THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of:	Brett Bernath et al.	
U.S. Patent No.:	8,631,450 B1	Attorney Docket No.: 45035-0031IP1
Issue Date:	January 14, 2014	
Appl. Serial No.:	11/231,349	
Filing Date:	September 19, 2005	
Title:	BROADBAND LOCAL AREA NETWORK	

DECLARATION OF TIM A. WILLIAMS

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DECLARATION OF TIM A. WILLIAMS

I, Tim A. Williams, declare:

I. Qualifications and Background Information

1. I am an independent consultant. All of my opinions stated in this declaration are based on my own personal knowledge and professional judgment. In formulating my opinions, I have relied upon my knowledge, training, and experience in the relevant art.

2. I am over 18 years of age, and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein. Although my qualifications are stated more fully in my curriculum vitae, attached hereto as DISH-1004, I provide below a brief summary of my qualifications.

3. I earned a Bachelor of Science degree in Electrical Engineering (BSEE) from Michigan Technological University in 1976. In 1982, I earned a Master's degree, also in Electrical Engineering (MSEE), from the University of Texas at Austin. I earned a Doctor of Philosophy (Ph.D.), also from the University of Texas at Austin, in 1985. My doctorate dissertation was "Digital Signal Processing Techniques for Acoustic Log Data." In 1991, I earned a Master of Business Administration degree from the University of Texas at Austin as well.

4. I have over 40 years of professional experience in wireless communications and telecom technology, including roles in large corporations as well as start-ups and consulting work.

5. For example, from 1979 through 1991, I held the positions of Senior Engineer, Senior Member of the Technical Staff, and Member of the Technical Staff at Motorola, Inc. My work at Motorola included serving as business manager, project leader, and senior technical member for projects relating to the development of various cellular modems, transceivers, and transcoders.

6. As another example, in 1991, I co-founded Wireless Access, Inc., a start-up company focused on the Narrow Band PCS equipment market and which developed the over-the-air protocols, subscriber equipment, and integrated circuits to deploy 2-way paging services. I held the positions of Co-Founder, Chief Technical Officer, Vice President of Engineering, and Vice President of Business Strategy at Wireless Access until it was sold to Glenarye Electronics in 1998.

7. As another example, between 1998 and 2000, I was the Chief Technology Officer and Advisory Board Member of Picazo Communications, which built and sold software PBXs Telephony equipment using VoIP and Circuit Switched Technologies.

8. As another example, in 2004, I founded DoceoTech Inc., which provides training for engineers in Wireless, Networking, and Telephony technologies. Since 2004, I have served as DoceoTech's Chairman.

9. I hold over 25 United States patents in wireless and signal processing technology, as well as numerous patent applications in the same field. Additionally, I am a Patent Agent registered with the U.S. Patent and Trademark Office since January 2002. Further, I have served as a technical expert in multiple patent proceedings.

10. These and other professional experiences, as well as other qualifications are described in my CV, attached as DISH-1004.

11. I have been retained on behalf of DISH to analyze and offer technical opinions relating to U.S. Patent No. 8,631,450 ("the '450 Patent") and prior art references relating to its subject matter. In forming my opinions, I read and considered the '450 Patent (DISH-1001), its prosecution history (DISH-1002), and the exhibits cited in the Exhibit List.

12. I have no financial interest in any party to this proceeding or in the outcome of this proceeding. I am being compensated for my work as an expert on an hourly basis. My compensation is not dependent on the outcome of these proceedings or the content of my opinions.

13. For any testimony I may give in this matter, I may use some or all of the documents and information cited to, referred to, and identified in this declaration, as well as any additional materials that are entered into evidence in this proceeding, including the following:

- U.S. Patent No. 8,631,450 (DISH-1001), and its accompanying prosecution history (DISH-1002)
- U.S. Patent No. 5,521,906 to Grube *et al.* ("Grube") (DISH-1005)
- U.S. Patent No. 6,473,438 to Cioffi *et al.* ("Cioffi") (DISH-1006)
- Canadian Patent Application 2350203 to Matsumoto ("Matsumoto") (DISH-1007)
- Microsoft Computer Dictionary, Fourth Ed., 1999 ("Microsoft") (DISH-1009)
- U.S. Patent No. 7,295,518 to Monk *et al.* ("Monk") (DISH-1010)
- U.S. Patent No. 6,252,900 to Liu *et al.* ("Liu") (DISH-1011)
- U.S. Patent No. 4,679,227 to Hughes-Hartogs ("Hughes-Hartogs") (DISH-1012)
- U.S. Patent No. 6,259,746 to Levin *et al.* ("Levin") (DISH-1013)
- U.S. Patent No. 6,072,779 to Tzannes *et al.* ("Tzannes") (DISH-1014)
- U.S. Patent No. 4,866,395 to Hostetter ("Hostetter") (DISH-1015)
- U.S. Patent No. 6,298,092 to Heath *et al.* ("Heath") (DISH-1016)

14. Figures that appear within this document have been prepared with the assistance of Counsel and present my understanding of the ’450 Patent and the prior art discussed below.

II. LEGAL PRINCIPLES

A. Obviousness

15. I have been informed that a patent claim is invalid as “obvious” under 35 U.S.C. § 103 in light of one or more prior art references if it would have been obvious to a POSITA, taking into account (1) the scope and content of the prior art, (2) the differences between the prior art and the claims, (3) the level of ordinary skill in the art, and (4) any so called “secondary considerations” of non- obviousness, which include: (i) “long felt need” for the claimed invention, (ii) commercial success attributable to the claimed invention, (iii) unexpected results of the claimed invention, and (iv) “copying” of the claimed invention by others.

16. For purposes of my analysis above and because I know of no indication from the patent owner to the contrary, I have applied a date of December 2, 2004, as the date of invention in my obviousness analyses, although in many cases the same analysis would hold true even at an earlier time than December 2, 2004. I currently hold no opinion regarding whether the ’450 Patent is entitled to claim priority to the December 2, 2004 provisional application, and I understand that DISH reserves its right to challenge this claim of priority.

17. I have been informed that a claim can be obvious in light of a single prior art reference or multiple prior art references. To be obvious in light of a single prior art reference or multiple prior art references, there must be a reason to modify the single prior art reference, or combine two or more references, in order to achieve the claimed invention. This reason may come from a teaching, suggestion, or motivation to combine, or may come from the reference or references themselves, the knowledge or "common sense" of one skilled in the art, or from the nature of the problem to be solved, and may be explicit or implicit from the prior art as a whole. I have been informed that the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. I also understand it is improper to rely on hindsight in making the obviousness determination.

III. OVERVIEW OF CONCLUSIONS FORMED

18. This expert Declaration explains the conclusions that I have formed based on my analysis. To summarize those conclusions:

- Based upon my knowledge and experience and my review of the materials listed above, I believe that Claims 29-38 are rendered obvious by the references listed above.
- Specifically, it is my opinion that Claims 29-31 and 34-36 are rendered obvious by Grube, Claims 29-31 and 34-36 are rendered obvious by

Grube in view of Cioffi, and Claims 29-38 are rendered obvious by Grube in view of Matsumoto and Grube-Cioffi in view of Matsumoto.

IV. BACKGROUND KNOWLEDGE ONE OF ORDINARY SKILL IN THE ART WOULD HAVE HAD PRIOR TO THE EARLIEST POSSIBLE PRIORITY DATE OF THE '450 PATENT

19. Based on the foregoing and upon my experience in this area, a person of ordinary skill in the art ("POSITA") relating to the subject matter of the '450 Patent as of December 2, 2004 would have had a degree in electrical engineering, computer engineering, or a related field and experience working in signal processing and/or communication systems/networks, e.g., a bachelor's and three or more years of experience; a master's and at least one year of experience; or a doctorate and some work experience. Additional education could substitute for professional experience, or *vice versa*.

20. For at least the reasons I explained in the paragraphs about my qualifications, I would consider myself to have qualified as a POSITA as of the earliest possible priority date for the '450 Patent of December 2, 2004.

V. INTERPRETATIONS OF THE '450 PATENT CLAIMS AT ISSUE

21. I understand that, for purposes of my analysis in this *inter partes* review proceeding, the terms appearing in the patent claims should be interpreted under the *Phillips* standard. *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005); *see* 37 C.F.R. §42.100. In that regard, I understand that the best indicator of claim meaning

is its usage in the context of the patent specification as understood by a POSITA. I further understand that the words of the claims should be given their plain meaning unless that meaning is inconsistent with the patent specification or the patent's history of examination before the Patent Office. I also understand that the words of the claims should be interpreted as they would have been interpreted by a POSITA at the time of the invention was made (not today).

22. Because I do not know at what date the invention as claimed was made, I have used the earliest possible priority date of the '450 Patent as the point in time for claim interpretation purposes. That date is December 2, 2004.

VI. OVERVIEW OF THE '450 PATENT

A. Brief Description

23. The '450 Patent relates to "[a] Broadband Coaxial Network (BCN) network formed by a plurality of common coaxial network elements[.]" DISH-1001, 4:12-13. This network can be implemented within a home or a building, as depicted in Figure 3[1] of the '450 Patent below.

[1] Annotations shown in color throughout this Petition have been added unless otherwise noted.

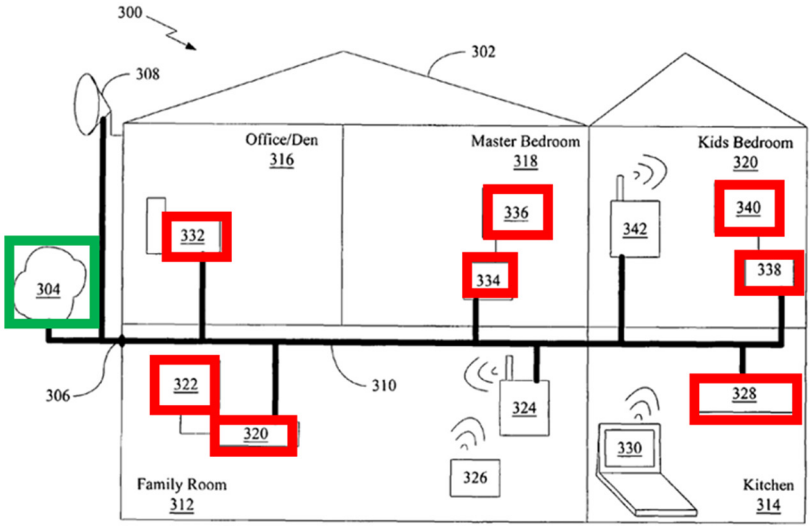


FIG. 3

'450 Patent Fig. 3 (annotated)

24. In Figure 3, element 304 represents the cable/terrestrial network (green), and home media server 320 connected to a television or video monitor 322, media center personal computer 332, set-top box 334 and television or video monitor 336, set-top box 338 and television or video monitor 340, and network audio appliance 328 are all components of the network (red) that are connected to the cable/terrestrial network via a coaxial cable connection. *Id.*, FIG. 3.

25. Indeed, the '450 Patent acknowledges that it was already known in the art to employ bit-loading modulation in broadband coaxial cable networks for wired communications between a service provider and multiple CPEs (customer premise equipment "such as cable converter boxes, televisions, video monitors, cable

modems, cable phones, audio video receivers, set-top boxes (STBs) and video game consoles") in home or building environments. *Id.*, 1:26-44, FIG. 1.

26. The'450 Patent's coaxial cable network is configured to determine the claimed "common bit-loading modulation scheme[.]" DISH-1001, Claims 29, 34. Indeed, coaxial cabling, bit-loading, and modulation schemes for multi-device communications were well-known.

27. These concepts were well known in the art before the priority date of the '450 Patent. For example, modulation is a communication technique in which data bits for transmission are encoded onto a carrier signal that a transmitter transmits to a receiver. One modulation type that was well-known prior to the filing date of the '450 Patent is Quadrature Amplitude Modulation (QAM). In this modulation, a QAM modulator in the transmitter alters the transmitted carrier signal by varying its amplitude and phase. This alternation allows the transmitter to encode multiple data bits onto a given portion of the carrier signal, such that more information (bits) can be conveyed in the same amount of time. The number of data bits that a transmitter encodes depends on the QAM order or modulation scheme that it uses. Each QAM order includes a different number of possible combinations of amplitude and phase to encode data bits. The different number of possible combinations, or number of constellation points ("constellation size"), specifies the number of bits that a transmitter can encode onto the carrier signal. For example, 4-

QAM, which has a constellation size of 4, can encode up to two bits of information, 16-QAM, which has a constellation size of 16, can encode up to four bits of information, and so on. Hostetter (DISH-1015) illustrates the concept of constellation points. FIGS. 1F and 4C graphically depict the number of constellation points (represented by the dots) used for a given QAM order, namely 64-QAM (64 constellation points) and 16-QAM (16 constellation points):

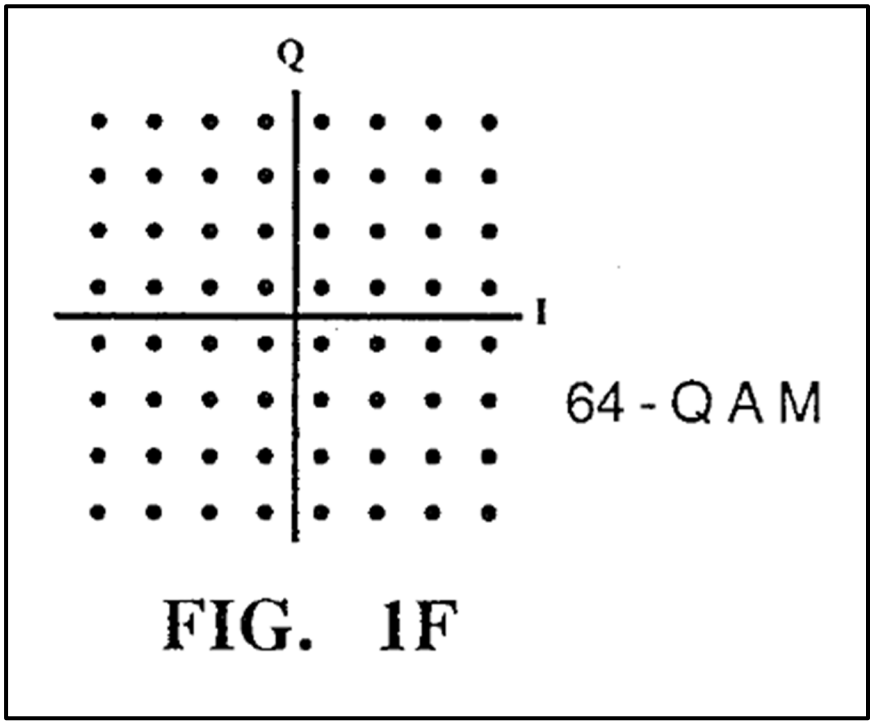
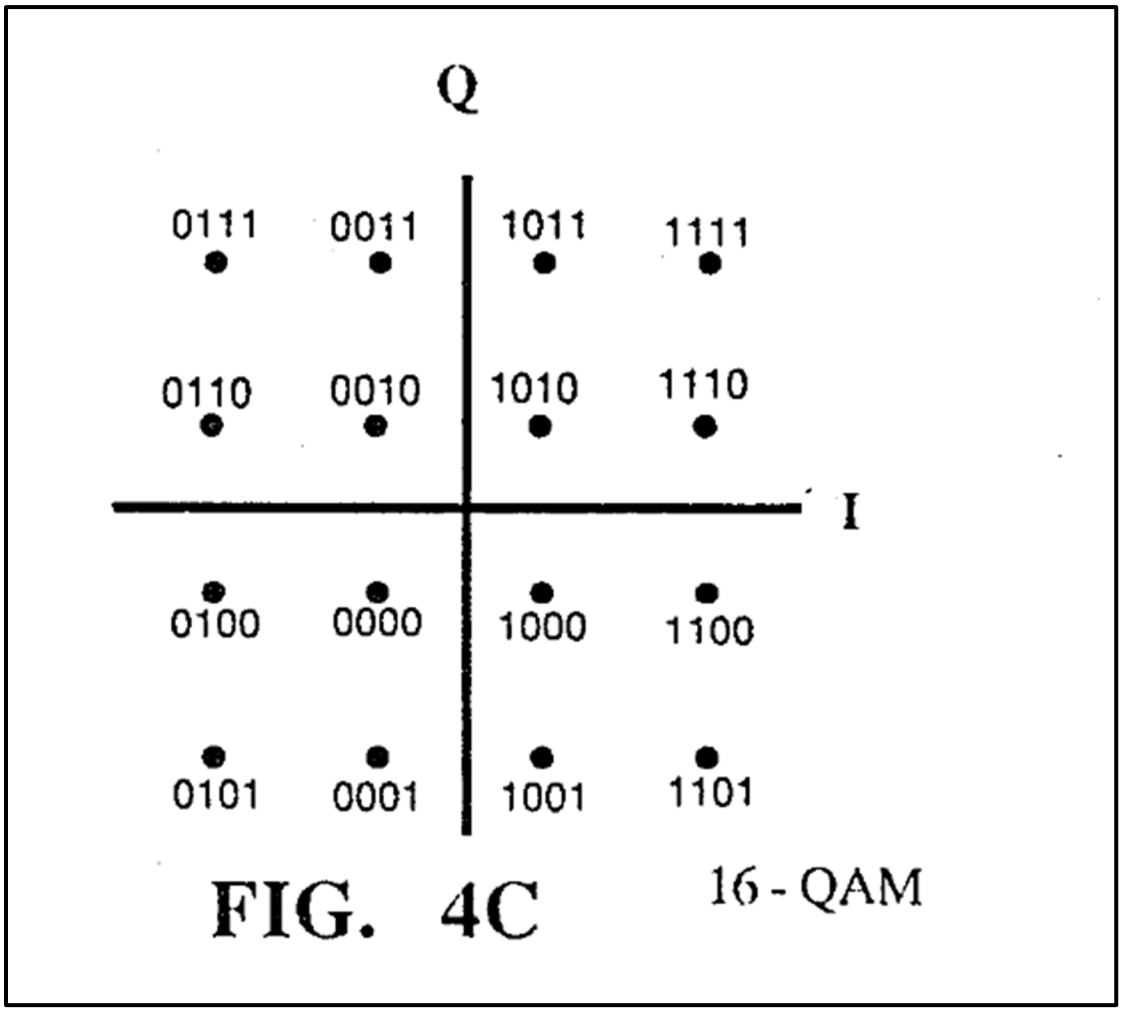


FIG. 1F

DISH-1015, Fig. 1F



DISH-1015, Fig. 4C

28. I note that in addition to discussing QAM, the ’450 Patent mentions Binary Phase-Shift Keying (BPSK) twice in the specification and Quadrature Phase Shift Keying (QPSK) once in the specification. These modulation types were also well-known prior to the earliest priority date of the ’450 Patent. BPSK encodes one

bit of information and does not have a QAM equivalent. Like 4-QAM, QPSK can encode two bits of information and therefore is closely related to 4-QAM.[2]

29. Bit-loading was another well-known digital signal processing technique prior to the filing date of the '450 Patent. In bit-loading, the transmission of data can be optimized by dynamically allocating different numbers of bits (per time) to various frequencies or sub-channels (also called carriers) within a signal. This approach takes advantage of the varying signal-to-noise ratios (SNR) across the transmission band. Frequencies with a higher SNR are typically assigned more bits, as they are less prone to errors, whereas frequencies with lower SNR are assigned fewer bits to maintain the quality of the transmission. More specifically, when a signal is transmitted over a medium, it is subject to various impairments like noise, interference, and fading. These impairments affect different frequencies in the signal differently. Bit-loading responds to these channel conditions by assigning more bits to "cleaner" frequencies (those with less noise and interference) and fewer bits to "noisier" frequencies. This dynamic allocation is often performed in

[2] QPSK is relatively simpler than QAM because QPSK varies phase only on a real axis. However, a POSITA would be motivated to use QAM over QPSK because QAM supports higher orders of modulation, and in turn, higher data rates.

conjunction with error correction coding to further ensure the reliability of the transmitted data.

30. The technique of bit-loading is especially useful in digital subscriber line (DSL) technologies and is a key component of the Discrete Multi-Tone (DMT) modulation method used in Asymmetric Digital Subscriber Line (ADSL) technology. In ADSL, for instance, the available bandwidth is divided into many sub-channels, and bit-loading determines how many bits to send on each sub-channel for every transmission.

31. This ability to convey more bits per symbol effectively increases the data rate, or throughput, without requiring additional bandwidth or transmission power. It makes the communication more efficient by maximizing the use of the available spectrum and adapting to the varying conditions of the transmission channel, which is a common challenge in wireless communications and other dynamic communication environments.

32. In the context of QAM, bit-loading enhances the efficiency of data transmission. Bit-loading does so by changing the QAM order to allocate more or fewer bits for transmission in a given sub-channel (carrier), e.g., based on the channel conditions in that sub-channel. For example, in a sub-channel with low noise and interference, a higher-order QAM (like 64-QAM or 256-QAM) can be used, which means more bits are transmitted in that sub-channel. Specifying the

desired number of bits for transmission in a sub-channel, i.e., bit-loading, informs a transmitter of the QAM order—this is the claimed "bit-loading modulation scheme," to use in that sub-channel. As an example, if the bit-loading specifies that based on channel conditions up to four bits are to be transmitted in sub-channel "A," the transmitter would know that "the bit-loading modulation scheme" to use in sub-channel "A" for subsequent transmissions is 16-QAM. As another example, if the bit-loading specifies that up to two bits are to be transmitted in sub-channel "B," the transmitter would know that "the bit-loading modulation scheme" to use in sub-channel "B" for subsequent transmissions is 4-QAM (assuming that the agreed upon modulation type in the system is QAM).

33. I note that a standard modulator available prior to the earliest priority date of the '450 Patent would have been able to implement QAM, BPSK, and QPSK. Generally, communication-system engineers select a modulation type, e.g., one of QAM, BPSK, and QPSK, to use in their communications prior to manufacture/deployment. Doing so simplifies the design and cost of the modulator as it will only need to be configured for one modulation type. However, even if a modulator were to support more than one modulation type, the nodes in a communication system would agree on (or be configured with) one modulation type to synchronize the nodes.

34. For example, Liu (DISH-1011) (filed in 1997) describes bit-loading on a wired network as follows:

> As with most communication environments, the transmission bit rates for both upstream and downstream communications in ADSL are not fixed but instead are determined by the quality of the channel. In the present invention, a number of well-known techniques can be used advantageously for setting up the initial data link. In general, these techniques work as follows: during initialization, the channel quality is measured and a certain data rate (typically a number of bits) is assigned for each DMT sub-channel; thereafter, a "hand-shaking" process is used to dynamically and adaptively change the bit loadings (and energy levels). The latter is often necessary because (among other things) changes may occur in the overall channel characteristics, changes in the target bit rate may be needed, or new bit distributions in the sub-channels may be required because of degradations in one of the sub-channels. The quality of the sub-channel response can be measured by the received signal to noise (SNR) ratio.

