

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

A. Overview and Motivation to Combine

81. ~~As discussed in more detail~~In my opinion, Ganz in combination with Larrick renders claims 1-11, 16-25, and 27-31 obvious. As I explain 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~~ultra-wideband transmitter and receiver, with data rates of at least 100 megabits per second and bandwidth between 100 and 500 MHz. ~~(EX1002, ¶81.)~~

82. 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

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

easily implemented into Ganz without technical challenge and with a reasonable expectation of success. ~~(EX1002, ¶82.)~~

83. 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.)~~

84. 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.)~~

85. Larrick’s UWB technology, which offers waveform adaptation that could improve signal ~~propagation~~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

86. 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.)~~

87. 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

88. 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.)
(EX1005, 8:39-40.)

Link Quality Assessment and Power Efficiency

89. 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.)

90. 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

91. 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~~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.)~~

92. 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.)~~

93. 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.)~~

94. 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.)~~

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

B. Limitation-By-Limitation Analysis

1. Claim 1

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

96. To the extent the preamble is limiting, Ganz discloses this limitation.

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.)~~

97. 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~~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.)~~

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

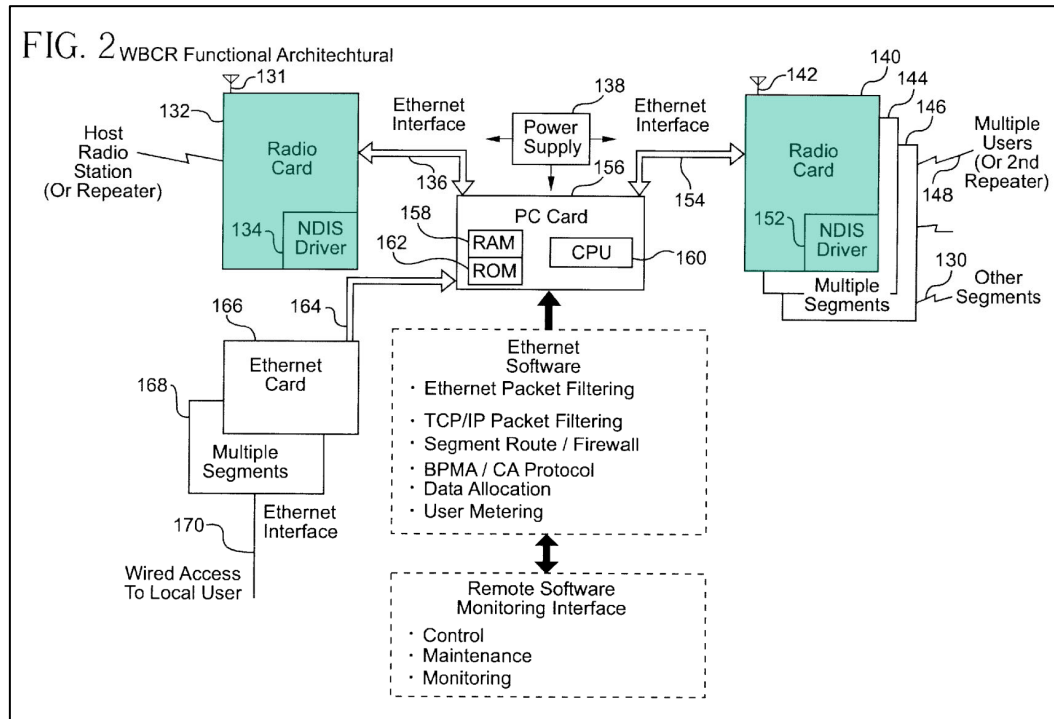
- b) **1[a]: a wireless transmitter that is configured for transmitting wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz at a data rate greater than or equal to 100 megabits per second and less than or equal to 480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

99. Ganz/Larrick-discloses this limitation.

“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”

