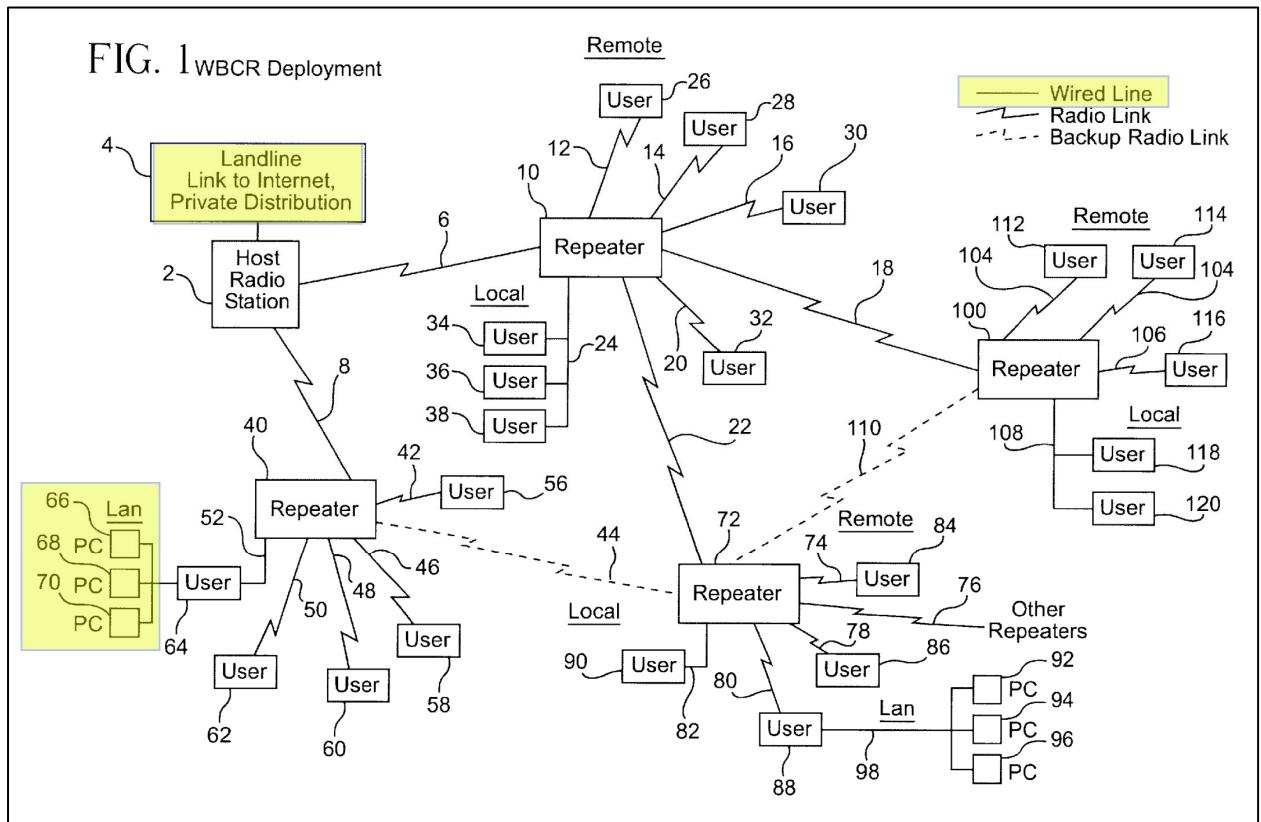
Ganz describes “[e]thernet circuits 166, 168 are included within the WBCR to provide wired access to users locally coupled to the WBCR.” (EX1005, 4:19-21.) (EX1002, ¶223.)



- h) 33[g]: wherein the wireless transmitter is configured for transmitting wireless data that contains information present in or determined from received wired data, and

Ganz describes that “[t]he 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.” “The users may also be electrically connected to a local area

network for further distribution of the data.” (EX1005, 3:39-43 and Abstract.)
(EX1002, ¶224.)