DISH-1011, 8:14-31.

35. Similarly, the basic concepts of using coaxial cables and splitters for multi-device communication were known prior to the '450 Patent's earliest priority date. For example, Monk (DISH-1010), acknowledges that several prior art references disclose multi-carrier modulation with bit-loading on wired networks. *Id.*, 8:19-26. For instance, Monk explains that U.S. Pat. Nos. 6,438,174 and 6,259,746 describe selecting bit-loading parameters based on channel characteristics:

> U.S. Pat. No. 6,438,174 "Multi-carrier transmission systems" incorporated herein by reference, discloses discrete multi-tone modulation and a technique for bit loading applied to point-to-point twisted pair wiring. U.S. Pat. No. 6,259,746 "Method for allocating

data and power in a discrete multi-tone communication system" discloses a technique for bit loading applied to discrete multi-tone modulation.

Id.

36. Similarly, Figure 2 of the '450 Patent explains that cable networks with splitters existed in the prior art:

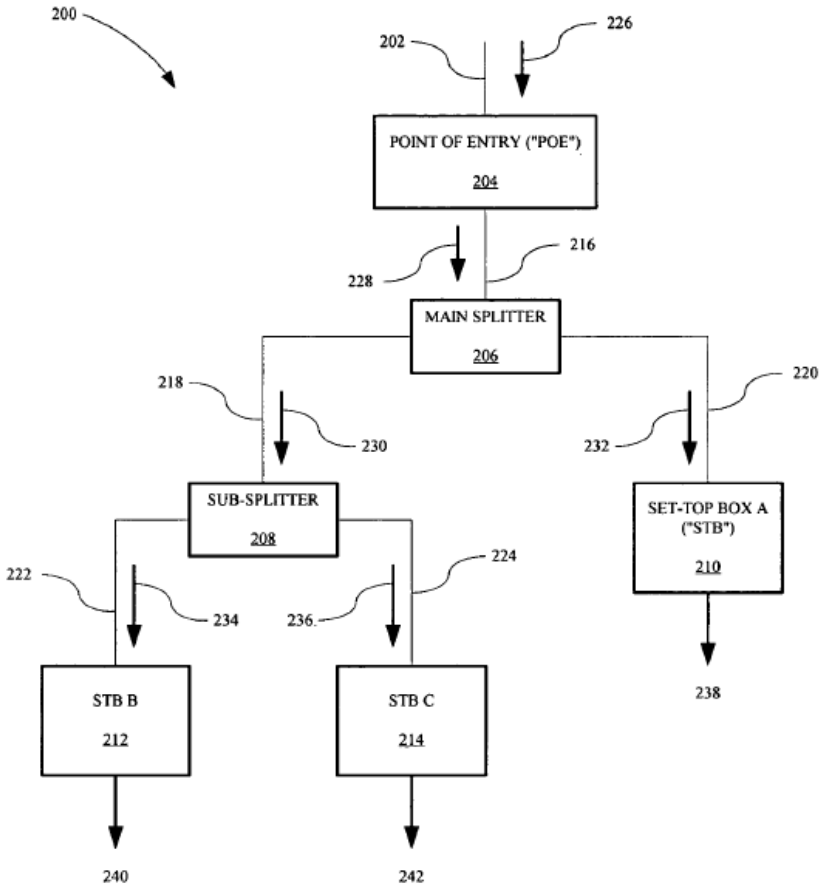


FIG. 2 (Prior Art)

DISH-1001, Fig. 2

37. With respect to Figure 2, the ’450 Patent explains:

> In FIG. 2, another example of a known broadband cable system is shown within a building (not shown) such as a typical home. The cable system 200 may be in signal communication with a cable provider (not shown), satellite TV dish (not shown), and/or external antenna (not shown) via a signal path 202 such as a main coaxial cable from the building to a cable connection switch (not shown) outside of the building. The cable system 200 may include a multi-tap device (not shown) that allows communication to neighboring homes, a POE to the home 204, N:1 Splitter 206, which in this system may also be considered a Root Node, sub-splitter 208, and node devices 210, 212 and 214.

DISH-1001, 2:10-21.

38. In such a network, a “transmitting node” “transmit[s] a probe signal to a plurality of receiving nodes.” DISH-1001, Claim 29. Each of the “plurality of receiving nodes” “receives the probe signal through a corresponding channel path,” “determines transmission characteristics of the corresponding channel path,” “determines a bit-loading modulation scheme for the corresponding channel path based on the transmission characteristics,” and then “transmits a response signal to the transmitting node informing the transmitting node of the bit-loading modulation scheme for the corresponding channel path.” *Id*. After the “transmitting node receiv[es] a plurality of response signals comprising a plurality of bit-loading modulation schemes from the plurality of receiving nodes,” the transmitting node then “compar[es] the plurality of bit-loading modulation schemes to determine a common bit-loading modulation scheme” and “transmit[s] a broadcast signal

relaying the common bit-loading modulation scheme to the plurality of receiving nodes." *Id.*

B. Prosecution History

39. The '450 Patent issued from U.S. Patent Application No. 11/231,349, which was filed on September 19, 2005 and which claims priority to U.S. Provisional Application Nos. 60/633,091, 60/632,797, 60/633,002, and 60/632,856, all of which were filed on December 2, 2004. *Id.*, Cover, 1:6-17.

40. More specifically, after the claims were rejected in eight office actions during the eight-year prosecution, Applicant added claims 34-43 (now issued claims 29-38), the subject matter of which was not previously recited in any of the previously recited claims. DISH-1002, 139-41. In response, the Examiner then contacted the Applicant by phone to indicate that claims 34-43 comprised allowable subject matter. *Id.*, 126. The Applicant then amended the remaining independent claims to incorporate at least the subject matter of independent claim 34 (the steps for determining the common bit-loading modulation scheme). *Id.*, 116-23.

41. The Examiner then issued a Notice of Allowance. *Id.*, 34-44.

VII. THE CHALLENGED CLAIMS ARE UNPATENTABLE

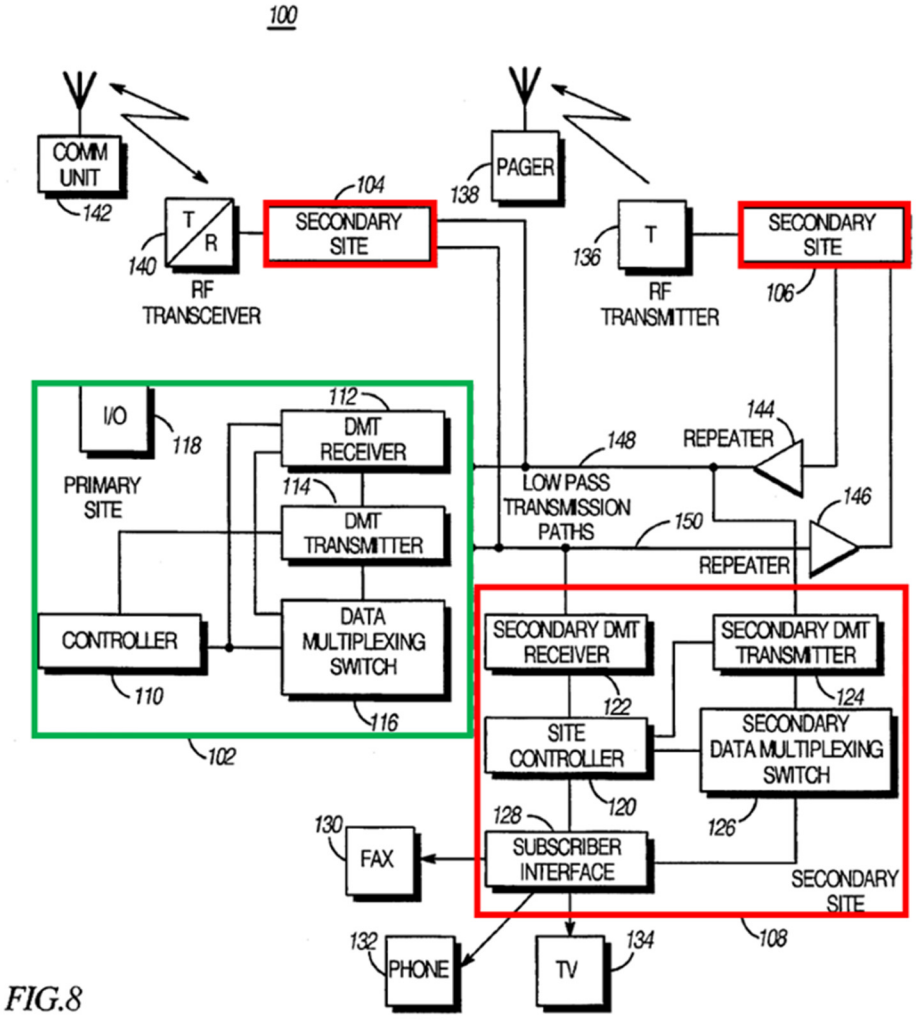
A. GROUND 1 – Grube (Claims 29, 31, 34, and 36)

1) Overview of Grube

42. Entitled "Method and Apparatus for Updating Carrier Channel Allocations," Grube was filed on January 26, 1995 and was published on May 28, 1996. DISH-1005, Cover.

43. Grube focuses on improving reliability and bandwidth over existing wiring in a home environment, e.g., telephone lines, to facilitate data and video transmission without compromising other services. *See id.*, 2:48-3:17. To do so, Grube uses frequency division multiplexing with discrete multi-tone ("DMT") modulation over multiple carrier channels to facilitate communication between a primary site and multiple secondary sites. *Id.*, 4:21-28 (explaining Grube applies to systems with "one-to-many and/or many-to-one communication[s]"), 6:57-60 (explaining Grube teaches a "communication system infrastructure utilizing low pass transmission path[s], i.e.[,] twisted pair telephone line[s]"). Grube's DMT system, like the '450 Patent, uses multicarrier modulation, with quadrature amplitude modulation ("QAM") as the modulation scheme, to ensure a central unit communicates efficiently with multiple subscribers. *Compare id.*, 3:27-28, 3:37-44, 6:57-67, 16:53-17:20, FIG. 8, FIG. 15, *with* DISH-1001, 3:6, 20:21-21:2, FIGS. 13A-C (describing the process of determining the claimed "common bit-load[ing] modulation scheme").

44. Figure 8 depicts a communications system with a primary site (green) connected to a plurality of secondary sites (red):



Grube Fig. 8 (annotated)

45. The primary site includes a controller, a DMT transmitter, and a DMT receiver. DISH-1005, 6:60-62, FIG. 8. Each of the plurality of secondary sites includes a site controller, a secondary DMT receiver, and a secondary DMT transmitter. *Id.* at 6:62-67. The primary site is "coupled" to the plurality of secondary sites "via [the] low pass transmission paths." *Id.* at 6:62-64.

46. Grube ensures that the secondary sites in a multi-unit system have enough bandwidth by (a) determining the secondary sites involved in a transmission, (b) determining a lowest-common-denominator bit-loading table across all the secondary sites, and (c) allocating channels based on bandwidth requirements. *Id.*, 14:36-48, 7:16-8:52.

47. Before transmitting information over the network, "an inbound control channel and an outbound control channel [are] established over the low pass transmission paths." *Id.*, 7:15-17. "The outbound control channel for the system infrastructure is generally established when the primary site transmits a training signal to each of the plurality of secondary sites." *Id.*, 7:34-36. "Upon receiving the training signal, each of the secondary sites performs a spectral response analysis of the outbound low pass transmission path based on the training signal and then creates bit loading information" based on the spectral response analysis. *Id.*, 7:37-40. The secondary sites provide this bit-loading information to the primary site, after which "the primary site[] generates a lowest common denominator (LCD) bit loading table as a compilation of all of the site bit loading tables." *Id.*, 7:41-48.

48. To provide more insight on Grube's table-generation, I note that U.S. Patent No. 4,679,227 ("Hughes-Hartogs"), DISH-1012, provides an example of how bit loading tables can be generated based on "line parameters." DISH-1012, 8:9-9:38. In general, Hughes-Hartogs teaches a method where a modem measures signal

loss across all frequencies used in a DMT system by transmitting a signal (an answer comb) at a known power level over all DMT frequencies and then compares the power level of the received signal to ascertain signal loss. *Id.*, 8:9-28. After ascertaining this information, the modem sends information on the number of bits and the power levels that each DMT frequency can support. *Id.*, 9:9-17. Hughes-Hartogs then uses a water-filling algorithm to calculate the power levels required to transmit data with a higher bit number. *Id.*, 10:31-11:20. Once the power level for each frequency is known, a table can be generated showing the number of bits that can be supported at that power, as shown in Figure 5:

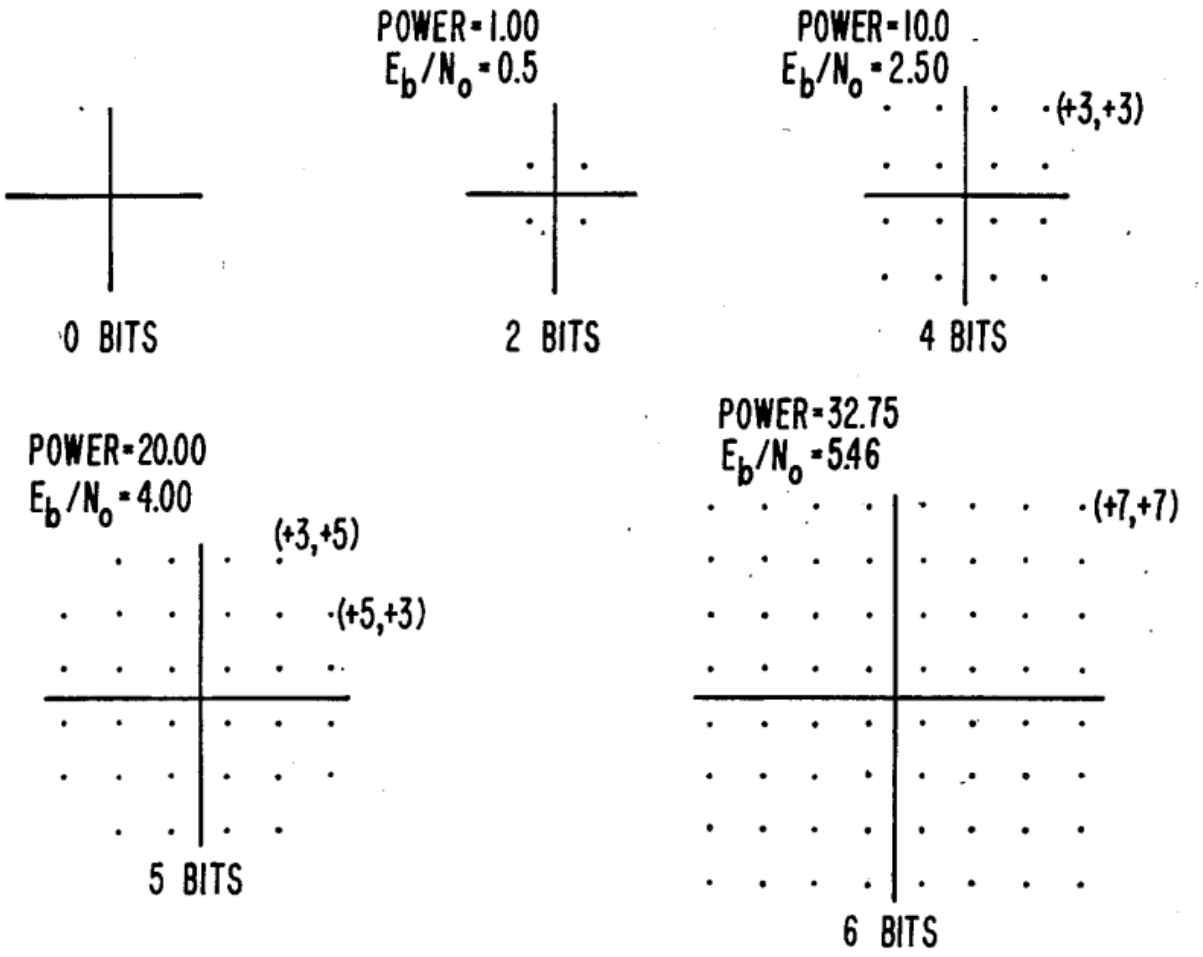
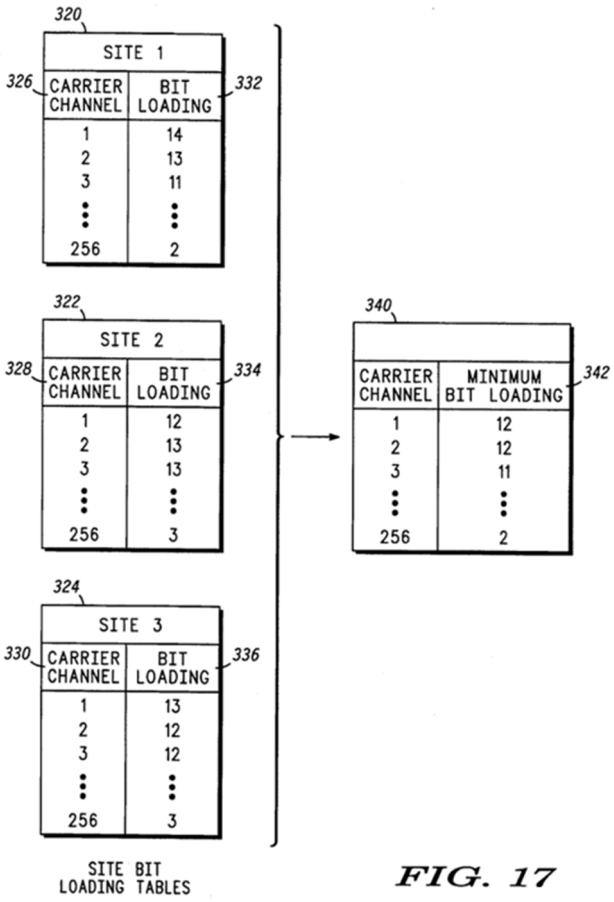


FIG. 5.

DISH-1012, FIG. 5

49. With respect to Figure 5, Hughes-Hartogs explains that "FIG. 5 depicts the QAM constellations for signals of various complexities B. An exemplary signal to noise ratio, E_b/N_O, for each constellation and the power required to transmit the number of bits in the constellation without exceeding $(BER)_O$ is depicted alongside each constellation graph." DISH-1012, 9:63-68.

50. "From the LCD bit loading table and bandwidth requirements for the outbound control channel, the primary site selects at least one outbound carrier channel … to function as the outbound control channel." DISH-1005, 7:48-52. With continued reference to Grube, Grube depicts the selection of a lowest common denominator (LCD) bit loading table in Figure 17. *Id.*, 18:17-67.



Grube Fig. 17

51. To determine the outbound carrier channel, the bit loading tables of each secondary site (e.g., tables 332, 334, and 336 depicted in Figure 17) are compared. *Id.*, 18:27-57. For example, the LCD bit loading table is updated with

the least common bit loading for Carrier Channel 1 across secondary sites after a comparison of bit loading for Carrier Channel 1 across all secondary sites—in this example, fourteen for Site 1, twelve for Site 2, and thirteen for Site 3, with twelve being the least common number. *Id.*, FIG. 17. After the outbound control channel is determined, "the primary site transmits a signal to all the secondary sites indicating the carrier channel allocations as the control channel." *Id.*, 18:9-12. Grube describes a similar process for establishing the inbound control channel. *Id.*, 7:53-67. After the control channel is established, the system uses the common bit-loading table to facilitate calls. *Id.*, 8:1-16.

52. In Grube's communication system, DMT transmission schemes are used to support communications, including plain old telephone service (POTS) phone calls, video data transfers, and audio data transfers, using existing telephone lines. *Id.,* 10:45-54. Grube recognizes that its methodology applies to secondary sites equipped with telephones, televisions, and cable boxes, or "any other type of device that can receive digital information." *Id.*, 8:29-52, 12:58-13:6. Simply put, Grube modulates data, and a POSITA would have understood that Grube's modulation techniques are agnostic as to the data content (audio, video, or otherwise). *See id.*, 7:34-52.

53. A POSITA would have further understood that Grube's modulation techniques are widely applicable to wired communications networks, including

home communications networks using pre-existing transmission paths. *See id.*, 4:24-28 (recognizing that "a need exists for a one-to-many and/or many-to-one communication system infrastructure that utilizes existing telephone lines while providing the highly reliable service subscribers of wireless communication systems expect"), 12:67-13:6 (explaining that the secondary sites can interface with "a television set 212, a cable box, a VCR, a virtual VCR, a teleconferencing interface" and other elements that are typical in a home network or a network within a building). By using pre-existing wiring, Grube's method avoids costly new infrastructure expenses. DISH-1005, 57:29-38. Accordingly, a POSITA would have understood Grube's methodology to apply to a wired home or building communications network, particularly one with pre-existing lines, including a coaxial cable network. Thus, a POSITA would have been motivated to use and modify the teachings of Grube to solve the issues facing the inventors of the '450 Patent.

54. A POSITA would have understood that Grube is analogous art to the '450 Patent.

55. Both Grube and the '450 Patent are from the same field of endeavor (communication network infrastructures involving one-to-many communications) and Grube is pertinent to the problems that the '450 Patent is concerned with (i.e., enabling one-to-many communications in a network using existing wired

communications infrastructure). DISH-1001, 3:65-67, 4:1-8, 23:41-24:9; DISH-1005, 1:6-8, 2:48-3:17, 4:21-28, 6:57-67.

56. A POSITA would thus have been motivated to look to Grube to solve the issues facing the inventors of the '450 Patent in the field of communications networking.

2) Independent Claim 29

[29pre] "A broadcasting method within a Broadband Coaxial Network ("BCN"), comprising"

57. I have been asked to consider whether Grube discloses or renders obvious the preamble of claim 29, but I have not been asked to render an opinion on whether the preamble should be considered a limitation. If the preamble of claim 29 is deemed to be a limitation, it is my opinion that Grube renders obvious this limitation.

58. Grube "provides a method and apparatus for establishing a communication system infrastructure utilizing low pass transmission path, i.e.[,] twisted pair telephone line." DISH-1005, 6:57-60. Grube notes that "Asymmetrical Digital Subscriber Loop, or Link, (ADSL)" is a technique for "increas[ing] the transmission capabilities of a twisted pair copper telephone line." *Id.*, 2:49-54. However, the ADSL system was "designed for one-to-one communications and not one-to-many or many-to-one communications," thus creating a need for "a one-to-

many and/or many-to-one communication system infrastructure that utilizes existing telephone lines." *Id.*, 4:21-28.

