

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

COMCAST CABLE COMMUNICATIONS, LLC,
Petitioner,

v.

ENTROPIC COMMUNICATIONS, LLC,
Patent Owner.

Patent No. 7,889,759

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Title: BROADBAND CABLE NETWORK UTILIZING COMMON BIT-
LOADING

Inter Partes Review No.: IPR2024-00452

**DECLARATION OF JAMES BERTONIS IN SUPPORT OF PETITION
FOR *INTER PARTES* REVIEW OF U.S. PAT. NO. 7,889,759**

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I, James G. Bertonis, declare that I have personal knowledge of the facts set forth in this declaration and, if called to testify as a witness, could and would do so competently.

I. INTRODUCTION

1. I have been retained as an expert witness on behalf of the Petitioner, Comcast Cable Communications, LLC, for the above-referenced *inter partes* review proceeding.

2. I have been asked to provide a declaration with my opinions regarding certain matters pertaining to the patentability of U.S. Patent No. 7,889,759 (“the ’759 patent”). I understand that the ’759 patent is owned by Entropic Communications, LLC (“Patent Owner”).

3. I am being compensated at my usual consulting rate for my work on this matter. My compensation is in no way dependent upon my opinions or testimony or the outcome of this proceeding. I have no financial interest in the parties or in the outcome of this proceeding.

II. PROFESSIONAL BACKGROUND AND QUALIFICATIONS

4. I offer statements and opinions on behalf of Petitioner Comcast Cable Communications, LLC (“Comcast” or “Petitioner”), generally regarding the validity, novelty, prior art, obviousness considerations, and understanding of a

person of ordinary skill in the art (“POSITA”) as it relates to the ’759 patent. Attached hereto as Appendix A, is a true and correct copy of my Curriculum Vitae describing my background, experience, and publications.

5. I received a B.S. in Electrical Engineering from Syracuse University in 1976, and an MBA from Santa Clara University in 1986. While at Syracuse University, I concentrated my senior year studies on communications engineering, including graduate level courses in this area taken as an elective. I also worked for the University part time as a paid assistant in their communications engineering lab during my last two years at the University.

6. After graduating from Syracuse University, my entire career has been devoted to the field of RF and wireless communications, both as an accomplished RF circuit design engineer, as well as the founding CEO of four wireless communications companies, and one continuing as the CTO post-merger.

7. I have also worked as a consultant on several occasions, both in the area of wireless circuit/product design engineering, and later during my career as an expert in the field of wireless communications technology.

8. In 2000 I presented a paper titled "High Speed Wireless Internet over Unlicensed Radio Bands - An Innovative Approach" which was published in Private Wireless & Broadband Magazine, June 2000. The paper focused on the application of the cable standard DOCSIS for use in wireless Internet networks.

9. During my time at ARCi, and later Arcwave (from 2000 to 2008), I was involved with numerous DOCSIS related engineering activities. This included developing a RF communications system for the cable industry, which extended the reach of cable modems by using a RF link to bring DOCSIS to areas not served by coaxial or fiber cable infrastructure. This product was purchased by all of the major cable operators and incorporated into numerous cable services.

10. During my time at Azurecomm (where I am currently employed) I was involved (from 2009 to 2012) with engineering a mobile WiMAX (802.16e) micro base station product. This work included developing the RF and baseband electronic modules and operating PHY and MAC software compliant to the WiMAX standard, to be sold and licensed to other wireless infrastructure manufacturers.

11. During this time developing a WiMAX (802.16e) product, I was involved with designing the multi-carrier RF modulators and demodulators, which were configured to process an OFDMA signal. OFDMA was the specified modulation and multiplexing format used by WiMAX.

12. During my time working for ADBS Corp., and also working as a consulting engineer (from 1986 to 2000), I was involved with numerous wireless local area network (WLAN) engineering activities. This included developing a WLAN module for Toshiba laptop computers (1990-1992), developing a WLAN

system for the golfing industry (1995-1996), and also consulting on wireline DSL multi-carrier related product engineering and development (1990-2000).

13. During this time period I also actively participated in the IEEE 802.11 WLAN standards body (1992-2000) as a voting member.

14. During this same time developing multiple WLAN products, I was involved with designing all of the RF and analog circuitry. This included designing the RF signal modulators and demodulators. These modulators and demodulators were configured to process the FSK, MSK, QPSK, QAM, and CDMA signals, which were the modulation formats that were used with Wi-Fi during that period.

15. Among my work-related achievements, I was awarded four U.S. patents (from 2003 to 2011, as listed in my CV) in the area of DOCSIS and wireless communications stemming from my work adapting the DOCSIS cable modem protocol, by now the leading broadband standard in the world, to operate over wireless communications channels. This technology was successfully employed by ARCi, and later Arcwave Inc., where I was involved with designing and bringing this technology to market.

16. My CV is included as Appendix A, which lists some of the companies I have been employed by, the projects I have worked on, as well as some of my consulting and expert witness activities.

III. MATERIALS REVIEWED

17. In connection with my study of this matter and reaching the opinions stated herein, I have reviewed a number of documents including the exhibits listed in Appendix B.

IV. UNDERSTANDING OF APPLICABLE LEGAL STANDARDS

18. Although I am not an attorney, I have a general understanding of the applicable legal standards pertaining to the patentability issues presented in this proceeding.

19. I understand that in this *inter partes* review (IPR) the Petitioner is challenging the patentability of claims 1-23 of the '759 patent. I understand that Petitioner has the burden of proving that each challenged claim is unpatentable by a preponderance of the evidence.

20. I understand that an analysis of patent claim validity first requires that the patent claims be properly construed, and that claim construction is determined as a matter of law. I address claim construction further as it pertains to my analyses in a subsequent section of my declaration.

21. I understand that to be valid, a (properly construed) patent claim must be “novel,” and is invalid if “anticipated” by a single prior art reference. I further understand that a reference anticipates if it discloses each and every element as

arranged in the claim, so as to enable a person of ordinary skill in the art (a “POSITA”) to make and use the claimed invention without undue experimentation.

22. I understand that a patent claim is unpatentable if, at the time of the invention, it would have been obvious to a POSITA to combine the teachings of the prior art to yield the patent claim. I also understand that it is not required (although it is acceptable) that each element/limitation of a patent claim be found in a single reference in order to find a patent claim obvious. For a patent claim to be found obvious, all the elements/limitations of the patent claim may be found in a combination of references at which a person of ordinary skill in the art would have been reasonably expected to arrive. I understand that a proper analysis of whether an invention is unpatentable for obviousness includes a review of the scope and content of the prior art, the differences between the patent claims at issue and the prior art, the level of ordinary skill in the field of the invention at the time of the invention, and other objective considerations identified below.

23. It is my understanding that the prior art and claimed invention should be viewed through the knowledge and understanding of a person of ordinary skill in the art at the time of the invention – one should not use his or her own insight or hindsight in deciding whether a claim is obvious. I further understand that a claim may be rendered obvious if a person of ordinary skill in the art could have implemented the claimed invention as a predictable variation of a known product.

I also understand that a person of ordinary skill in the art is presumed to have knowledge of the relevant prior art at the time of the claimed invention, which comprises any prior art that was reasonably pertinent to the particular problems the inventor faced.

24. I understand that a showing of obviousness requires some articulated reasoning with a rational underpinning to support the combination of the references. I understand that in consideration of the issue of obviousness it is important to identify whether a reason existed at the time of the invention that would have led a POSITA to combine elements of the references in a way that yields the claimed invention.

25. I understand that a claim may be considered unpatentable for obviousness for various reasons. I have been informed that the following exemplary rationales may support a finding of obviousness:

- (A) combining prior art elements according to known methods to yield predictable results;
- (B) simply substituting one known element for another to obtain predictable results;
- (C) use of a known technique to improve similar devices in the same way;
- (D) applying a known technique to a known device ready for improvement to yield predictable results;

- (E) choosing from a finite number of identified, predictable solutions with a reasonable expectation of success;
- (F) known work in a field that prompts variations in the work in the same or a different field that leads to predictable results; and
- (G) some teaching, suggestion, or motivation in the prior art that would have led a person of ordinary skill in the art to modify a prior art reference or combine multiple prior art references or teachings to arrive at the claimed invention.

26. I understand that various objective or “real world” factors, also referred to as secondary considerations, may be indicative of non-obviousness. I understand that such factors/considerations include:

- (A) the commercial success of the claimed invention;
- (B) the existence of a long-felt, unresolved need for a solution to the problem solved by the claimed invention;
- (C) failed attempts to solve the problem solved by the claimed invention;
- (D) copying of the claimed invention;
- (E) unexpected results of the claimed invention;
- (F) praise for the claimed invention by others in the relevant field; and
- (G) willingness of others to accept a license under the patent because of the merits of the claimed invention.

27. It is my understanding that the prior art references themselves may provide a suggestion, motivation, or reason to combine, but other times the link may be common sense. I further understand that the obviousness analysis recognizes that market demand, rather than scientific literature, often drives innovation, and that is sufficient motivation to combine references.

28. It is my understanding that a particular combination may be proven obvious merely by showing that it was obvious to try the combination. For example, common sense is a good reason for a person of ordinary skill to pursue known options when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions.

29. I further understand that a proper obviousness analysis focuses on what was known or obvious to a person of ordinary skill in the art, not just the patentee. Accordingly, it is my understanding that any need or problem known in the field at the time of invention and addressed by the patent can provide a reason for combining the limitations in the manner claimed.

V. TECHNICAL BACKGROUND

A. Digital Data Modulation

30. A basic understanding of digital data transmission and modulation techniques is important to an appreciation of the issues presented. A brief summary is presented here, with references to the industry text *Modern Cable Television*

Technology: Video, Voice, and Data Communications by Walter Ciciora, First Ed. (1999). Ex. 1012.

31. The objective of digital data transmission in a network is to get a stream of bits from one network location (i.e., node) to one or more others. It is possible to transmit bits of data over a RF carrier, using the same variables as are used in analog transmission. One can vary, that is modulate, the amplitude, frequency, or phase of the carrier, with the information to be transmitted. *Id.*, 21 (§ 4.2).

32. A measure used for comparing different modulation formats is “spectral efficiency.” Spectral efficiency is expressed in bits per Hertz, that is, the number of bits per second of data, divided by the bandwidth required to transmit it. A modulation format with high spectral efficiency can transmit more bits per second of data in the same number of Hertz of RF bandwidth. On the other hand, format can be expected to cost more and be less robust (i.e., more susceptible to noise and transmission distortion). *Id.*, 21-22 (§ 4.2.1).

33. A brief summary of some of the types of digital data modulation well known at the time of the alleged invention of the ’759 patent is now presented, generally progressing from lowest to highest in terms of spectral efficiency. Generally, each format builds on the previous in terms of its structure and required processing.

34. First, we have **frequency shift keying (FSK)**. In this simplest commonly used modulation method, information is transmitted by shifting an oscillator between two frequencies. *Id.*, 22 (§ 4.2.2). FSK modulation is used for relatively low-speed data transmissions, including certain downstream data transmissions to addressable cable TV set-top terminals. The spectral efficiency of FSK is very poor, but this is relatively unimportant in low-speed applications. On the positive side, the transmission is robust, meaning it is not easily damaged by noise or distortion. Also, the required hardware is relatively low in cost. For further detail regarding FSK, *see id.*, 22-26.

35. Next, we have **bi-phase shift keying (BPSK)**. In a BPSK system, the phase is shifted 180° between transmission of a zero and a one. *Id.*, 26 (§ 4.2.6). BPSK modulation provides very good immunity to noise, is simple, and is low in cost. Its downside is that, similar to FSK, it is inefficient in its use of the spectrum. For further detail, *see id.*, 26-34.

36. In order to make better use of the spectrum, possible states can be represented by different analog levels and/or phases, transmitting more than one bit at a time. The next modulation formats to be discussed are expansions of BPSK, which improve on the spectrum efficiency by transmitting more than one bit at a time. The penalties are an increasing complexity and reduced immunity to noise and other transmission impairments. *Id.*, 34 (§ 4.2.8).

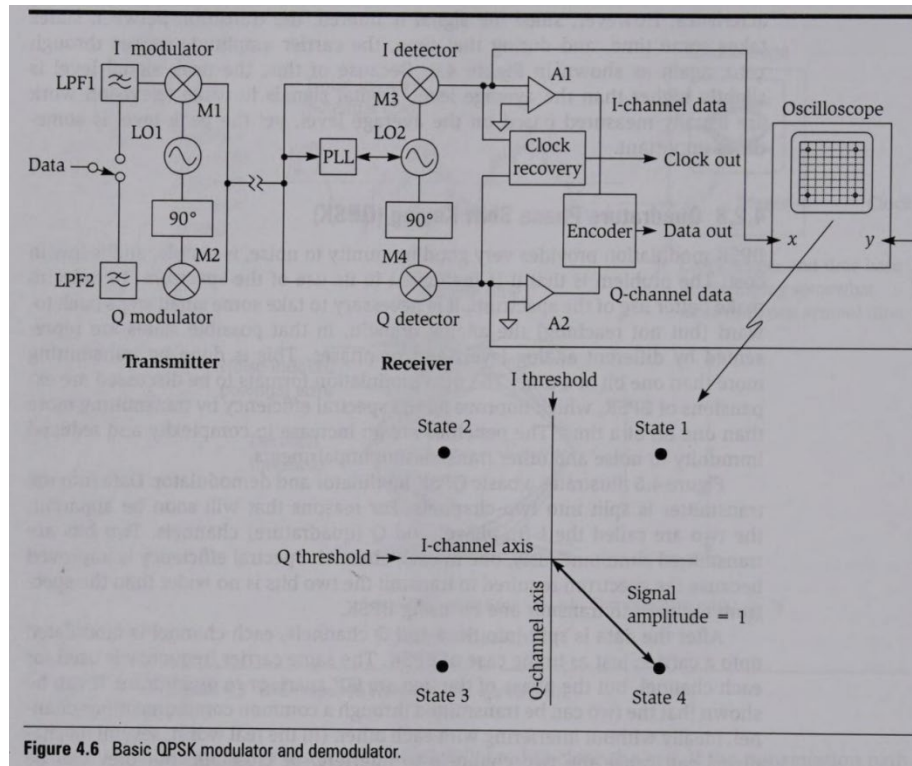
37. The first expansion of BPSK to be discussed is **quadrature phase shift keying (QPSK)**, which is a technique specifically referenced in the subject '759 patent, e.g., in claim 8. With QPSK, and as shown in Ciciora's Fig. 4.6, data into the transmitter is split into two channels. Those two channels are called the I (in-phase) and Q (quadrature) channels. Two bits are transmitted simultaneously, one in each channel. Spectrum efficiency is improved because the spectrum required to transmit the two bits is no wider than the spectrum required to transmit one bit using BPSK. *Id.*, 34 (§ 4.2.8). While QPSK provides twice the data rate versus BPSK, it does require twice the signal power (+3 dB) versus BPSK to achieve the same bit error rate (BER) with the same channel bandwidth. See generally, *id.*

38. After the data is split into the I and Q channels, each channel is modulated onto a carrier, just as in the case of BPSK. The same carrier frequency is used for each channel, but the phase of the two are 90° apart, or in quadrature. Ex. 1012, 34.

39. On the receiver side, the signal is split into the in-phase (I) and quadrature (Q) components, and sent to respective demodulators. An encoder combines the two bits from the I and Q channels into the resulting data stream. *Id.*. See Ciciora's Figure 4.6 (reproduced below) for a basic QPSK modulator/demodulator arrangement. *Id.*, 36.

40. The rate at which bits are transmitted (the bit rate) is measured in bits per second. However, in QPSK, and most other (higher-order) modulation methods, more than one bit is transmitted at a time. The bits that are transmitted simultaneously are grouped into what is called a “symbol.” The rate at which symbols are transmitted is the baud rate. *Id.*, 34-35 (§ 4.2.8).

41. A particularly useful representation of QPSK and higher-order signals/modulation schemes is the constellation diagram, such as seen (for QPSK) at the bottom of Ciciora’s Figure 4.6 (reproduced below). Ex. 1012, 35-36. Therein, each of the four possible positions of the symbol is formed from the I and Q channel data. The position along the X axis is determined by the I data, while the position along the Y axis is determined by the Q data. The peak amplitude of the signal is proportional to the length of the vector from the origin to any one of the four possible states. In the case of QPSK, these lengths are equidistant from the origin, reflecting equal peak amplitudes. *Id.*, 36.

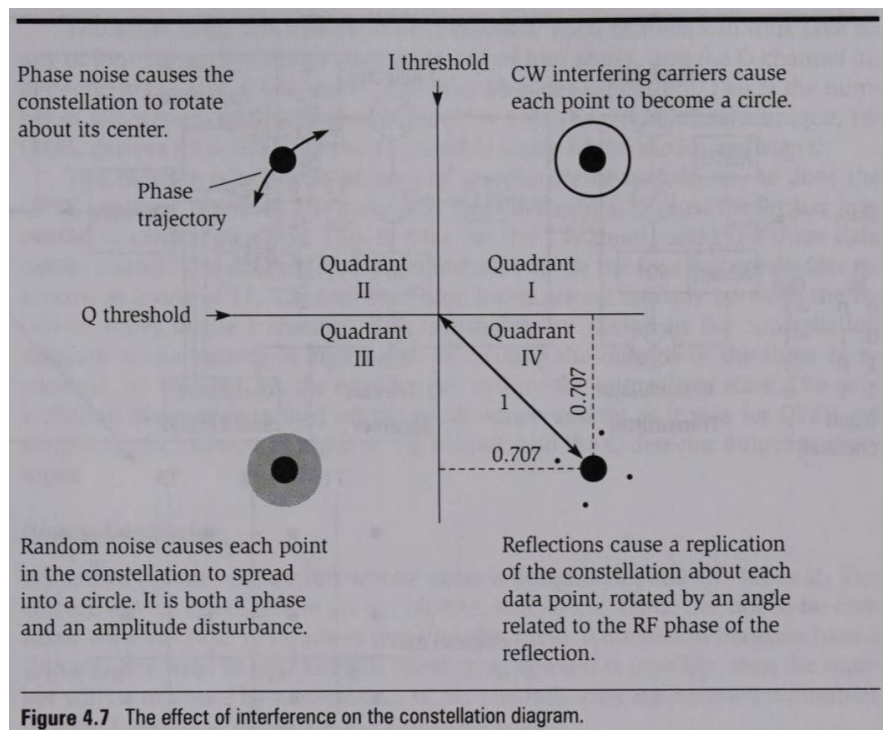


Ex. 1012, Fig. 4.6 (page 36)

42. The Y axis forms the decision threshold for the I channel since it is halfway between the I channel states. Similarly, the decision threshold for the Q channel is defined by the X axis. Computation of a bit error rate (BER) is based on determining the proportion of time that any one spot in the constellation could be forced to cross a threshold into another state's place in the constellation. When this happens, at least one, and sometimes more, bits are received an error. It will be appreciated that the closer together the states in the constellation, that is the denser the modulation, the less noise or other disturbance can be tolerated before a state can be misinterpreted as another. *Id.*, 36.