- i) **33[h]: wherein the wireless network device is configured for transmitting via the wired connection port wired data that contains information present in or determined from wireless data that has been received by the wireless receiver.**

Ganz discloses that, generally, “[t]he processor 204 performs per-packet processing and is responsible for examining data packets from incoming ports, looking up a destination address and queuing the data packets to an appropriate port for transmission.” (EX1005, 9:5-9.) In addition, “users maybe electrically connected to a local area network for further distribution of the data.” (*Id.*, Abstract.) Moreover,

“[t]he WBCR ‘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**). The data packets are encapsulated at different open system interconnection (OSI) levels.” (EX1005, 4:36-40.) Ganz also describes that “[t]he routing table 270, determines whether data packets should be sent back to the packet exchange bus for delivery to another radio, or if they should be delivered to the local Ethernet.” (EX1005, 13:5-9.) Ganz also claims receiving a data packet by a radio/data link element of a wireless repeater and “routing the received data packets addressed to the at least one of the plurality of repeaters through the forwarding engine TCP/IP stack including passing the data packets through the routing table to determine whether the received data packets should be sent back to the packet exchange bus for delivery to another repeater or to deliver the packets **to an Ethernet local to the at least one of the plurality of wireless communication repeaters.**” (*Id.*, 16:10-20.) (EX1002, ¶225.)

3. Claim 34

- a) **The wireless network device of claim 33 wherein the wireless network device is configured for processing received wired data and determining whether any, a portion, or all information in the processed wired data should be transmitted as wireless data to one or more other devices by the wireless transmitter.**

See limitations 1[d] and 1[e]. Ganz/Larrick discloses this limitation. (EX1002,

¶226.)

4. Claim 35

- a) **The wireless network device of claim 33 wherein the wireless network device is configured for providing an internet connection to one or more other devices.**

See claim 33. Ganz/Larrick discloses this limitation. (EX1002, ¶227.)

5. Claim 36

- a) **The wireless network device of claim 33 wherein the wired internet connection is an Ethernet connection.**

See claim 33. Ganz/Larrick discloses this limitation. (EX1002, ¶228.)

6. Claim 39:

- a) **39[pre]: A wireless network device, comprising:**

See 1[pre]. Ganz/Larrick discloses this limitation. (EX1002, ¶229.)

- b) **39[a]: a wireless transmitter configured for transmitting wireless data through OFDM electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz;**

Ganz/Larrick discloses transmitting wireless data through electromagnetic signals with these bandwidths. *See* 1[a]. Soomro discloses transmitting and receiving wireless data through OFDM electromagnetic signals. *See* 33[a]. (EX1002, ¶230.)

- c) **39[b]: a wireless receiver is configured for receiving wireless data through OFDM electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz;**

Ganz/Larrick discloses receiving wireless data through electromagnetic signals with these bandwidths. *See* 1[b]. Soomro discloses transmitting and receiving wireless data through OFDM electromagnetic signals. *See* 33[a]. (EX1002, ¶231.)

- d) **39[c]: wherein the wireless transmitter is configured for transmitting wireless data that contains information present in or determined from wireless data that has been received by the wireless receiver,**

See 1[c]. Ganz/Larrick discloses this limitation. (EX1002, ¶232.)

- e) **39[d]: wherein the wireless network device is configured for processing wireless data received by the wireless receiver,**

See 1[d]. Ganz/Larrick discloses this limitation. (EX1002, ¶233.)

- f) **39[e]: wherein the wireless network device is configured for determining whether any, a portion, or all information in the processed wireless data should be transmitted by the wireless transmitter.**

See 1[e]. Ganz/Larrick discloses this limitation. (EX1002, ¶234.)

XI. Ground 5: Ganz, Larrick, Soomro in Combination with Bareis Renders Claims 37-38 Obvious

A. Overview and Motivation to Combine

Bareis teaches wired internet connections that include coaxial and optical. Such technologies were conventional and well-known by the time of the '999 patent. (EX1002, ¶235.)