"Broadcasting Method"

59. Grube discloses or renders obvious a "broadcasting method." For example, Grube sought to develop a one-to-many "communication system infrastructure" that utilized the "twisted pair telephone line" by providing "a primary site which includes a controller, a data multiplexing switch, a DMT transmitter[,] and a DMT receiver." *Id.*, 6:59-62. The "primary site is coupled to a plurality of secondary sites via low pass transmission paths" (i.e., the twisted pair telephone lines). *Id.*, 6:61-64. Each of the secondary sites includes "a secondary DMT receiver, a secondary DMT transmitter, a secondary DMT data multiplexing switch, a site controller[,] and at least one subscriber interface." *Id.*, 6:64-67. As depicted in Figure 8 below, Grube teaches the transmission of data from a primary site 102 (green) along the low pass transmission paths 148 to a plurality of secondary sites 104, 106, and 108 (red).

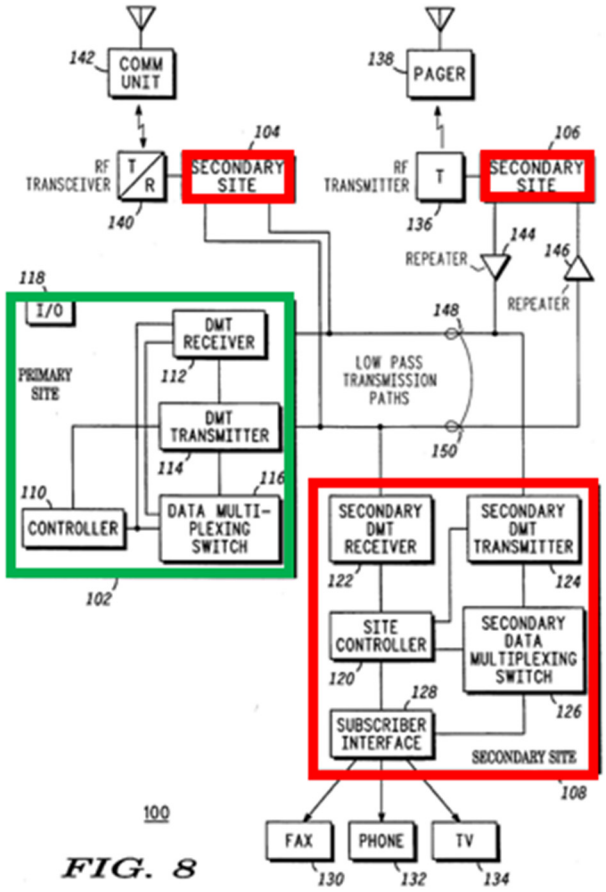


FIG. 8

Grube Fig. 8 (annotated)

60. Further, Grube teaches that the transmission of data from a primary site is transmitted to each of the plurality of secondary sites simultaneously. *See id.*, 15:38-40. Indeed, Grube states that the "primary site transmits a first training signal to all secondary sites." *Id.*, *see also id.*, FIG. 14.

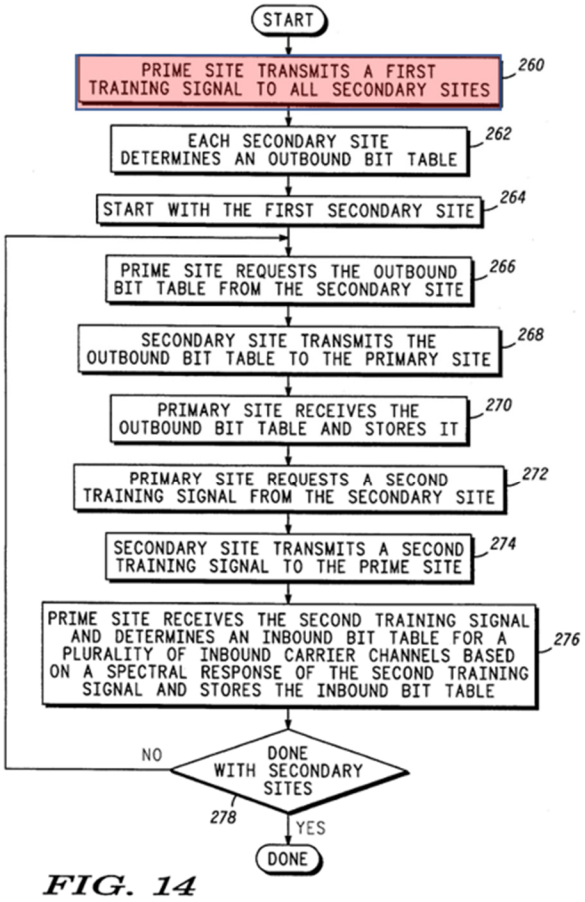


FIG. 14

Grube Fig. 14 (annotated)

61. Grube's DMT-based one-to-many communication system and method is a "broadcasting method" as recited by the '450 Patent. *Compare* DISH-1001, 20:12-16 (explaining that the network "ensure[s] that both Node B … and Node C … are able to receive a broadcast signal transmitted from Node A … [by utilizing] [t]he common bit-loaded modulation scheme"), *with* DISH-1005 at 4:24-26 (designed to support "one-to-many … communication system infrastructure").

Broadband Coaxial Network

62. Grube renders obvious that the claimed "broadcasting method" is implemented "within a Broadband Coaxial Network." Indeed, a POSITA would have been motivated and would have found it obvious to implement the DMT-based one-to-many communication system and method of Grube in a broadband coaxial network.

63. Grube couples its secondary sites to "a communication unit 142, … a telephone 132, … or any other type of device that can receive digital information." DISH-1005, 8:46-53; *see also id.*, FIG. 8. Such devices were commonly used in broadband coaxial networks, because such devices were common in home/building environments, and broadband coaxial networks were also common in home/building environments. Nonetheless, Grube does not explicitly describe its system as such a network. However, it is my opinion that a POSITA would have been motivated and would have found it obvious to implement Grube's system and method in broadband coaxial networks.

64. The '450 Patent clarifies that the claimed "Broadband Coaxial Network" is a solution to "utilizing the home coaxial cable as a medium for high speed home networking by utilizing frequencies above the ones currently used by the Cable Operators for their cable service," because the "home coaxial cable is a natural medium for connecting multimedia devices since it has enormous amount of

available bandwidth required for the high data rates which are needed for such applications and also, all the multimedia devices and appliances are most likely to be already connected to the coaxial cable." DISH-1001, 3:11-21. Thus, a POSITA would have understood that it would have been obvious to implement Grube's "broadcasting method" "within a Broadband Coaxial Network" because it would have allowed Grube's invention to reap the well-known benefits of the high bandwidth available in coaxial networks.

65. A POSITA would be motivated to apply Grube's system and method to a coaxial cable network as described in the '450 Patent for several reasons. First, Grube explicitly recognizes that its secondary sites may be coupled to "a communication unit 142, a pager unit 138, a facsimile unit 130, a telephone 132, a television 134, or any other type of device that can receive digital information." DISH-1005, 8:46-53; *see also id.*, FIG. 8. These devices are commonly found in a home networking environment. Similarly, the '450 Patent clarifies that the claimed "broadband coaxial network" utilizes the "home coaxial cable." DISH-1001, 3:11-21.

66. Second, Grube is applicable to pre-existing networks within a home or building environment. DISH-1005, 4:24-26 (recognizing the need for communication system infrastructure that "utilizes existing telephone lines"). Coaxial cable networks were already commonly used in home networking

environments to connect various devices throughout a home, and because pre-existing coaxial wiring in the home presented inexpensive, robust network components to further Grube's goal of improving reliability and bandwidth for in-home video/data transmission.

67. Third, coaxial cable networks used multiple carrier channels for data transmissions to various devices connected to the network, where each carrier channel might have different characteristics at different points in time. For example, Cioffi (DISH-1006) notes that the "sub-channels" are "dynamic[ally] allocat[ed] … based upon the current characteristics of the transmission environment," and that "it is desirable to periodically update the central unit's information concerning the characteristics of the sub-channels." *Id.*, 16:67-17:25. Accordingly, transmission to multiple receiving devices in coaxial cable networks would have required a modulation scheme that enables communications to all of the receiving devices for each carrier channel in light of the varying characteristics of each carrier channel. Grube directly addressed this problem by identifying the "lowest [bit loading] value for each carrier channel" across the various receiving nodes. DISH-1005, 14:11-15.

68. Additionally, a POSITA would have been motivated to implement Grube's system and method in a broadband coaxial network because a POSITA would have understood that Grube's system and method do not require modification to be implemented in the context of coaxial cable networks. Coaxial cable networks

and Grube's twisted-pair telephone line networks are structurally similar—both types of networks involve a single point of entry into a home or building networking environment, where wires then connect each device in the networking environment to the point of entry to accommodate multiple devices in a network. *See also* DISH-1006, FIG. 1, 7:22-40 (depicting the structure of a "typical multiuser subscriber network," which could apply in the context of either "twisted pair phone lines" or "coaxial cables" as the "transmission media").

69. Finally, it would have been obvious to a POSITA to implement Grube's system and method in a coaxial cable network because a POSITA would have understood the applicability of Grube's DMT-based adaptive bit-loading communication schemes over multiple carrier channels, each of which could possess different transmission characteristics, to coaxial cable networks. Coaxial cable networks use adaptive orthogonal frequency division multiplexing (OFDM) to perform modulation, which also involves the use of the multiple carrier channels, each of which could possess different transmission characteristics from the point of entry to a network device, to coaxial cable networks. It would therefore have been obvious to a POSITA to apply Grube's adaptive bit-loading systems and methods to coaxial cable networks to enable broadcast communications to multiple devices in the network.

70. Additionally, a POSITA would have also been motivated to apply Grube's method in the context of a broadband network. As a preliminary matter, Grube recognized the benefit of having increased bandwidth even in one-to-one communications to accommodate data transmissions. DISH-1005, 4:21-24 ("While the ADSL system increases the bandwidth of a telephone line, up to 1.1 megahertz, it is designed for one-to-one communications"). It is my opinion that Grube's twisted pair telephone line network is therefore a broadband network, because broadband networks have increased bandwidth and operates at high speeds. Even if Grube's network is not interpreted to be a broadband network, as a POSITA expanded Grube's communications system from one-to-one communications to one-to-many communications, it would have been an obvious design choice for a POSITA to use a broadband coaxial network to ensure that the communications system could still accommodate data transmissions among an increased number of devices while maintaining and/or increasing transmission speeds.

71. As a result, it is my opinion that Grube renders obvious this limitation.

[29a] "a transmitting node transmitting a probe signal to a plurality of receiving nodes"

72. It is my opinion that Grube discloses this limitation.

73. The '450 Patent's limited description of a "probe signal" indicates that a probe signal is used to "determine[] the transmission characteristics of the channel path" and then "determine[] a bit-loaded modulation scheme for the transmission

characteristics of the channel path in step 1910." DISH-1001, 23:49-55. It also only references a transmitting node and a plurality of receiving nodes in a recitation of the claim limitations within the specification. *See generally id.* Thus, in the context of the '450 Patent, it is my opinion that a POSITA would have understood that the claim encompasses a transmitting node and a plurality of receiving nodes that are capable of performing the functions recited in the claims.

74. Similarly, Grube explains that its "communication system" includes a "primary site" and "a plurality of secondary sites … interoperably coupled to the primary site" (i.e., the claimed "transmitting node" and "plurality of receiving nodes" respectively). DISH-1005, 8:17-20. The primary site is configured to "transmit[] a training signal to each of the plurality of secondary sites." *Id.*, 7:34-36. Figure 14 of Grube depicts a flowchart to demonstrate that training signals are transmitted from the primary site to the plurality of secondary sites at Step 260 (highlighted).

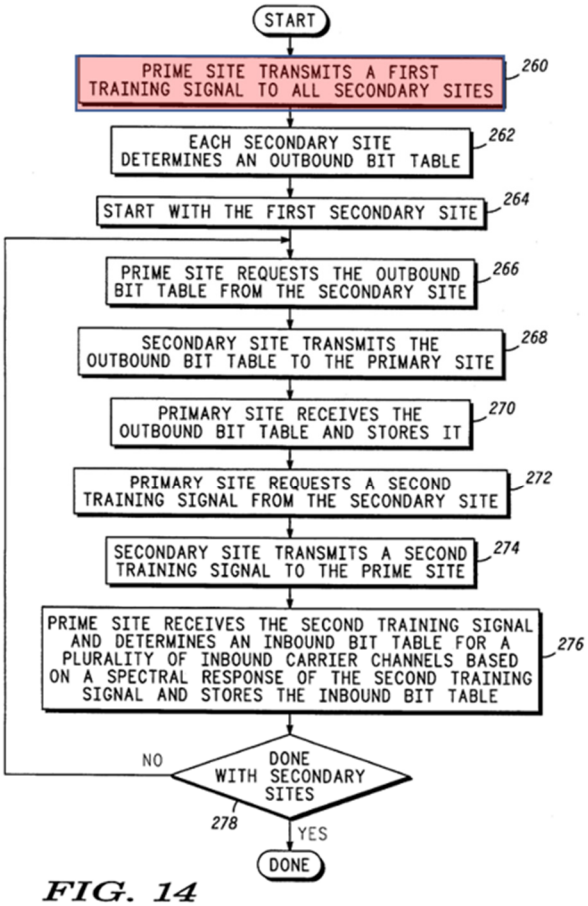


FIG. 14

Grube Fig. 14 (annotated)

75. Like the ’450 Patent, which discloses the transmission of the probe signal from the transmitting node to the plurality of receiving nodes as part of the process to determine a common bit-loading modulation scheme, the transmission of the training signal in Grube is part of Grube’s process to ultimately determine bit loading information. DISH-1001, FIG. 19; DISH-1005, FIG. 14.

76. The transmission of the training signal in Grube is further illustrated in Figure 15.

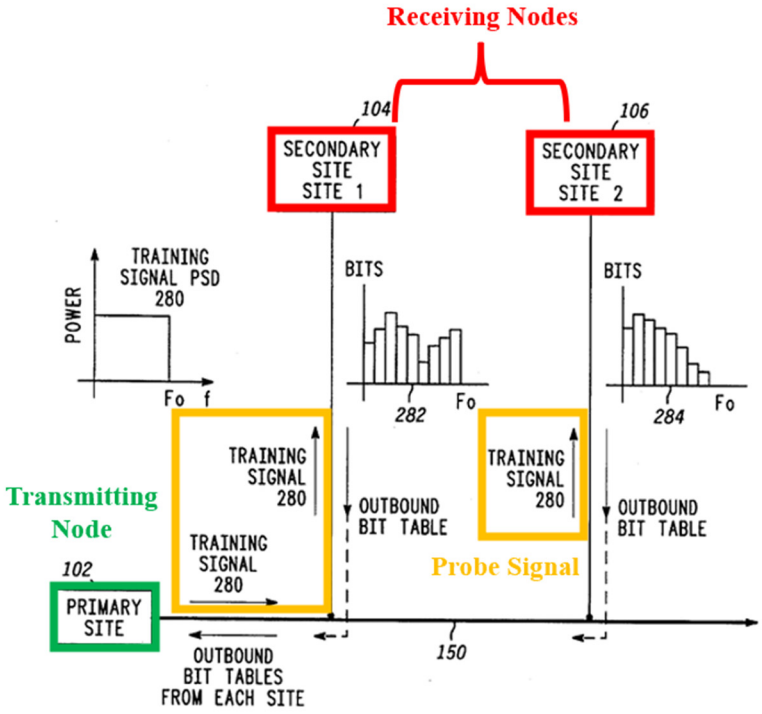


FIG. 15

Grube Fig. 15 (annotated)

77. Indeed, as depicted in Grube's Figure 15, the "primary site 102" transmits a "training signal 280" (yellow) (the claimed "probe signal") to both of secondary site 104 and secondary site 106 (red), which function as the claimed "plurality of receiving nodes"). DISH-1005, FIG. 15. Each of the secondary site 104 and the secondary site 106 receive the "training signal 280." DISH-1005, 16:53-56.

78. It is my opinion that the "training signal 280" in Grube functions as the claimed "probe signal." Grube recognizes that its training signals are used to determine the "spectral response" of the paths between the primary site and each of

the secondary sites, and the "spectral response" is then used to determine a bit-loading table. *See* DISH-1005, 15:53-16:12 (the "spectral response is determined by analyzing each of the plurality of sinusoidal signals of the training signal," and the "bit loading" can be "calculate[d]" from the "spectral response"). Each bit-loading table is provided to the primary site, and the primary site determines a "lowest common denominator (LCD) bit loading table" for the network using the bit-loading tables. *See id.*, 18:18-57. Thus, Grube's training signals are used to probe characteristics of the transmission paths in the network and to determine the bit-loading modulation schemes used on those paths. *Id.*, 15-53:16-12, 18:18-57.

79. As a result, it is my opinion that Grube discloses this limitation.

[29b] "the transmitting node receiving a plurality of response signals comprising a plurality of bit-loading modulation schemes from the plurality of receiving nodes"

80. It is my opinion that Grube discloses or renders obvious this limitation.

81. The '450 Patent provides little explanation as to the claimed "response signals." *See* DISH-1001, 23:55-63. According to the '450 Patent, the response signals merely "inform[] the transmitting node of the corresponding bit-loaded modulation scheme determined by each of the plurality of receiving nodes." *Id.*, 23:61-63. A similar process occurs in Grube.

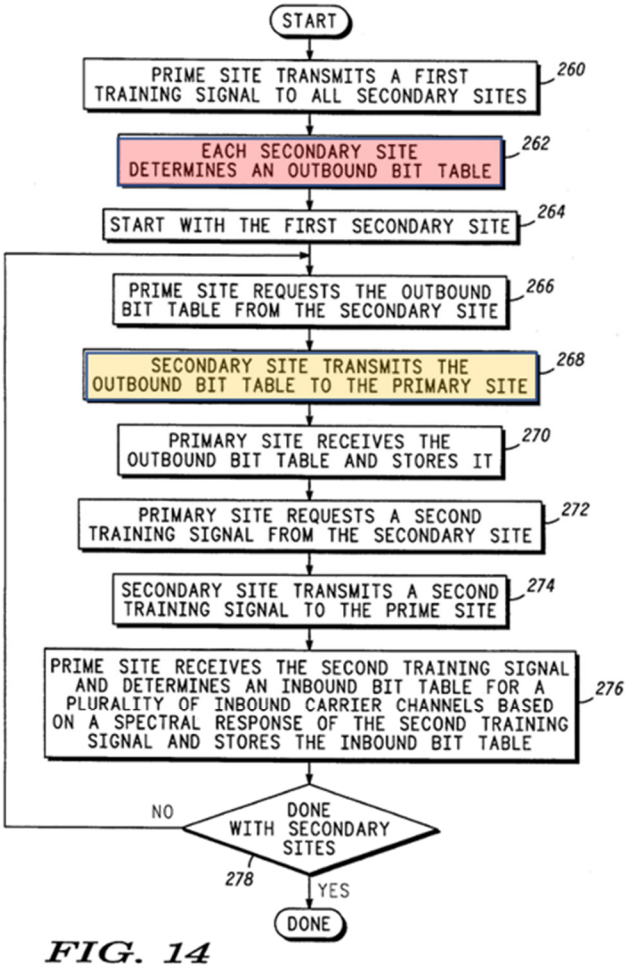


FIG. 14

Grube Fig. 14 (annotated)

82. As depicted above, as part of the method for determining the "inbound bit loading information and the outbound bit loading information," in response to receiving the training signal, each secondary site "determines an outbound bit table" (red), which is then transmitted to the primary site (yellow). DISH-1005, FIG. 14, 15:36-38.

83. Further, the claimed "response signals" comprising "bit-loading modulation schemes" which are transmitted from the plurality of receiving nodes to

the transmitting node is like Grube's bit-loading information (i.e., the claimed "bit-loading modulation schemes") transmitted from the plurality of secondary sites to the primary site. In discussing Step 264, Grube notes that the "secondary site responds with its bit loading table," which is the format in which the bit loading information is stored. DISH-1005, 16:15-19, 16:65-17:3 (clarifying that the "bit loading table" is produced by the secondary site using the "bit loading for each of the carrier channel[s]"); *see also id.*, FIG. 14 (Steps 270 and 276). The bit loading table "includes, for each carrier channel, a number of bits that the carrier channel can support" (i.e., the bit loading information). *Id.*, 3:53-55. Accordingly, the "plurality of response signals" from the secondary site comprise at least a plurality of bit loading schemes.

84. A POSITA would have understood that Grube's "bit loading of [each] carrier channel" is a "bit-loading modulation scheme." The bit loading of each carrier channel, when read in conjunction with the corresponding discussion in the specification, coincides with a constellation encoding scheme. *Id.*, 51:51-64 (the "bit loading of a carrier channel indicates the number of constellation points, i.e., the number of constellation points, i.e., the number of magnitude and phase combinations for the vector [associated with the carrier channel]. For example, if the bit loading of a carrier channel is 2, the number of constellation points is 4 (2^2) which can be equated to a binary numbering system.").

85. Grube also clarifies that it uses QAM constellations as part of the modulation process. *Id.*, 34:45-52. As an example, Grube recognizes that "[p]er the ADSL requirements, the minimum bit loading a carrier channel can have is 2 bits. With two bits, the quadrature amplitude modulation (QAM) signal generated from the two bits will have a single constellation point in each quadrant. Having one constellation point in each quadrant is the minimum amount of constellation points that a QAM signal can represent." *Id*.

86. As explained above, QAM was well-known prior to the filing date of the '450 Patent. *See, e.g.,* DISH-1015 (explaining that in systems that use QAM schemes, each QAM scheme (also known as a QAM order) corresponds to a number of constellation points. For example, 4-QAM has 4 constellation points, 16-QAM has 16 constellation points, and so on.). Due to the correspondence between the number of constellation points available for a carrier and the bit-loading modulation scheme that can be used for that carrier,[3] knowing the number of constellation points

[3] I note that a "constellation point" refers to each point on a QAM grid, like the ones shown in Grube (DISH-1005), Hostetter (DISH-1015, Figs. 1F and 4C), and Hughes-Hartogs (DISH-1012, Figs. 2 and 5). A constellation point represents a different combination of amplitude and phase shift of the carrier. The number of

for a carrier is disclosure of the bit-loading modulation scheme for that carrier to a POSITA. Thus, in Grube's example, four constellation points discloses a 4-QAM scheme.

87. Thus, because Grube's primary site and the plurality of secondary sites are configured for QAM modulation, the bit loading information transmitted from each secondary site to the primary site is a modulation scheme, because the transmission of the bit loading information in Grube is sufficient to enable Grube's system and method to perform modulation.

88. Figures 15 and 17 of Grube further explain how Grube renders obvious a plurality of response signals comprising a bit-loading modulation scheme being transmitted from the plurality of receiving nodes to the transmitting node.

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points on a given QAM grid represents the number of bits that each symbol can carry.