43. Thus, a defining characteristic of QPSK is that it has four signal states, all of the same amplitude. It is interesting to observe in this regard that QPSK is nothing more than two BPSK signals combined 90° out of phase. *Id.*, 34. Also of note, QPSK is also called 4-state quadrature amplitude modulation (i.e., 4-QAM), a reference to its four signal states and use of two sinusoidal waveforms in quadrature (QAM is discussed further below).

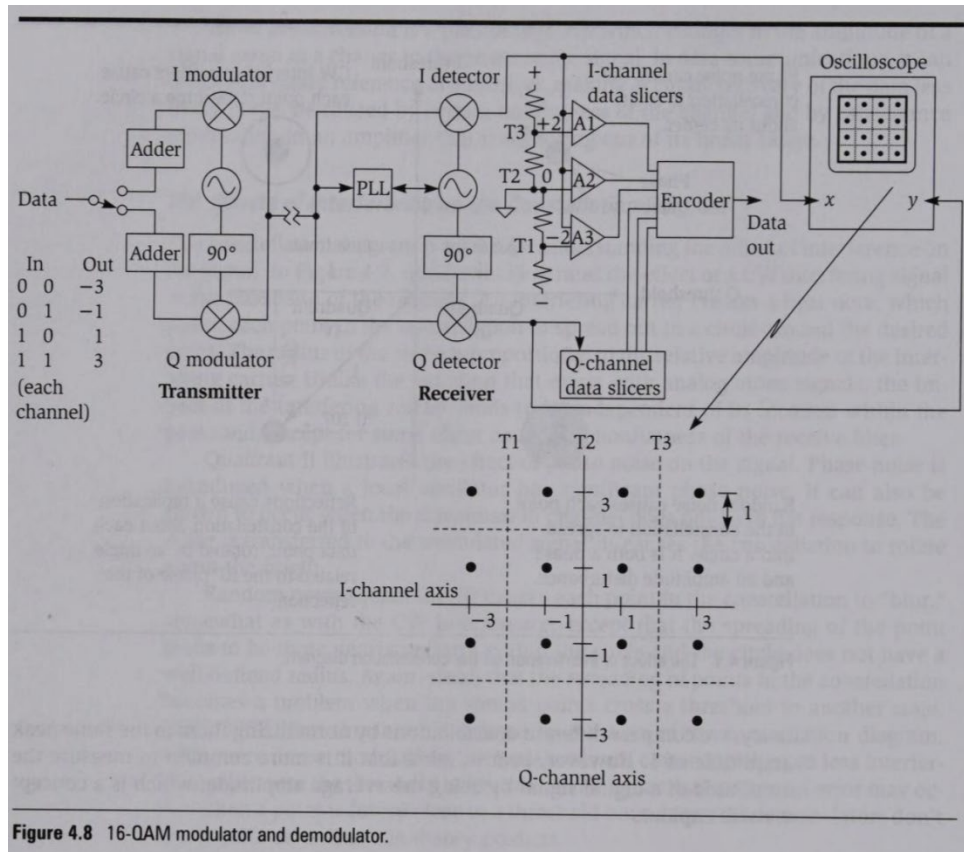
44. Ciciora describes the effects of interference on the constellation diagram with a helpful illustration provided in Figure 4.7 (reproduced below). Ex. 1012, 37-38. The different types of interference include carrier wave, (CW) interference, phase noise interference, and random noise interference. *Id.*



Ex. 1012, Fig. 4.7 (page 38)

45. With QPSK, the signal state thresholds are defined by the axis of the constellation diagram. With more dense (higher-order) modulation, the thresholds are closer, so less interference will cause the thresholds to be crossed. Ex. 1012, 37. Thus, it will be appreciated that higher-order modulation formats are more susceptible to signal interference.

46. The next denser (higher-order) modulation format commonly found in cable television networks is **16-QAM** (16-state quadrature amplitude modulation). *See id.*, 38 (§ 4.2.9). 16-QAM is similar to QPSK, except that each axis is divided into four levels, so that each channel (I and Q) can carry the information of two bits at a time. Each of the two phases carries two bits at a time, so there are four bits per symbol; the baud rate is 1/4 of the bit rate. Each channel of the 16-QAM modulator can take on not only the two phases of QPSK, but also the intermediate amplitude values (represented by differing distances from origin), as seen in the lower part of Figure 4.8 (reproduced below). *Id.*, 38-39.

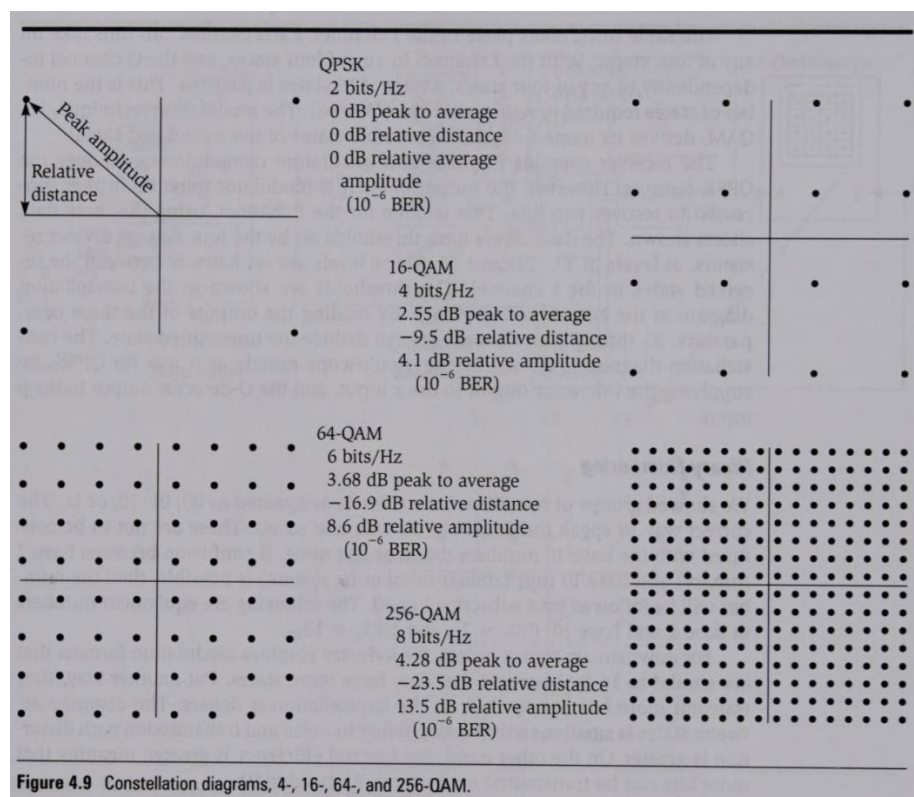


Ex. 1012, Fig. 4.8 (page 39)

47. Thus, with 16-QAM, instead of only one bit being routed to each channel at a time, two bits are routed to each. Each channel can take on any of four states. With the I channel in any of four states, and the Q channel independently in any of four states, a total of 16 states is possible. This is the number of states required to represent four bits ($2^4 = 16$). The modulation technique 16-QAM derives its name from the 16 possible states of the modulated signal. *Id.*, 39-40.

48. Continuing to move up the modulation density scale, we next have **64-QAM** and **256-QAM**. Ciciora's Figure 4.9 (reproduced below) illustrates the

constellation diagrams for 4-QAM (that is, QPSK), 16-QAM, 64-QAM, and 256-QAM, allowing those to be compared. *Id.*, 40-41. Here, the differences in density are readily apparent. The distance between states is smaller as the order of QAM gets higher, so the susceptibility to noise and transmission path distortion increases. On the other hand, the spectral efficiency also increases, meaning that more bits can be transmitted in the same RF bandwidth.



Ex. 1012, Fig. 4.9 (page 41)

49. Ciciora's Figure 4.9 indicates (among other things), the theoretical spectral efficiency in bits per Hertz for each modulation type. Again, this indicates

how many bits per second can be transmitted per Hertz of RF bandwidth. For additional information regarding these constellation diagrams, *see id.*, 40-41.

B. Multi-Carrier Transmission

50. Thus far, the modulation techniques discussed have been described in terms of how data is modulated for transmission on a specific carrier. It was also known to use these modulation techniques in conjunction with multi-carrier transmission schemes. Two well-known and closely related multi-carrier transmission schemes were **discrete multi-tone (DMT)** and **Orthogonal frequency division multiplexing (OFDM)**. With these techniques, instead of modulating a bitstream onto a single relatively wide carrier band, the bitstream is divided-up and spread across multiple sub-carriers within the band for transmission in parallel with each other.

51. DMT protocols had been developed, in large part, to increase the data transmission rates achievable over conventional telephone lines, for the provision of high-speed data networking. These known protocols include, e.g., Asymmetric Digital Subscriber Loop (ADSL), High bit rate Digital Subscriber Loop (HDSL) and Very fast asymmetric Digital Subscriber Loop (VDSL). *See, e.g., EP 1 087 586 (Mirfakhraei; Ex. 1013), ¶ [0003].*

52. With DMT, each sub-channel has a relatively narrow bandwidth (e.g., 4 kHz) to reduce distortion within the sub-channel signal. A sending modem breaks

a data stream into packets for simultaneous transmission on the separate sub-channels, independently modulating that data onto the sub-channels, e.g., using QAM. A receiving modem demodulates the separate sub-channel signals, and reassembles the data. *Id.*, *see also id.*, ¶ [0004] (use of QAM for modulating data onto the sub-channels).

53. As Mirfakhraei further describes, “[a] concern for DMT protocols is differences between the separate channels. Specifically, sub-channels having low carrier frequencies may perform differently from sub-channels having high carrier frequencies. Accordingly, some sub-channels may be able to accurately carry more data than others.” Ex. 1013, ¶ [0004].

54. Similarly, in OFDM, a wide bandwidth carrier is divided into multiple narrow-band sub-carriers, for carrying respective portions of a divided-up bitstream to be transmitted in parallel. With OFDM, the adjacent sub-carriers are arranged to be orthogonal with each other. Ex. 1012, 50. “Orthogonal” here refers to the signals being out-of-phase with respect to each other by 90°. This allows a closer spacing of the sub-channels, without the need for a guard band. *See*, e.g., US 2009/0279498 (Li; Ex. 1014), ¶ [0003]; *see also*, Ex. 1012, 50-51.

55. Similar to the situation with DMT, with OFDM, differences of performance may arise between the separate sub-channels, with certain sub-channels being able to accurately carry more data than others. For example, as Li

explains, “multi-path” (i.e., multiple RF carrier reflections) can cause frequency selective fading, which is common for both wireless transmission, and along a coaxial cable based network. Ex. 1014, ¶ [0005]. OFDM serves to mitigate these transmission impairments, and by doing so extends the effective overall data rate of the wireless or cable data network. *Id.*, ¶¶ [0005]-[0006].

56. The channel fading is typically different for different sub-carriers. *Id.*, ¶ [0005]. This is where the known technique of bit-loading comes in. By determining which sub-carriers are being impaired by these signal reflections and impairments, bit-loading allows those sub-carriers so impaired to be modulated by a more robust modulation format (i.e. using QPSK versus 64-QAM), or eliminated altogether from the data modulation.

57. In this regard, for example, Mirfakhraei discloses an arrangement wherein “a modem or transceiver that implements a DMT protocol [] employs a ‘bit-loading’ process that characterizes the capabilities of sub-channels and determines the number of bits-per-symbol transmitted over the channel. The gains of the sub-channels are adjusted to achieve a desired data rate with acceptable signal-to-noise ratios and bit error rates in each channel.” Ex. 1013, ¶ [0014].

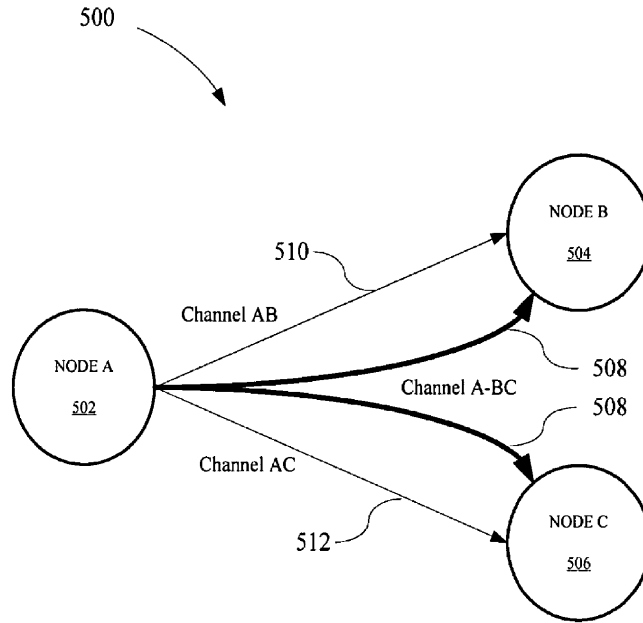
58. Grube US 5,682,419 (Ex. 1009) similarly discloses the use of bit-loading for improving multi-carrier (e.g., DMT) transmissions, extending the general approach to a multi-cast data transmission scenario where a lowest

common denominator (LCD) bit-loading table is determined for the various transmission paths. *See*, e.g., Ex. 1009, 14:59-15:5, 18:44-19:26, Fig. 17.

VI. SUMMARY OF THE '759 PATENT

59. The '759 patent is directed to a broadband cable network ("BCN"). The BCN has nodes that communicate with each other using the multi-carrier modulation technique known as "bit-loaded orthogonal frequency division multiplexing (OFDM)." Ex. 1001, 7:19-20. As the '759 patent describes, "[b]it-loading is the process of optimizing the bit distribution to each of the channels [(carriers)] to increase throughput." *Id.*, 7:12-14.

60. The '759 patent's process includes determining a common bit-loading modulation scheme for broadcasting or multi-casting. This means transmitting from a transmitting node (e.g., A) to multiple receiving nodes (e.g., B, C). *See* Ex.1001, Abstract, 6:55-7:4. The '759 patent depicts this transmission mode in Figure 5, with NODE A sending the same message to NODES B and C over Channel A-BC (paths 510, 512). *Id.*



Ex. 1001, Fig. 5

61. Here, the different physical attributes of paths 510, 512, amongst other things, dictate the most-efficient bit-loading for each path. The '759 patent determines and uses a common bit-loading modulation scheme to address this. *See* Ex. 1001, 6:58-7:14, 10:6-14. In the process, the transmitting node (A) sends a probe signal to the receiving nodes (A, B). The receiving nodes reply with a bit-loading modulation scheme. The transmitting node determines a common scheme from the responses. Ex. 1001, 10:58-11:28.

62. Figures 10A-10C of the '759 patent illustrate the methodology used for determining the common bit-loading scheme from plural schemes for different transmission paths. Ex. 1001, 10:15-57. Figure 10A depicts a plot of the bit-

loading constellation size (QAM order) versus carrier number for the AB channel (path 510):

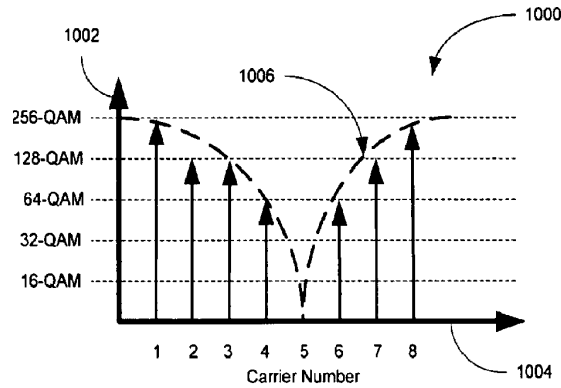


FIG. 10A

Ex. 1001, Fig. 10A

63. Fig. 10B depicts the same thing for the AC channel (path 512):

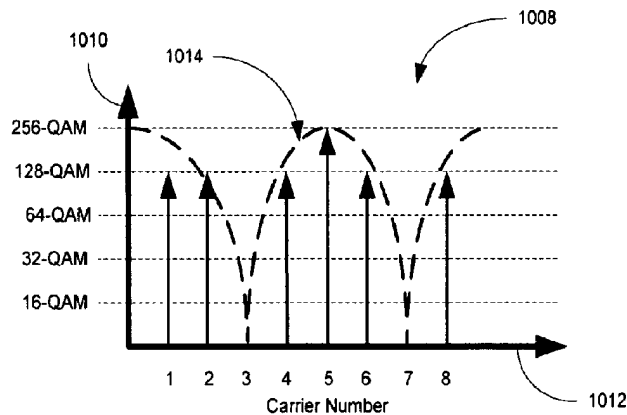


FIG. 10B

Ex. 1001, Fig. 10B

64. Finally, Fig. 10C shows plots that graphically representing the “common bit-loaded modulation scheme” determined for the A-BC channel path between node A and nodes B and C:

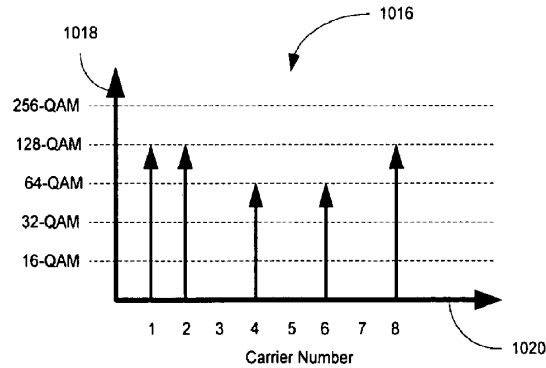


FIG. 10C

Ex. 1001, Fig 10C

Ex. 1001, 10:41-44, 10:54-56. This “common bit-loaded modulation scheme” is the result of “comparing the carrier number signals from the AB channel in FIG. 10A and the corresponding carrier number signals from the AC channel in FIG. 10B and choosing *the lowest corresponding modulation value* for each carrier number.” *Id.*, 10:49-56 (emphasis added). Thus, as shown, the “common bit-loaded modulation scheme” of Figure 10C uses 128-QAM for carriers 1, 2, and 8; 64-QAM for carriers 4 and 6; and carriers 3, 5, and 7 are kept OFF. *Id.*, 10:46-54.

VII. THE ’759 PATENT’S PROSECUTION HISTORY

65. I understand that the ’759 patent’s underlying application originally presented 81 claims. Ex. 1004, 29-49. The first Office Action rejected all but 24 of the claims, which it objected-to without comment. *Id.*, 90-106.