A POSITA would have been motivated to incorporate Bareis's teachings because of the well-known advantages of coaxial or optical internet connections.

Indeed, either technology was a design choice given the limited number of available wired broadband technologies at the time. (EX1002, ¶236.)

Coaxial was known to be advantageous because of its use of pre-installed coaxial lines that were and are present in many homes. Coaxial lines were installed decades ago to provide cable television to homes. In addition, coaxial provides excellent speeds and reliable performance. (EX1002, ¶237.)

Wired optical internet, especially optical fiber, had the advantage of high speed and low latency given its use of light and fiber optics for transmitting signals. (EX1002, ¶238.)

A POSITA would have had a reasonable expectation of success combining Ganz-Larrick-Soomro with Bareis. Coaxial and optical were a well-known and conventional broadband 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. (EX1002, ¶239.)

B. Limitation-By-Limitation Analysis

1. Claim 37:

- a) The wireless network device of claim 33 wherein the wired internet connection is a coaxial connection.**

Bareis discloses that its broadband multidrop local network's internet

connection “could consist of **coaxial cable in a cable network.**” (EX1009, [0036].)

In Figure 2, for example, “a building 80 contains at least one network device to be connected via twisted-pair wire 84 to Local Interconnect Company 70 through demarcation point 82, thence via a short run of outside plant wiring 76, through a broadband multidrop local network interface 86, and **finally through an outside plant optical fiber or coaxial cable 74.**” (EX1009, [0042].) (EX1002, ¶240.)

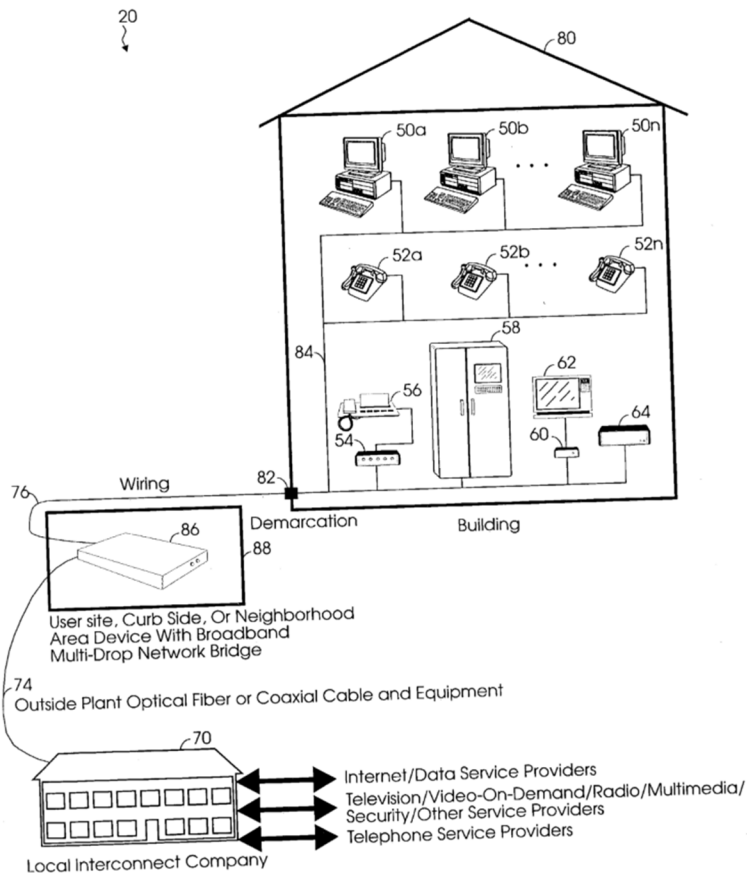


FIG. 2

2. Claim 38:

- a) The wireless network device of claim 33 wherein the wired internet connection is a wired optical cable

connection.