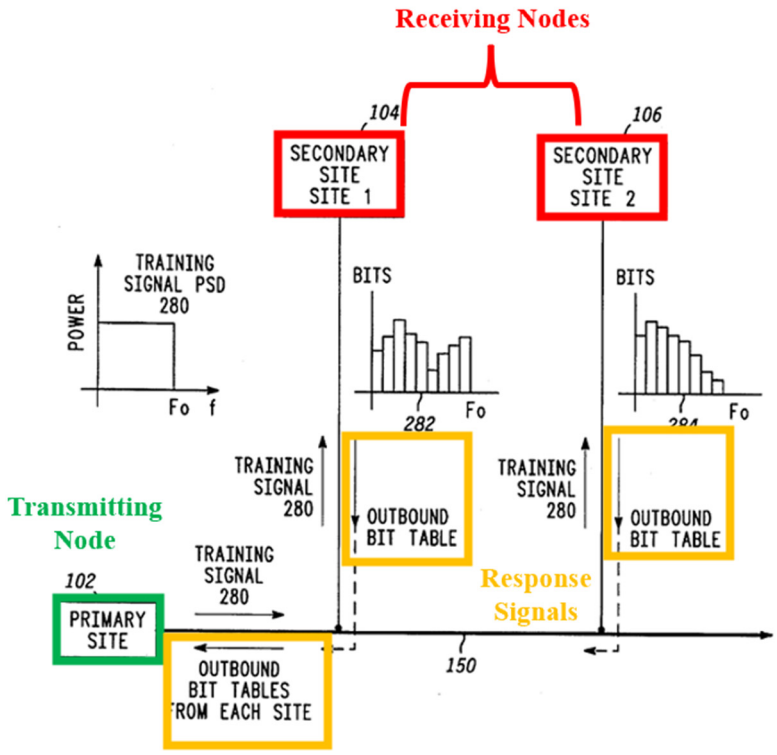


FIG. 15

Grube Fig. 15 (annotated)

89. As depicted in Figure 15, each secondary site 104, 106 generates an "outbound bit table" (yellow) that is transmitted to the primary site 102. *Id.*, FIG. 15. In the corresponding description of Figure 15, the "outbound bit table" is also known as a "bit loading table." *Id.*, 17:7-9. In the context of Figure 17, which explains how the "outbound control channel bit loading table" is generated from the various bit loading tables, the "outbound bit table" or "bit loading table" of Figure 15 is also known as an "outbound bit loading table" or a "site bit loading table." *Id.*, FIG. 17, 18:7-26. As shown below in Figure 17, each outbound bit loading table

320-324 contains "a carrier channel field 326-330 and a bit loading field 332-336" for every carrier channel. *Id.*

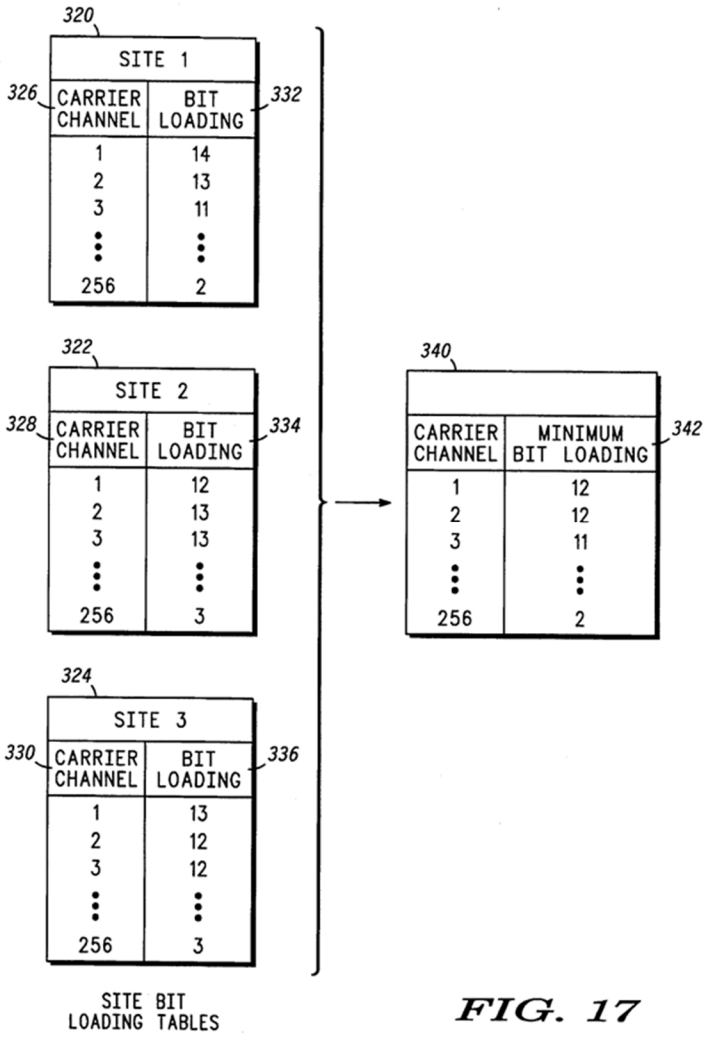


FIG. 17

90. Figure 17 thus makes clear that these bit loading tables are simply a format for organizing bit loading information – the "site bit loading tables" 330, 332, and 334 each display the corresponding bit loading information for each carrier channel. *Id.* A POSITA would therefore have understood that the terms "outbound bit table," "bit loading table," "outbound bit loading table," and "site bit loading

table" could be used interchangeably, with "bit loading information" and "outbound site bit loading information" being used interchangeably to indicate the information stored in the "bit loading table." Not only do these bit loading tables indicate "a number of bits that [each] carrier channel can support," but they also are a modulation scheme that is compatible with each carrier channel between the primary site and the applicable secondary site. DISH-1005, 3:53-55, 51:51-64 (explaining that the relationship between the number of bits supported by each carrier channel (n) and the modulation constellation size (x) is x-QAM = 2^n). For example, a POSITA would have understood that, if the number of bits supported by a carrier is 6, the modulation scheme to be used for subsequent transmissions would have been 64-QAM (i.e., 2^6). Similarly, if the number of bits supported by a carrier is 7, the modulation scheme would be 128-QAM (i.e., 2^7), and if the number of bits supported by a carrier is 4, the modulation scheme would be 16-QAM (i.e., 2^4). With respect to Grube's earlier description of a carrier channel supporting "up to 15 bits of QAM information," the modulation scheme would be 32,768-QAM (i.e., 2^{15}). *See* DISH-1005, 3:36-37. A POSITA would thus have understood that Grube's outbound bit loading table teaches the claimed "bit-loading modulation scheme" in the '450 Patent.

91. To the extent that Grube does not explicitly disclose a "bit-loading modulation scheme," a POSITA would have understood that Grube renders obvious

a "bit-loading modulation scheme." For example, a POSITA would have understood that including a modulation scheme in Grube would allow for the system to maximize efficiency in signal transmissions by allocating modulation schemes to carrier channels based on bit-loading capabilities. Doing so would enhance signal strength and improve the reception quality of signals transmitted on those channels, particularly those transmitted over long distances.

92. Further, a POSITA would have understood that the transmitter and receiver need to use the same modulation scheme on each carrier for the receiver to understand the transmitter (the system does not work if the transmitter and receiver use different modulation schemes on the same channel). Grube explains the process of receiving modulation schemes in relation to Figure 14, where the primary site sends a request (e.g., probe) message to a secondary site (step 264) and receives a response that includes its "bit loading table[]," i.e., the modulation scheme. DISH-1005, 16:13-15. Grube repeats this process for every secondary site in the network (steps 268 and 278). DISH-1005, 16:23-26, 16:43-48. Additionally, a POSITA would have found using a QAM modulation scheme in a DMT system a logical choice, because QAM supports higher orders of modulation than other modulation schemes, and in turn, supports higher data rates (as explained in paragraph ## above).

93. A POSITA would have also experienced a reasonable expectation of success in implementing a "bit-loading modulation scheme" in Grube. As discussed, Grube already disclosed the determination of "bit loading information" for each carrier, which a POSITA would have understood to disclose a QAM constellation scheme. Thus, a POSITA would have understood this to be the combination of prior art elements (a modulation scheme) according to known methods (implementing modulation schemes in broadband coaxial networks) to yield predictable results (a broadband coaxial network with a modulation scheme to regulate signal transmissions).

94. As a result, it is my opinion that Grube discloses or renders obvious this limitation.

[29c] "wherein each of the plurality of receiving nodes receives the probe signal through a corresponding channel path,"

95. It is my opinion that Grube discloses this limitation.

96. Grube explains that the primary site is configured to "transmit[] a training signal to each of the plurality of secondary sites." DISH-1005, 7:34-36; *see supra* §IV(A)(2)(a)[29a]. After the training signal has been transmitted, Grube explicitly recognizes that "each of the secondary sites receives the [] training signal." *Id.* at 15:53-55; *see also id.*, FIG. 15 (each of the secondary site 104 and the secondary site 106 receives the "training signal 280" that has been transmitted by

the "primary site 102"), 16:63-64 (the first secondary site 104 "receiv[es] the training signal").

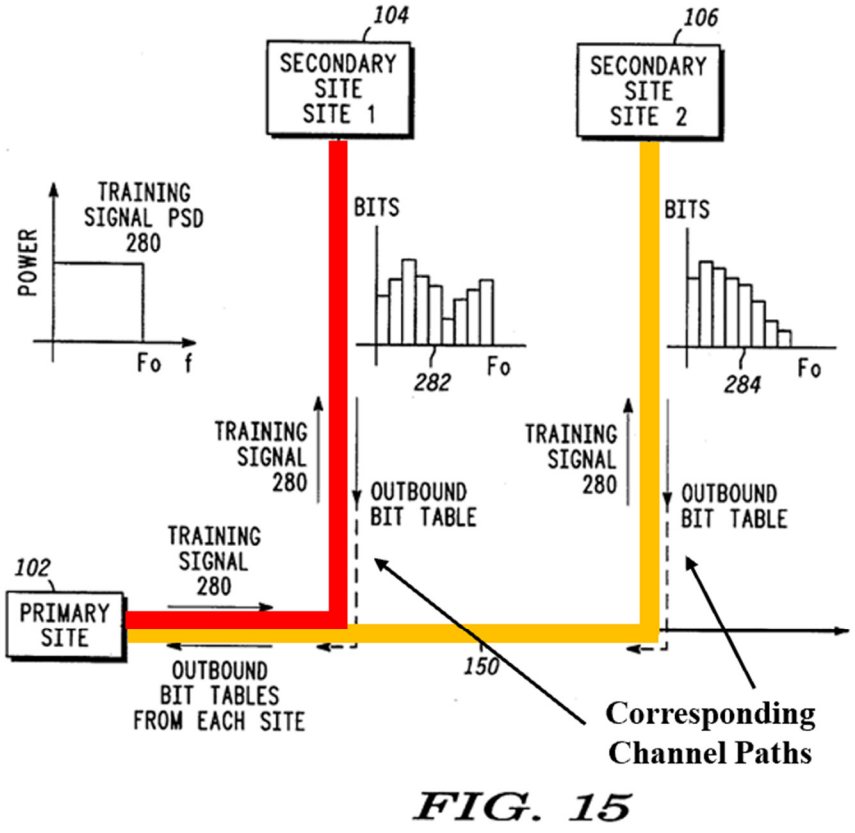


FIG. 15

Grube Fig. 15 (annotated)

97. As shown in FIG. 15 above, each of the plurality of receiving nodes receives the probe signal through a corresponding channel path.

98. Additionally, as explained below in relation to limitation [29d], the purpose of the claimed "probe signal" is for use in determining the transmission characteristics of each channel path. *See infra* §IV(A)(2)(a)[29d]. To do so, Grube's training signal necessarily travels along the corresponding channel paths.

99. As a result, it is my opinion that Grube discloses this limitation.

[29d] "determines transmission characteristics of the corresponding channel path,"

100. It is my opinion that Grube discloses this limitation.

101. Grube states that upon "receiving the training signal, each of the secondary sites performs a spectral response analysis of the outbound low pass transmission path based on the training signal." DISH-1005, 7:38-41. More specifically, Grube explains that the "spectral response is determined by analyzing each of the plurality of sinusoidal signals of the training signal." *Id*., 15:57-59. "In essence, the secondary site determines the magnitude, and/or phase of the received sinusoidal signal and compares it to the magnitude and phase of the known transmitted sinusoidal signal. From the differences that occur, a spectral response can be obtained for an individual sinusoidal signal of the training signal," where the "individual sinusoidal signal corresponds to a carrier channel." *Id.*, 15:59-65. Grube thus teaches that the spectral response is assessed for each carrier channel of a channel path, thus amounting to the determination of transmission characteristics for the channel path, which includes multiple carrier channels.

102. The spectral response in Grube is the claimed "transmission characteristics." It is my opinion that a POSITA would have understood that Grube's "spectral response" is a measure of a transmission characteristic—i.e., how successful the path is in delivering a signal. *See, e.g.,* DISH-1010, 10:12-14 (stating

that the "[d]etermination of a channel response ... from a known signal is well known in the art"); DISH-1009 (defining “spectral response” as “[i]n relation to sensing devices, the relationship between the device’s sensitivity and the frequency of the detected energy”).

103. Further, I note that Grube uses “spectral response” as a tautology—Grube uses the term to describe how a given channel responds when a signal is transmitted on that channel. By way of example, Grube explains:

> Each carrier channels can support up to 15 bits of QAM information. The actual amount of bits a carder [sic] channel supports varies, however, due to the spectral response of the telephone line. For example, one carrier channel may be able to accommodate 15 bits while another may be only able to accommodate 4 bits. Due to ADSL requirements the minimum amount of bits a carrier channel can support, referred to as bit loading, is 2 bits and still carry data.
>
> To determine the spectral response of the telephone line, the ADSL transceivers use an algorithm as shown in FIG. 5. As shown, a first ADSL transceivers will transmit a wide band test signal to a second ADSL transceiver. Upon receipt, the second ADSL transceiver evaluates the received signal to determine the spectral response of the telephone line. Having the spectral response, the second ADSL generates a bit loading table and sends the bit loading table to the first ADSL transceiver. The bit loading table includes, for each carrier channel, a number of bits that the carrier channel can support.

DISH-1005, 3:36-55 (and as explained below, a carrier channel that can support up to 15 bits of QAM information would use 32,768-QAM because the “15” in “15 bits” is the base-2 exponent in the QAM scheme (i.e., $2^{15} = 32{,}768$)). At a high-level abstraction, Grube also explains that a spectral response is a comparison of two

values (initial and subsequent) observed at the start and end of a transmission. Grube explains:

> In step 262, each of the secondary sites receives the first training signal and determines a spectral response of the outbound transmission path. From the spectral response, an outbound bit loading table for a plurality of outbound carrier channel is generated. The spectral response is determined by analyzing each of the plurality of sinusoidal signals of the training signal. In essence, the secondary site determines the magnitude, and/or phase of the received sinusoidal signal and compares it to the magnitude and phase of the known transmitted sinusoidal signal. From the differences that occur, a spectral response can be obtained for an individual sinusoidal signal of the training signal. The individual sinusoidal signal corresponds to a carrier channel. From the spectral response, the secondary site can then calculate the bit loading for this particular carrier channel. For example, if the sinusoidal signal for a particular carrier channel had very little degradation from its transmitted signal, the carrier channel can handle a maximum number of bits. For an ADSL system, the maximum bits a carrier channel can accommodate per frame is 15 bits. Thus, as the quality of the transmission path decreases, the number of bits of a particular carrier channel can accommodate, or bit loading, decreases. Per ADSL requirements, the minimum number of bits a channel can accommodate is two bits. Thus, if the spectral response of a particular carrier channel is so poor that it would only accommodate 1 bit, this particular carrier channel is set to a bit loading of zero.

DISH-1005, 15:53-16:12.

104. More specifically, Grube explains that "[f]rom the spectral response, the secondary site can then calculate the bit loading for this particular channel. For example, if the sinusoidal signal for a particular channel had very little degradation from its transmitted signal, the carrier channel can handle a maximum number of bits." DISH-1005, 15:65-16:3. "Thus, as the quality of the transmission path

decreases, the number of bits of a particular carrier channel can accommodate, or bit loading, decreases." *Id.*, 16:5-8. "Per ADSL requirements, the minimum number of bits a channel can accommodate is two bits. Thus, if the spectral response of a particular carrier channel is so poor that it would only accommodate 1 bit, this particular carrier channel is set to a bit loading of zero." *Id.*, 16:8-12. Grube thus teaches that the spectral response includes information about the amount of degradation to a transmitted signal caused by the channel path, which is related to the quality of the channel path. Accordingly, the spectral response generated in Grube includes the amount of degradation at each channel path, which is related to the quality of the channel path. *See, e.g.,* DISH-1016, 3:46-4:8 (any "quality parameter" such as "signal-to-interference noise ratio, signal-to-noise ratio, power level, level crossing rate, level crossing duration, bit error rate, symbol error rate, packet error rate, and error probability" can be used to determine a channel's transmission characteristics).

105. This understanding of the "spectral response" indicating a "transmission characteristic" is further reinforced in Grube. Grube states that "[t]he 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 channel to produce a bit loading table 282. As shown, the bit loading table of the

first secondary site 104 has some carrier channels having more bit loading capabilities while others have less. Lower bit loading capabilities result from the transfer function of the outbound transmission path at particular carrier channels having more attenuation than other carrier channels which have less attenuation." DISH-1005, 16:63-17:6. Grube thus recognizes that the spectral response is used to calculate bit loading capabilities, and the bit loading capabilities are impacted by attenuation of the carrier channels. *Id. See, e.g.,* DISH-1016, 3:46-4:8 (any "quality parameter" such as "signal-to-interference noise ratio, signal-to-noise ratio, power level, level crossing rate, level crossing duration, bit error rate, symbol error rate, packet error rate, and error probability" can be used to determine a channel's transmission characteristics).

106. While Grube omits the names of particular methods used to characterize the spectral response of the channel, such methods would have been well-known to a POSITA. For example, Hughes-Hartogs uses "signal loss" to measure the spectral response of the channel. DISH-1012, 8:9-20. Similarly, Levin uses "channel analysis" to measure the spectral response of the channel. DISH-1013, 1:62-2:8, 3:15-36. Levin explains:

> Prior to transmitting real-time data with an ADSL system, an initialization process occurs. During a first portion of the initialization process, an activation and acknowledgment step occurs. It is during this step that a transmit activation tone is generated following power-up of the ADSL system. Transceiver training is the next step of the initialization process. During transceiver training, the equalization

> filters of the ADSL system are trained and system synchronization is achieved. Next, channel analysis and exchange are performed as part of the initialization processes. During the channel analysis and exchange, the Signal to Noise Ratio (SNR) of the channels is determined, and bit loading configuration of the bins and other configuration information is transferred.

DISH-1013, 1:62-2:8. Levin later adds:

> FIG. 3 illustrates a method for implementing the present invention. While the specific embodiment will address a specific DMT implementation, it is to be understood that the present invention applies to any DMT implementation. At step 311, an analysis of an ADSL channel is performed. In one embodiment of the present invention, the channel analysis step 311 would return a signal-to-noise ratio (SNR) for a channel in an initial state. Generally, the channel analysis step 311 of FIG. 3 is performed as part of the initialization process. However, other implementations where the steps of FIG. 3 are performed during real time operation are anticipated by the present invention.
>
> At step 312, the data capacity of each bin is calculated. In one embodiment, the data capacity is calculated based upon the SNR of a carrier, as determined in step 311, and the SNR reference table of FIG. 2. The data capacity can be determined by identifying, for a given SNR reference table, the maximum number of bits that can be transmitted. For example, according to the table of FIG. 2, the maximum number of bits that could be allocated to a bin having an SNR of 32 is seven bits.

Id., 3:15-35.

107. Accordingly, Hughes-Hartogs (DISH-1012) and Levin (DISH-1013) reinforce that "spectral response" is simply a broad term that is generally synonymous with other terms used to describe channel performance. Thus, a POSITA would have understood that the spectral response includes the attenuation of each of the carrier channels (i.e., one of the claimed "transmission characteristics

of the channel path"). The transmission characteristics of the carrier channels in sum are the "transmission characteristics of the channel path."

108. Grube further acknowledges that "[a]s is known, over time the transmission characteristics of the telephone line changes. Thus requiring the spectral response of the data line to be periodically updated." DISH-1005, 19:2-5. Thus, Grube explains that its spectral response is the claimed "transmission characteristics of the channel path" of the '450 Patent.

109. As a result, it is my opinion that Grube discloses this limitation.

[29e] "determines a bit-loading modulation scheme for the corresponding channel path based on the transmission characteristics, and"

110. It is my opinion that Grube discloses or renders obvious this limitation.

111. As discussed above, Grube's spectral response indicating signal degradation and signal attenuation discloses or renders obvious the claimed "transmission characteristics of the channel path." *See supra* § IV(A)(2)(a)[29d]. Grube further states that "[e]ach of the secondary sites calculate[s] the bit loading information from a spectral response of the output transmission path, wherein the bit loading information indicates, for each carrier channel, the number of bits that the carrier channel can support." DISH-1005, 13:54-58. The bit loading information may be "stored in a site bit loading table." *Id.*, 7:43-44. Grube thus renders obvious bit loading information being determined based on the claimed "transmission characteristics of the channel path."

112. Additionally, it is my opinion that a POSITA would have understood that the claimed "bit-loading modulation scheme" would be determined based on the claimed "transmission characteristics" as described in relation to limitation [29d].

113. For example, Tzannes (DISH-1014) uses a "channel characteristic" to set the bit-loading values for a given channel. *See* DISH-1014. Tzannes explains:

> Bit loading is a technique for assigning bits to subchannels according to each subchannel's signal to noise ratio. A bit loading algorithm provides a bit allocation table that indicates the amount of information (in bits) that is to be encoded on each of the carriers. . . .
>
> Shaping the transmission to match the channel characteristics is known. For example, a technique known as "water pouring" was introduced by Gallager in 1968 ("Information Theory and Reliable Communication", page 389) and by Wozencraft in 1965 ("Principles of Communication Engineering", pp. 285-357). Water pouring involves distributing the energy of the transmission signal according to the channel frequency response curve (a plot of the signal to noise ratio as a function of frequency). The frequency response curve is inverted and the available signal energy (the "water") is "poured" into the inverted curve so that more of the energy is distributed into those portions of the channel having the highest signal to noise ratio. In a multicarrier system in which the transmission band is divided into numerous subchannels, throughput can be maximized by putting as many bits in each subcarrier as can be supported given the "water pouring" energy and a desired error rate.

DISH-1014, 1:33-58. Tzannes later explains that the relationship between channel characteristics and constellation sizes exist:

> The relationship between BER and SNR is well-known in the art of multicarrier communication. Tables are available that show the minimum SNR that can support a BER of a fixed amount or less for a given constellation size. For example, the table shown below, SNR[c_j], a constellation signal to noise ratio, indicates the minimum SNR needed

> to transmit a constellation having the indicated size in order to obtain an expected BER of 10^{-7} (i.e., an error of one bit per every 10^7 bits that are transmitted.) Note that as the constellation size increases, the minimum required SNR also increases.

Id., 6:28-39.