66. I understand that the Examiner found most of the claims obvious over a combination of two prior art references, Ling (Ex. 1015) in view of Li (Ex. 1014). *Id.*, 94-101. The Examiner found that Ling discloses most of the claimed elements,

including transmitting a probe signal and determining a common bit-loading scheme based on a feedback signal including the signal-to-noise ratio (“SNR”) of the channel. The Examiner found that Li discloses a receiving node making a determination of a bit-loading modulation scheme and transmitting that back in a response signal. Ex. 1004, 94-95. The Examiner concluded that Ling in view of Li rendered obvious most of the claims. *Id.*, 94-101.

67. The Examiner also found that a third reference, US 2005/0031044 (Ex. 1016, Gesbert II), discloses using bit-error rate (“BER”) and “product [sic: packet]-error rate (‘PER’)” as measures of the transmission characteristics of the received probe signal, thus rendering obvious (in combination with Li-Ling) the claims reciting these limitations. Ex. 1004, 11-12.

68. I understand that in response, the Applicant cancelled every rejected claim and amended the objected-to claims to place those claims in independent form. *Id.*, 126-146. In support of the claims, the Applicant asserted that its claim amendments rendered those rejections “moot.” *Id.*, 147-148.

69. I understand that the Examiner subsequently allowed the remaining amended claims (Ex. 1004, 153-158), and that those claims ultimately issued on February 15, 2011 as ’759 patent claims 1-23. Ex. 1004, 177.

VIII. EARLIEST PRIORITY DATE FOR THE CLAIMS

70. I have been instructed that the earliest possible priority date for the claims of the '759 patent is July 12, 2004, the filing date of the continuation-in-part (CIP) application (SN 10/889,975) that issued as the '759 patent. I understand that this follows as a matter of law from the fact that neither of the '759 patent's two parent applications, abandoned SN 10/778,505 (Ex. 1005), and SN 10/322,834, now US 7,295,518 (Ex. 1006), nor any other priority application, discloses any method, apparatus or functionality of "determining a common bit-loading modulation scheme" as is described throughout the '759 patent and recited in each of the claims.

IX. OVERVIEW OF THE RELIED UPON PRIOR ART

A. Gurantz (US 2002/0166124) – Ex. 1007

71. Gurantz published on November 7, 2002, more than a year prior to the July 12, 2004 effective filing date of the '759 patent. Ex. 1007, cover. I understand it is thus prior art under 35 U.S.C. § 102(b) (pre-AIA).

72. I understand that Gurantz, filed as SN 09/910,412, is in the same family as the '759 patent, constituting a grand-parent application of the '759 patent's CIP application. Ex. 1001, cover. It would thus be expected, and my review confirms that it is, directed to closely related, analogous art, and the same field of endeavor, as the '759 patent. This field of endeavor may be characterized as broadband local

area networking over coaxial cable, through which terminal devices (i.e., customer premises equipment (CPE)) may communicate with each other. *See*, e.g., Ex. 1007, Abstract; *cf.*, Ex. 1001, 3:62-4:3.

73. Gurantz teaches, like the '759 patent, network nodes that communicate with each other using multi-carrier modulation (e.g., OFDM), and bit-loading, for overcoming frequency selective channel impairments in coaxial building wiring. *See*, Ex. 1007, ¶¶ [0046]-[0050]; *cf.*, Ex. 1001, 7:5-14, 7:19-30.

B. Grube (US 5,682,419) – Ex. 1009

74. Grube issued on October 28, 1997, more than one year prior to the July 12, 2004 effective filing date of the '759 patent. Ex. 1009, cover. I understand that Grube is thus prior art under 35 U.S.C. § 102(b) (pre-AIA).

75. Grube, like Gurantz, focuses on improving reliability and bandwidth over existing wiring to facilitate data transmission without compromising other services. Grube takes things a step further, addressing the need for “a one-to-many and/or many-to-one communication system infrastructure.” Ex. 1009, 4:43-51. This refers to a multi-cast or broadcast scenario, as the '759 patent similarly addresses. Ex. 1001, 6:52-63. To do this, Grube uses discrete multi-tone (“DMT”) modulation to facilitate communication between a primary site and multiple secondary sites. Ex. 1009, 7:9-19, Fig. 9 (depicting an embodiment with a primary site 102 connected to secondary sites 104, 106 and 108). Specifically, Grube’s

DMT system uses multicarrier modulation, with quadrature amplitude modulation (“QAM”). *See id.*, 35:4-11.

76. Addressing the multi-cast/broadcast scenario, Grube ensures that there is sufficient bandwidth for communications between the primary site and the multiple secondary sites by, among other things, determining a lowest-common-denominator (LCD) bit-loading table. Ex. 1009, 14:59-15:5. Channels (from the LCD table) are allocated to the communication, based on the bandwidth requirements. *Id.*, 7:37-8:37.

77. The primary site determines the LCD table through a comparison of the bit-loading tables received from the multiple secondary sites. Ex. 1009, 18:44-55, Fig. 17. The secondary sites determine their respective bit-loading tables, and return those to the primary site, in response to receiving a “training signal” from the primary site. *Id.*, 7:56-65.

78. Grube teaches using this methodology at a variety of “secondary sites” (e.g., as seen in Fig. 9), including sites equipped with cable boxes or “any ... device that can receive digital information.” Ex. 1009, 8:50-9:6, 13:13-29, 24:8-19.

C. Gesbert (US 2002/0056066) – Ex. 1010

79. Gesbert published on May 9, 2002, more than a year prior to the July 12, 2004 effective filing date of the ’759 patent. Ex. 1010, cover. I understand it is thus prior art under pre-AIA 35 U.S.C. § 102(b).

80. Gesbert discloses a multi-mode wireless data transmission system, wherein the selection of a transmission mode is made from among multi-carrier transmission modes having different modulation rates and coding rates. *See*, e.g., Ex. 1010, ¶¶ [0036]-[0037], Table 1. The mode selections are made based on one or more monitored quality parameters of the communication channel, including bit error rate (BER), packet error rate (PER) and signal-to-noise ratio (SNR). *Id.*, ¶¶ [0014]-[0017].

D. Shattil (US 7,418,043) – Ex. 1011

81. Shattil was filed on December 8, 2003 and subsequently issued as a patent. Ex. 1011, cover. I understand that it is thus prior art to the '759 patent, which has an effective filing date of July 12, 2004, under 35 U.S.C. § 102(e) (pre-AIA).

82. Shattil discloses, similar to Gurantz, a multicarrier transmission protocol (including OFDM). Ex. 1011, Title, 22:62. Further, it also employs bit-loading based on determined channel characteristics. Shattil specifically discloses that in such a method “[t]he modulation of the binary input data can be of many types [including] quadrature amplitude modulation (QAM) or other derivatives of these modulation schemes, such as . . . 64-QAM.” *Id.*, 6:20-25.

X. LEVEL OF ORDINARY SKILL IN THE RELEVANT ART

83. I understand that the following four factors may be considered when identifying the appropriate level of a POSITA: (i) the types of problems encountered by those working in the field and prior art solutions thereto; (ii) the sophistication of the technology in question, and the rapidity with which innovations occur in the field; (iii) the educational level of active workers in the field; and (iv) the educational level of the inventor. I understand that a POSITA is one who is presumed to be aware of all pertinent art, thinks along conventional wisdom in the art, and is a person of ordinary creativity.

84. It is my opinion that, for the '759 patent, a POSITA would have had a bachelor's degree in electrical engineering, computer engineering, or a similar discipline, and three to four years of experience working in signal processing and/or communication systems/networks. Additional education may substitute for experience, and significant work experience may substitute for formal education.

85. In this Declaration, wherever I refer to a POSITA, it should be understood that I'm referring to a hypothetical person at the time of the alleged invention of the '759 patent (i.e., July 12, 2004) meeting the description I have provided.

XI. CLAIM CONSTRUCTION

86. I understand that my analyses require a proper understanding of the claims of the '759 patent. I understand that absent some other definition provided in the patent, the claim terms are to be given their plain and ordinary meaning to a POSITA, in light of the patent specification. Therefore, in my analysis below, and except as otherwise noted, I have assumed that all claim terms are to be given their plain and ordinary meaning as would have been understood by a POSITA reading the patent specification at the time of its effective filing date (i.e., July 12, 2004).

87. I understand that U.S. patent law allows for claiming with means-plus-function limitations. In particular, I understand that a “means-plus-function” limitation should be interpreted to cover the corresponding structure described in the specification for performing the recited function, and equivalents thereof. I also understand that a limitation will be presumed to be a means-plus-function limitation if (a) the claim limitation uses the phrase “means for”; (b) the “means for” is modified by functional language; and (c) the phrase “means for” is not modified by sufficient structure for achieving the specified function.

88. A large number of the terms in claims 14 and 18-23 of the '759 patent use the words “means for” followed by a statement of function, and thus presumptively constitute means-plus-function limitations. I understand that construing these terms requires first identifying the claimed function, then

identifying the corresponding structure described in the specification. Specifically, per 35 U.S.C. § 112 (pre-AIA), I understand that the means-plus-function terms are to be construed “to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.” I address construction of these terms as necessary in connection with setting forth my opinions of unpatentability below.

89. My review indicates that the various “means” recited in the claims are typically identified (in the claims) as being included at one or more particular nodes of a BCN, e.g., transmitting node A (502) or receiving nodes B (404) and C (406), as seen in Figure 5; the functions as recited generally correspond to the steps of the process flowchart of Figure 11.

90. The ’759 patent generally and inclusively describes the BCN *structure* that may be used to carry out the process steps of Figure 11, as “hardware or software.” Ex. 1001, 11:52-53. For example, according to the ’759 patent:

If the process is performed by software, the software may reside in software memory (not shown) in the BCN. The software ... may include an ordered listing of executable instructions for implementing logical functions ... may selectively be embodied in any computer-readable (or signal-bearing) medium for use by or in connection with an instruction execution system ... such as a computer based system...

Ex. 1001, 11:53-67.

91. In my opinion, a POSITA would understand the structure for carrying out the variously recited BCN functions to be conventional BCN hardware components operating under the control of suitable programming.

92. As such, I understand that the means-plus-function terms appearing in the claims should be construed to cover BCN hardware and/or software systems operable to carry out the particular function recited, at any particular location within the BCN that may be specified in the claims, e.g., at a “transmitting node” or “receiving node” of the network.

93. I understand that claims 4-6 are computer-readable medium (CRM) claims, i.e., drawn to “[a] *non-transitory computer-readable medium having software for* [carrying out a specified function].” Here, as with the means-plus-function terms, I understand that a broad construction is warranted for purposes of this proceeding. In this regard, the inventors acted as their own lexicographers in providing an all-encompassing definition: “In the context of this document, a ‘computer-readable medium’ . . . is any means that may contain, store, communicate, propagate, or transport the program for use by or in connection with the instruction execution system, apparatus or device.” *Id.*, 11:67-12:4; *see also id.*, 12:4-22.

XII. UNPATENTABILITY ANALYSES

94. For the reasons that I discuss in detail below, it is my opinion that each of claims 1-23 of the '759 patent would have been obvious to a POSITA. In short, it is my opinion that:

- Claims 1, 4, 7-9, 11, 14-16, 20 and 21 are Rendered Obvious by Gurantz in view of Grube. (GROUND A)
- Claims 2, 3, 5, 6, 12, 13, 22, and 23 are Rendered Obvious by Gurantz in view of Grube and further in view of Gesbert. (GROUND B)
- Claims 10 and 17 are Rendered Obvious by Gurantz in view of Grube and further in view of Shattil. (GROUND C)
- Claims 18 and 19 are Rendered Obvious by Gurantz in view of Grube and further in view of Shattil and Gesbert. (GROUND D)

95. I understand that Petitioner has assigned labels (e.g., [1PRE], [1A], [1B], etc.) to different limitations of the claims to facilitate analysis of the claims. Accordingly, in my analyses below, I have referred to the claim limitations using those same labels, which are shown in the Claim Listing Appendix attached to this declaration as Appendix C.

A. Claim Commonality

96. Counsel has pointed out to me, and through my own review I have confirmed, that there is a high degree of commonality and overlap among the claims.

97. Independent method claims 1-3 are largely identical to each other, differing only with respect to claim 2 including a “generating” step [2H], and by claim 1 element [1G] referencing “signal-to-noise” (SNR), while claim 2 element [2G] references “bit-error rate” (BER).

98. Claims 1 and 3 are identical but for element [3H] referencing “packet-error rate” (PER) instead of “SNR” in claim 1 element [1G].

99. Independent claims 4-6 are computer readable medium (CRM) claims corresponding substantially to method claims 1-3. The only differences are described below.

100. Claim 4 corresponds to claim 1 but also includes a “logic configured for generating” element [4G] corresponding to claim 2’s “generating” step [2H].

101. Claim 5 corresponds to claim 1, except that element [5D] references claim 2’s “BER” rather than claim 1’s “SNR.”

102. Claim 6 tracks claim 1 but like claim 4 includes a “logic configured for generating” in element [6D] corresponding to claim 2’s “generating” step [2H].

Also, claim 6 element [6E] references claim 3's "PER" rather than claim 1's "SNR."

103. Independent claim 7, and claims 11-13 depending therefrom, are apparatus claims drawn to a "broadband cable network" (BCN); these claims recite various "capable of" functional limitations corresponding directly to method steps of claims 1-3. I note that claim 7 is broader than claims 1-3 in that it does not specify how the receiving nodes determine the bit-loading modulation schemes (e.g., based on SNR, BER or PER).

104. Claim 14 is, like claim 7, an apparatus claim drawn to a BCN. Each of the elements of claim 14 corresponds directly to an element of claim 7, while simply substituting "means for" in place of "capable of."

105. Claims 15-17 depending from claim 14 correspond directly to claims 8-10 depending from claim 7.

106. Similar to claims 11-13 (depending from claim 7), claims 18-19 (depending from claim 17), recite various functional limitations corresponding directly to method steps of claims 1-3, but expressed as "means for."

107. Independent claim 20 is largely similar to claim 14, drawn to a BCN and having various elements expressed as means-plus-function. Claim 20 includes additional limitations, which merely represent in "means for" format, the various method steps of claim 1 and/or claim 2.

108. The above-noted commonality and overlap of the claims allows me to streamline somewhat my analyses in order to avoid needless repetition. For common claim elements and limitations that I have already addressed for another claim, I will refer back to those prior discussions. Notably, the discussions of claims 1-4 and 7-10 collectively address all of the elements and limitations that appear later in remaining claims 5-6 and 11-23. In this sense, claims 1-4 and 7-10 may be considered representative.

B. GROUND A: Claims 1, 4, 7-9, 11, 14-16, 20 and 21 are Rendered Obvious by Gurantz in view of Grube

109. As set forth below, it is my opinion that Gurantz in view of Grube renders obvious each of claims 1, 4, 7-9, 11, 14-16, 20 and 21.

1. INDEPENDENT CLAIM 1

a) [1PRE]: “A method for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in a broadband cable network (“BCN”), the method comprising:”

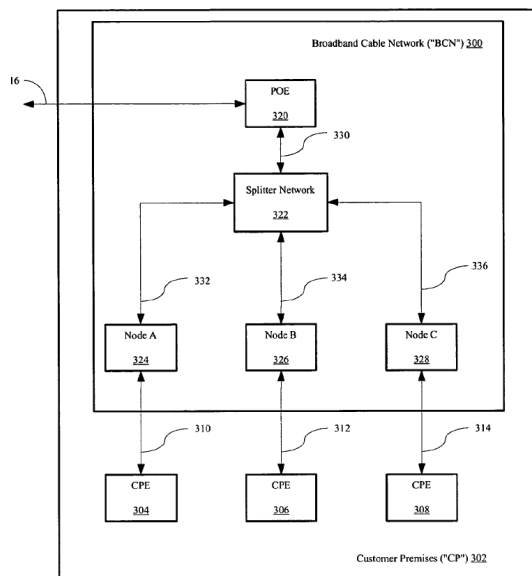
110. Gurantz in view of Grube teaches [1PRE]. Specifically, Gurantz teaches a method including determination and use of a bit-loading modulation scheme for communicating between a plurality of nodes in a BCN. Regarding communication between plural nodes in a BCN, Gurantz teaches, e.g.:

A local area network uses coaxial cable wiring for interconnection of terminal devices. . . By reflecting network upstream signals back . . . as downstream signals, the network interface provides a path for

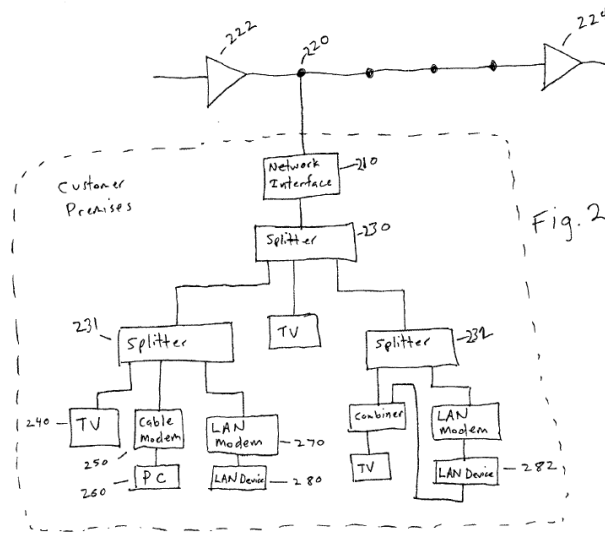
terminal devices to transmit to and receive from other terminal devices.

Ex. 1007, Abstract. *See also, id.*, ¶¶ [0013], [0020], Fig. 2. In this regard, it is useful to compare Figure 3 of the '759 patent (Ex. 1001), with Figure 2 of Gurantz (Ex. 1007).

111. In Gurantz's Figure 2, each of the representative pairs of LAN modem/device ((LAN modem 270, LAN device 280), (LAN modem (unlabeled), LAN device 282)), correspond to a respective one of the '759 patent's node/customer premises equipment (CPE) pairs, (Node A 324, CPE 304), (Node B 326, CPE 306), (Node C 328, CPE 308):



Ex. 1001, Fig. 3



Ex. 1007, Fig. 2

112. I note that here that Gurantz's pair of cable modem 250 and PC 260 appear to be outside of the LAN. These are described as "[e]xisting devices" that

“use frequency bands distinct from the frequency band used by the LAN and therefor operate in a normal manner.” Ex. 1007, ¶ [0021].

113. Bit-loading was a known technique used for carrying out multi-carrier modulation. In this regard, Gurantz discloses “[a]pplication of DMT and OFDM,” which are both methods of multi-carrier modulation. *Id.*, ¶¶ [0046]-[0047]. As Gurantz explains, “OFDM provides a mechanism to overcome the frequency selective channel impairments present in coaxial building wiring when employing a network interface device according to the present invention.” Ex.1007, ¶ [0048].

114. This is where the bit-loading comes in. In that regard, Gurantz teaches that “[h]igher SNR [signal-to-noise] channels can support higher data capacity. Frequency bins occupying parts of the channel where the SNR is high can be used to transmit more bits. Each carrier may be modulated with a different order constellation, where higher SNR frequencies can bear a higher order constellation, and the resulting closer spacing of the constellation points. Frequencies with the lower SNR use lower order constellations such as QPSK.” *Id.*, ¶ [0050].