Bareis discloses that “optical versions” of its claimed network “could be deployed using optical fiber to transport the data in the network.” (EX1009, [0036].) In Figure 2, for example, “a building 80 contains at least one network device to be connected via twisted-pair wire 84 to Local Interconnect Company 70 through demarcation point 82, thence via a short run of outside plant wiring 76, through a broadband multidrop local network interface 86, and **finally through an outside plant optical fiber or coaxial cable 74.**” (EX1009, [0042].) (EX1002, ¶241.)

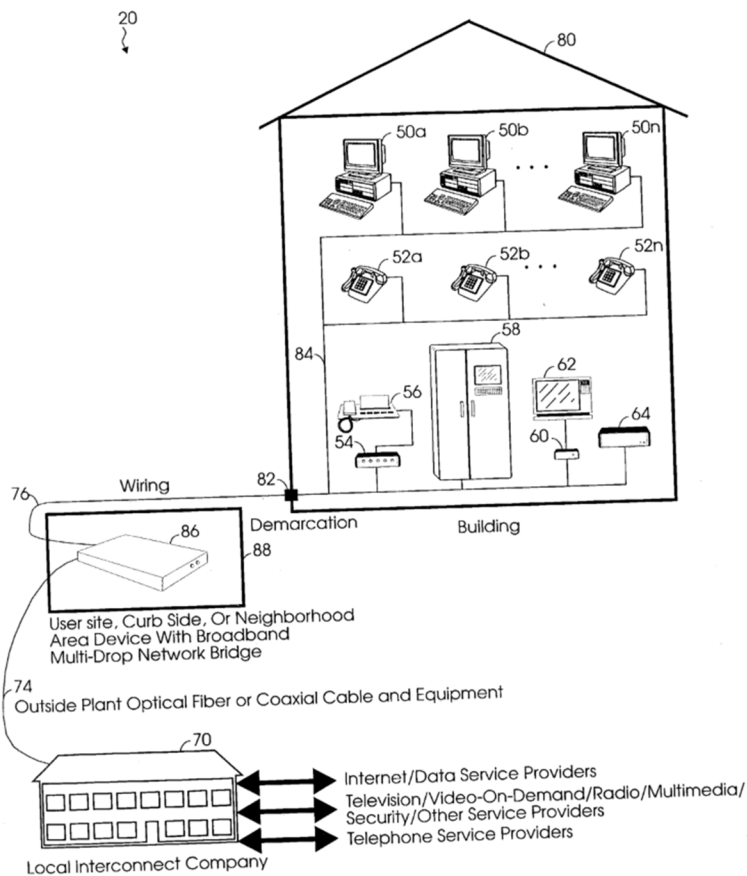


FIG. 2

XII. GROUND 6: Ganz and Larrick in Combination with Garndner Renders Claims 27-28 Obvious

A. Overview and Motivation to Combine

Gardner³ discloses the simultaneous use of multiple 20 MHz channels to transmit data. For example, Gardner discloses that “[m]ulti-channel extended 802.11 systems might simultaneously transmit on several 20 MHz channels.” (EX1013, ¶26.) Further, Gardner teaches that its techniques for using multiple channels can use an “arbitrary number of channels.” (*Id.*, ¶52.) This allows an increase in data rates. (*Id.*, ¶26.) Under Patent Owner’s apparent interpretation of “have a bandwidth,” wherein a bandwidth of 100 MHz or 160 MHz can be met by simultaneously transmitting over multiple channels, Gardner teaches bandwidths of 100 MHz and 160 MHz. (EX1002, ¶242.)

³ To the extent Patent Owner argues that Gardner is not prior art, claims 27 and 28 of the ’999 patent are not entitled to the filing date of the provisional applications 60/498,324 and 60/496,913. EX1011, EX12. Neither application describes a wireless transmitter with bandwidth at 100 or 160 MHz and a data rate greater than 100 megabits per second. Indeed, the provisional applications are directed to UWB radios with a bandwidth greater than 500 MHz, which was how the FCC defined the term at the time of the provisional applications.