114. Further, as discussed above, the bit loading information in Grube is analogous to a bit-loading modulation scheme. *See* above §IV(A)(2)(a)[29b]. Accordingly, Grube thus renders obvious "a bit-loading modulation scheme" for the channel path "based on the transmission characteristics," where the "channel path" is the path between the "primary site" (i.e., the claimed "transmitting node") and the corresponding "secondary site" (i.e., one of the claimed "plurality of receiving nodes"). *See* above §IV(A)(2)(a)[29c].

115. To the extent that Grube does not explicitly disclose a "bit-loading modulation scheme," a POSITA would have understood that Grube renders obvious a "bit-loading modulation scheme" based on "transmission characteristics." For example, a POSITA would have understood that including a modulation scheme in Grube based on the spectral response would allow for the system to maximize efficiency in signal transmissions by allocating modulation schemes to carrier channels based on bit-loading capabilities. Doing so would enhance signal strength and improve the reception quality of signals transmitted on those channels, particularly those transmitted over long distances.

116. A POSITA would have also experienced a reasonable expectation of success in implementing a "bit-loading modulation scheme" in Grube. As discussed, Grube already disclosed the determination of "bit loading information" for each carrier, which a POSITA would have understood to disclose a QAM constellation scheme. Thus, a POSITA would have understood this to be the combination of prior art elements (a modulation scheme) according to known methods (implementing modulation schemes in broadband coaxial networks) to yield predictable results (a broadband coaxial network with a modulation scheme to regulate signal transmissions).

117. As a result, it is my opinion that Grube discloses or renders obvious this limitation.

[29f] "transmits a response signal to the transmitting node informing the transmitting node of the bit-loading modulation scheme for the corresponding channel path"

118. It is my opinion that Grube discloses or renders obvious this limitation.

119. As explained in relation to [29b], each of Grube's secondary sites transmits a response signal to the transmitting node, where the response signals each comprise a bit-loading modulation scheme. *See supra* §IV(A)(2)(a)[29b]. Grube further clarifies that each bit-loading modulation scheme is generated for a corresponding channel path. *See supra* §IV(A)(2)(a)[29c].

120. As a result, it is my opinion that Grube discloses or renders obvious this limitation.

[29g] "the transmitting node comparing the plurality of bit-loading modulation schemes to determine a common bit-loading modulation scheme; and"

121. It is my opinion that Grube discloses or renders obvious this limitation.

122. The '450 Patent defines the determination of a "common bit-loading modulation scheme" as "comparing the carrier number signals" from one channel to the "corresponding carrier number signals" from another channel, and then "choosing the lowest corresponding modulation value for each carrier number." DISH-1001, 20:55-65. This is illustrated in Figures 13A-C of the '450 Patent.

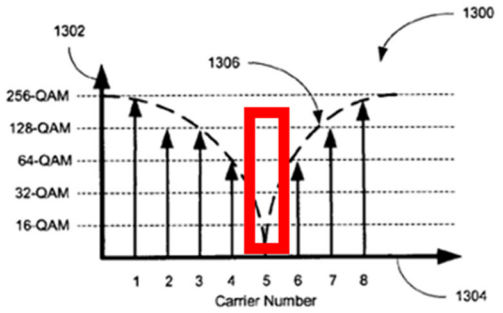


FIG. 13A

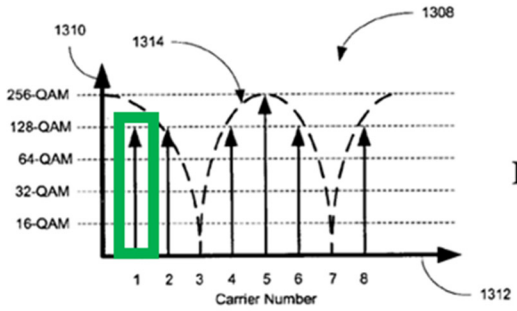


FIG. 13B

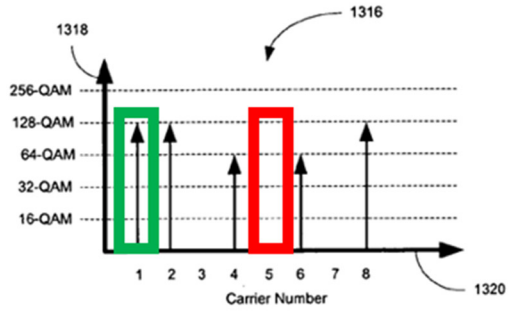


FIG. 13C

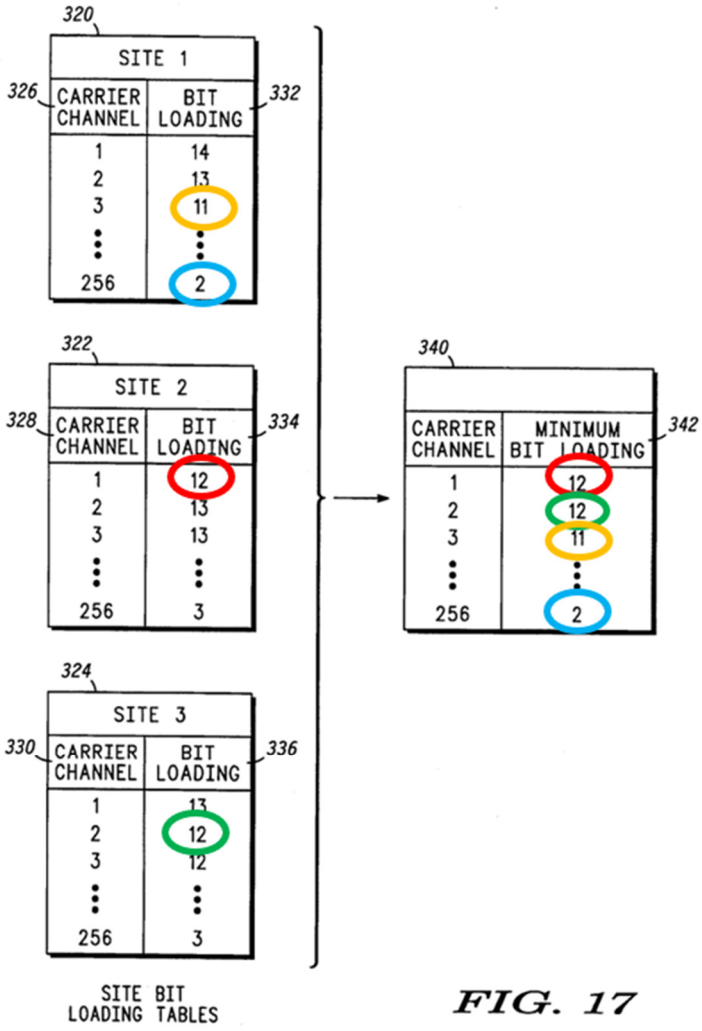
Grube Figs. 13A-C (annotated)

123. As depicted above in Figures 13A-C, each channel path includes eight carrier channels. *Id.*, FIGS. 13A-C. Figure 13A depicts carrier frequency signals for a channel path between Node A and Node B (the "AB channel"), while Figure 13B depicts carrier frequency signals for a channel path between Node A and Node C (the "AC channel"). *Id.* Figure 13C then depicts the common bit-loading modulation scheme for a network involving Nodes A, B, and C. *Id.* As shown in

Figures 13A-B, carrier number signal one may transmit at a constellation size of 256 QAM over the AB channel but at a constellation size of 128 QAM over the AC channel (green). *Id.* Thus, as depicted in Figure 13C, the common bit-loading modulation scheme would permit carrier number signal one to only transmit at 128 QAM (green). *Id.* Similarly, Figures 13A-B illustrate that carrier number signal five may be off over the AB channel (red) but may transmit at a constellation size of 256 QAM over the AC channel. *Id.* Figure 13C thus depicts that the common bit-loading modulation scheme would keep carrier number signal five off (red). *Id.* This pattern of choosing the lowest modulation value for each carrier number signal is replicated across each carrier number signal to arrive at the claimed "common bit-loading modulation scheme." *Id.*

124. As discussed above, Grube's primary site renders obvious the reception of "a plurality of bit-loading modulation schemes" from the secondary sites. *See supra* §IV(A)(2)(a)[29b]. Grube states that the "bit loading, or bit numbers" for each carrier channel "in the respective outbound bit loading tables are compared" to produce the "outbound control channel bit loading table," which is also known as the "lowest common denominator (LCD) call bit loading table." DISH-1005, 8:5-8, 17:36-38. Indeed, Grube acknowledges that the "outbound control channel bit loading table" is generated "from the plurality of site bit loading tables." *Id.*, 18:63-67.

125. In its comparison, like the '450 Patent, Grube "determine[es], for each carrier channel within the bit loading tables, a lowest bit loading value, [thereby] obtain[ing] the lowest value for each carrier channel." *Id.*, 14:11-15. This is illustrated by Figure 17 of Grube.



Grube Fig. 17 (annotated)

126. Grube's Figure 17 depicts three bit loading tables, each associated with a different secondary site. *Id.*, FIG. 17. As an example, carrier channel one is

capable of supporting up to 14 bits over the channel path to secondary site one, up to 13 bits over the channel path to secondary site two, and up to 13 bits over the channel path to secondary site three. *Id.* Because the lowest number of maximum bits supported by carrier channel one is 12, carrier channel one of the "outbound control channel bit loading table" will only support up to 12 bits over the channel path (red). *Id.* A similar pattern is replicated across each carrier channel of the channel path (green for carrier channel two, orange for carrier channel three, and blue for carrier channel 256). *Id.*

127. Grube further depicts this method at Figures 53-54, in which the bit loading tables received from six secondary sites are compared to obtain "control channel bit loading table 110" using the pattern described above.

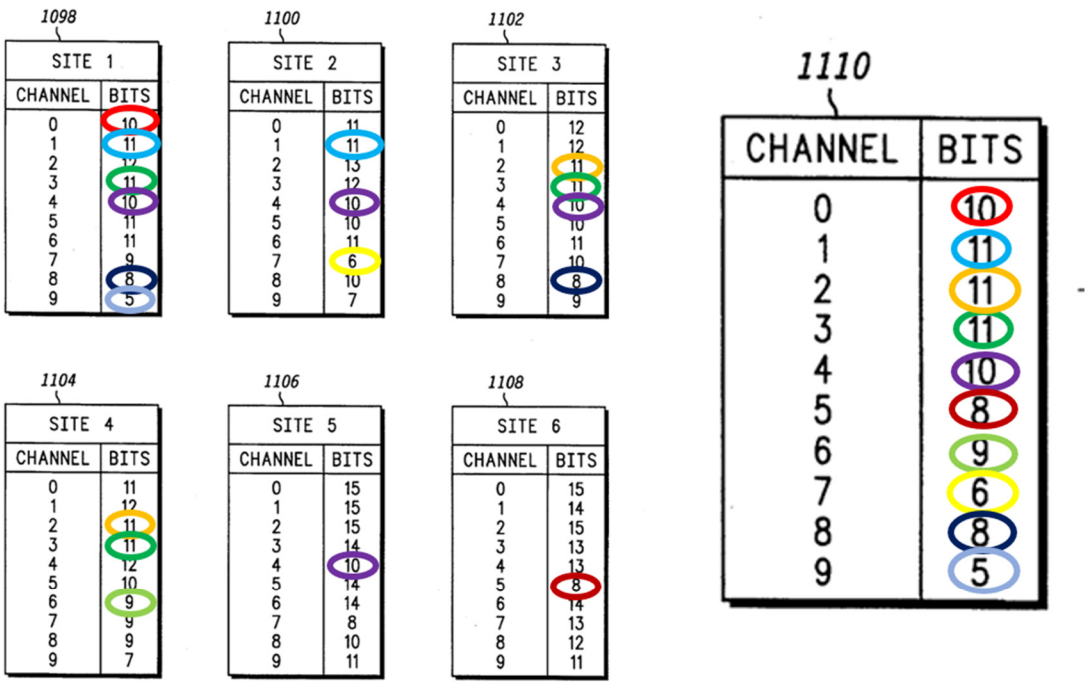


FIG. 53

Grube Figs. 53-54 (excerpted) (annotated)

128. The bit loading values in the "control channel bit loading table 1110" further coincide with a constellation encoding scheme. As explained above, Grube teaches that the bit loading information for a carrier channel indicates a compatible QAM order for each carrier channel. *See supra* § IV(A)(2)(a)[29b]. When the site bit loading tables from each secondary site has been compared to generate the "control channel bit loading table 1110", the control channel bit loading table 1110 not only indicates the number of bits that each carrier channel can support across all secondary sites, but the number of bits is also correlated to the number of QAM constellation points associated with each carrier channel. As explained above in

relation to limitation [29b], a POSITA would have understood that the information in the "control channel bit loading table 1110" would be the claimed "common bit-loading modulation scheme" because the primary site and the plurality of secondary sites are configured for a particular type of modulation (in Grube, QAM modulation) and the bit-loading information in the "control channel bit loading table 1110" is sufficient for the sites in Grube to perform modulation. The "control channel bit loading table 1110" of Grube is therefore analogous to the claimed "common bit-loading modulation scheme."

129. To the extent that one might argue that Grube does not disclose the determination of a "common bit-loading modulation scheme," a POSITA would have understood that it would have been obvious to include such a "scheme" in Grube as discussed above. *See* §IV(A)(2)(a)[29b] *supra*.

130. As a result, it is my opinion that Grube discloses or renders obvious this limitation.

[29h] "the transmitting node transmitting a broadcast signal relaying the common bit-loading modulation scheme to the plurality of receiving nodes"

131. It is my opinion that Grube renders obvious this limitation.

132. As explained above, Grube renders obvious the determination of a common bit-loading modulation scheme. *See supra* § IV(A)(2)(a)[29g]. Grube further teaches that the carrier channel allocations for data transmissions are transmitted from the primary site (i.e., the claimed "transmitting node") to the

secondary sites (i.e., the claimed "plurality of receiving nodes"). DISH-1005, 18:9-12 (when a call occurs over the Grube network, "[h]aving selected the outbound control channel, the primary site transmits a signal to all the secondary sites indicating the carrier channel allocations as the control channel.").

133. Given that Grube discloses the transmission of a signal to all the secondary sites to indicate the carrier channel allocations in the context of a call over the network, a POSITA would have understood that it was well-known in the relevant art to transmit information from the primary site to the plurality of secondary sites to enable effective data transmissions. For example, a POSITA would have understood that transmitting the "control channel bit loading table 1110" in Grube to all the secondary sites prior to the occurrence of a call over the network would be beneficial to allow Grube's secondary sites to prepare to receive data transmissions from the primary site. *See also* DISH-1007, 6:24-7:3, 5:9-14 (The "commonly-used carrier among the communication devices and the commonly-used number of bits that can be assigned to each carrier" is also known as "mapping information," which may be provided to "all the communication devices simultaneously" to allow "all the communication devices" to operate "based upon the mapping information").

134. Accordingly, because Grube discloses the transmission of a signal to all the secondary sites to indicate the carrier channel allocations, a POSITA would

have understood Grube to render obvious the transmission of a signal comprising the common bit-loading modulation scheme from the primary site to the secondary sites.

135. As a result, it is my opinion that Grube renders obvious this limitation.

136. For the reasons discussed above, Grube therefore renders obvious claim 29.

3) Independent Claim 34

[34pre] "A Broadband Coaxial Network ("BCN") comprising"

137. I have been asked to consider whether Grube discloses or renders obvious the preamble of claim 34, but I have not been asked to render an opinion on whether the preamble should be considered a limitation. If the preamble of claim 34 is deemed to be a limitation, it is my opinion that Grube teaches this limitation.

138. As discussed above, Grube renders obvious a Broadband Coaxial Network. *See supra* §VI(A)(2)(a)[29pre] (describing a method performed within a Broadband Coaxal Network)).

139. As a result, it is my opinion that Grube renders obvious this limitation.

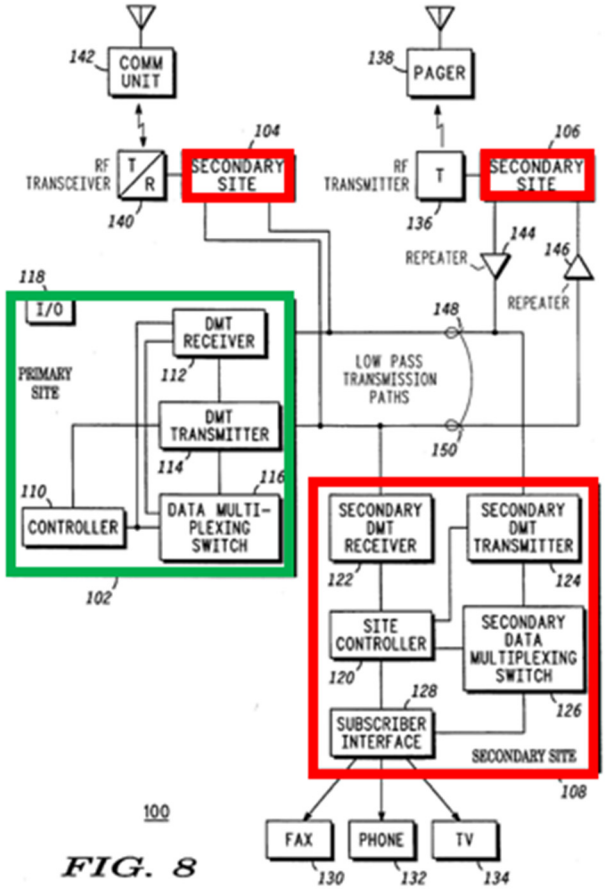
[34a] "a first BCN modem comprising a first controller; and"

140. It is my opinion that Grube discloses or renders obvious this limitation.

141. As recited in this claim, the "first BCN modem" performs the same functions as the "transmitting node" in independent claim 29. *Compare* DISH-1001, Cl. 29, *with id.*, Cl. 34. Grube therefore renders obvious a first BCN modem for the

same or similar reasons that Grube renders obvious a transmitting node. *See supra* §IV(A)(2)(a)[29a].

142. Grube further discloses a *modem* that performs the same functions as the transmitting node. As noted above, the primary site in Grube includes a DMT transmitter 114 and a DMT receiver 112. *See supra* §VI(A)(2)(a)[29a]; *see also* DISH-1005, FIG. 8.



Grube Fig. 8 (annotated)

143. Grube explains that the DMT transmitter in an ADSL system (the system in Grube) includes a DMT modulator. DISH-1005, 43:55-57, FIG. 36 (depicting the DMT transmitter, with the DMT modulator in red).

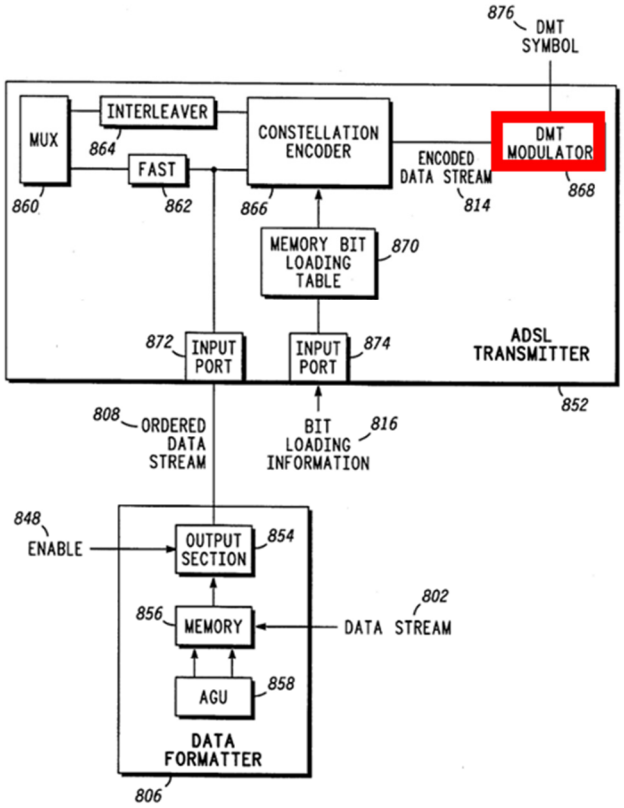


FIG. 36

Grube Fig. 36 (annotated)

144. Grube further explains that it was well-known in the prior art schematics of the DMT receiver in an ADSL system to include a demodulator for demodulating the DMT symbol to produce a demodulated signal. *Id.*, 4:10-13; FIG. 7 (depicting the DMT receiver, with the DMT demodulator in red).

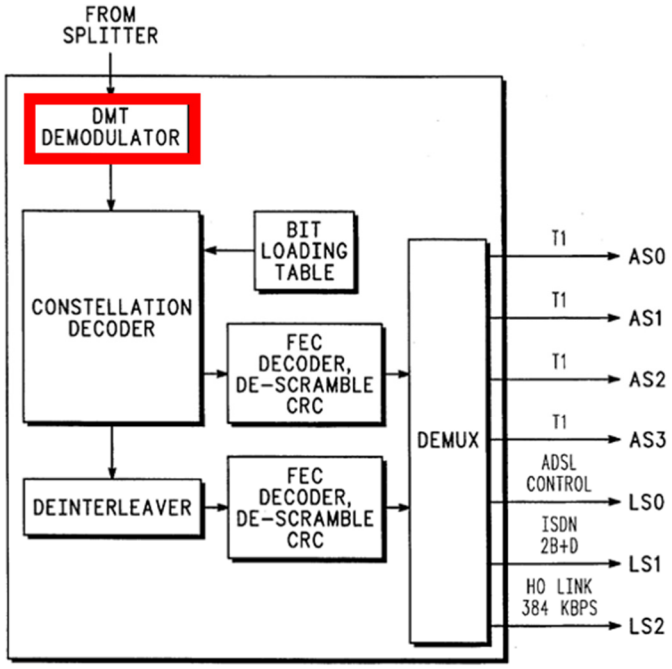


FIG. 7
-PRIOR ART-

Grube Fig. 7 (annotated)

145. Thus, a POSITA would have understood that a modem must comprise at least both a modulator and a demodulator. Similarly, the primary site in Grube comprises both a modulator and a demodulator.

146. Grube further discloses the first BCN modem comprising a first controller. For example, Grube explains that the "primary site" (i.e., the claimed "first modem") "includes a controller 110, data multiplexing switch 116, the DMT transmitter 114, the DMT receiver 112, memory 182, input/output port 183, a data bus 176, a control bus 178, and an address bus 180." DISH-1005, 9:63-67. This is depicted in Figure 8 of Grube, where "controller 110" is located at the primary site

102 (green). *Id.*, FIG. 8. Further, the primary site's controller in Grube is capable of executing the primary site's functions. *Id.*, 10:3-6 ("Whichever type of processing device is used as the controller 110, it should have sufficient processing power and memory to execute the primary site functions described throughout this specification"). A POSITA would have understood that the controller alone would not be able to fully execute the primary site functions without the DMT transmitter and the DMT receiver, which allow the primary site to transmit and receive data.