115. Gurantz’s modulation of the carriers “with a different order constellation, where higher SNR frequencies can bear a higher order constellation,” and where “[f]requencies with the lower SNR use lower order constellations” is the essence of bit-loading. *Id.*

116. I note that, consistently, according to the '759 patent, “[b]it-loading is the process of optimizing the bit distribution to each of the channels to increase throughput.” Ex.1001, 7:12-14. And further, that the '759 patent references (and incorporates by reference) an earlier application (10/322,834, which issued as US 7,295,518, Ex. 1006). Ex. 1001, 7:14-17. The '518 patent characterizes bit-loading as “a method of allocating a higher order signal constellation to carriers that have higher signal to noise ratio and a lower order constellation to carriers that have lower signal to noise ratio.” Ex. 1006, 8:9-12. Further, the '518 patent describes bit-loading in precisely the same terms as Gurantz. *See id.*, 8:12-19; *cf.*, Ex. 1007, ¶ [0050].

117. While Gurantz discloses bit-loading, it does not disclose determining a “common” bit-loading modulation scheme as recited. This feature is unquestionably taught by Grube, however, as I further describe below with respect to elements [1B]-[1G].

b) [1A] “transmitting a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes;”

118. Gurantz’s network includes a transmitting node within the plurality of nodes, and a sub-plurality of receiving nodes, as I have noted. Gurantz does not disclose the detail of transmitting a probe signal from the transmitting node to the

sub-plurality of receiving nodes. Grube teaches transmission of a “probe signal” to a sub-plurality of receiving nodes.

119. Specifically, with reference to Figure 15, Grube teaches the transmission of a “training signal” 280 from a primary site 102 (a transmitting node) to a plurality of secondary sites 104-106 (a sub-plurality of receiving nodes). Ex. 1009, 17:10-45. These receiving nodes ascertain a “spectral response” of the training signal which is used to determine “a bit loading for each of the carrier channels to produce a bit loading table 282.” Ex. 1009, 17:10-31, Fig. 15. A POSITA would have understood that Grube’s “spectral response” would indicate SNR among other characteristics of the channel under test.

120. In my opinion, it would have been obvious to a POSITA to employ in Gurantz a training (i.e., probe) signal transmitted from a transmitting node to a sub-plurality of receiving nodes as taught by Grube, for purposes of making SNR determinations for the multi-carrier channels and bit-loading, in accordance with the teachings of Gurantz (e.g., Ex. 1007 ¶ [0050]).

121. A POSITA would have recognized that Grube’s teachings for improving data transmission over a network utilizing two-wire (e.g., twisted pair) telephone line would have similar application, with similar benefits, as applied to Gurantz’s BCN employing coaxial cable. In this respect, a POSITA would have

understood that both types of networks are subject to similar interference and signal reflections.

122. While coaxial cable is shielded, the cable is often damaged from wear and tear. Further, data transmissions over coaxial cable are subject to degradation due to intervening network hardware components such as splitters, couplers, and connectors. The main difference between the two types of network wiring is that coaxial cable can support a higher frequency spectrum, and thus data bit rate, as compared to telephone wire-based networks. As a result, different methodologies had been used to maximize data transmission capacity over the different wiring.

123. For example, Asymmetrical Digital Subscriber Loop (ADSL) had been used with twisted pair telephone line, and employs the form of multi-carrier transmission known as Discrete Multi-Tone (DMT). *See, e.g., Ex. 1009, 3:5-34.* The closely-related multi-carrier technique OFDM was in common use (in conjunction with different orders of QAM) for maximizing bandwidth over coaxial cable. *See, e.g., Ex. 1012, 50-51 (§ 4.3.3.).*

124. A POSITA would have considered the concerns with transmission impairments, and the advantages obtainable through the use bit-loading, to be largely common as between the two types of wiring, and the two related forms of multi-carrier transmission. Notably, and as I mentioned above, Gurantz describes

application of both DMT and OFDM to its coaxial cable-based LAN (BCN). Ex. 1007, ¶ [0046]-[0047].

125. Applying Grube to Gurantz in the manner I’ve described would have been nothing more than combining prior art elements—Gurantz’s bit-loading BCN network, with Grube’s technique for determining the bit-loadings using a transmitted training (i.e., probe) signal—using the known methods taught by the respective prior art references. And it would have yielded the predictable result of a BCN employing bit-loading and including a methodology for determining an optimal bit-loading for particular transmission paths.

126. In the combination, parts of the channel with higher SNR would be used to transmit more bits, while frequencies having a lower SNR would use “lower order constellations,” in accordance with Gurantz’s teachings Ex. 1007, ¶ [0050]. This falls right in line with Gurantz’s objective of overcoming “frequency selective channel impairments.” *Id.*, ¶ [0048]. Simply put, Grube supplies detail missing from Gurantz for suitably determining the bit-loading that Gurantz itself contemplates. *Id.*

- c) [1B] “receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node;”

127. Gurantz in view of Grube teaches this limitation. Specifically, Gurantz teaches use of a “bit-loading modulation scheme” as previously set forth, but does not specifically describe that scheme being determined by a corresponding receiving node and included in a plurality of received response signals (responsive to the transmitted probe signal). Grube teaches such an arrangement and would have suggested to a POSITA its use in Gurantz.

128. Specifically, Grube provides details concerning a *common* bit-loading methodology for use in a multi-cast scenario where the same data is to be transmitted simultaneously to multiple receiving nodes. This data may, e.g., be control data. According to Grube, multiple secondary sites (“receiving nodes”) of a communication network determine and inform a primary site (“transmitting node”) of a bit-loading table (“scheme”) for the respective secondary site, responsive to receiving the training (“probe”) signal sent by the primary site (“transmitting node”). Ex. 1009, 14:3-19, 17:10-45, Figs. 12, 15.

129. These bit-loading tables are compared by the primary site (“transmitting node”) in order to determine a *common* bit-loading scheme for

outgoing multi-carrier data transmissions. Grube uses the term “lowest common denominator (LCD)” bit-loading. *Id.*, 14:64-15:5, 18:44-19:26, Fig. 17.

130. In further detail, and with reference to Figure 12 (reproduced below), Grube explains that in a process for establishing an infrastructure path for data transmission, “[a]t step 230, the primary site obtains outbound bit loading information from a plurality of secondary sites. This is generally done by providing a training signal to each of the plurality of secondary sites.” Ex. 1009, 14:5-8. The secondary sites each calculate bit-loading information from a spectral response of the output transmission path (to the training signal), and provide that information to the primary site. *Id.* 14:11-19. At step 238, the primary site utilizes the bit-loading information it receives from the secondary sites “to establish an infrastructure for a data transmission.” Ex. 1009, 14:59-61. While Grube discloses similar steps for establishing both outbound and inbound control channels, as well as “call” channels my focus for purposes of demonstrating obviousness of the ’759 patent claims will be on the bit-loading determination for establishing the outgoing control channel.

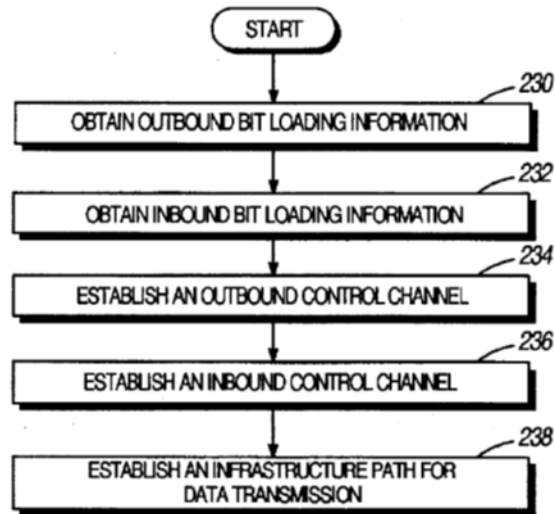
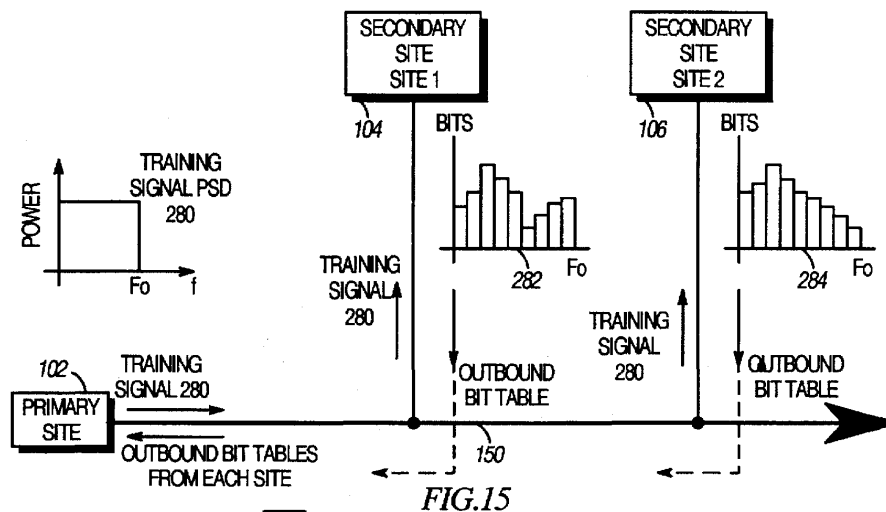


FIG.12

Ex. 1009, Fig. 12

“In general, this is accomplished by first determining the number of sites involved in the data transmission [a multi-cast scenario] and retrieving the respective site bit loading tables. From the site bit loading tables, a lowest common denominator call [sic: site] bit loading table is determined” *Id.* 14:61-65.

131. Grube describes the process for obtaining the outbound bit-loading tables from the secondary sites in response to the training signals, in greater detail with reference to Figure 15 (reproduced below).

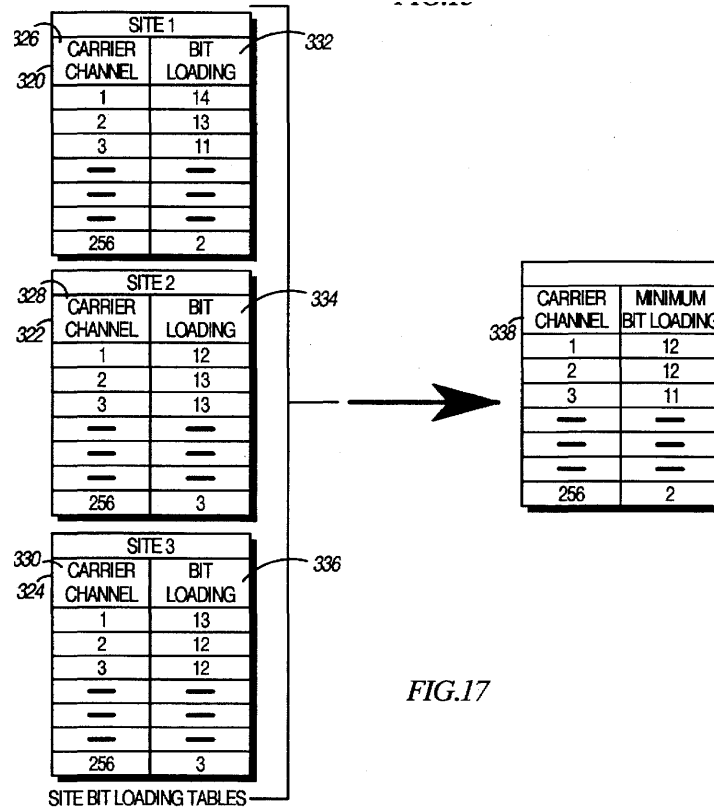


Ex. 1009, Fig. 15

As shown, the primary site 102 transmits a training signal 280 to a plurality of secondary sites 104-106. . . . The first secondary site 104, upon receiving the training signal, generates a spectral response for each of the sinusoidal signals of the training signal 280. From the spectral response, the secondary site determines a bit loading for each of the carrier channels to produce a bit loading table 282. . . . The second secondary site 106 calculates a similar bit loading table and provides the bit loading table back to the primary site 102.

Ex. 1009, 17:11-34.

132. Grube describes the process for determining a *common* bit-loading table (outbound control channel bit loading table 338) from the bit-loading tables (320, 322, 324) it receives back from the secondary sites (1-3) in response to the training signals. This is illustrated in Grube's Figure 17 (reproduced below).



Ex. 1009, Fig. 17

Outbound bit loading tables for the plurality of sites are shown as outbound site bit loading tables 320-324. . . . The outbound control channel bit loading table 338 is generated by comparing the bit loading, on a carrier channel by carrier channel basis, of all of the site bit loading tables. . . . This process continues on a carrier channel by carrier channel basis until the outbound control channel bit loading table 338 contains, for each carrier channel entry, the lowest bit loading value of all of the site bit loading tables.

Id. 18:45-19:16.

133. Outbound control channel bit loading table 338 constitutes a determined *common* bit-loading modulation scheme, as recited.

134. It is my opinion that it would have been obvious for a POSITA to have employed Grube's teachings concerning a common bit-loading scheme in carrying out the system of Gurantz. Initially, I note that Grube is analogous art to both the '759 patent and Gurantz. All three pertain to data communications between network nodes employing multi-carrier modulation (e.g., OFDM or DMT) and bit-loading. Additionally, Grube shares the goal of Gurantz to allow communication infrastructure to be placed in areas where it was not achievable before. Gurantz seeks to extend the usefulness of existing home cable wiring for use in broadband local area networking. Ex. 1007, ¶ [0020]. Grube similarly seeks to extend the usefulness of twisted pair telephone line. *See, e.g.*, Ex. 1009, 58:4-14.

135. Further, Grube presents an improvement over the known use of bit-loading in ADSL. ADSL is extended beyond one-to-one communication to provide a "one-to-many and/or many-to-one" communications system architecture (*id.*, 4:43-51), i.e., a multi-cast scenario. Combining Grube with Gurantz would have been motivated in order to achieve a similar improvement in data networking over coaxial cable.

136. In particular, the combination would have been motivated by the benefits expressly taught in Grube, e.g., optimizing communications for the case of multi-cast data communications. *Id.*, 4:43-51. Grube optimizes data transmission for the case of multi-cast communications through determining, for different paths

from the primary site to the secondary sites, which carrier channels have a higher bit-loading capability and which have a lower bit-loading capability. *Id.*, 17:20-34; *see also, id.*, 17:34-40 (“Note that the bit loading information from the first secondary site 104 is considerably different than the bit loading information from the secondary site 106. This occurs due to the different characteristics in the transmission path between the primary site and the secondary site 106.”). As previously noted, Gurantz similarly recognizes that for a given transmission path, “higher SNR frequencies” can bear a higher bit-loading (QAM constellation) whereas frequencies with a lower SNR “use lower constellations such as QPSK.” Ex. 1007, ¶ [0050]. Grube tailors its common bit-loading table (scheme) accordingly, in order to successfully and efficiently transmit data simultaneously to multiple secondary sites (receiving nodes).

137. A POSITA would have recognized the approach to be similarly beneficial in the Gurantz BCN, for multicast or broadcast transmissions from a transmitting node to plural receiving nodes. In a case where Gurantz’s LAN device 280 is “for example, a personal computer (PC)” (Ex. 1007, ¶ [0020], Fig. 2), Grube’s approach would have improved the efficiency of a broadcast transmission from that PC to multiple receiving nodes on the BCN.

138. In an illustrative (obvious) example, a database or server would have been associated with the PC (e.g., as Grube shows for its primary site 102 in Figure

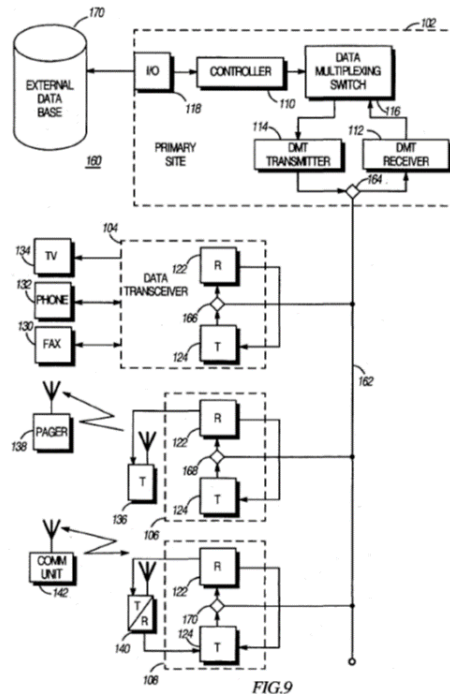
9—"external data base 170") (*see*, Ex. 1009, Fig. 9, 11:29-51). The broadcast/multicast data would have comprised control data and/or content of that database/server.

139. Applying Grube to Gurantz in the manner I've described would have been nothing more than combining prior art elements (Gurantz's bit-loading BCN network, and Grube's system of comparing determined bit-loadings of multiple receiving nodes to arrive at a common bit-loading scheme) according to known methods as taught in Gurantz and Grube. This would have yielded the predictable result of a BCN advantageously employing common bit-loading for plural transmission paths in a multi-cast or broadcast scenario.

d) [1C] "determining the common bit-loading modulation scheme from the received plurality of response signals;"

140. The obvious combination of Gurantz and Grube that I have described above for [1B] teaches this step. Gurantz teaches use of a "bit-loading modulation scheme," but does not provide detail as to that scheme being determined by a corresponding receiving node and included in a plurality of received response signals (responsive to the transmitted probe signal). Nor does Gurantz disclose determining a *common* bit-loading modulation scheme as recited. As I have explained for [1B], Grube teaches an arrangement with each of these elements, and would have suggested to a POSITA its use in Gurantz.

141. More specifically, according to Grube, a determination of a common bit-loading scheme for outgoing multi-carrier data transmissions is made by a “primary site” (e.g., primary site 102 as depicted in Grube’s Figure 9 (reproduced below)). The primary site makes this determination based on the bit-loading tables it receives back from designated “secondary sites” (e.g., Grube’s secondary sites 104, 106 and 108), which tables are sent in response to the training (i.e., probe) signals sent to the secondary sites by the primary site 102.