100. 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.)~~



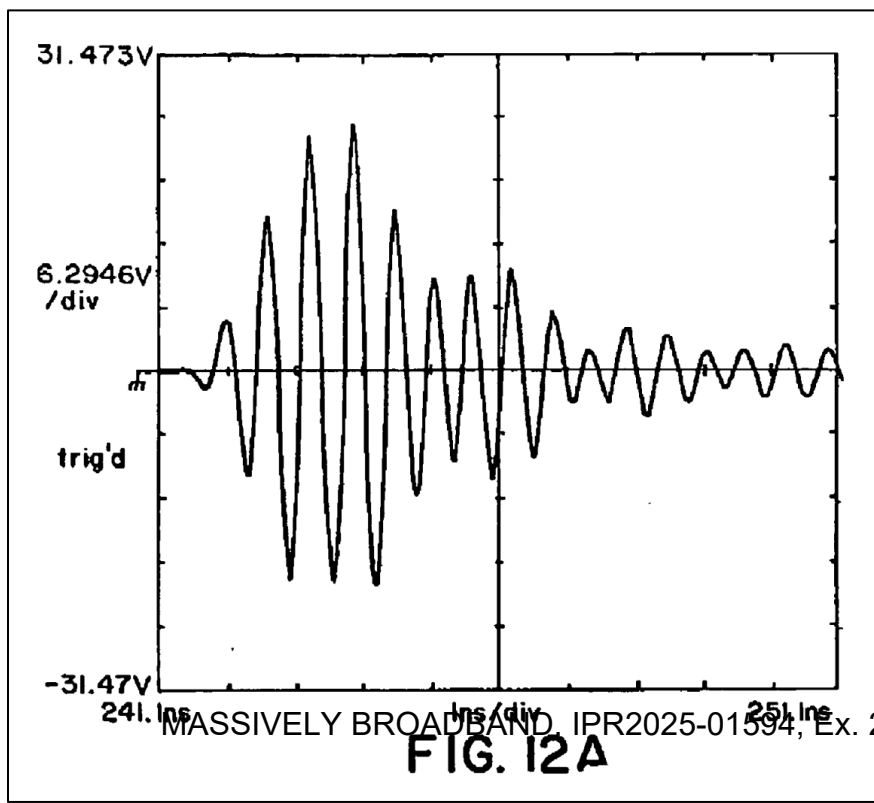
101. Ganz does not expressly disclose that the transmitter is configured for transmitting wireless data through signals that have a 100-500 MHz bandwidth. However, Larrick discloses a transmitter using the claimed bandwidth and as discussed above, a POSITA would have been motivated to combine Ganz and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

102. Larrick “relates to the field of ultra-wideband communication systems. More particularly, [Larrick] relates to the controlled transmission and reception of ~~ultra—wideband~~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

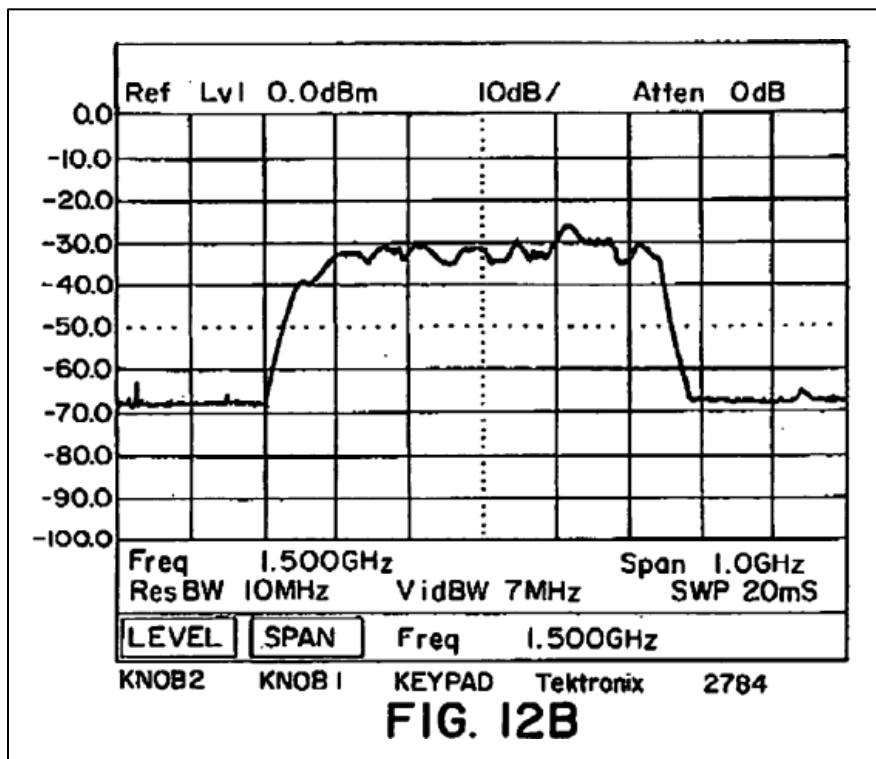
of bandpass filter 102 provides complete control over all aspects of the spectral emissions of the UWB transmitter. This is because the spectral emissions are determined exactly by the characteristics of bandpass filter 102, for instance by the center frequency, bandwidth, out of band rejection and skirt responses.” (*Id.*, 11:26-35.) ~~(EX1002, ¶102.)~~