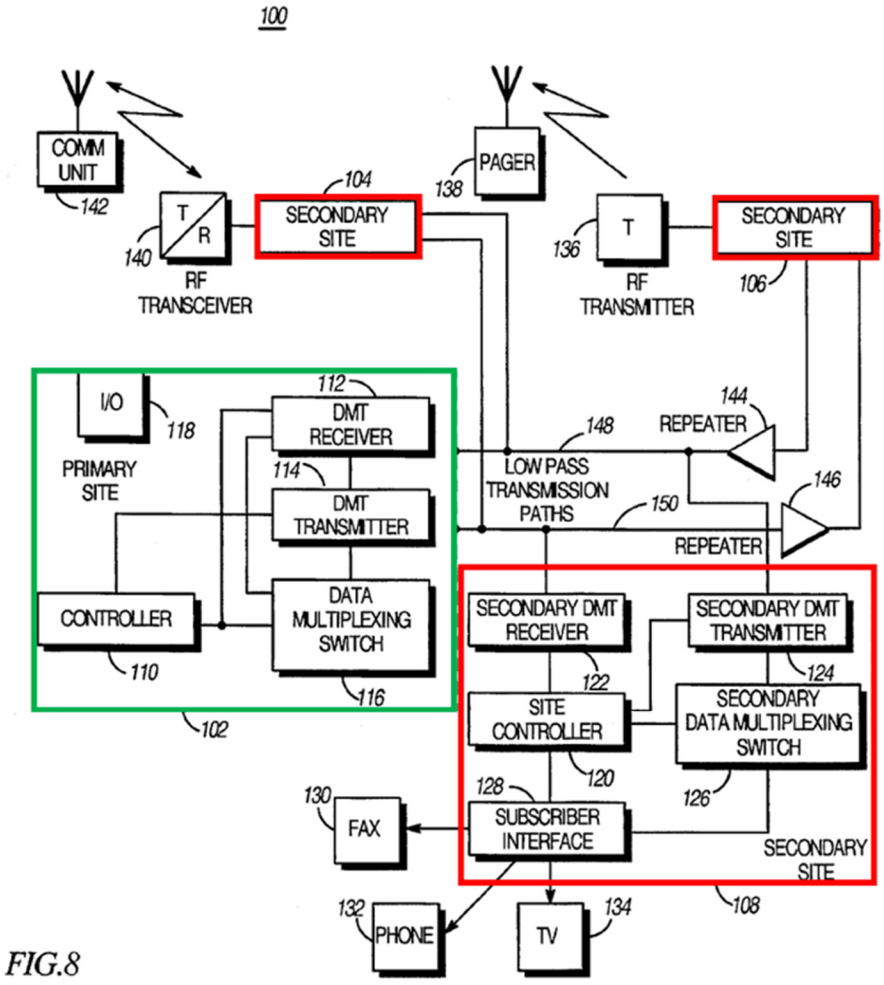


FIG.8

Grube Fig. 8 (annotated)

147. Grube's controller 110, in combination with the DMT receiver 112 and the DMT transmitter 114, is thus analogous to the claimed "controller."

148. As a result, it is my opinion that Grube discloses or renders obvious this limitation.

[34b] "a plurality of BCN modems comprising a plurality of controllers;"

149. It is my opinion that Grube discloses or renders obvious this limitation.

150. As recited in this claim, the "plurality of BCN modems" performs the same functions as the "plurality of receiving nodes" in independent claim 29. *Compare* DISH-1001, Cl. 29, *with id.*, Cl. 34. Grube therefore renders obvious a plurality of BCN modems. *See supra* §IV(A)(2)(a)[29a].

151. Grube further discloses a plurality of *controllers* that performs the same functions as the plurality of receiving nodes recited in Claim 29. As noted above, the plurality of secondary sites in Grube each includes a secondary DMT transmitter 124 and a secondary DMT receiver 122. *See supra* §IV(A)(2)(a)[29a]; *see also* DISH-1005, FIG. 8.

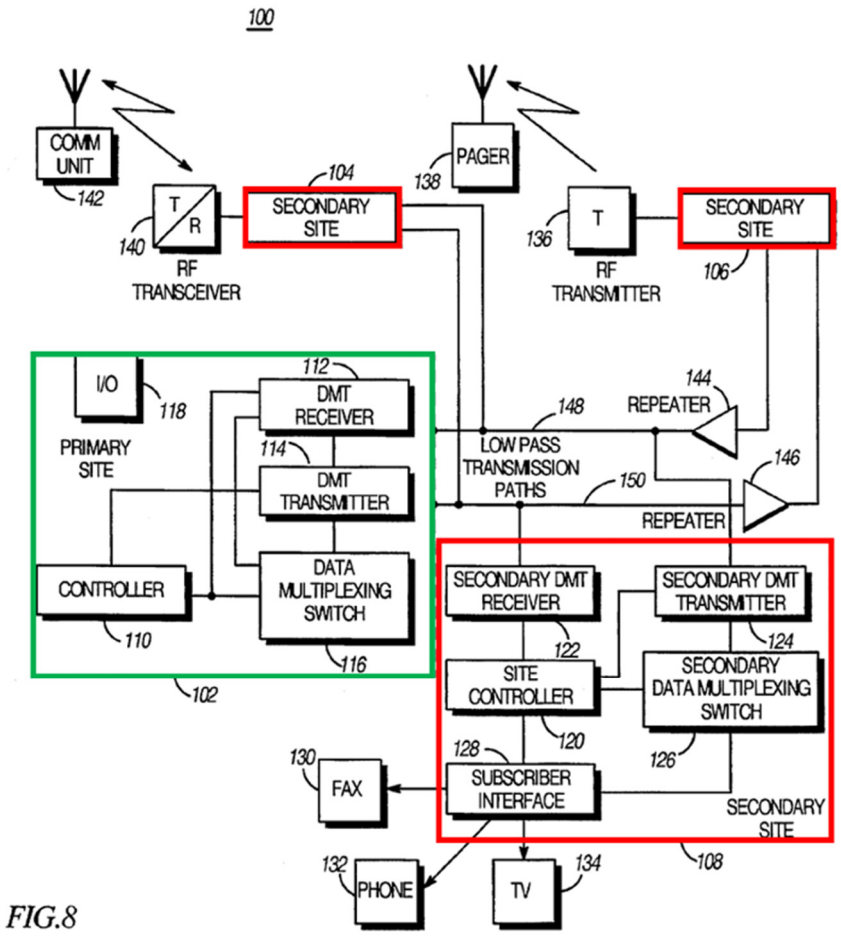


FIG.8

Grube Fig. 8 (annotated)

152. As further explained above, Grube clarifies that the secondary DMT transmitter contains a DMT modulator (*see* above §IV(A)(2)(b)[34a]; DISH-1005, 43:55-57, FIG. 36) and that the secondary DMT receiver contains a DMT demodulator (*see* above §IV(A)(2)(b)[34a]; DISH-1005, 4:10-13, FIG. 7). Because each secondary site in Grube comprises both a modulator and a demodulator, a POSITA would have understood that each secondary site in Grube functions as a modem.

153. Grube further discloses that the plurality of BCN modems comprise a plurality of controllers. Grube explains that each secondary site "include[s] a secondary site controller 120, a secondary DMT receiver 122, a secondary DMT transmitter 124, a secondary data multiplexing switch 126[,] and at least one subscriber interface 128." *Id.*, 8:29-32. This is depicted in Figure 8 of Grube, where "site controller 120" is located at the secondary site 108 (noted in red below). *Id.*, FIG. 8. Further, the secondary site's controller in Grube is capable of executing the secondary site's functions. *Id.*, 12:42-44 ("Upon receiving the control information, the site controller 120 interprets the control information and determines whether an action is required by the secondary site"). A POSITA would have understood that each secondary site controller alone would not be able to fully execute the secondary site's functions without the DMT transmitter and the DMT receiver, which allow each secondary site to transmit and receive data.

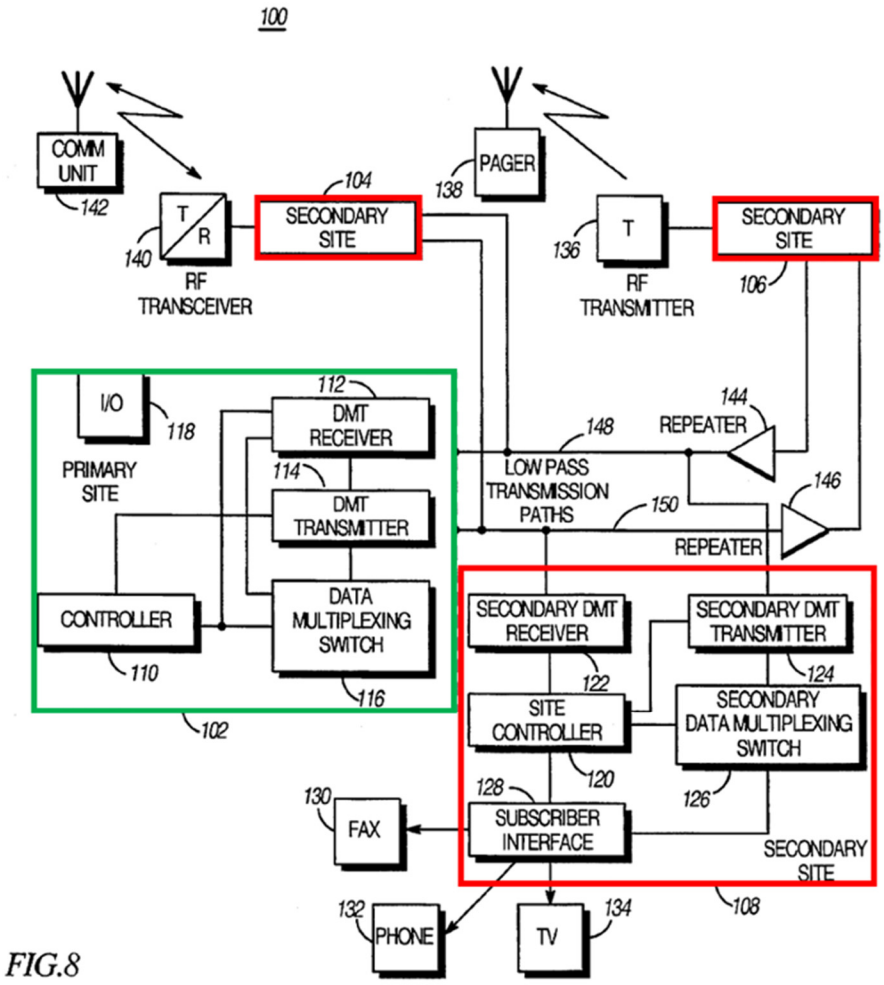


FIG.8

Grube Fig. 8 (annotated)

154. In each secondary site, Grube's site controller 120, in combination with the secondary DMT receiver 122 and the secondary DMT transmitter 124, is thus analogous to each controller in the claimed "plurality of controllers."

155. As a result, it is my opinion that Grube discloses or renders obvious this limitation.

[34c] "wherein the first controller is configured to transmit a probe signal to the plurality of controllers"

156. It is my opinion that Grube discloses or renders obvious this limitation.

157. As discussed above, Grube discloses or renders obvious a first controller being configured to transmit a probe signal to the plurality of controllers. *See* above §§VII(A)(2)[29a], VII(A)(3)[34a-34b].

158. As a result, it is my opinion that Grube discloses or renders obvious this limitation.

[34d] "receive a plurality of response signals comprising a plurality of bit-loading modulation schemes from the plurality of controllers,"

159. It is my opinion that Grube discloses or renders obvious this limitation.

160. As discussed above, Grube discloses or renders obvious a first controller receiving a plurality of response signals comprising a plurality of bit-loading modulation schemes from the plurality of controllers. *See* above §§VII(A)(2)[29b], VII(A)(3)[34a-34b].

161. As a result, it is my opinion that Grube discloses or renders obvious this limitation.

[34e] "wherein each of the plurality of controllers is configured to receive the probe signal through a corresponding channel path,"

162. It is my opinion that Grube discloses or renders obvious this limitation.

163. As discussed above, Grube discloses or renders obvious ach of the plurality of controllers being configured to receive a probe signal through a corresponding channel path. *See* above §§VII(A)(2)[29c], VII(A)(3)[34a-34b].

164. As a result, it is my opinion that Grube discloses or renders obvious this limitation.

[34f] "determine transmission characteristics of the corresponding channel path"

165. It is my opinion that Grube discloses or renders obvious this limitation.

166. As discussed above, Grube discloses or renders obvious each of the plurality of controllers being configured to determine transmission characteristics of the corresponding channel path. *See* above §§VII(A)(2)[29d], VII(A)(3)[34a-34b].

167. As a result, it is my opinion that Grube discloses or renders obvious this limitation.

[34g] "determine a bit-loading modulation scheme for the corresponding channel path based on the transmission characteristics, and"

168. It is my opinion that Grube discloses or renders obvious this limitation.

169. As discussed above, Grube discloses or renders obvious each of the plurality of controllers being configured to determine a bit-loading modulation scheme for the corresponding channel path based on the transmission characteristics. *See* above §§VII(A)(2)[29e], VII(A)(3)[34a-34b].

170. As a result, it is my opinion that Grube discloses or renders obvious this limitation.

[34h] "transmit a response signal to the first controller informing the first controller of the bit-loading modulation scheme for the corresponding channel path,"

171. It is my opinion that Grube discloses or renders obvious this limitation.

172. As discussed above, Grube discloses or renders obvious each of the plurality of controllers being configured to transmit a response signal to the first controller informing the first controller of the bit-loading modulation scheme for the channel path. *See* above §§VII(A)(2)[29f], VII(A)(3)[34a-34b].

173. As a result, it is my opinion that Grube discloses or renders obvious this limitation.

[34i] [wherein the first controller is configured to] "compare the plurality of bit-loading modulation schemes to determine a common bit-loading modulation scheme, and"

174. It is my opinion that Grube discloses or renders obvious this limitation.

175. As discussed above, Grube discloses or renders obvious the first controller comparing the plurality of bit-loading modulation schemes to determine a common bit-loading modulation scheme. *See* above §§VII(A)(2)[29g], VII(A)(3)[34a-34b].

176. As a result, it is my opinion that Grube discloses or renders obvious this limitation.

[34j] [wherein the first controller is configured to] "transmit a broadcast signal relaying the common bit-loading modulation scheme to the plurality of controllers."

177. It is my opinion that Grube renders obvious this limitation.

178. As discussed above, Grube renders obvious the first controller transmitting a broadcast signal relaying the common bit-loading modulation scheme to the plurality of controllers. *See* above §§VII(A)(2)[29h], VII(A)(3)[34a-34b].

179. As a result, it is my opinion that Grube renders obvious this limitation.

4) Dependent Claim 30

[30] "The broadcasting method within the BCN of claim 29, wherein the broadcast signal comprises handshake data."

180. It is my opinion that Grube renders obvious this claim.

181. It is my opinion that a POSITA would have understood that a handshake between two nodes involves back-and-forth data transmission between the two nodes.

182. As discussed above, Grube discloses the transmission of a response signal comprising a bit-loading modulation scheme from each secondary site to the primary site. *See supra* §IV(A)(2)(c)[29f]. Grube further renders obvious the transmission of a broadcast signal relaying the common bit-loading modulation scheme from the primary site to the plurality of secondary sites in response to the transmission of the response signals. *See supra* §IV(A)(2)(c)[29g]. Grube thus renders obvious the broadcast signal being handshake data.

183. A POSITA would have been motivated to include handshake functionality in Grube because it would allow the devices participating in the handshake to establish protocols of a communication link at the start of the

communications process. This creates a more efficient system because it establishes rules for one when device can communicate with another. A POSITA would have experienced a reasonable expectation of success in implementing this functionality because it would've been nothing more than the combination of prior art elements (handshaking and Grube's communication system) according to known methods (handshaking in network communications systems) to yield predictable results.

184. As a result, it is my opinion that Grube renders this claim obvious.

5) Dependent Claim 31

[31] "The broadcasting method within the BCN of claim 29, wherein the broadcast signal is a communication message comprising video data, music data, or voice data."

185. It is my opinion that Grube renders obvious this claim.

186. As discussed above, Grube renders obvious the transmission of a broadcast signal comprising the common bit-loading modulation scheme from the transmitting node to the plurality of receiving nodes, because Grube teaches the transmission of the carrier channel allocations from the primary site to the plurality of secondary sites. *See supra* §IV(A)(2)(a)[29h].

187. If Claim 31 requires the same broadcast signal include the common bit-loading modulation scheme and video/music/voice data, Grube also discloses that "the primary site transmits, via the outbound transmission path, [] requested digital information to the [secondary sites]." *Id.*, 29:46-48, FIG. 25 (yellow, below). For

the "requested digital information," Grube clarifies that its communication system may be used to support various forms of "data transfer," including "a video data transfer, an audio data transfer, … , a plain old telephone service (POTS) call, … , and other digital information transfers." DISH-1005, 23:54-60; *see id.*, 30:52-54 (noting Grube's system supports "transfer of digital audio [or] digital video"). .

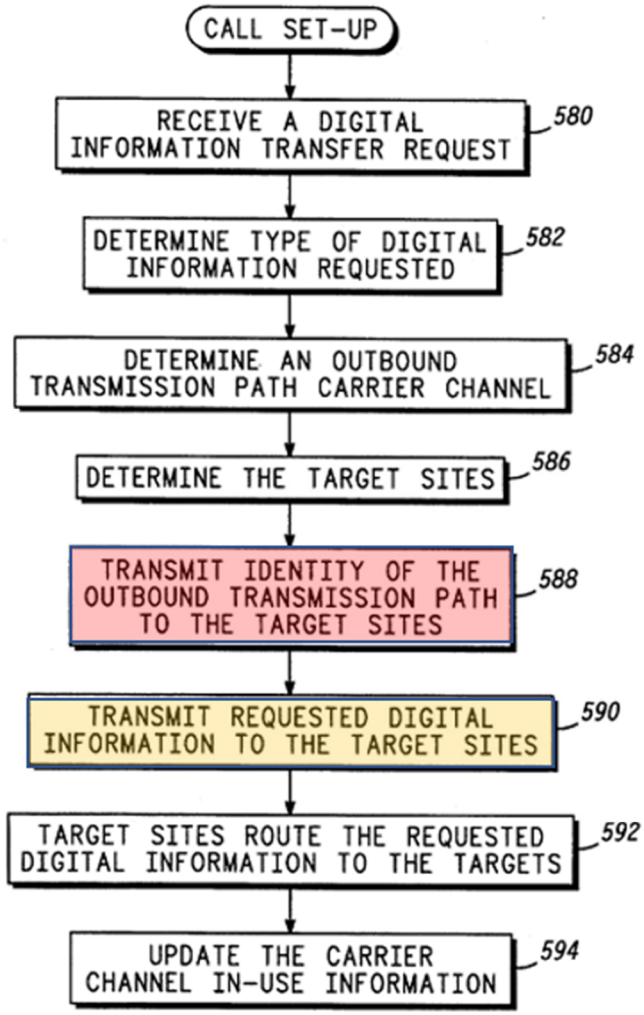


FIG. 25

Grube Fig. 25 (annotated)

188. A POSITA would have been motivated to combine the transmission of the "requested digital information" and the transmission of the "identity of carrier channels functioning as the outbound transmission path" into a single transmission to improve the efficiency in Grube. This transmission to increase efficiency would also be compatible with Grube, because Grube seeks to provide "highly reliable service," and because, per Grube's Figure 25 (above), no action is required on the part of Grube's secondary sites between receiving the claimed "common bit-loading modulation scheme" (red) and receiving a subsequent transmission of digital information (yellow). DISH-1005, 4:24-28, FIG. 15.

189. A POSITA would have experienced a reasonable expectation of success in implementing this functionality—it would have been nothing more than the combination of prior art elements (transmission of video/music/voice data or transmission of a modulation scheme in a communication system) according to known methods (methods for transmitting media packets in networks) to yield predictable results (transmission of video/music/voice data and a modulation scheme in a communication system).

190. As a result, it is my opinion that Grube renders this claim obvious.

6) Dependent Claim 35

[35] "The BCN of claim 34, wherein the broadcast signal comprises handshake data."

191. It is my opinion that Grube renders obvious this claim.

192. As discussed above, Grube renders obvious the broadcast signal being a communication message comprising video data, music data, or voice data. *See* above §VII(A)(4)[30].

193. As a result, it is my opinion that Grube renders this claim obvious.

7) Dependent Claim 36

[36] "The BCN of claim 34, wherein the broadcast signal is a communication message comprising video data, music data, or voice data."

194. It is my opinion that Grube renders obvious this claim.

195. As discussed above, Grube renders obvious the broadcast signal being a communication message comprising video data, music data, or voice data. *See* above §VII(A)(5)[31].

196. As a result, it is my opinion that Grube renders this claim obvious.

B. GROUND 2: Grube in view of Cioffi (Claims 29-31 and 34-36)

1) Overview of Cioffi

197. Entitled "Method and Apparatus for Coordinating Multi-Point To-Point Communications in a Multi-Tone Data Transmission System," Cioffi was filed on June 2, 1995. DISH-1006, Cover.

198. Cioffi describes "bi-directional data transmission systems that facilitate communications between a plurality of remote units and a central unit using a frame based discrete [DMT] multi-carrier transmission scheme." DISH-1006, 3:1-4. The DMT transmission scheme can be used in "applications well beyond data

transmissions over telephone lines," including "cable based subscriber systems (which typically use coaxial cable)." *Id.*, 2:5-11. Cioffi explicitly recognizes that a transmission scheme for a "typical multiuser subscriber network" having a "central unit 10 (which includes a central modem) [that] communicates with a plurality of remote units over a common transmission line 17 which is split into a plurality of feeds 18" can use a "variety of transmission media" including "twisted pair phone lines" and "coaxial cables." *Id.*, 7:21-40. Cioffi further notes that its network supports the use of broadband signals. *See, e.g., id.*, 3:63-65 ("When a remote unit is being initialized, it transmits a broad-band initialization signal to the central unit during a synchronized quiet time.").

199. The communications network infrastructure of Cioffi is depicted in Figure 1. DISH-1006, FIG. 1. Figure 1 could be a coaxial cable network or a twisted pair telephone line communications network (like that in Grube). *Id.*, 7:37-41.