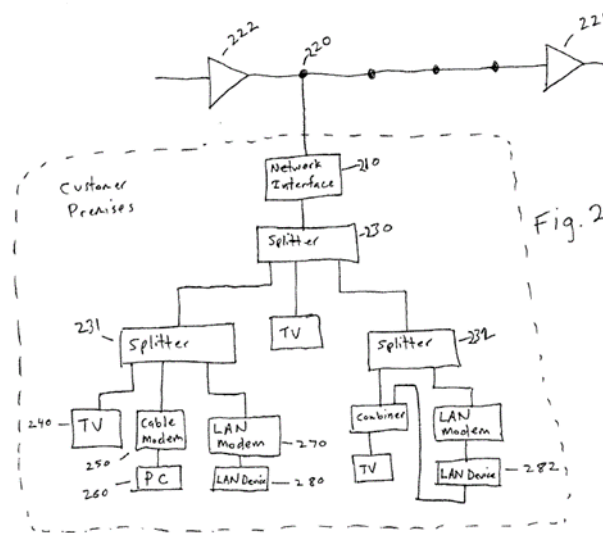


Ex. 1009, Fig. 9

142. In view of these teachings of Grube, it is my opinion that it would have been obvious to a POSITA to configure any one of Gurantz’s terminal devices as a

primary site, and Gurantz's other terminal devices as secondary sites with which the primary site would communicate.

143. To elaborate, Gurantz's Figure 2 (reproduced below) depicts a cable LAN on a customer premises comprising, on one branch, LAN modem 270 and LAN device 280.



Ex. 1007, Fig. 2

As Gurantz discloses, “terminal devices such as LAN modem 270, can receive a signal transmitted by another terminal device connected to the LAN wiring forming the network” Ex. 1007, ¶ [0020]. LAN modem 270 further “provides modulation and demodulation of the waveform transmitted over the cable”; and “has an interface to communicate with [the] LAN device 280 which is the source or destination of data transmitted over the LAN.” *Id.* Gurantz further discloses: “LAN device 280 can be, for example, a personal computer (PC). LAN device

282 [shown at a second node] can be, for example, a modulator to produce a signal for driving a TV through a signal combiner.” *Id.*

144. In my opinion, it would have been obvious to a POSITA to have configured Gurantz’s LAN modem/device pair 270/280 as a primary site, while configuring other LAN modem/device pairs, such as illustrated LAN modem/device pair (unlabeled)/282, as secondary sites on the LAN, according to Grube. See my discussion of [1B] above. In this obvious configuration, it would be Gurantz’s LAN modem/device pair 270/280, configured as a primary site according to Grube, that determines a common bit-loading modulation scheme. And this determination would be made from the plurality of response signals received from the plurality of secondary sites, as exemplified by Gurantz’s LAN modem/device pair (unlabeled)/282.

145. It should be noted that while Gurantz’s Figure 2 depicts two LAN nodes, either of which may be a receiving node or a transmitting node (Ex. 1007, ¶ [0020]), a POSITA would understand from Gurantz that the BCN may obviously include any desired number of such nodes. It would be understood that the number depicted is arbitrary and for merely illustrative purposes. Thus, a scenario where two or more of the nodes are configured as receiving nodes, while one is configured as a transmitting node, would have been obvious to a POSITA.

146. As with element [1B] previously discussed, applying Grube to Gurantz in the manner described would have been nothing more than combining prior art elements, namely Gurantz's bit-loading BCN network with Grube's system of comparing determined bit-loadings of multiple receiving nodes to arrive at a common bit-loading scheme, according to known methods (as taught in Gurantz and Grube). The predictable result would be a BCN employing common bit-loading for plural transmission paths in a multi-cast or broadcast scenario.

e) [1D] “receiving the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission;”

147. The obvious combination of Gurantz and Grube that I set forth above for [1PRE]-[1C] teaches this step. With reference to the detailed Gurantz-Grube combination set forth for [1C], it would have been Gurantz's representative LAN modem/device pair (unlabeled)/282 (and other like nodes), configured as secondary sites according to Grube, that receive the training (probe) signal from Gurantz's LAN modem/device pair 270/280 configured as a primary site. The signal would be received over the channel path connecting these terminal devices/nodes, as depicted in Gurantz's Figure 2.

f) [1E] “determining the transmission characteristics of the channel path at the one receiving node; and”

148. The obvious combination of Gurantz and Grube that I have set forth above for [1PRE]-[1D] teaches this step. As I set forth above for [1D], Gurantz's

representative LAN modem/device pair (unlabeled)/282 would be configured as a secondary site according to Grube. It would receive the training (probe) signal from Gurantz's LAN modem/device pair 270/280 (configured as a primary site). That signal would be sent over the channel path connecting these terminal devices/nodes, as depicted in Gurantz's Figure 2. It would be this same receiving node ("the one receiving node") that determines the transmission characteristics (e.g., Grube's "spectral response") of that channel path using the training (probe) signal.

g) [1F] "transmitting a response signal from the one receiving node to the transmitting node,"

149. The obvious combination of Gurantz and Grube that I have set forth above for [1PRE]-[1E] teaches this step. In the combination, Gurantz's representative LAN modem/device pair (unlabeled)/282 is configured as a secondary site according to Grube. It receives the training (probe) signal from Gurantz's LAN modem/device pair 270/280 (configured as a primary site), over the channel path connecting these terminal devices/nodes, as depicted in Gurantz's Figure 2. This same receiving node ("the one receiving node") would determine the transmission characteristics (e.g., Grube's "spectral response") of that channel path using the training (probe) signal. From these characteristics, a bit-loading table would be determined, and that table would be sent in a response signal to the primary site ("transmitting node").

h) [1G] “wherein the transmission characteristics of the channel path are determined by measuring the signal-to-noise (“SNR”) characteristics of the received probe signal at the one receiving node and”

150. Gurantz-Grube also teaches this limitation. Regarding bit-loading, Gurantz teaches that:

[h]igher SNR channels can support higher data capacity. Frequency bins occupying parts of the channel where the SNR is high can be used to transmit more bits. Each carrier may be modulated with a different order constellation, where higher SNR frequencies can bear a higher order constellation, and the resulting closer spacing of the constellation points. Frequencies with the lower SNR use lower constellations such as QPSK.

Ex. 1007, ¶ [0050]. Gurantz does not provide details regarding how the SNR of a given channel is to be determined. Grube provides more detail in this regard, suggesting the use of a training signal (i.e., a “probe signal” as recited).

151. Specifically, with reference to Figure 15, Grube teaches transmission from a primary site 102 of a “training signal” 280 to a plurality of secondary sites 104-106. Ex. 1009, 17:11-34. These receiving nodes ascertain a “spectral response” of the training signal which is used to determine “a bit loading for each of the carriers to produce a bit loading table 282.” *Id.*, 17:10-31, Fig. 15.

152. A POSITA would understand that Grube’s “spectral response” would indicate the signal-to-noise ratio (SNR) among other characteristics of the channel under test. It is my opinion that it would have been obvious to a POSITA to

employ in Gurantz a training (i.e., probe) signal as taught by Grube for purposes of making SNR determinations for the multi-carrier channels, in accordance with the teachings of Gurantz. In this regard, and as I noted before for element [1A], Grube supplies detail missing from Gurantz (i.e., use of a probe signal) for suitably determining the bit-loading that Gurantz itself contemplates.

153. Applying Grube to Gurantz in this manner would have been nothing more than combining prior art elements—Gurantz’s bit-loading BCN network, with Grube’s technique for determining the bit-loadings using a transmitted training (i.e., probe) signal. This would have been done using the known methods taught by the respective prior art references. The combination would have yielded the predictable result of a BCN employing bit-loading and including a methodology for determining an optimal bit-loading for particular transmission paths.

- i) [1H] **“wherein determining a common bit-loading modulation scheme includes: comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and determining the common bit-loading modulation scheme in response to comparing the plurality of bit loaded modulation schemes.”**

154. The Gurantz-Grube combination as I have set forth above for [1PRE]-[1G] also teaches this limitation. Gurantz does not disclose that its determined bit-loading modulation scheme is a “common” bit-loading modulation scheme.

However, this feature is taught by Grube. In particular, as I have set forth for [1B], Grube teaches in detail a *common* bit-loading scheme for use in a multi-cast scenario where the same data (e.g., control data) is to be transmitted simultaneously to multiple receiving nodes.

155. In the combination, multiple secondary sites (“receiving nodes”) of a communication network determine and inform a primary site (“transmitting node”) of a bit-loading table (“scheme”) for the respective secondary site, responsive to receiving the training (probe) signal sent by the primary site (“transmitting node”). Ex. 1009, 14:3-19, 17:10-45, Figs. 12, 15.

156. These tables are compared by the primary site (“transmitting node”) in order to determine a common bit-loading scheme for outgoing multi-carrier data transmissions, which Grube terms lowest common denominator (LCD) bit-loading. *Id.*, 14:64-15:5, 18:44-19:26, Fig. 17.

157. Grube describes the process for determining a common bit-loading table (outbound control channel bit loading table 338) from the bit-loading tables (320, 322, 324) it receives back from the secondary sites (1-3) in response to the training signals with reference to Figure 17 (reproduced above in paragraph 128). Therein, and as I have previously described, bit loading table 338 constitutes a determined common bit-loading modulation scheme, and the determination of that scheme is made based on a comparison as recited. “The outbound control channel

bit loading table 338 is generated by comparing the bit loading, on a carrier channel by carrier channel basis, of all of the site bit loading tables.” Ex. 1009, 18:53-55. Further, for the reasons I have previously set forth for element [1B], it is my opinion that it would have been obvious for a POSITA to have employed Grube’s teachings concerning a common bit-loading scheme in carrying out the system of Gurantz for a multi-cast scenario.

2. CLAIM 4

158. Gurantz in view of Grube teaches each and every limitation of claim 4, as I detail below.

a) [4PRE] (CRM preamble corresponds directly to method preamble of [1PRE])

159. For the same reasons I set forth for [1PRE] above, Gurantz in view of Grube teaches this preamble. With respect to the requirement for a “non-transitory computer-readable medium having software” for carrying out the recited functions/steps, I understand that a broad construction is warranted for purposes of this proceeding (*see* my paragraph 92 above). The limitation is met by the Gurantz-Grube combination in that a POSITA would understand each of the Gurantz and Grube systems to be carried out, implicitly and obviously, as software-driven computer-based processes. For example, Gurantz teaches that its terminal devices, e.g., LAN device 280, “can be, for example, a personal computer (PC).” Ex. 1007, ¶ 20. Similarly, Grube describes its primary site components as

including a controller 110 including a processor 172 and memory 174, which “may be a micro-computer, a personal computer, a work station, or a main frame computer” and having “sufficient processing power and memory to execute the primary site functions described throughout this specification.” Ex. 1009, 10:15-26, Fig. 10.

b) [4A] (CRM “logic” corresponds directly to method step [1A])

160. For the same reasons I set forth above for [1A], Gurantz in view of Grube teaches [4A].

c) [4B] (CRM “logic” corresponds directly to method step [1B])

161. For the same reasons I set forth above for [1B], Gurantz in view of Grube teaches [4B].

d) [4C] (CRM “logic” corresponds directly to method step [1C])

162. For the same reasons I set forth above for [1C], Gurantz in view of Grube teaches [4C].

e) [4D] (CRM “logic” corresponds directly to method step [1D])

163. For the same reasons I set forth above for [1D], Gurantz in view of Grube teaches [4D].

f) [4E] (CRM “logic” corresponds directly to method step [1E])

164. For the same reasons I set forth above for [1E], Gurantz in view of Grube teaches [4E].

g) [4F] (CRM “logic” corresponds directly to method step [1F])

165. For the same reasons I set forth above for [1F], Gurantz in view of Grube teaches [4F].

h) [4G] (CRM “*logic configured for generating the response signal, wherein the response signal utilizes a bit-loading modulation scheme that is generated by the one receiving node in response to determining the transmission characteristics of the channel path;*”—corresponds directly to method step [2H])

166. I note that a corresponding “generating” step is not included in claim 1, although similar limitations are included in steps of “receiving a plurality of response signals” [1B] and “transmitting a response signal” [1F]. The recited “logic configured for generating” is taught by the Gurantz-Grube combination.

167. Gurantz teaches use of a “bit-loading modulation scheme” as I have previously set forth, but does not give detail on that scheme being generated by a corresponding receiving node and included in a response signal (responsive to the transmitted probe signal). Grube teaches such an arrangement and, in my opinion, would have suggested to a POSITA its use in Gurantz.

168. Specifically, Grube teaches in detail a common bit-loading scheme for use in a multi-cast scenario where the same data is to be transmitted

simultaneously to multiple receiving nodes. Therein, secondary sites (“receiving nodes”) of a communication network generate a bit-loading table (“scheme”), responsive to receiving the training signal (probe) sent by the primary site (“transmitting node”). The table is generated based on the characteristics of the channel path ascertained from a “spectral response” of the training (probe) signal (which as taught by Gurantz would include evaluation of SNR—see my discussion of element [1G] above). Ex. 1009, 14:3-19, 17:10-45, Figs. 12, 15. Once generated, these bit-loading tables are sent to, and compared by, the primary site (“transmitting node”) in order to determine a common bit-loading scheme for outgoing multi-carrier data transmissions. Grube uses the term lowest common denominator (LCD) bit-loading to describe this common bit-loading scheme. *Id.*, 14:59-15:5, 18:44-19:26, Fig. 17.

169. In my opinion, it would have been obvious for a POSITA to have employed Grube’s teachings concerning a common bit-loading scheme in carrying out the system of Gurantz, for benefits as expressly taught in Grube, including optimizing communications for the case of multi-cast data communications. *Id.*, 4:43-51. See my discussion of element [1B] above for more detail in this regard. The obvious combination would have resulted in a step of (and logic configured for) generating the response signal as recited, i.e., the Grube bit-loading tables being generated at a receiving node of the Gurantz BCN.

i) [4H] (CRM “logic” corresponds directly to method step [1G])

170. For the same reasons I set forth above for [1G], Gurantz in view of Grube teaches [4H].

j) [4I] (CRM “logic” corresponds directly to method step [1H])

171. For the same reasons I set forth above for [1H], Gurantz in view of Grube teaches [4I].

3. CLAIM 7

172. Gurantz in view of Grube teaches each and every limitation of claim 7, as I detail below.

a) [7PRE] “A broadband cable network (“BCN”) for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in the BCN, the BCN comprising:”

173. Previous element [1PRE] is directed to a corresponding method carried out in a BCN as recited in [7PRE]. For the same reasons I have set forth for [1PRE], Gurantz-Grube teaches [7PRE].

b) [7A] “a transmitting node within the plurality of nodes, the transmitting node *capable of* sending a probe signal; and”

174. As I have discussed with respect to element [1PRE], Gurantz’s network includes a transmitting node within the plurality of nodes, and a sub-plurality of receiving nodes, but does not disclose the detail of the transmitting node being

capable of sending a probe signal. Grube teaches a transmitting node capable of sending a probe signal as recited, as I have discussed for element [1A].

175. For the reasons I have set forth above for element [1A], it would have been obvious to a POSITA to employ in Gurantz a training (i.e., probe) signal transmitted from a transmitting node as taught by Grube, for purposes of making SNR determinations for the multi-carrier channels in accordance with the teachings of Gurantz.

176. It is thus my opinion that Gurantz in view of Grube teaches limitation [7A].

c) [7B] “a sub-plurality of receiving nodes within the plurality of nodes, wherein the sub-plurality of receiving nodes are *capable of* transmitting a sub-plurality of response signals in response to receiving the probe signal, wherein the sub-plurality of response signals includes a plurality of bit-loading modulation schemes, wherein each bit loading modulation scheme of the plurality of bit loading modulation schemes is determined by a receiving node within the sub-plurality of receiving nodes,”

177. Previous element [1B] is directed to a corresponding step of receiving a sub-plurality of response signals from the sub-plurality of receiving nodes, wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node in response to receiving the probe signal. For the reasons I have set forth above for element [1B], Gurantz-Grube teaches a sub-

plurality of receiving nodes capable of transmitting a sub-plurality of response signals as recited in element [7B].

d) [7C] “wherein the transmitting node is *capable of* determining the common bit-loading modulation scheme from the sub-plurality of response signals, wherein the transmitting node is further *capable of* determining the common bit-loading modulation scheme in response to comparing all bit-loading modulation schemes within the plurality of bit-loading modulation schemes.”

178. Elements [1C] and [1H] collectively recite the same functional limitations. For the same reasons I have set forth above for these elements, Gurantz-Grube teaches a transmitting node capable of determining a common bit-loading modulation scheme from the sub-plurality of response signals as recited, including by comparing all bit-loading schemes within the plurality of bit-loading modulation schemes of the response signals.

4. CLAIMS 8 AND 9 DEPENDING FROM CLAIM 7

179. Gurantz in view of Grube teaches each and every limitation of claims 8 and 9, as I detail below.

a) [8] “The BCN of claim 7, wherein each bit-loading modulation scheme utilizes a quadrature phase shift keying (QPSK) modulation.”

180. Gurantz teaches this limitation through its teaching of “[a]pplication of DMT and OFDM to the present invention.” Ex. 1007, ¶ [0046]. As Gurantz explains, “OFDM utilizes **quadrature phase shift keying (QPSK)** and multi-level

quadrature amplitude modulation (QAM) wherein each OFDM carrier can be modulated by an amplitude/phase varying signal.” *Id.*, ¶ [0047] (emphasis added). *See also, id.*, ¶ [0049] (explaining composition and use of QPSK).

181. Gurantz further teaches bit-loading as part of the modulation. “Higher SNR channels can support higher data capacity. . . . Frequencies with the lower SNR use lower order constellations such as QPSK.” *Id.*, ¶ [0050].

182. In view of Gurantz’s teachings of QPSK modulation, it is my opinion that it would have been obvious to carry out the combined teachings of Gurantz and Grube with each bit-loading modulation scheme utilizing QPSK. This would have been nothing more than choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success, and combining prior art elements according to known methods to yield predictable results. *Id.*

b) [9] “The BCN of claim 7, wherein the [sic] each bit-loading modulation scheme utilizes quadrature amplitude modulation (QAM).”

183. Gurantz teaches this limitation through its teaching of “[a]pplication of DMT and OFDM to the present invention.” Ex. 1007, ¶ [0046]. As Gurantz explains, “OFDM utilizes quadrature phase shift keying (QPSK) and **multi-level quadrature amplitude modulation (QAM)** wherein each OFDM carrier can be modulated by an amplitude/phase varying signal.” *Id.*, ¶ [0047] (emphasis added). *See also, id.*, ¶ [0049] (explaining composition and use of QAM).

184. Gurantz further teaches bit-loading as part of the modulation. “Higher SNR channels can support higher data capacity. Frequency bins occupying parts of the channel where the SNR is high can be used to transmit more bits. Each carrier may be modulated with a different order constellation, where higher SNR frequencies can bear a higher order constellation, and the resulting closer spacing of the constellation points.” Ex. 1007, ¶ [0050].

185. In view of Gurantz’s teachings to use QAM modulation as set forth above, it is my opinion that it would have been obvious for a POSITA to carry out the combined teachings of Gurantz and Grube with each bit-loading modulation scheme utilizing QAM. This would have been nothing more than choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success, and combining prior art elements according to known methods to yield predictable results.