103. 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.~~)

104. 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~~Id., 10:65-

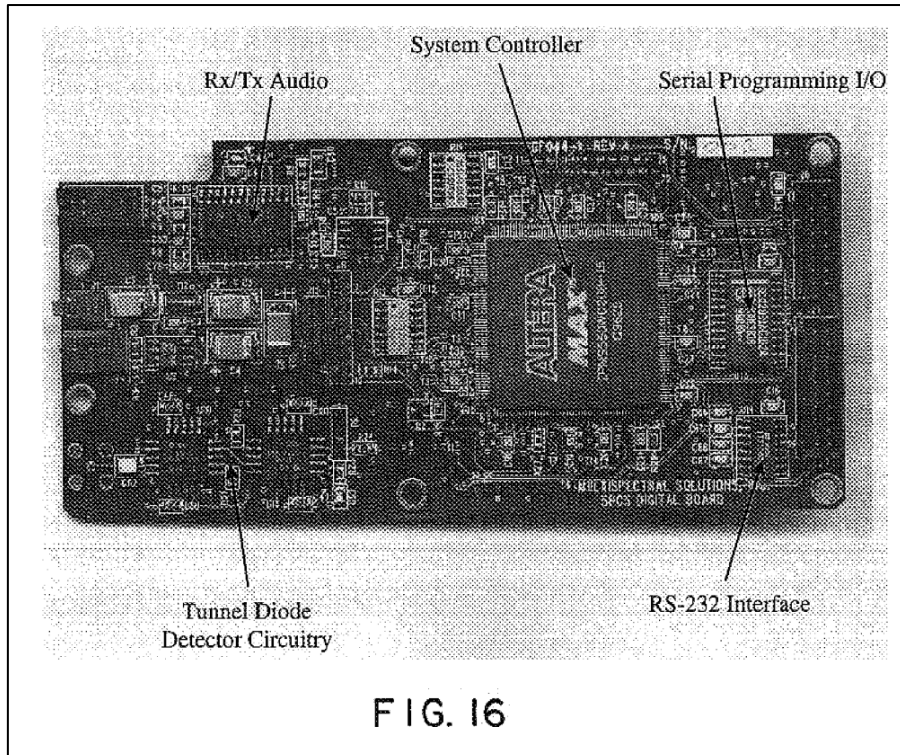


11:4). (~~EX1002, ¶104.~~)

105. FIG. 16 “a photograph of a circuit board of a transceiver utilizing the present invention” (~~EX1007~~id., 9:7-8) “shows the UWB receiver imbedded in a full duplex, voice/data ultra wideband transceiver. The RF section of this particular unit (lower left hand side) is wideband from a few MHz to beyond 4 GHz. Tunnel diodes with adequate response characteristics to 26 GHz and beyond are currently

available, and thus **the UWB receiver can readily accommodate a wide variety of center**

frequencies between a few MHz upwards toward 26 GHz.” (*Id.* 21:54-61.) ~~(EX1002, ¶105.)~~



106. 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 19:35–21:35-21:12) 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”

107. 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~~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.)