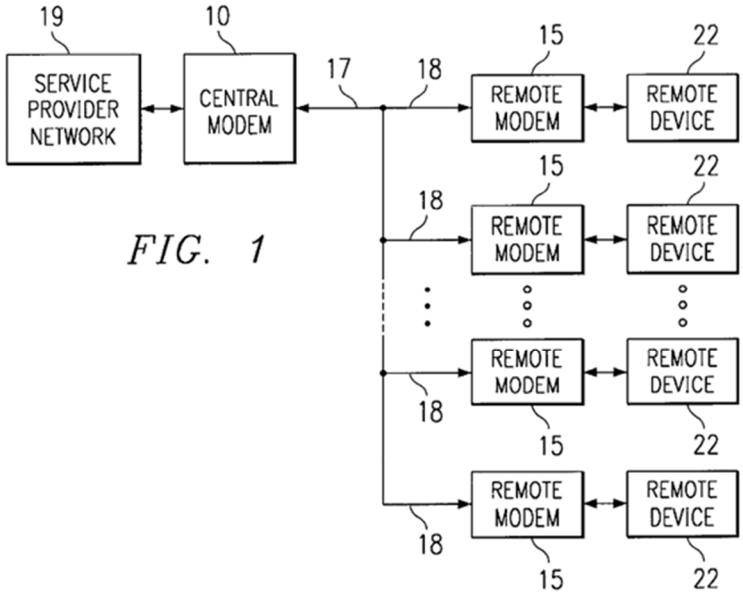
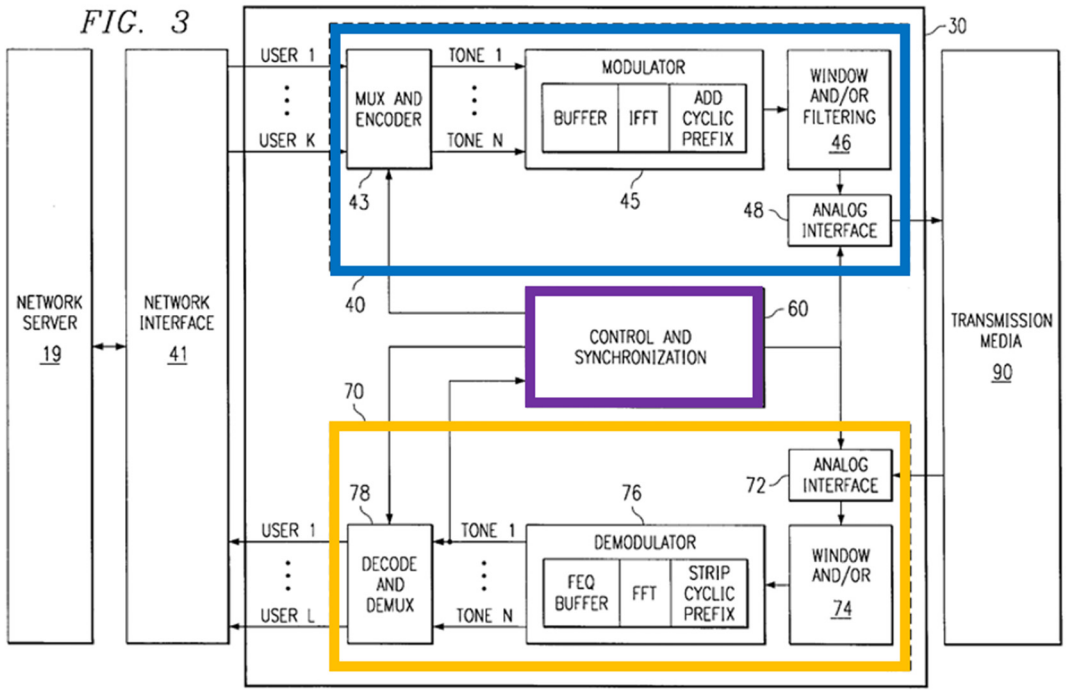


FIG. 1

Cioffi Fig. 1

200. Cioffi's "central modem 30" comprises a "transmitter 40" (blue), a "receiver 70" (yellow), and a "controller 60" (purple). DISH-1006, 24:67-25:2, FIG. 3. Cioffi notes that the "transmitter 40 incorporates several components including … a discrete multi-tone modulator 45." *Id.*, 25:12-14. Similarly, Cioffi acknowledges that the "receiver 70 includes … a demodulator 76." *Id.*, 26:16-19.

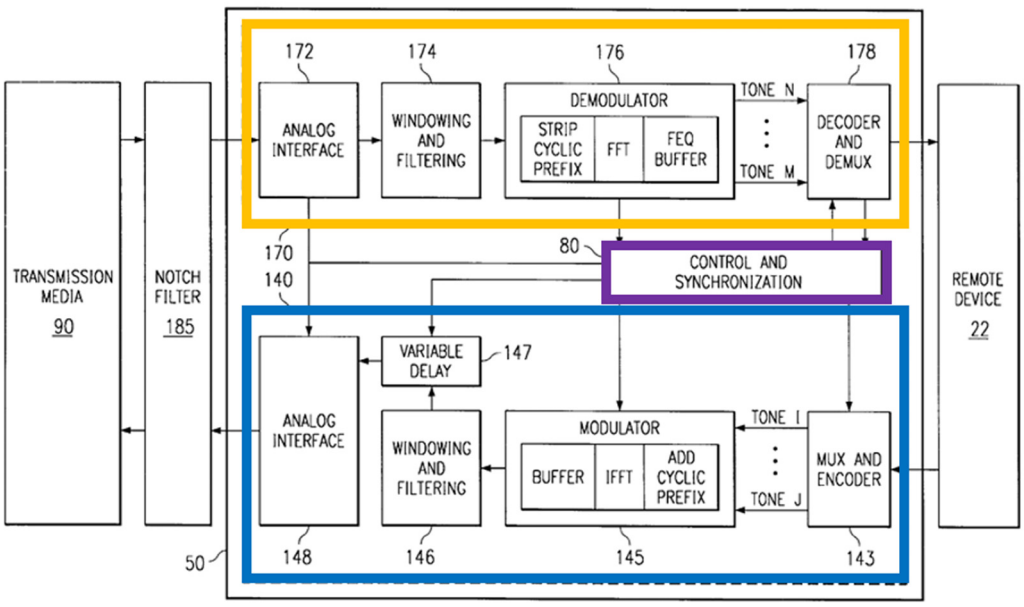


Cioffi Fig. 3 (annotated)

201. Cioffi's "remote modem 50" comprises a component labeled "140" (blue), a component labeled "170" (yellow), and a "remote synchronization controller" (purple). DISH-1006, 9:60-61, FIG. 4. Although component 140 in Cioffi is not explicitly labeled in the specification, a POSITA would have understood that component 140 refers to a transmitter at the "remote modem 50" because the components of component 140 are the same as the components in the transmitter 40 at the central modem 30. Cioffi notes that the "remote modem 50 … include[s] … a multi-tone modulator 145" (which is located in component 140). *Id.*, 27:4-5, FIG. 4. Similarly, Cioffi acknowledges that the "remote unit 50 includes … a

demodulator 176." *Id.*, 26:45-48. While component 170 is not explicitly labeled in the specification, a POSITA would have understood that component 170 refers to a receiver at the "remote modem 50" because the components of component 170 are the same as the components in receiver 70 at the central modem 30. Indeed, the "demodulator 176" is located in component 170. DISH-1006, FIG. 4.

FIG. 4



Cioffi Fig. 4 (annotated)

202. Like Grube (*see* §VII(A)(2)[29pre] *supra*), Cioffi is analogous art to the '450 Patent because both Cioffi and the '450 Patent are from the same field of endeavor (communication network infrastructures involving one-to-many communications) and because Cioffi is pertinent to the problems that the '450 Patent is concerned with (increasing the efficiency of the use of transmission channels in

one-to-many communications networks). DISH-1001, 3:65-67, 16:4-8; DISH-1006, 1:16-20, 2:57-58.

2) Motivation to Combine Grube and Cioffi

203. A POSITA would have been motivated to modify Grube's system to incorporate the teachings of Cioffi with a reasonable expectation of success.

204. The Grube-Cioffi combination incorporates Grube's teachings about methods for determining a common bit-loading modulation scheme in a DMT transmission scheme into Cioffi's teachings about utilizing DMT transmission schemes (such as that used in Grube) in various types of networks (*e.g.*, coaxial networks).

205. Although Grube teaches the use of DMT transmission schemes via the determination of a common bit-loading modulation scheme in the context of a "primary site" having "a DMT transmitter" and a "DMT receiver," and a plurality of secondary sites, each having "a secondary DMT receiver" and "a secondary DMT transmitter," the exemplary infrastructure for such a communications network taught by Grube is a "twisted pair telephone line." DISH-1005, 6:57-67.

206. The issue faced by the inventors of the '450 Patent was the need for "a system that allows node devices ('CPEs') to communicate directly over the existing coaxial cable with its current architecture without the need to modify the home cable infrastructure." DISH-1001, 3:37-40. To do so, a POSITA would have looked to

Grube, which renders obvious such a system in the context of the existing "twisted pair telephone line" network in a home/building environment. It is my opinion that methods applied in the context of twisted pair networks would be applicable to coaxial cable networks due to the similarities between twisted pair networks and coaxial cable networks, as described above. *See supra* §VII(A)(2)[29pre].

207. To the extent that Patent Owner argues a POSITA would not have found it obvious to implement Grube's system and method in a broadband coaxial network, Cioffi establishes that such an implementation would have been obvious.

208. Indeed, Cioffi recognizes that "DMT transmission scheme has the potential for use in applications well beyond data transmissions over telephones," and it "can be used in a variety of other digital subscriber access systems as well," including "cable based subscriber systems (which typically use coaxial cable)." DISH-1006, 2:5-10; *see also id.*, 3:9-16 (recognizing applicability of DMT transmission schemes to both twisted pair telephone lines and coaxial cables). Cioffi further teaches the use of broadband signals in its coaxial cable network. *See, e.g., id.*, 3:63-65 ("When a remote unit is being initialized, it transmits a broad-band initialization signal to the central unit during a synchronized quiet time.").

209. A POSITA would have thus been motivated to incorporate Cioffi's coaxial cable network infrastructure that supports the transmission of broadband signals into Grube's determination of a common bit-loading modulation scheme in

the context of DMT transmission schemes. This is particularly so because DMT transmission schemes are preferred in existing cable systems because they are more efficient. *See, e.g.,* DISH-1006, 2:17-28 ("In some existing cable systems (which do not use discrete multi-tone transmission schemes), each remote unit is given a dedicated frequency band over which it is to communicate with the central station. However, such an approach is inherently an inefficient use of transmission bandwidth and typically requires the use of analog filters to separate transmissions from the various remote units. Other existing cable systems use a single wide band for all remote units, which use time division multiple access (TDMA) to access the upstream channel. This approach is inefficient because of the lower total capacity of the single channel and because of the time required for the accessing process.").

210. Specific to Claims 34-38, a POSITA would further be motivated to incorporate the modems in Cioffi (including the central modem and the remote modems) into Grube's method. As explained above, a POSITA would have been motivated to expand the applicability of Grube's method by incorporating a broadband coaxial network taught by Cioffi into Grube's teachings. A POSITA would therefore be motivated to incorporate the communications infrastructure associated with said broadband coaxial network (including the central modem and the remote modems) into Grube's teachings.

211. Indeed, such a combination would have been obvious at least because it involves combining prior art elements (such as the broadband coaxial network and its corresponding structure in Cioffi and the adaptive bit-loading methods in Grube) according to known methods (applying the adaptive bit-loading methods in Grube to a coaxial cable network without modifications to the adaptive bit-loading methods) to yield predictable results (where the output LCD outbound control channel bit loading table remains the same regardless of whether the network is a broadband coaxial network or a twisted-pair telephone line network).

212. Additionally, such a combination would have been obvious at least because it involves the use of known techniques (such as the method for determining a LCD outbound control channel bit loading table in Grube and the coaxial cable network of Cioffi) to improve similar devices (such as the broadband coaxial network and its corresponding structure in Cioffi) in the same way (where Grube's adaptive bit-loading method would perform the same functions in the context of a broadband coaxial network).

213. A POSITA would have had a reasonable expectation that the Grube-Cioffi combination would produce a successful outcome. This is particularly so because Grube and Cioffi are analogous art, so a combination of the two references would have been predictable. *See* above, §§VII(A)(1), IV(B)(1).

214. A POSITA would thus have found the implementation of Cioffi's network infrastructure to Grube's method to be a predictable and routine exercise to extend the DMT transmission scheme in Grube to other types of communications networks beyond those that are explicitly disclosed in Grube, such as networks disclosed by Cioffi. Cioffi teaches that DMT transmission schemes are applicable to broadband coaxial networks. *See* DISH-1006, 2:5-10, 3:63-65. Such a combination would thus have been within the skill level of a POSITA because a POSITA would have simply implemented the central modem of Cioffi as the primary site in Grube (green), while retaining the functionalities of the primary site in Grube, and a POSITA would have further implemented the remote modems of Cioffi as the secondary sites in Grube (red), while retaining the functionalities of the secondary sites in Grube.

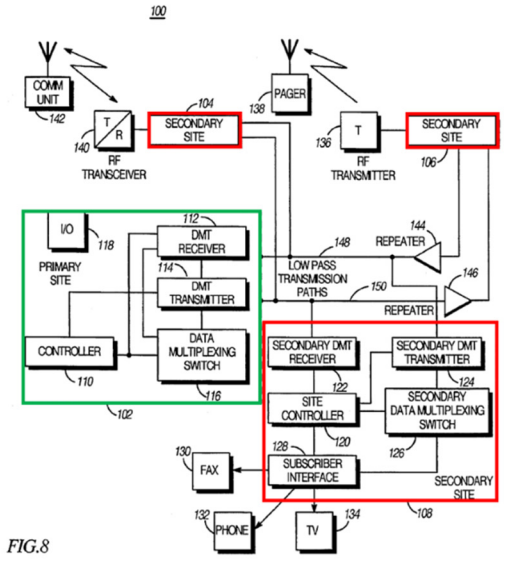


FIG.8

Grube Fig. 8 (annotated)

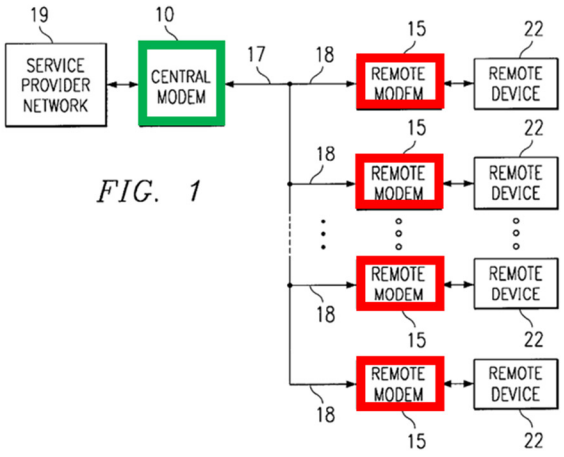


FIG. 1

Cioffi Fig. 1 (annotated)

215. A POSITA would also expect the implementation of Cioffi's network to Grube's method to be successful because a POSITA would have understood that switching the link medium neither alters Grube's technique for determining a common bit-loading modulation scheme nor renders parts of Grube's method redundant. In fact, Cioffi recognizes that its infrastructure in Figure 1 can use either twisted pair telephone lines or coaxial cables in a broadband network, thus emphasizing the interchangeability of the link medium. DISH-1006, 7:37-41. Accordingly, a POSITA would have experienced a reasonable expectation of success in applying Cioffi's broadband coaxial network to Grube's technique for determining a common bit-loading modulation scheme, and a POSITA would have been motivated to make that combination to expand the applicability of the DMT transmission scheme in Grube to other compatible communications networks.

216. A POSITA would therefore have been motivated to combine Grube and Cioffi.

3) Independent Claim 29

217. It is my opinion that Grube-Cioffi renders obvious claim 29. As discussed above, Grube renders claim 29 obvious (*see* above §VII(A)(2)) under Ground 1, and it is my opinion that [29pre] is also supported by Cioffi as explained below.

[29pre] "A broadcasting method within a Broadband Coaxial Network

("BCN"), comprising:"

218. I have been asked to consider whether Grube-Cioffi renders obvious the preamble of claim 29, but I have not been asked to render an opinion on whether the preamble should be considered a limitation. If the preamble of claim 29 is deemed to be a limitation, it is my opinion that Grube-Cioffi renders obvious this limitation.

219. To the extent that one might argue Grube does not explicitly disclose or render obvious that the broadcasting method is within a broadband coaxial network, the Grube-Cioffi combination further renders obvious [29pre]. Cioffi teaches the use of DMT transmission schemes in broadband coaxial networks.

220. Cioffi recognizes that the "discrete multi-tone (DMT) transmission scheme has the potential for use in applications well beyond data transmissions over telephone lines," and "DMT can be used in a variety of other digital subscriber access systems," including "cable based subscriber systems (which typically use coaxial cable)." DISH-1006, 2:5-10.

221. Cioffi further teaches the use of broadband signals in its coaxial cable network. *See, e.g., id.*, 3:63-65 ("When a remote unit is being initialized, it transmits a broad-band initialization signal to the central unit during a synchronized quiet time."). Thus, Cioffi teaches a broadband coaxial network.

222. As a result, and for the reasons discussed above regarding motivation to combine, it is my opinion that Grube-Cioffi renders this limitation obvious.

223. As discussed above, Grube renders Claim 29 obvious, and for the reasons discussed above regarding motivation to combine, Grube-Cioffi therefore renders obvious Claim 29.

4) Independent Claim 34

224. It is my opinion that Grube-Cioffi renders obvious claim 34. As discussed above, Grube renders claim 34 obvious (*see* above §VII(A)(3)) under Ground 1, and it is my opinion that [34pre], [34a], and [34b] are also supported by Cioffi as explained below.

[34pre] "A Broadband Coaxial Network ("BCN") comprising"

225. I have been asked to consider whether Grube-Cioffi renders obvious the preamble of claim 34, but I have not been asked to render an opinion on whether the preamble should be considered a limitation. If the preamble of claim 34 is deemed to be a limitation, it is my opinion that Grube-Cioffi renders obvious this limitation.

226. As discussed above, in addition to the teachings of Grube, Cioffi renders obvious a broadband coaxial network. *See* above, §VII(B)(3)[29pre].

227. As a result, and for the reasons discussed above regarding motivation to combine, it is my opinion that Grube-Cioffi renders the preamble obvious.

[34a] "a first BCN modem comprising a first controller; and"

228. It is my opinion that Grube-Cioffi renders obvious this limitation.

229. As discussed above, Grube discloses a first BCN modem comprising a first controller. *See supra* §VII(A)(3)[34a]. To the extent that Patent Owner asserts Grube does not explicitly disclose that the first modem is a BCN modem comprising a first controller, Cioffi further discloses or renders obvious the first modem being "a first BCN modem comprising a first controller."

230. As explained above, the coaxial cable network depicted in Figure 1 of Cioffi can be easily substituted into the communications network infrastructure of Grube. *See supra* §VII(B)(2). This is particularly so since Cioffi explicitly recognizes that the communications network infrastructure of Figure 1 could not only be a coaxial cable network, but it could also be a twisted pair telephone line communications network, which is taught in Grube. DISH-1006, 7:37-41.

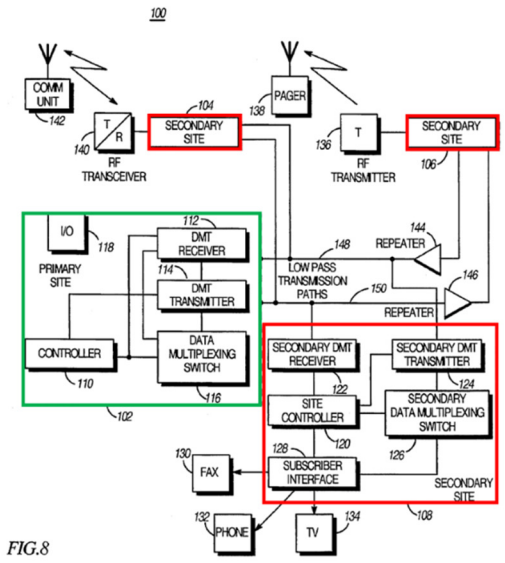


FIG.8

Grube Fig. 8 (annotated)

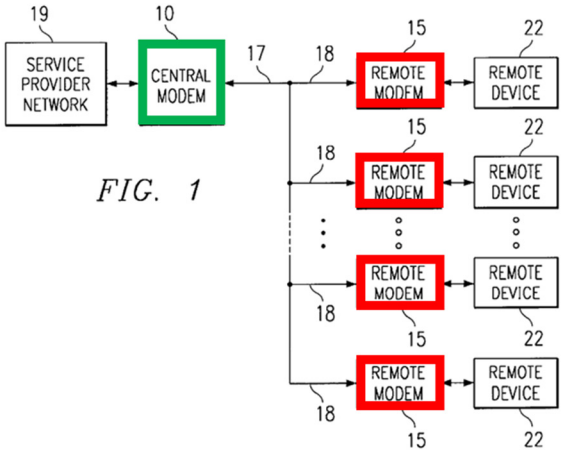


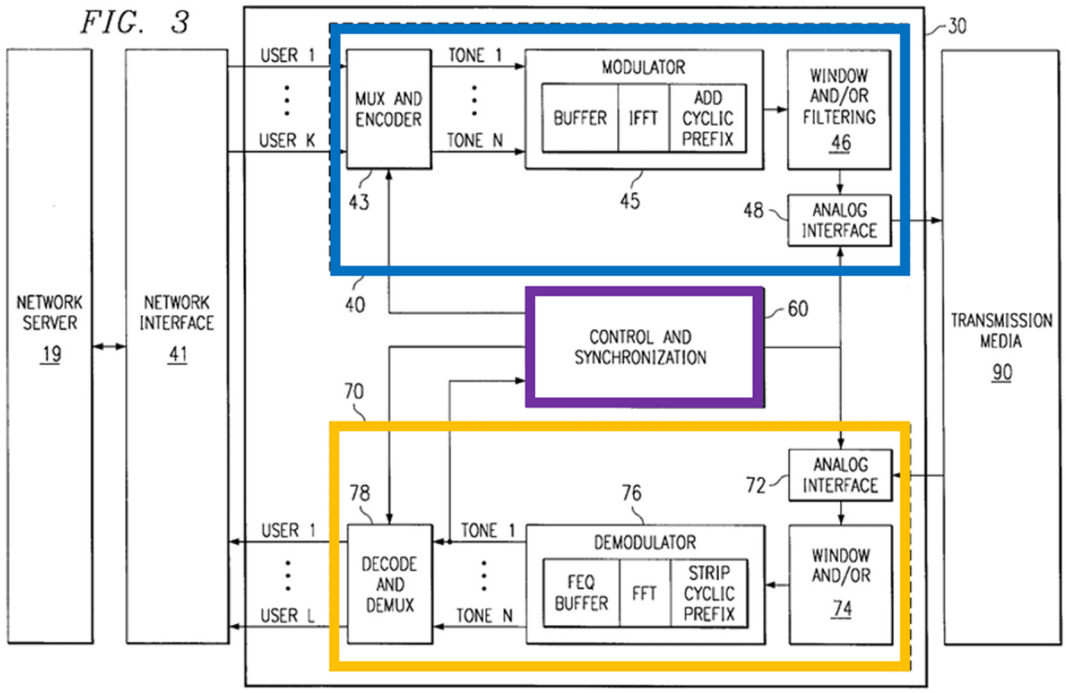
FIG. 1

Cioffi Fig. 1 (annotated)

231. It would therefore have been obvious to a POSITA to replace Grube's primary site with the "central modem" of Cioffi, which is part of a coaxial cable network that supports broadband signal tranmissions.