A person of ordinary skill in the art would have been motivated to employ multiple 20 MHz channels, such as aggregated 100 or 160 MHz channels, in the design of an 802.11 repeater in order to increase the aggregate throughput of Ganz/Larrick available for user data. By 2003, it was well understood in the wireless networking field that the 20 MHz channel width defined in the original IEEE 802.11 standards imposed a practical limit on data rates. Aggregating multiple adjacent channels as taught in Gardner offered a straightforward way to scale bandwidth without requiring fundamentally new modulation or coding schemes. A skilled artisan would have recognized that using wider effective channels allowed the repeater to handle higher-speed traffic and to support emerging multimedia applications such as streaming video and high-quality voice over IP, which were becoming important drivers of WLAN adoption. Indeed, Gardner itself teaches that by using its “multi-channel” techniques, “data rates can be increased over 802.11a data rates.” (EX1013, ¶26.) (EX1002, ¶243.)

In addition, a person of skill would have appreciated that repeaters are often performance bottlenecks because they must receive and retransmit packets, effectively doubling the airtime for a given payload. Increasing the channel bandwidth directly offsets this constraint by raising the available data rate. At the time, proposals within the IEEE 802.11 working groups were already exploring channel bonding and other mechanisms to expand beyond 20 MHz operation, and

chip vendors were experimenting with multi-channel front ends. Thus, incorporating multiple 20 MHz channels into a repeater design would have been seen as a natural and predictable variation to improve throughput, reduce latency associated with store-and-forward relaying, and maintain competitiveness with other high-speed wireless standards that were emerging in the early 2000s. (EX1002, ¶244.)

A POSITA would have had a reasonable expectation of success combining Ganz-Larrick with Gardner. Gardner in fact teaches how to use its multi-channel techniques, such as through the use of a “modified preamble” within each channel, a modification that was well-within the skill of an ordinary artisan. (EX1013, Abstract.) (EX1002, ¶245.)

B. Limitation-By-Limitation Analysis

1. Claim 27:

Patent Owner’s infringement contentions contend that this claim is met by a “non-contiguous spectrum” that “comprises two 4 channels (20 MHz) that are bonded together and concatenated to form 160 MHz non-contiguous spectrum.” (EX1014, 21.) Under Patent Owner’s construction, Gardner discloses transmitting wireless data with a bandwidth of 100 MHz. Specifically, Gardner describes “simultaneously transmit[ting] on several 20 MHz channels” through the use of 802.11a signals. (EX1013, ¶26.) By doing so, Gardner expressly teaches achieving a “100 MHz channel[]” bandwidth. (EX1013, ¶¶28, 30.) (EX1002, ¶246.)

2. Claim 28:

See claim 27. Under Patent Owner's construction, Gardner discloses the aggregation of an arbitrary number of 20 MHz channels. A POSITA would recognize that eight 20 MHz channels could be aggregated to arrive at 160 MHz of bandwidth. A POSITA would have also found it obvious to aggregate eight 20 MHz channels in order to increase bandwidth and data rates compared to the expressly disclosed 100 MHz aggregated bandwidth. The use of these additional channels would have reasonably expected to succeed as Gardner teaches the use of an arbitrary number of channels, which can be achieved by simply adding additional antennas to the transmitter. (EX1002, ¶247.)

XIII. CONCLUSION

For at least the foregoing reasons, this Petition should be instituted.

Respectfully submitted,

Date: September 30, 2025

/s/ James M. Glass

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CERTIFICATION UNDER 37 C.F.R. § 42.24

Under the provisions of 37 C.F.R. § 42.24, the undersigned hereby certifies that the word count for the foregoing Petition for *inter partes* review (excluding the table of contents, table of authorities, mandatory notices, certificate of service or word count, and appendix of exhibits or claim listing) totals 13,742 words, which is within the word limit allowed under 37 C.F.R. § 42.24(a)(1)(i).

Date: September 30, 2025

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6(e), 42.105(a), the undersigned hereby certifies service on the PO of a copy of this Petition and its respective exhibits at the official correspondence address for the attorneys of record for the '999 patent as shown in USPTO PAIR via FedEx:

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

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