5. CLAIM 11

186. Gurantz in view of Grube teaches each and every limitation of claim 11, as I detail below.

a) [11PRE] “The BCN of claim 7, wherein a receiving node within the sub-plurality of receiving nodes is capable of:”

187. The receiving nodes of Gurantz-Grube have the recited capabilities, as I demonstrate for [11A]-[11F] below.

b) [11A] “receiving the probe signal at the receiving node ...” (direct correspondence to method step [1D])

188. For the same reasons I have set forth above for [1D], Gurantz in view of Grube teaches [11A].

c) [11B] “determining the transmission characteristics of the channel path ...” (direct correspondence to method step [1E])

189. For the same reasons I have set forth above for [1E], Gurantz in view of Grube teaches [11B].

d) [11C] “transmitting a response signal ... from the receiving node to the transmitting node,” (direct correspondence to method step [1F])

190. For the same reasons I have set forth above for [1F], Gurantz in view of Grube teaches [11C].

e) [11D] “receiving node” capability directly corresponding to method limitation [1G]—SNR measurement

191. For the same reasons I have set forth above for [1G], Gurantz in view of Grube teaches [11D].

f) [11E] “receiving node” capability directly corresponding to method step [2H] and logic of [4G]—generating the response signal

192. For the same reasons I have set forth above for [4G], Gurantz in view of Grube teaches [11E].

g) [11F] “transmitting node” capability directly corresponding to method step [1H]—determining a common bit-loading modulation scheme

193. For the same reasons I have set forth above for [1H], Gurantz in view of Grube teaches [11F].

6. CLAIM 14

194. Gurantz in view of Grube teaches each and every limitation of claim 14, as I detail below.

a) [14PRE] (same as [7PRE])

195. Previous element [1PRE] is directed to a corresponding method carried out in a BCN as recited in [14PRE]. For the same reasons I have set forth above for [1PRE], Gurantz-Grube teaches [14PRE].

b) [14A] (same as [7A] but substituting “having means for” for “capable of”)

196. For the same reasons I have set forth above for [7A], Gurantz in view of Grube teaches [14A].

c) [14B] (same as [7B] but substituting “have means for” for “are capable of”)

197. For the same reasons I have set forth for [7B], Gurantz in view of Grube teaches [14B].

- d) [14C] (same as [7C] but substituting “includes means for” for “is capable of” and substituting “further includes means for” for “is further capable of”)**

198. For the same reasons I have set forth above for [7C], Gurantz in view of Grube teaches [14C].

7. CLAIMS 15-16 DEPENDING FROM CLAIM 14

- a) [15] (same as [8] but depending from [14])**

199. For the same reasons I have set forth above for [8], Gurantz in view of Grube teaches [15].

- b) [16] (same as [9] but depending from [14])**

200. For the same reasons I have set forth above for [9], Gurantz in view of Grube teaches [16].

8. CLAIM 20

201. As I detail below, Gurantz in view of Grube teaches each and every limitation of claim 20.

- a) [20PRE] (same as [14PRE], [7PRE])**

202. Previous element [1PRE] is directed to a corresponding method carried out in a BCN as recited in [20PRE]. For the same reasons I have set forth above for [1PRE], Gurantz-Grube teaches [20PRE].

- b) [20A] (same as [14A]; same as [7A] but substituting “having means for” for “capable of”)**

203. For the same reasons I have set forth above for [7A], Gurantz in view of Grube teaches [20A].

- c) **[20B] (same as [14B]; same as [7B] but substituting “have means for” for “are capable of”)**

204. For the same reasons I have set forth above for [7B], Gurantz in view of Grube teaches [20B].

- d) **[20C] (recites the same “transmitting node includes means for determining the common bit-loading modulation scheme ...” as recited in [14C]; same with respect to [7C], but substituting “includes means for” for “is capable of”)**

205. For the same reasons I have set forth above for [7C], Gurantz in view of Grube teaches [20C].

- e) **[20D] (a “receiving node” includes “means for” carrying out the same method step (function) recited in [1D]—receiving the probe signal)**

206. For the same reasons I have set forth above for [1D], Gurantz in view of Grube teaches [20D].

- f) **[20E] (“means for” carrying out the same method step (function) recited in [1E]—determining the transmission characteristics)**

207. For the same reasons I have set forth above for [1E], Gurantz in view of Grube teaches [20E].

- g) **[20F] (“means for” carrying out the same method step (function) recited in [1F]—transmitting a response signal)**

208. For the same reasons I have set forth above for [1F], Gurantz in view of Grube teaches [20F].

h) [20G] (receiving node includes “means for” carrying out the same method step (function) recited in [1G]—SNR measuring)

209. For the same reasons I have set forth above for [1G], Gurantz in view of Grube teaches [20G].

i) [20H] (same “means” as [18B]; “receiving node includes means for” carrying out the same method step (function) in [2H] and logic of [4G]—generating the response signal)

210. For the same reasons I have set forth above for [4G], Gurantz in view of Grube teaches [20H].

j) [20I] (same as [18C]; redundant of [20C])

211. As with redundant [20C] and identical [18C], for the same reasons I have set forth above for [7C], Gurantz in view of Grube teaches [20I].

k) [20J] (same as [18D]; “means for” recitations directly corresponding to the method steps (functions) of [1H]—related to determining the common bit-loading modulation scheme)

212. For the same reasons I have set forth above for [1H], Gurantz in view of Grube teaches [20J].

9. CLAIM 21

213. As I detail below, Gurantz in view of Grube teaches each and every limitation of claim 21.

a) [21PRE] (same as [7PRE], [14PRE], [20PRE])

214. Previous element [1PRE] is directed to a corresponding method carried out in a BCN as recited in [21PRE]. For the same reasons I have set forth above for [1PRE], Gurantz-Grube teaches [21PRE].

b) [21A] (“means for” carrying out the same method step (function) recited in [1A]—transmitting a probe signal)

215. For the same reasons I have set forth above for [1A], Gurantz in view of Grube teaches [21A].

c) [21B] (“means for” carrying out the same method step (function) recited in [1B]—receiving a plurality of response signals)

216. For the same reasons I have set forth above for [1B], Gurantz in view of Grube teaches [21B].

d) [21C] (“means for” carrying out the same method step (function) recited in [1C]—determining the common bit-loading modulation scheme)

217. For the same reasons I have set forth for [1C], Gurantz in view of Grube teaches [21C].

e) [21D] (“means for” carrying out the same method step (function) recited in [1D]—receiving the probe signal)

218. For the same reasons I have set forth above for [1D], Gurantz in view of Grube teaches [21D].

- f) [21E] (“means for” carrying out the same method step (function) recited in [1E]—determining the transmission characteristics)**

219. For the same reasons I have set forth above for [1E], Gurantz in view of Grube teaches [21E].

- g) [21F] (like [20F]; “means for” carrying out the same method step (function) recited in [1F]—transmitting a response signal)**

220. For the same reasons I have set forth above for [1F], Gurantz in view of Grube teaches [21F].

- h) [21G] (like [18B] and [20H]; “means for” carrying out the same method step (function) in [2H] and logic in [4G]—generating the response signal)**

221. For the same reasons I have set forth above for [4G], Gurantz in view of Grube teaches [21G].

- i) [21H] (“means for” carrying out the same method step (function) recited in [1G]—SNR measuring)**

222. For the same reasons I have set forth above for [1G], Gurantz in view of Grube teaches [21H].

- j) [21I] (same as [20J], [18D]; “means for” recitations directly corresponding to the method steps (functions) of [1H]—related to determining the common bit-loading modulation scheme)**

223. For the same reasons I have set forth above for [1H], Gurantz in view of Grube teaches [21I].

C. GROUND B: Claims 2, 3, 5, 6, 12, 13, 22, 23 are Rendered Obvious by Gurantz in view of Grube and further in view of Gesbert

1. CLAIM 2

224. As I detail below, Gurantz in view of Grube and further in view of Gesbert teaches each and every limitation of claim 2.

a) [2PRE] (identical to [1PRE])

225. For the same reasons I have set forth above for [1PRE], Gurantz in view of Grube teaches [2PRE].

b) [2A] (identical to [1A])

226. For the same reasons I have set forth above for [1A], Gurantz in view of Grube teaches [2A].

c) [2B] (identical to [1B])

227. For the same reasons I have set forth above for [1B], Gurantz in view of Grube teaches [2B].

d) [2C] (identical to [1C])

228. For the same reasons I have set forth above for [1C], Gurantz in view of Grube teaches [2C].

e) [2D] (identical to [1D])

229. For the same reasons I have set forth above for [1D], Gurantz in view of Grube teaches [2D].

f) [2E] (identical to [1E])

230. For the same reasons I have set forth above for [1E], Gurantz in view of Grube teaches [2E].

g) [2F] (identical to [1F])

231. For the same reasons I have set forth above for [1F], Gurantz in view of Grube teaches [2F].

h) [2G] “wherein the transmission characteristics of the channel path are determined by measuring the bit-error rate (“BER”) characteristics of the received probe signal at the one receiving node and”

232. This limitation [2G] is identical to [1G] above, except that [2G] substitutes “bit-error rate (‘BER’) characteristics” for “signal-to-noise (‘SNR’) characteristics” as the measured parameter of the received probe signal. Gurantz-Grube, while disclosing SNR as a measure of the characteristics of the received probe signal, does not expressly mention BER as an alternative measure. It is my opinion that this alternative measure would have been obvious to a POSITA in view of Gesbert, for reasons I will now explain.

233. Gesbert discloses a multi-mode wireless data transmission system, wherein the selection of a transmission mode is made from among multi-carrier transmission modes having different modulation rates and coding rates. *See, e.g.*, Ex. 1010, ¶¶ [0036]-[0037], Table 1. The mode selections are made based on one

or more monitored quality parameters of the communication channel, including BER and SNR. *Id.*, ¶¶ [0014]-[0017].

234. In view of Gesbert, it would have been obvious to employ in the Gurantz-Grube combination a bit error rate (BER) (as an additional or alternative measure to SNR) for determining the channel characteristics from which bit-loading would be determined. BER is a measure for the average number of bit errors in a data transmission. A POSITA would have appreciated that BER and SNR are closely-related measures of transmission characteristics, with BER being a digital domain measure generally inversely correlated to the SNR, an analog measurement. *Id.* For a given form of digital modulation (i.e. QPSK or QAM), graphs were known that plotted this inverse relationship. *Id.* A POSITA would have recognized both measures as useful for carrying out bit-loading. *Id.* In this regard, the '759 patent itself recognizes these (and other) measures as mere examples of “metric values of the channel path” that would be “appreciate[d] by those skilled in the art.” Ex. 1001, 11:5-14.

235. To use in Gurantz-Grube BER instead of (or in addition to) SNR, for determining transmission characteristics (and hence suitable bit-loading) would have been nothing more than choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success.

**i) [2H] (step of “generating the response signal”
corresponding directly to function of CRM “logic”
recited in [4G])**

236. For the same reasons I have set forth above for [4G], Gurantz in view of Grube teaches [2H].

j) [2I] (identical to [1H])

237. For the same reasons I have set forth above for [1H], Gurantz in view of Grube teaches [2I].

2. CLAIM 3

238. As I detail below, Gurantz in view of Grube and further in view of Gesbert teaches each and every limitation of claim 3.

a) [3PRE] (identical to [1PRE])

239. For the same reasons I have set forth for [1PRE], Gurantz in view of Grube teaches [3PRE].

b) [3A] (identical to [1A])

240. For the same reasons I have set forth above for [1A], Gurantz in view of Grube teaches [3A].

c) [3B] (identical to [1B])

241. For the same reasons I have set forth above for [1B], Gurantz in view of Grube teaches [3B].

d) [3C] (identical to [1C])

242. For the same reasons I have set forth above for [1C], Gurantz in view of Grube teaches [3C].

e) [3D] (identical to [1D])

243. For the same reasons I have set forth above for [1D], Gurantz in view of Grube teaches [3D].

f) [3E] (identical to [1E])

244. For the same reasons I have set forth above for [1E], Gurantz in view of Grube teaches [3E].

g) [3F] (identical to [1F])

245. For the same reasons I have set forth above for [1F], Gurantz in view of Grube teaches [3F].

h) [3G] (identical to [1G])

246. For the same reasons I have set forth above for [1G], Gurantz in view of Grube teaches [3G].

i) [3H] “wherein the transmission characteristics of the channel path are determined by measuring the packet-error rate (“PER”) characteristics of the received probe signal at the one receiving node, and”

247. This limitation [3H] is identical to [1G] above, except that [3H] substitutes “packet-error rate (“PER”) characteristics” for “signal-to-noise (‘SNR’) characteristics.” Gurantz-Grube, while disclosing SNR as a measure of the

characteristics of the received probe signal, does not expressly mention PER as an alternative measure. In my opinion, this alternative measure would have been obvious to a POSITA in view of Gesbert, for reasons I will now explain.

248. As I described above for [2G], Gesbert discloses a multi-mode wireless data transmission system, wherein the selection of a transmission mode is made from among multi-carrier transmission modes having different modulation rates and coding rates. *See, e.g.*, Ex. 1010, ¶¶ [0036]-[0037], Table 1. The mode selections are made based on one or more monitored quality parameters of the communication channel, including PER (in addition to BER and SNR). *Id.*, ¶¶ [0014]-[0017].

249. In view of Gesbert, it would have been obvious to a POSITA to employ in the Gurantz-Grube combination a packet error rate (PER) (as an additional or alternative measure to SNR) for determining the channel characteristics from which bit-loading would be determined. While BER is a measure for the average number of bit errors in a data transmission, PER takes this measure one step further, to measure the average error rates in transmitted packets of bits. Both are measures of performance in the "digital" domain.

250. A POSITA would have appreciated that PER, BER and SNR are closely-related measures of transmission characteristics, with PER and BER being digital measures generally inversely correlated to the SNR, a measurement taken in

the analog domain. A POSITA would have recognized all three measures as useful for carrying out bit-loading. In this regard, the '759 patent itself recognizes these three measures as mere examples of “metric values of the channel path” that would be “appreciate[d] by those skilled in the art.” Ex. 1001, 11:5-14; *Id.*

251. To use in Gurantz-Grube PER instead of (or in addition to) SNR, for determining transmission characteristics (and hence suitable bit-loading) would have been nothing more than choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success.

j) [3I] (identical to [1H])

252. For the same reasons I have set forth above for [1H], Gurantz in view of Grube teaches [3I].

3. CLAIM 5

253. As I detail below, Gurantz in view of Grube, and further in view of Gesbert, teaches each and every limitation of claim 5.

a) [5PRE] (same as [4PRE]—CRM preamble corresponds directly to method preamble of [1PRE])

254. For the same reasons I have set forth above for [4PRE] and [1PRE], Gurantz in view of Grube teaches [5PRE].

b) [5A] (same as [4A]—CRM “logic” corresponds directly to method step [1A])

255. For the same reasons I have set forth above for [1A], Gurantz in view of Grube teaches [5A].

c) [5B] (same as [4B]—CRM “logic” corresponds directly to method step [1B])

256. For the same reasons I have set forth above for [1B], Gurantz in view of Grube teaches [5B].

d) [5C] (same as [4C]—CRM “logic” corresponds directly to method step [1C])

257. For the same reasons I have set forth above for [1C], Gurantz in view of Grube teaches [5C].

e) [5D] (CRM “logic” corresponds directly to method step [2G])

258. For the same reasons I have set forth above for [2G], Gurantz in view of Grube, and further in view of Gesbert, teaches [5D].

f) [5E] (CRM “logic” corresponds directly to method step [1H])

259. For the same reasons I have set forth above for [1H], Gurantz in view of Grube teaches [5E].

4. CLAIM 6

260. As I detail below, Gurantz in view of Grube, and further in view of Gesbert, teaches each and every limitation of claim 6.

a) [6PRE] (same as [4PRE]—CRM preamble corresponds directly to method preamble of [1PRE])

261. For the same reasons I have set forth above for [4PRE] and [1PRE], Gurantz in view of Grube teaches [6PRE].

b) [6A] (same as [4A]—CRM “logic” corresponds directly to method step [1A])

262. For the same reasons I have set forth above for [1A], Gurantz in view of Grube teaches [6A].

c) [6B] (same as [4B]—CRM “logic” corresponds directly to method step [1B])

263. For the same reasons I have set forth above for [1B], Gurantz in view of Grube teaches [6B].

d) [6C] (same as [4C]—CRM “logic” corresponds directly to method step [1C])

264. For the same reasons I have set forth above for [1C], Gurantz in view of Grube teaches [6C].

e) [6D] (same as [4G]—CRM “logic” corresponds directly to method step [2H])

265. For the same reasons I have set forth above for [4G], Gurantz in view of Grube teaches [6D].

f) [6E] (CRM “logic” corresponds directly to method step [3H])

266. For the same reasons I have set forth above for [3H], Gurantz in view of Grube, and further in view of Gesbert, teaches [6E].

g) [6F] (same as [4I]—CRM “logic” corresponds directly to method step [1H])

267. For the same reasons I have set forth above for [1H], Gurantz in view of Grube teaches [6F].

5. CLAIM 12 (DEPENDING FROM CLAIM 7)

268. As I detail below, Gurantz in view of Grube, and further in view of Gesbert, teaches each and every limitation of claim 12.

a) [12PRE] (same as [11PRE])

269. The receiving nodes of Gurantz-Grube-Gesbert have the recited capabilities, as I demonstrate below for [12A]-[12F].

b) [12A] (same as [11A]; direct correspondence to method step [1D])

270. For the same reasons I have set forth above for [1D], Gurantz in view of Grube teaches [12A].

c) [12B] (same as [11B]; direct correspondence to method step [1E])

271. For the same reasons I have set forth above for [1E], Gurantz in view of Grube teaches [12B].

d) [12C] (same as [11C]; direct correspondence to method step [1F])

272. For the same reasons I have set forth above for [1F], Gurantz in view of Grube teaches [12C].

e) [12D] “receiving node” capability directly corresponding to method limitation [2G]—BER measurement

273. For the same reasons I have set forth above for [2G], Gurantz in view of Grube, and further in view of Gesbert, teaches [12D].

f) [12E] (same as [11E]; “receiving node” capability directly corresponding to method step [2H]—generating the response signal)

274. For the same reasons I have set forth above for [2H], Gurantz in view of Grube teaches [12E].

g) [12F] (same as [11F]; “transmitting node” capability directly corresponding to method step [1H]—determining a common bit-loading modulation scheme)

275. For the same reasons I have set forth above for [11F] and [1H], Gurantz in view of Grube teaches [12F].

6. CLAIM 13 (DEPENDING FROM CLAIM 7)

276. As I detail below, Gurantz in view of Grube, and further in view of Gesbert, teaches each and every limitation of claim 13.

a) [13PRE] (same as [11PRE], [12PRE])

277. The receiving nodes of Gurantz-Grube-Gesbert have the recited capabilities, as I demonstrate below for [13A]-[13F].

b) [13A] (same as [11A], [12A]; direct correspondence to method step [1D])

278. For the same reasons I have set forth above for [1D], Gurantz in view of Grube teaches [13A].

c) [13B] (same as [11B], [12B]; direct correspondence to method step [1E])

279. For the same reasons I have set forth above for [1E], Gurantz in view of Grube teaches [13B].

d) [13C] (same as [11C], [12C]; direct correspondence to method step [1F])

280. For the same reasons I have set forth above for [1F], Gurantz in view of Grube teaches [13C].

e) [13D] (“receiving node” capability directly corresponding to method limitation [3H]—PER measurement)

281. For the same reasons I have set forth above for [3H], Gurantz in view of Grube teaches [13D].

f) [13E] (same as [11E], [12E]; “receiving node” capability directly corresponding to method step [2H]—generating the response signal)

282. For the same reasons I have set forth above for [2H], Gurantz in view of Grube teaches [13E].

g) [13F] (same as [11F], [12F]; “transmitting node” capability directly corresponding to method step [1H]—determining a common bit-loading modulation scheme)

283. For the same reasons I have set forth above for [1H], Gurantz in view of Grube teaches [13F].

7. CLAIM 22

284. Gurantz in view of Grube and further in view of Gesbert teaches each and every limitation of claim 22, as I detail below.