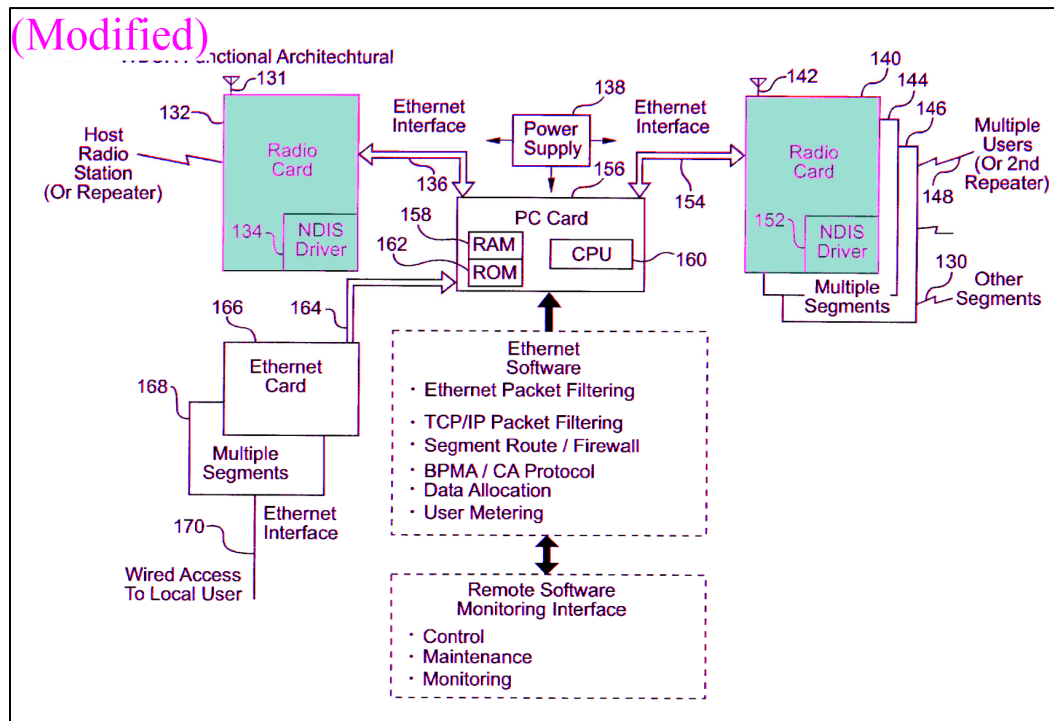
- c) 1[b]: a wireless receiver that is configured for receiving wireless data through electromagnetic signals that have a bandwidth greater than or equal to 100 MHz and less than or equal to 500 MHz at a data rate greater than or equal to 100 megabits per second and less than or equal to 480 megabits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

108. Ganz/Larrick discloses this limitation.

“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”

109. 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

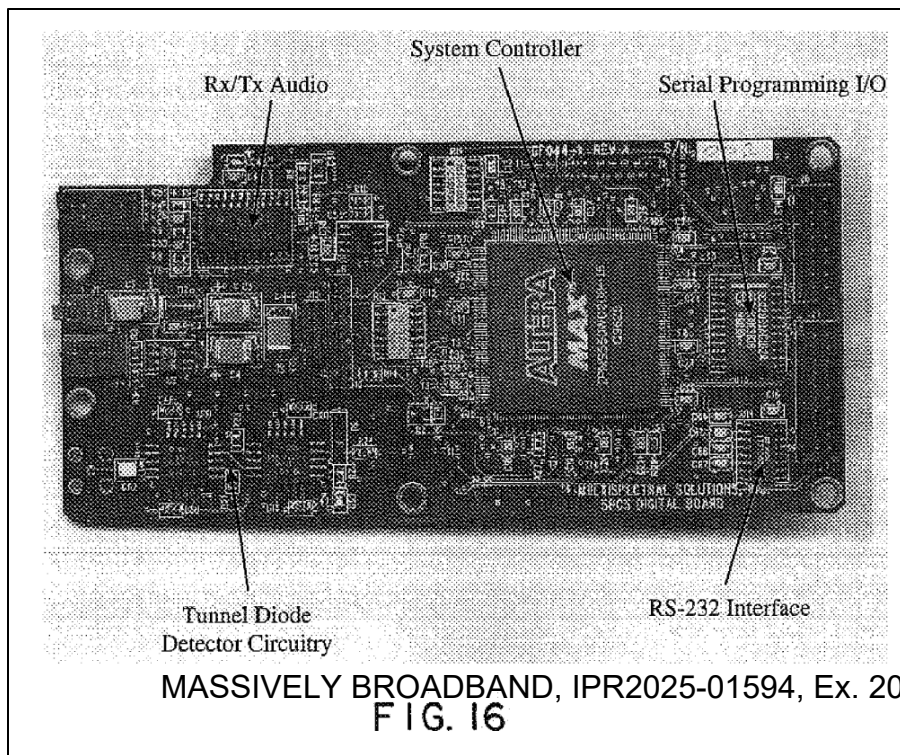
functions, such that the data packets coming from the user side, are received by the second radio transceiver circuit 140.” (EX1005, 4:22-24.) ~~(EX1002, ¶109.)~~