- a) **[22PRE] (same as [7PRE], [14PRE], [20PRE], [21PRE])**

285. Previous element [1PRE] is directed to a corresponding method carried out in a BCN as recited in [22PRE]. For the same reasons I have set forth for [1PRE], Gurantz-Grube teaches [22PRE].

- b) **[22A] (same as [21A]; “means for” carrying out the same method step (function) recited in [1A]—transmitting a probe signal)**

286. For the same reasons I have set forth above for [1A], Gurantz in view of Grube teaches [22A].

- c) **[22B] (same as [21B]; “means for” carrying out the same method step (function) recited in [1B]—receiving a plurality of response signals)**

287. For the same reasons I have set forth above for [1B], Gurantz in view of Grube teaches [22B].

- d) **[22C] (same as [21C]; “means for” carrying out the same method step (function) recited in [1C]—determining the common bit-loading modulation scheme)**

288. For the same reasons I have set forth above for [1C], Gurantz in view of Grube teaches [22C].

- e) **[22D] (same as [21D]; “means for” carrying out the same method step (function) recited in [1D]—receiving the probe signal)**

289. For the same reasons I have set forth above [1D], Gurantz in view of Grube teaches [22D].

- f) [22E] (same as [21E]; “means for” carrying out the same method step (function) recited in [1E]—determining the transmission characteristics)**

290. For the same reasons I have set forth above for [1E], Gurantz in view of Grube teaches [22E].

- g) [22F] (same as [21F]; “means for” carrying out the same method step (function) recited in [1F]—transmitting a response signal)**

291. For the same reasons I have set forth above for [1F], Gurantz in view of Grube teaches [22F].

- h) [22G] (same as [21G]; “means for” carrying out the same method step (function) recited in [2H]—generating the response signal)**

292. For the same reasons I have set forth above for [2H], Gurantz in view of Grube teaches [22G].

- i) [22H] (same means recited in [18A]; “receiving node includes means for” carrying out the same method step (function) recited in [2G]—BER measuring)**

293. For the same reasons I have set forth above for [2G], Gurantz in view of Grube, and further in view of Gesbert, teaches [22H].

- j) [22I] (same as [20J], [18D]; “means for” recitations directly corresponding to the method steps (functions) of [1H]—related to determining the common bit-loading modulation scheme)**

294. For the same reasons I have set forth above for [1H], Gurantz in view of Grube teaches [22I].

8. CLAIM 23 (DEPENDING FROM CLAIM 22)

295. As I detail below, Gurantz in view of Grube, and further in view of Gesbert, teaches each and every limitation that claim 23 adds to its base claim 22 (which I have already addressed above).

- a) [23A] (same as/redundant of [22G]; “means for” carrying out the same method step (function) recited in [2H]—generating the response signal)**

296. For the same reasons I have set forth above for [2H], Gurantz in view of Grube teaches [23A].

- b) [23B] (same as/redundant of [22I]; “means for” recitations directly corresponding to the method steps (functions) of [1H]—related to the determining a common bit-loading modulation scheme)**

297. For the same reasons I have set forth above for [1H], Gurantz in view of Grube teaches [23B].

D. GROUND C: Claims 10 and 17 are Rendered Obvious by Gurantz in view of Grube and further in view of Shattil

1. CLAIM 10 (DEPENDING FROM CLAIM 9)

- a) [10] “The BCN of claim 9, wherein each bit-loading modulation scheme is chosen from the group essentially consisting of 64 QAM modulation, 128 QAM modulation, 256 QAM modulation, 512 QAM modulation and 1024 QAM modulation.”**

298. Gurantz teaches each bit-loading modulation scheme comprising QAM of higher and lower order constellations as sustainable by the respective carriers, as I explained above with respect to [1PRE]. *See also*, Ex.1007, ¶ [0047] (“OFDM

utilizes . . . multi-level [QAM] wherein each OFDM carrier can be modulated by an amplitude/phase varying signal. To modulate, data bits are encoded into a number of m-ary PSK constellations, which then modulate the respective carriers.”).

299. Gurantz does not specifically mention the particular orders of QAM modulation that may be used, i.e., 64 QAM, 128 QAM, etc. It is my opinion, however, that it would have been obvious to a POSITA to carry out the Gurantz-Grube methodology employing one or more of 64 QAM, 128 QAM, 256 QAM, 512 QAM and 1024 QAM as recited, considering Shattil.

300. Shattil, similar to Gurantz, teaches a multicarrier transmission protocol (including OFDM) and employing bit-loading based on determined channel characteristics. Shattil further discloses that “[t]he modulation of the binary input data can be of many types ... [including] quadrature amplitude modulation (QAM) or other derivatives of these modulation schemes, such as . . . 64-QAM.” Ex. 1011, 6:20-25.

301. Thus, Shattil evidences recognition in the art of 64-QAM as a known suitable order of QAM for use in multi-carrier (including OFDM) data transmissions employing bit-loading. *See also*, Ex. 1012, 38-42 (§ 4.2.9) (general knowledge in the art regarding QAM, including 64- and 256-QAM). Selection of 64-QAM as one of the orders of QAM modulation used in the Gurantz-Grube bit-

loading (thus meeting the claim limitation) would have been nothing more than choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success.

2. CLAIM 17 (DEPENDING FROM CLAIM 16)

a) [17] (same as [10] but depending from [16])

302. For the same reasons I have set forth above for claim 10, Gurantz in view of Grube and further in view of Shattil teaches claim 17.

E. GROUND D: Claims 18 and 19 are Rendered Obvious by Gurantz in view of Grube and further in view of Shattil and Gesbert

1. CLAIM 18 (DEPENDING FROM CLAIM 17)

303. Gurantz in view of Grube and further in view of Shattil and Gesbert teaches each and every limitation of claim 18, as I detail below. Shattil is applied in the manner I have described above for parent claim 17.

a) [18A] (“receiving node includes means for” carrying out the same method step (function) recited in [2G]—BER measuring)

304. For the same reasons I have set forth above for [2G], Gurantz in view of Grube and further in view of Gesbert teaches [18A].

b) [18B] (“receiving node includes means for” carrying out the same method step (function) recited in [2H]—generating the response signal; corresponds directly to function of CRM “logic” recited in [4G])

305. For the same reasons I have set forth above for [4G], Gurantz in view of Grube teaches [18B].

- c) [18C] (“transmitting node includes means for” carrying out the same method step (function) recited in [1C]—determining a common bit-loading modulation scheme)**

306. For the same reasons I have set forth above for [1C], Gurantz in view of Grube teaches [18C].

- d) [18D] (“means for” recitations directly corresponding to the method steps (functions) of [1H]—related to determining the common bit-loading modulation scheme)**

307. For the same reasons I have set forth above for [1H], Gurantz in view of Grube teaches [18D].

2. CLAIM 19 (DEPENDING FROM CLAIM 17)

308. Gurantz in view of Grube, and further in view of Shattil and Gesbert, teaches each and every limitation dependent claim 19 adds to its parent claim 17 (which I have addressed above). Shattil is applied in the manner I have described above for parent claim 17.

- a) [19A] (“receiving node includes means for” carrying out the same method step (function) recited in [3H]—PER measuring)**

309. For the same reasons I have set forth above for [3H], Gurantz in view of Grube and further in view of Gesbert teaches [19A].

- b) [19B] (same as [18B]; “receiving node includes means for” carrying out the same method step (function) recited in [2H]—generating the response signal; corresponds directly to function of CRM “logic” recited in [4G])**

310. For the same reasons I have set forth above for [4G], Gurantz in view of Grube teaches [19B].

- c) [19C] (same as [18C]; “transmitting node includes means for” carrying out the same method step (function) recited in [1C]—determining the common bit-loading modulation scheme)**

311. For the same reasons I have set forth above for [1C], Gurantz in view of Grube teaches [19C].

- d) [19D] (same as [18D]; “means for” recitations directly corresponding to the method steps (functions) of [1H]—related to the determining a common bit-loading modulation scheme)**

312. For the same reasons I have set forth above for [1H], Gurantz in view of Grube teaches [19D].

F. EVIDENCE OF NON-OBVIOUSNESS

313. It is my understanding that in order for evidence of non-obviousness or secondary considerations to be relevant, there must be a nexus between the claimed invention and the evidence. I am not aware of any evidence of non-obviousness or secondary considerations pertinent to the '759 patent claims.

XIII. CONCLUSION

All of the statements made in this declaration of my own knowledge are true. All statements made based on information and belief are believed to be true. Further, these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under § 1001 of Title 18 of the United States Code.

Date: 2-14-2024


James G. Bertonis

Appendix A

PROFESSIONAL EXPERIENCE

2009 to
Present **Azure Communications Inc.**
CEO

Azurecomm designs and develops wireless broadband solutions and advanced radio communications technology. The company has deep technical experience over the vast array of wireless protocols, devices, and systems employed across the RF and microwave frequency spectrum. Participation in the IEEE 802.11, 802.15, and 802.16 standards. Azurecomm has a proven track record having developed and sold broadband wireless equipment in use by major broadband service providers worldwide. The company is currently developing wireless designs and systems for new 5G, and IoT applications.

2003 to
2008 **Arcwave Inc.**
Chief Technical Officer

Arcwave was created by the merger of Advanced Radio Cells Inc., and CoWave Networks. Managed all technology and product development efforts of the company. Architected and led the design team for the evolution of a DOCSIS based broadband wireless system originally for Wireless ISP's, to address the requirements of cable system operators (MSOs) to provide broadband wireless extension to their cable plants. This product strategy created a new market segment, and enabled Arcwave in one year to become the recognized industry leader in wireless solutions for the cable industry.

2000 to
2003 **Advanced Radio Cells Incorporated (ARCi)**
CEO and Founder

Lead the company from inception to over \$1 million in sales and raised over \$7 million in corporate and venture capital investment. Assembled the management team, developed corporate partners and key customer relationships. Performed successfully in a difficult business environment to adapt plans to reflect changing market and financial conditions. Successfully drove the merger of ARCi with CoWave Networks in March 2003.

ARCi developed and brought to market a high performance broadband wireless delivery system operating in the license-free 5.3, and 5.8 GHz frequency bands. ARCi concentrated its development effort on RF system engineering, and adapting the DOCSIS cable modem standard for wireless Internet capability, creating wireless DOCSIS. This leveraged solution enabled ISPs to deliver profitable wireless broadband service to communities, providing affordable high-speed wireless Internet delivery. ARCi has a wireless ISP and Telco installed system customer base, serving both business and residential users.

1986 to
2000 **ADBS CORPORATION**
CEO

Wireless consulting firm specializing in design and engineering of Wireless LAN, WAN, Satellite, Cellular handset design, and base stations. Technology includes 802.16/WiMAX, 802.11/Wi-Fi, CDMA, DOCSIS, DBS, VSATs, OFDM, Spread Spectrum, FSK, MSK, QPSK to 256QAM modulation. Patent analysis, assessment and litigation support including James Bertonis testifying as a wireless technology expert in several litigations.

1981 to
1984 **TELECOM INDUSTRIES CORPORATION**
CEO/Co-founder

Manufacturer of satellite communications products and a pioneer in the home satellite TV industry. Innovative products included the first 4 GHz integrated low noise satellite down-converter, an award winning TVRO receiver design, and a portable collapsible dish antenna. Lead company through product development, manufacturing start-up, sales development, and corporate financing. Company was sold to its largest customer.

1978 to
1980 **NATIONAL SEMICONDUCTOR CORPORATION**
Design Engineer/Project Manager, Module Products Group

Developed specialized analog and RF functional circuit modules for high volume production in consumer, cable television, and industrial product applications. Managed project design, customer engineering, and the release to manufacturing.

1976 to
1978 **BLONDER-TONGUE LABORATORIES, INC.**
RF Design Engineer, Advanced Cable Products Division

On the development team for the world's first broadcast wireless Cable-TV system, deployed from transmitters located on the World Trade Center tower, providing pay television throughout the New York metropolitan area. Responsible for RF and video circuit design for descrambling systems, modulators, and set-top box development.

EXPERT WITNESS AND LITIGATION SUPPORT EXPERIENCE

Case: **Motorola Solutions v. Hytera Communications**
Matter: Trade Secret theft
Court: United States District Court, N. Illinois, Case No. 1:17 CV-1973
Project: Technical expert - Analysis and report on scope of development for digital two-way radio product engineering, impact of stolen trade secrets on the cost, timeline.
Date: 2019
Client: Kirkland and Ellis LLP; Justin Singh, Attorney for Motorola

Case: **Apple Inc. v. Nokia**
Matter: Patent Litigation (US and EU)
Court: United States Patent and Trademark Office, and European Patent Office
Project: Technical expert for Inter Partes Review (IPR) challenging validity of multi-mode cellphone receiver patent. Client reached global settlement before filing of IPR.
Date: 2017
Client: Ropes and Gray LLP; Carolyn Redding, Attorney for Apple

Case: **Provident - Pomona Properties v. SolSource**
Matter: Service Contract Litigation
Court: California Superior Court, Los Angeles, Case No. KC068239
Project: Performed on site performance testing of campus Wi-Fi network; Prepared report categorizing wireless system architecture and user upstream/downstream data rate
Date: 2016
Client: Manly, Stewart & Finaldi, Attorneys for plaintiffs

Case: **Comcast Cable v. British Telecom**
Matter: Patent infringement and invalidity
Court: U.S. District Court, Delaware, Case No. 1:11-cv-00843-SLR
Project: Expert for DOCSIS, OpenCable standards, related patents and technology
Date: 2012
Client: Kecker & Van Nest, Attorneys for plaintiff

Case: **Chavarria v. Trabert**
Matter: Personal injury civil lawsuit
Court: California Superior Court, Santa Clara County, San Jose, CA
Project: Testified at jury trial regarding design and maintenance of electrical equipment.
Date: 2010
Client: Fernando V. Hernandez, Attorney for plaintiff

Case: **Intel Corp. v. Wi-LAN Inc.**
Matter: Patent infringement and invalidity
Court: Federal District Court, Northern California, Case No. 5:08-CV-04555
Project: Non-testimonial expert for WiMAX patents and broadband wireless technology
Date: 2008 - 2009
Client: Kirkland & Ellis LLP, Attorneys for Intel

Case: **Malikyar v. Sramek**
Matter: Federal wiretapping statute, civil jury trial
Court: Federal District Court, Northern California District, San Francisco, CA
Project: Expert witness for wireless telephone wiretapping communications equipment.
Testified in Federal District Court; provided research for plaintiff's attorney.
Date: 2009

Case: **Rembrandt v. Cox Communications**
Matter: Patent infringement matter
Court: Federal
Project: Non-testimonial expert in DOCSIS broadband technology and patent analysis.
Date: 2008
Client: Kilpatrick Stockton LLP, Atlanta, for defendants

Case: **Huff v. Andrew Corporation**
Matter: Patent and business valuation dispute
Court: California Superior Court, Santa Clara County
Project: Testimonial expert witness regarding broadband and VSAT satellite technology.
Testified, provided research, and assisted questioning of opposing experts.
Date: 2005
Client: Bergeson LLP co-w/Gardner, Carton & Douglas for Andrew Corp., defendants.

Case: **CSIRO v. Netgear Inc.**
Matter: Patent infringement matter
Court: United States District Court, Northern District, San Jose, California
Project: Expert consultant regarding 802.11a, 802.11g, 802.11n and OFDM technology
Date: 2005
Client: Wilson, Sonsini, Goodrich & Rosati (Palo Alto) for Netgear, defendants

Case: **Research in Motion v. 3Com/US Robotics Corp.**
Matter: Product defect, product development contract dispute
Court: American Arbitration Association, New York
Project: Testimonial expert witness on wireless modem products and technology; provided technical research, prepared reports, and assisted questioning of opposing experts.
Date: 1998
Client: Barrett, Gravante & Stern, for 3Com

Case: **Network Services Corp. v. Buckner Inc.**
Matter: Product defect, product development contract dispute
Court: American Arbitration Association, San Francisco
Project: Testimonial expert witness on low cost two-way RF pager technology;
Provided research, testified at arbitration; assisted questioning opposing experts.
Date: 1998
Client: Kimble MacMichael & Upton, for Buckner, defendants

Case: **L3 Communications et al v. Titan Comm. et al.**
Matter: Product defect litigation
Court: Arbitration, San Diego, CA
Project: Testimonial expert witness on VSAT satellite technology
Date: 1998
Client: Popelka Allard, for L3

Case: **Life Point et al. v. Cargill, Voyager Technologies et al**
Matter: Patent infringement, trade secret misappropriation
Court: United States District Court, San Jose
Project: Testimonial expert witness on security system using 802.11 technology
Date: 1995 - 2000 inclusive
Client: Cooley Godward, for Voyager Technologies, defendant

EDUCATION

BSEE, Syracuse University, Syracuse, NY, May 1976

MBA, Santa Clara University, Santa Clara, CA, June 1986

PUBLICATIONS

Bertonis, James, and Wilson, Eric "High Speed Wireless Internet over Unlicensed Radio Bands - An Innovative Approach"

Private Wireless & Broadband Magazine, June 2000

Bertonis, James, "Scorecard Tracks PCS Technical Standards"

Electrical Engineering Times, October 21, 1996

Bertonis, James G., "Overview of 3G Personal Communications Technology" IC Expo Applications Conference on Communications Technology - Proceedings, October 1996

AFFILIATIONS AND MEDIA

Board of Directors, Momentum for Health, Santa Clara Valley nonprofit provider of health services offering treatment for adults, teens and families in the community with health issues.

Property Tax Advisory Board, Los Gatos-Saratoga Union High School District

Science and Technology Instructor, USA Prepares, nationally syndicated radio show.