110. 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)~~

111. ➔ 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.)~~

112. FIG. 16 “a photograph of a circuit board of a transceiver utilizing the present invention” (~~EX1007~~, *id.*; 9:7-8) “shows the UWB receiver imbedded in a full duplex, voice/data ultra wideband transceiver. The RF section of this particular unit (lower left hand side) is wideband from a few MHz to beyond 4 GHz. Tunnel diodes with adequate response characteristics to 26 GHz and beyond are currently



available, and thus the UWB receiver can readily accommodate a wide variety of center frequencies between a few MHz upwards toward 26 GHz.” (*Id.*; 21:54-61.)

~~(EX1002, ¶112.)~~

113. 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~~*Id.*, 24:52-25:5; 26:17-30.)

~~(EX1002, ¶113.)~~

114. 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”

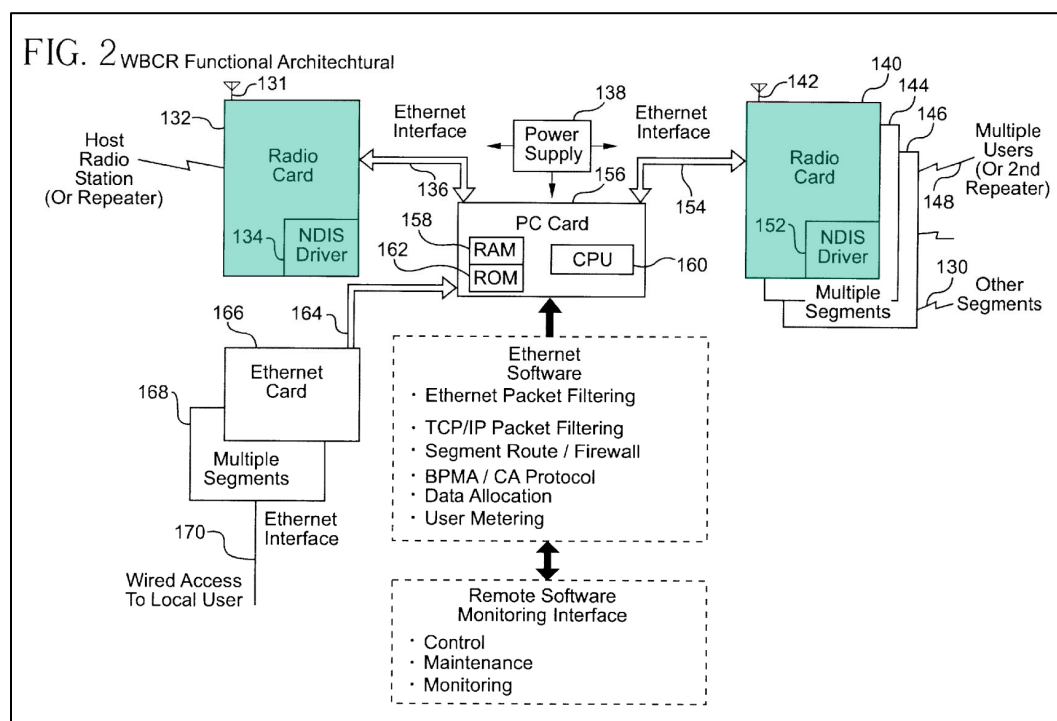
115. Larrick discloses a receiver with the claimed bandwidth and data rates and, as discussed above, a POSITA would have been motivated to combine Ganz

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;

116. Ganz/Larrick discloses this limitation.

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



~~(EX1002, ¶117.)~~

118. 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**

119. Ganz/Larrick discloses this limitation. 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.)~~

120. 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.~~)

121. Ganz also discloses that the WBCR performs “IP filtering,” which “allows for certain data packets to be blocked, *processed* according to QoS policies and used to assess and sort according to traffic load on each WBCR radio segment.” (*Id.*, 11:~~45–48~~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.~~)

122. 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.**

123. Ganz/Larrick discloses this limitation.

124. 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~~36- 39). (~~EX1002, ¶124.~~)

125. 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.~~)

126. 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-~~

45-48

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.)~~

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