PATENTS

Apparatus and Method for High-Speed Wireless Upstream Data Transmission Using CATV Compatible Modems
6,625,222 Issued Sept. 2003

Apparatus and Method for Extending DOCSIS Cable Modem Service Over Wireless Links
7,596,798 Issued Sept. 2009

Apparatus and Method for Extending a Cable Modem Data Service Over Wireless Links
7,840,989 Issued Nov. 2010

Apparatus and Method for Extending a Cable Modem Data Service Over Wireless Links
7,917,931 Issued Mar. 2011

Appendix B

EXHIBITS

- Ex. 1001: U.S. Patent No. 7,889,759 (“the ’759 patent”), with Certificate of Correction
- Ex. 1002: Expert Declaration of James Bertonis
- Ex. 1003: [Reserved]
- Ex. 1004: Certified Prosecution History of the ’759 patent
- Ex. 1005: Abandoned U.S. Application Serial No. 10/778,505 (co-parent of ’759 patent)
- Ex. 1006: U.S. Patent No. 7,295,518 (co-parent of ’759 patent)
- Ex. 1007: U.S. Pub. No. 2002/0166124 (“Gurantz”)
- Ex. 1008: [Reserved]
- Ex. 1009: U.S. Patent No. 5,682,419 (“Grube”)
- Ex. 1010: U.S. Pub. No. 2002/0056066 (“Gesbert”)
- Ex. 1011: U.S. Patent No. 7,418,043 (“Shattil”)
- Ex. 1012: Ciciora, Walter S. *Modern Cable Television Technology: Video, Voice, and Data Communications*. San Francisco, Calif: Morgan Kaufmann Publishers, 1999, Sections 4.1-4.3.3 (Chapter 4, pp. 161-192)
- Ex. 1013: EP 1087586 (“Mirfakhraei”)
- Ex. 1014: U.S. Pub. No. 2009/0279498 (“Li”)
- Ex. 1015: U.S. Pub. No. 2009/0323851 (“Ling”)
- Ex. 1016: U.S. Pub. No. 2005/00310444 (“Gesbert II”)

Appendix C

CLAIM LISTING APPENDIX

U.S. Pat. No. 7,889,759

Designation	Claim Language
Claim 1	
[1PRE]	A method for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in a broadband cable network (“BCN”), the method comprising:
[1A]	transmitting a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes;
[1B]	receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node;
[1C]	determining the common bit-loading modulation scheme from the received plurality of response signals;
[1D]	receiving the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission;
[1E]	determining the transmission characteristics of the channel path at the one receiving node; and
[1F]	transmitting a response signal from the one receiving node to the transmitting node,
[1G]	wherein the transmission characteristics of the channel path are determined by measuring the signal-to-noise (“SNR”) characteristics of the received probe signal at the one receiving node and
[1H]	wherein determining a common bit-loading modulation scheme includes: comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.
Claim 2	
[2PRE]	A method for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in a broadband cable network (“BCN”), the method comprising:

Designation	Claim Language
[2A]	transmitting a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes;
[2B]	receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node;
[2C]	determining the common bit-loading modulation scheme from the received plurality of response signals;
[2D]	receiving the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission;
[2E]	determining the transmission characteristics of the channel path at the one receiving node;
[2F]	transmitting a response signal from the one receiving node to the transmitting node,
[2G]	wherein the transmission characteristics of the channel path are determined by measuring the bit-error rate (“BER”) characteristics of the received probe signal at the one receiving node and
[2H]	generating the response signal, wherein the response signal utilizes a bit-loading modulation scheme that is generated by the one receiving node in response to determining the transmission characteristics of the channel path,
[2I]	wherein determining a common bit-loading modulation scheme includes: comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.
Claim 3	
[3PRE]	A method for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in a broadband cable network (“BCN”), the method comprising:
[3A]	transmitting a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes;

Designation	Claim Language
[3B]	receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node; and
[3C]	determining the common bit-loading modulation scheme from the received plurality of response signals;
[3D]	receiving the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission;
[3E]	determining the transmission characteristics of the channel path at the one receiving node; and
[3F]	transmitting a response signal from the one receiving node to the transmitting node,
[3G]	wherein the transmission characteristics of the channel path are determined by measuring the signal-to-noise (“SNR”) characteristics of the received probe signal at the one receiving node,
[3H]	wherein the transmission characteristics of the channel path are determined by measuring the packet error rate (“PER”) characteristics of the received probe signal at the one receiving node, and
[3I]	wherein determining a common bit-loading modulation scheme includes: comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.
Claim 4	
[4PRE]	<i>A non-transitory computer-readable medium having software for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in a broadband cable network (“BCN”), the non-transitory computer-readable medium comprising:</i>
[4A]	<i>logic configured for</i> transmitting a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes;
[4B]	<i>logic configured for</i> receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each

Designation	Claim Language
	response signal includes a bit-loading modulation scheme determined by a corresponding receiving node;
[4C]	<i>logic configured for</i> determining the common bit-loading modulation scheme from the received plurality of response signals,
[4D]	<i>logic configured for</i> receiving the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission;
[4E]	<i>logic configured for</i> determining the transmission characteristics of the channel path at the one receiving node;
[4F]	<i>logic configured for</i> transmitting a response signal from the one receiving node to the transmitting node; and
[4G]	<i>logic configured for</i> generating the response signal, wherein the response signal utilizes a bit-loading modulation scheme that is generated by the one receiving node in response to determining the transmission characteristics of the channel path;
[4H]	wherein the transmission characteristics of the channel path are determined by <i>logic configured for</i> measuring the signal-to-noise (“SNR”) characteristics of the received probe signal at the one receiving node, and
[4I]	wherein the <i>logic configured for</i> determining a common bit-loading modulation scheme includes: <i>logic configured for</i> comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and <i>logic configured for</i> determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.
Claim 5	
[5PRE]	A <i>non-transitory computer-readable medium having software</i> for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in a broadband cable network (“BCN”), the <i>non-transitory computer-readable medium</i> comprising:
[5A]	<i>logic configured for</i> transmitting a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes;

Designation	Claim Language
[5B]	<i>logic configured for</i> receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node; and
[5C]	<i>logic configured for</i> determining the common bit-loading modulation scheme from the received plurality of response signals,
[5D]	wherein the transmission characteristics of the channel path are determined by <i>logic configured for</i> measuring the bit-error rate (“BER”) characteristics of the received probe signal at the one receiving node, and
[5E]	wherein the <i>logic configured for</i> determining a common bit-loading modulation scheme includes: <i>logic configured for</i> comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and <i>logic configured for</i> determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.
Claim 6	
[6PRE]	A <i>non-transitory computer-readable medium having software</i> for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in a broadband cable network (“BCN”), the <i>non-transitory computer-readable medium</i> comprising:
[6A]	<i>logic configured for</i> transmitting a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes;
[6B]	<i>logic configured for</i> receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node;
[6C]	<i>logic configured for</i> determining the common bit-loading modulation scheme from the received plurality of response signals; and
[6D]	<i>logic configured for</i> generating the response signal, wherein the response signal utilizes a bit-loading modulation scheme that is generated by the one receiving node in response to

Designation	Claim Language
	determining the transmission characteristics of the channel path
[6E]	wherein the transmission characteristics of the channel path are determined by <i>logic configured for</i> measuring the product-error rate (“PER”) characteristics of the received probe signal at the one receiving node,
[6F]	wherein [<i>the logic configured for</i>] determining a common bit-loading modulation scheme includes: <i>logic configured for</i> comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and <i>logic configured for</i> determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.
Claim 7	
[7PRE]	A broadband cable network (“BCN”) for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in the BCN, the BCN comprising:
[7A]	a transmitting node within the plurality of nodes, the transmitting node capable of sending a probe signal; and
[7B]	a sub-plurality of receiving nodes within the plurality of nodes wherein the sub-plurality of receiving nodes are capable of transmitting a sub-plurality of response signals in response to receiving the probe signal, wherein the sub-plurality of response signals includes a plurality of bit-loading modulation schemes, wherein each bit-loading modulation scheme of the plurality of bit-loading modulation schemes is determined by a receiving node within the sub-plurality of receiving nodes,
[7C]	wherein the transmitting node is capable of determining the common bit-loading modulation scheme from the sub-plurality of response signals, wherein the transmitting node is further capable of determining the common bit-loading modulation scheme in response to comparing all bit-loading modulation schemes within the plurality of bit-loading modulation schemes.
Claim 8	

Designation	Claim Language
[8]	The BCN of claim 7, wherein each bit-loading modulation scheme utilizes a quadrature phase shift keying (“QPSK”) modulation.
Claim 9	
[9]	The BCN of claim 7, wherein the each bit-loading modulation scheme utilizes quadrature amplitude modulation (“QAM”).
Claim 10	
[10]	The BCN of claim 9, wherein each bit-loading modulation scheme is chosen from the group essentially consisting of 64 QAM modulation, 128 QAM modulation, 256 QAM modulation, 512 QAM modulation and 1024 QAM modulation.
Claim 11	
[11PRE]	The BCN of claim 7, wherein a receiving node within the sub-plurality of receiving nodes is capable of:
[11A]	receiving the probe signal at the receiving node through a channel path of transmission; and
[11B]	determining the transmission characteristics of the channel path at the receiving node; and
[11C]	transmitting a response signal, of the sub-plurality of response signals, from the receiving node to the transmitting node,
[11D]	wherein the receiving node is capable of determining the transmission characteristics of the channel path by measuring the signal-to-noise (“SNR”) characteristics of the received probe signal at the receiving node
[11E]	wherein the receiving node is capable of generating the response signal, wherein the response signal utilizes a bit-loading modulation scheme that is generated by the receiving node in response to determining the transmission characteristics of the channel path, and
[11F]	wherein the transmitting node is capable of determining a common bit-loading modulation scheme by: comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.
Claim 12	

Designation	Claim Language
[12PRE]	The BCN of claim 7, wherein a receiving node within the sub-plurality of receiving nodes is capable of:
[12A]	receiving the probe signal at the receiving node through a channel path of transmission;
[12B]	determining the transmission characteristics of the channel path at the receiving node; and
[12C]	transmitting a response signal, of the sub-plurality of response signals, from the receiving node to the transmitting node,
[12D]	wherein the receiving node is capable of determining the transmission characteristics of the channel path by measuring the bit-error rate (“BER”) characteristics of the received probe signal at the one receiving node,
[12E]	wherein the receiving node is capable of generating the response signal, wherein the response signal utilizes a bit-loading modulation scheme that is generated by the receiving node in response to determining the transmission characteristics of the channel path, and
[12F]	wherein the transmitting node is capable of determining a common bit-loading modulation scheme by: comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.
Claim 13	
[13PRE]	The BCN of claim 7, wherein a receiving node within the sub-plurality of receiving nodes is capable of:
[13A]	receiving the probe signal at the receiving node through a channel path of transmission;
[13B]	determining the transmission characteristics of the channel path at the receiving node; and
[13C]	transmitting a response signal, of the sub-plurality of response signals, from the receiving node to the transmitting node,
[13D]	wherein the receiving node is capable of determining the transmission characteristics of the channel path by measuring the packet error rate (“PER”) characteristics of the received probe signal at the one receiving node,

Designation	Claim Language
[13E]	wherein the receiving node is capable of generating the response signal, wherein the response signal utilizes a bit-loading modulation scheme that is generated by the receiving node in response to determining the transmission characteristics of the channel path, and
[13F]	wherein the transmitting node is capable of determining a common bit-loading modulation scheme by: comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.
Claim 14	
[14PRE]	A broadband cable network (“BCN”) for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in the BCN, the BCN comprising:
[14A]	a transmitting node within the plurality of nodes, the transmitting node <i>having means for</i> sending a probe signal; and
[14B]	a sub-plurality of receiving nodes within the plurality of nodes, wherein the sub-plurality of receiving nodes <i>have means for</i> transmitting a sub-plurality of response signals in response to receiving the probe signal, wherein the sub-plurality of response signals includes a plurality of bit-loading modulation schemes, wherein each bit-loading modulation scheme of the plurality of bit-loading modulation schemes is determined by a receiving node within the sub-plurality of receiving nodes; and
[14C]	wherein the transmitting node <i>includes means for</i> determining the common bit-loading modulation scheme from the sub-plurality of response signals, wherein the transmitting node further includes <i>means for</i> determining the common bit-loading modulation scheme in response to comparing all bit-loading modulation schemes within the plurality of bit-loading modulation schemes.
Claim 15	
[15]	The BCN of claim 14, wherein each bit-loading modulation scheme utilizes a quadrature phase shift keying (“QPSK”) modulation.

Designation	Claim Language
Claim 16	
[16]	The BCN of claim 14, wherein the each bit-loading modulation scheme utilizes quadrature amplitude modulation (“QAM”).
Claim 17	
[17]	The BCN of claim 16, wherein each bit-loading modulation scheme is chosen from the group essentially consisting of 64 QAM modulation, 128 QAM modulation, 256 QAM modulation, 512 QAM modulation and 1024 QAM modulation.
Claim 18	
[18A]	The BCN of claim 17, wherein the receiving node includes <i>means for</i> determining the transmission characteristics of the channel path by measuring the bit-error rate (“BER”) characteristics of the received probe signal at the one receiving node,
[18B]	wherein the receiving node includes <i>means for</i> generating the response signal, wherein the response signal utilizes a bit-loading modulation scheme that is generated by the receiving node in response to determining the transmission characteristics of the channel path,
[18C]	wherein the transmitting node includes <i>means for</i> determining a common bit-loading modulation scheme, and
[18D]	wherein the <i>means for</i> determining a common bit-loading modulation scheme includes: <i>means for</i> comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and <i>means for</i> determining the common bit-loading modulation scheme in response to the means for comparing the plurality of bit-loaded modulation schemes.
Claim 19	
[19A]	The BCN of claim 17, wherein the receiving node includes <i>means for</i> determining the transmission characteristics of the channel path by measuring the packet error rate (“PER”) characteristics of the received probe signal at the one receiving node,
[19B]	wherein the receiving node includes <i>means for</i> generating the response signal, wherein the response signal utilizes a bit-loading modulation scheme that is generated by the receiving

Designation	Claim Language
	node in response to determining the transmission characteristics of the channel path,
[19C]	wherein the transmitting node includes means for determining a common bit-loading modulation scheme,
[19D]	wherein the <i>means for</i> determining a common bit-loading modulation scheme includes: <i>means for</i> comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and <i>means for</i> determining the common bit-loading modulation scheme in response to the means for comparing the plurality of bit-loaded modulation schemes.
Claim 20	
[20PRE]	A broadband cable network (“BCN”) for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in the BCN, the BCN comprising:
[20A]	a transmitting node within the plurality of nodes, the transmitting node having means for sending a probe signal; and
[20B]	a sub-plurality of receiving nodes within the plurality of nodes, wherein the sub-plurality of receiving nodes have means for transmitting a sub-plurality of response signals in response to receiving the probe signal, wherein the sub-plurality of response signals includes a plurality of bit-loading modulation schemes, wherein each bit-loading modulation scheme of the plurality of bit-loading modulation schemes is determined by a receiving node within the sub-plurality of receiving nodes; and
[20C]	wherein the transmitting node includes <i>means for</i> determining the common bit-loading modulation scheme from the sub-plurality of response signals,
[20D]	wherein a receiving node within the sub-plurality of receiving nodes includes: <i>means for</i> receiving the probe signal at the receiving node through a channel path of transmission;
[20E]	<i>means for</i> determining the transmission characteristics of the channel path at the receiving node; and
[20F]	<i>means for</i> transmitting a response signal, of the sub-plurality of response signals, from the receiving node to the transmitting node

Designation	Claim Language
[20G]	wherein the receiving node includes <i>means for</i> determining the transmission characteristics of the channel path by measuring the signal-to-noise (“SNR”) characteristics of the received probe signal at the receiving node,
[20H]	wherein the receiving node includes <i>means for</i> generating the response signal, wherein the response signal utilizes a bit-loading modulation scheme that is generated by the receiving node in response to determining the transmission characteristics of the channel path,
[20I]	wherein the transmitting node includes <i>means for</i> determining a common bit-loading modulation scheme, and
[20J]	wherein the <i>means for</i> determining a common bit-loading modulation scheme includes: <i>means for</i> comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and <i>means for</i> determining the common bit-loading modulation scheme in response to the means for comparing the plurality of bit-loaded modulation schemes.
Claim 21	
[21PRE]	A broadband cable network (“BCN”) for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in the BCN, the BCN comprising:
[21A]	<i>means for</i> transmitting a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes;
[21B]	<i>means for</i> receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node;
[21C]	<i>means for</i> determining the common bit-loading modulation scheme from the received plurality of response signals;
[21D]	<i>means for</i> receiving the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission;
[21E]	<i>means for</i> determining the transmission characteristics of the channel path at the one receiving node;
[21F]	<i>means for</i> transmitting a response signal from the one receiving node to the transmitting node; and

Designation	Claim Language
[21G]	<i>means for</i> generating the response signal, wherein the response signal utilizes a bit-loading modulation scheme that is generated by the one receiving node in response to determining the transmission characteristics of the channel path;
[21H]	wherein the one receiving node includes <i>means for</i> determining the transmission characteristics of the channel path by measuring the signal-to-noise (“SNR”) characteristics of the received probe signal at the one receiving node, and
[21I]	wherein the <i>means for</i> determining a common bit-loading modulation scheme includes: means for comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and <i>means for</i> determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.
Claim 22	
[22PRE]	A broadband cable network (“BCN”) for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in the BCN, the BCN comprising:
[22A]	<i>means for</i> transmitting a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes;
[22B]	<i>means for</i> receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node; and
[22C]	<i>means for</i> determining the common bit-loading modulation scheme from the received plurality of response signals;
[22D]	<i>means for</i> receiving the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission;
[22E]	<i>means for</i> determining the transmission characteristics of the channel path at the one receiving node;
[22F]	<i>means for</i> transmitting a response signal from the one receiving node to the transmitting node; and
[22G]	<i>means for</i> generating the response signal, wherein the response signal utilizes a bit-loading modulation scheme that is

Designation	Claim Language
	generated by the one receiving node in response to determining the transmission characteristics of the channel path,
[22H]	wherein the one receiving node includes <i>means for</i> determining the transmission characteristics of the channel path by measuring the bit-error rate (“BER”) characteristics of the received probe signal at the one receiving node, and
[22I]	wherein the <i>means for</i> determining a common bit-loading modulation scheme includes: <i>means for</i> comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and <i>means for</i> determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.
Claim 23	
[23A]	The BCN of claim 22, further including <i>means for</i> generating the response signal, wherein the response signal utilizes a bit-loading modulation scheme that is generated by the one receiving node in response to determining the transmission characteristics of the channel path,
[23B]	wherein the <i>means for</i> determining a common bit-loading modulation scheme includes: <i>means for</i> comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and <i>means for</i> determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.