232. The implementation of Cioffi's "central modem" to replace Grube's "primary site" renders obvious the claimed "first BCN modem" comprising a "first controller." Cioffi's "central modem 30" comprises a "transmitter 40" (blue), a "receiver 70" (yellow), and a "controller 60" (purple). DISH-1006, 24:66-25:2, FIG. 3. Cioffi notes that the "transmitter 40 incorporates several components including … a discrete multi-tone modulator 45." *Id.*, 25:12-14. Similarly, Cioffi acknowledges that the "receiver 70 includes … a demodulator 76." *Id.*, 26:16-19; *see* §VII(A)(3)[34a]-[34b] *supra* (explaining that a modem comprises at least a modulator and a demodulator).

233. As depicted in Figure 3, Cioffi thus discloses or renders obvious a "modem" comprising a modulator and a demodulator that functions like the "transmitting node" in claim 29.



Cioffi Fig. 3 (annotated)

234. Further, as noted in Grube, although Cioffi's modem includes a "controller 60," a POSITA would have understood that the controller alone would not be able to fully execute the central modem's functions without the transmitter and the receiver, which allow the central modem to transmit and receive data. *See also* DISH-1006, 10:15-17 (the "controller 60 … generates a downstream synchronization signal that is transmitted back to the remote units," which necessitates the involvement of a transmitter to perform the actual transmission of the synchronization signal). Thus, Grube's controller 60 in combination with the transmitter 40 and the receiver 70 is analogous to the claimed "controller."

235. As a result, and for the reasons discussed above regarding motivation to combine, it is my opinion that Grube-Cioffi renders this limitation obvious.

[34b] "a plurality of BCN modems comprising a plurality of controllers;"

236. It is my opinion that Grube-Cioffi renders obvious this limitation.

237. As discussed above, Grube teaches "a plurality of BCN modems comprising a plurality of controllers." *See supra* §VII(A)(3)[34b]. To the extent that Patent Owner asserts that Grube does not explicitly disclose that the plurality of modems are BCN modems comprising a plurality of controllers, Cioffi further renders obvious the plurality of modems being BCN modems comprising a plurality of controllers.

238. As explained above, the coaxial cable network depicted in Figure 1 of Cioffi can be easily substituted into the communications network infrastructure of Grube, replacing the existing cabling. *See supra* §VII(B)(2). This is particularly so since Cioffi explicitly recognizes that the communications network infrastructure of Figure 1—in which Cioffi's system may be implemented—could not only be a coaxial cable network, but it could also be a twisted pair telephone line communications network, which is taught in Grube. DISH-1006, 7:37-41.

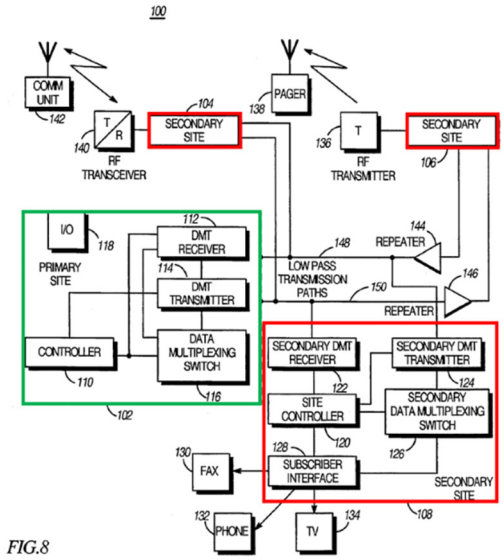


FIG.8

Grube Fig. 8 (annotated)

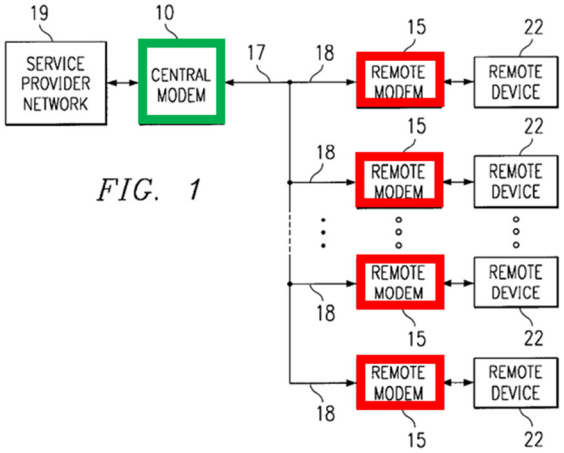


FIG. 1

Cioffi Fig. 1 (annotated)

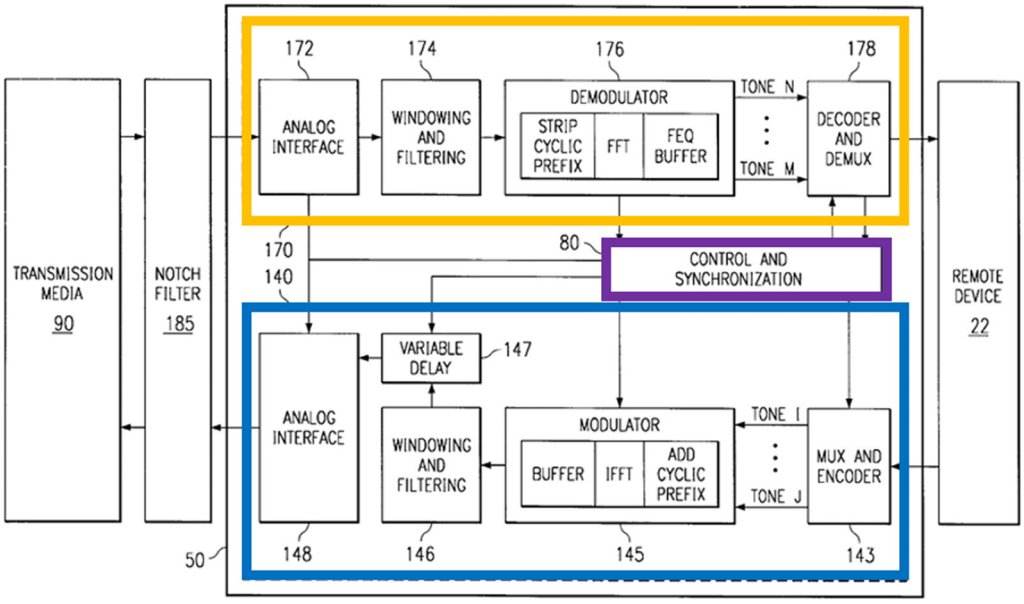
239. It would therefore have been obvious to a POSITA to replace each of Grube's secondary sites with a "remote modem" of Cioffi, which is part of Cioffi's coaxial cable network that supports broadband signal tranmissions.

240. The implementation of Cioffi's "remote modem" (also known as a "remote unit" in Cioffi) to replace each of Grube's "secondary site[s]" renders obvious the claimed plurality of "modems" comprising a plurality of "controllers." Cioffi's "remote modem 50" comprises a component labeled "140" (blue), a component labeled "170" (yellow), and a "remote synchronization controller" (purple). DISH-1006, 9:60-61, FIG. 4. Although component 140 in Cioffi is not explicitly labeled in the specification, a POSITA would have understood that component 140 refers to a transmitter at the "remote modem 50." This is because the components of component 140 are the same as the components in the transmitter

40 at the central modem 30. Cioffi notes that the "remote modem 50 … include[s] … a multi-tone modulator 145" (which is located in component 140). *Id.*, 27:4-5, FIG. 4. Similarly, Cioffi acknowledges that the "remote unit 50 includes … a demodulator 176." *Id.*, 26:45-48. While component 170 is not explicitly labeled in the specification, a POSITA would have understood that component 170 refers to a receiver at the "remote unit 50." This is because the components of component 170 are the same as the components in receiver 70 at the central modem 30. Indeed, the "demodulator 176" is located in component 170. DISH-1006, FIG. 4.

241. As depicted in Figure 4, Cioffi thus renders obvious a "modem" comprising a modulator and a demodulator that functions like each "receiving node" in claim 29.

FIG. 4



Cioffi Fig. 4 (annotated)

242. Further, as noted in Grube, although Cioffi's modem includes a "remote synchronization controller 80," a POSITA would have understood that the controller alone would not be able to fully execute the remote modem's functions without the other sub-components in components 140 and 170 in the remote modem, which allow the remote modem to transmit and receive data. *See also* DISH-1006, 10:15-17 (the "controller 60 … generates a downstream synchronization signal that is transmitted back to the remote units," which necessitates the involvement of a transmitter to perform the actual transmission of the synchronization signal). Thus, Grube's remote synchronization controller 80 in combination with components 140 and 170 is analogous to each claimed "controller."

243. As a result, and for the reasons discussed above regarding motivation to combine, it is my opinion that Grube-Cioffi renders this limitation obvious.

244. As discussed above, Grube renders Claim 34 obvious, and for the reasons discussed above regarding motivation to combine, Grube-Cioffi therefore renders obvious Claim 34.

5) Dependent Claim 30

[30] "The broadcasting method within the BCN of claim 29, wherein the broadcast signal comprises handshake data."

245. It is my opinion that the combination of Grube-Cioffi renders obvious this claim.

246. As discussed above, Grube renders obvious the broadcast signal comprising handshake data. *See* above §VII(A)(4)[30].

247. For the reasons discussed above, Grube-Cioffi therefore renders this claim obvious.

6) Dependent Claim 31

[31] "The broadcasting method within the BCN of claim 29, wherein the broadcast signal is a communication message comprising video data, music data, or voice data."

248. It is my opinion that the combination of Grube-Cioffi renders obvious this claim.

249. As discussed above, Grube renders obvious the broadcast signal being a communication message comprising video data music data, or voice data. *See* above §VII(A)(5)[31].

250. For the reasons discussed above, Grube-Cioffi therefore renders this claim obvious.

7) Dependent Claim 35

[35] "The BCN of claim 34, wherein the broadcast signal comprises handshake data."

251. It is my opinion that the combination of Grube-Cioffi renders obvious this claim.

252. As discussed above, Grube renders obvious the broadcast signal comprising data. *See* above §VII(A)(6)[35].

253. For the reasons discussed above, Grube-Cioffi therefore renders this claim obvious.

8) Dependent Claim 36

[36] "The BCN of claim 34, wherein the broadcast signal is a communication message comprising video data, music data, or voice data."

254. It is my opinion that the combination of Grube-Cioffi renders obvious this claim.

255. As discussed above, Grube renders obvious the broadcast signal being a communication message comprising video data music data, or voice data. *See* above §VII(A)(7)[36].

256. For the reasons discussed above, Grube-Cioffi therefore renders this claim obvious.

C. [GROUNDS 3A-B] – Grube in view of Matsumoto, and Grube-Cioffi in view of Matsumoto (Claims 29-38)

1) Overview of Matsumoto

257. Entitled "Method of and Device for Communication," Matsumoto was filed on October 3, 2000, and was published on April 12, 2001. DISH-1007, Cover.

258. Matsumoto discloses "a communication method which realizes data communication through the existing power lines by using a method such as the DMT (Discrete Multi Tone) modem system." *Id.*, 1:9-12. Matsumoto further explores the applicability of the "multi-carrier modem system" to "any communication device for carrying out cable communication." *Id.*, 1:17-21. Indeed, Matsumoto recognizes

that synchronization can be difficult "in the case of N to N communications," and seeks to provide a "communication device, which, by using a multi-carrier modem system, makes it possible . . . to readily achieve a N-to-N high-speed communication." *Id.*, 3:21-4:5.

259. Matsumoto discloses a "communication device serving as a virtual master" that "carries out training on all the other communication devices." DISH-1007, 23:4-6. The "virtual master" compares the "training results" from each of the "slave device[s]" to determine the "common tones that can be used among the communication devices and the common number of bits that can be used for the tones." *Id.*, 23:9-25. As an example, the training results from the "first slave device" indicate zero bits for tone 1, eight bits for tone 2, nine bits for tone 3, and ten bits for tone 4, while the training results from the "second slave [device]" indicate five bits for tone 1, ten bits for tone 2, nine bits for tone 3, and seven bits for tone 4, and the training results from the "third slave [device]" indicate eight bits for tone 1, ten bits for tone 2, six bits for tone 3, and eight bits for tone 4. *Id*. Across the three "slave device[s]," the lowest number of bits for tone 1 is zero, the lowest number of bits for tone 2 is eight, the lowest number of bits for tone 3 is six, and the lowest number of bits for tone 4 is seven. *Id*. As such, tone 1 is determined to be unusable, and the common number of bits to be used for tones 2, 3, and 4 are eight, six, and seven respectively. *Id*. The "commonly-used carrier among the communication devices

and the commonly-used number of bits that can be assigned to each carrier" is also known as "mapping information," which is analogous to the claimed "common bit-loading modulation scheme" of the '450 Patent and the "LCD outbound control channel bit loading table" in Grube. *Id.*, 6:24-7:3.

260. Matsumoto further recognizes that "mapping information" may be provided to "all the communication devices simultaneously" to allow "all the communication devices" to operate "based upon the mapping information." *Id.*, 5:9-14.

261. Matsumoto additionally recognizes that the "communication devices connected to the transmission path . . . to operate [as] either a virtual master or a slave." *Id.*, 25:1-3. This enables the communication network in Matsumoto to support "N-to-N communications." *Id.*, 25:6-7.

262. Like Grube and Cioffi, Matsumoto is analogous art to the '450 Patent.

263. Grube, Cioffi, and Matsumoto are analogous art to the '450 Patent because each of Grube, Cioffi, Matsumoto and the '450 Patent are from the same field of endeavor (cable communication networks involving broadcast communications) and because Grube, Cioffi, and Matsumoto are reasonably pertinent to the problems that the '450 Patent is concerned with (i.e., the need for a communications network that could connect multiple electric products using

existing power lines). DISH-1001, 4:12-13, 3:37-40; DISH-1007, 1:25-2:8, 4:4-7; *see* §§VII(A)(2)[29pre], (B)(3)[29pre] *supra*.

2) Motivation to Combine Grube with Matsumoto and Grube-Cioffi with Matsumoto

264. It is my opinion that a POSITA would have been motivated to modify Grube's method to incorporate Matsumoto's teachings with a reasonable expectation of success. It is also my opinion that a POSITA would have been motivated to modify Grube-Cioffi's method and system to incorporate Matsumoto's teachings with a reasonable expectation of success.

265. Grube presents a method for determining a common bit-loading modulation scheme to facilitate data transmissions from a primary site to a plurality of secondary sites. DISH-1005, 6:57-67. To complete the process of determining the common bit-loading modulation scheme, the "primary site transmits a signal to all the secondary sites indicating the carrier channel allocations as the control channel." *Id.*, 18:9-12. Nevertheless, Grube does not explicitly disclose all of the details of this transmission, such as how the common bit-loading modulation scheme is applied to the receiving nodes. To the extent that it would not have been obvious to transmit the claimed "common bit-loading modulation scheme," a POSITA would thus have been motivated to look to another reference to determine how the transmission in Grube's method would occur. A POSITA would therefore have

turned to other literature, such as Matsumoto, which provides details and explanations as to how this transmission would occur.

266. Similarly, Grube-Cioffi presents a method for determining a common bit-loading modulation scheme to facilitate data transmissions from a central modem to a plurality of remote modems in a broadband coaxial network. DISH-1005, 6:57-67; DISH-1006, 4:63-65, 7:24-26. To complete the process of determining the common bit-loading modulation scheme, the central modem "transmits a signal" to all the remote modems "indicating the carrier channel allocations as the control channel." DISH-1005, 18:9-12. Nevertheless, Grube-Cioffi does not explicitly disclose all of the details of this transmission, such as how the common bit-loading modulation scheme is applied to the receiving nodes. A POSITA would thus have been motivated to look to another reference to determine how the transmission in Grube-Cioffi's method in the context of a broadband coaxial network would occur. A POSITA would therefore have turned to other literature, such as Matsumoto, which provides details and explanations as to how this transmission would occur, to fill in these gaps.

267. Indeed, Matsumoto recognizes that "mapping information" may be provided to "all the communication devices simultaneously" to allow "all the communication devices" to operate "based upon the mapping information." DISH-1007, 5:9-14. A POSITA would have thus been motivated to incorporate the

simultaneous transmission of the "LCD outbound control channel bit loading table" in Grube and Grube-Cioffi, which is analogous to the "mapping information" because both contain the same types of data content (the number of bits assigned to each carrier channel), in the context of Grube's method and Grube-Cioffi's method. This is particularly so because a POSITA would have understood that Matsumoto's method of transmitting its "mapping information" to all the other communication devices simultaneously would ensure efficient use of the transmission channels by avoiding duplicative transmissions.

268. Additionally, Grube recognizes the applicability of its method to "a one-to-many and/or many-to-one communication system infrastructure." DISH-1005, 4:21-26. A POSITA would thus have recognized the benefit of having increased connectivity between nodes. *See generally* DISH-1007 (applicable to N-to-N communications). A POSITA would have further recognized the need for increased connectivity between nodes in a network as technology advanced and an increasing number of devices are located within a home or building environment. To further increase connectivity between nodes, a POSITA would have been motivated to expand the method of Grube and Grube-Cioffi to include many-to-many communications.

269. While Grube and Grube-Cioffi do not explicitly disclose how N-to-N communications would work, a POSITA would have turned to other literature, such

as Matsumoto, which discloses N-to-N communications. A POSITA would therefore have been motivated to implement Matsumoto's teachings that a communication device can operate as a "virtual master or a slave" into Grube's method and Grube-Cioffi's method to enable N-to-N communications in the context of Grube and Grube-Cioffi. DISH-1007, 25:1-3. Configuring the primary site and the plurality of secondary sites in Grube to each be able to determine a common bit-loading modulation scheme would allow each site to transmit data to other nodes in the network, thus enhancing connectivity within the network. Alternatively, configuring the central modem and the plurality of remote modems in Grube-Cioffi to each be able to determine a common bit-loading modulation scheme would allow each site to transmit data to other nodes in the network, thus enhancing connectivity within the network.

270. Indeed, such a combination would have been obvious at least because it involves combining prior art elements (such as the nodes in Matsumoto that can switch between being a "virtual master" or a "slave", and Matsumoto's teaching of transmitting "mapping information" to all other nodes simultaneously and Grube's method for determining an LCD outbound control channel bit loading table) according to known methods (applying Grube's method to each node in Matsumoto's network with no modifications to Grube's method) to yield predictable results (an N-to-N communication system where each node determines a respective

common bit-loading modulation scheme and transmits the LCD outbound control channel bit loading table to other nodes).

271. Similarly, such a combination would have been obvious at least because it involves combining prior art elements (such as the nodes in Matsumoto that can switch between being a "virtual master" or a "slave", and Matsumoto's teaching of transmitting "mapping information" to all other nodes simultaneously and Grube-Cioffi's method for determining an LCD outbound control channel bit loading table) according to known methods (applying Grube-Cioffi's method to each node in Matsumoto's network with no modifications to Grube-Cioffi's method) to yield predictable results (an N-to-N communication system where each node determines a respective common bit-loading modulation scheme and transmits the LCD outbound control channel bit loading table to other nodes).

272. Additionally, such a combination would have been obvious at least because it involves the use of known techniques (such as the method for determining a LCD outbound control channel bit loading table in Grube and Matsumoto's teachings that the nodes can switch between being a "virtual master" or a "slave," and where the nodes are configured to transmit "mapping information" to all other nodes in the network simultaneously) to improve similar devices (nodes in a communication network) in the same way (where each node in a network is capable

of N-to-N communications and determining a respective common bit-loading modulation scheme).

273. Similarly, such a combination would have been obvious at least because it involves the use of known techniques (such as the method for determining a LCD outbound control channel bit loading table in Grube-Cioffi and Matsumoto's teachings that the nodes can switch between being a "virtual master" or a "slave," and where the nodes are configured to transmit "mapping information" to all other nodes in the network simultaneously) to improve similar devices (nodes in a communication network) in the same way (where each node in a network is capable of N-to-N communications and determining a respective common bit-loading modulation scheme).

274. A POSITA would have had a reasonable expectation that the Grube-Matsumoto combination would produce a successful outcome. A POSITA would also have had a reasonable expectation that the Grube-Cioffi-Matsumoto combination would produce a successful outcome.

275. This is particularly so because Grube and Matsumoto are analogous art, so a combination of the two references would have been predictable. *See* above, §§VII(A)(1), IV(C)(1). Likewise, Grube, Cioffi, and Matsumoto are analogous art, so a combination of the three references would have been predictable. *See id.*

276. A POSITA would thus have found the implementation of Matsumoto's simultaneous transmission of mapping information to Grube's method and Grube-Cioffi's method to be a predictable and routine exercise to clarify how the transmission of the "carrier channel allocations" in Grube and Grube-Cioffi occur, which is not explicitly disclosed in Grube or Cioffi. Such a combination would thus have been within the skill level of a POSITA because a POSITA would have simply transmitted the common bit-loading modulation scheme simultaneously to Grube's secondary sites (or Cioffi's remote modems) without changing any principles of operation in Grube's method and Grube-Cioffi's method.

277. A POSITA would have also expected the implementation of Matsumoto's teachings of simultaneous transmission of mapping information to all other communication devices to Grube's method and Grube-Cioffi's method to be successful because a POSITA would have understood that limiting the transmission of the common bit-loading modulation scheme to simultaneous transmissions neither alters Grube's and Grube-Cioffi's technique for determining a common bit-loading modulation scheme nor renders parts of Grube's method or Grube-Cioffi's method redundant. Accordingly, a POSITA would have found applying Matsumoto's teachings to Grube's and Grube-Cioffi's technique for determining a common bit-loading modulation scheme to be an obvious choice with a reasonable expectation of success, and a POSITA would have been motivated to pursue that

choice to ensure that data transmissions in Grube and Grube-Cioffi occur at an increased efficiency.

278. Further, a POSITA would have implemented Matsumoto's communication devices' ability to operate as a "virtual master" or a "slave" in Grube's method to be a predictable and routine exercise to ensure that each node in Grube is capable of at least temporarily taking on the role of the "primary site," so as to increase connectivity within the network. Such a combination would have been within the skill level of a POSITA because a POSITA would have replicated Grube's method to each node in the Grube network, such that each site is configured to be capable of performing the functions of the primary site in Grube. Also, a POSITA would have implemented Matsumoto's communication devices' ability to operate as a "virtual master" or a "slave" in Grube-Cioffi's method to be a predictable and routine exercise to ensure that each node in Grube-Cioffi is capable of at least temporarily taking on the role of the "central modem," so as to increase connectivity within the network. Such a combination would have been within the skill level of a POSITA because a POSITA would have replicated Grube-Cioffi's method to each node in the Grube-Cioffi network, such that each modem is configured to be capable of performing the functions of the central modem in Grube-Cioffi.

279. Further, specific to Claims 34-38, the secondary sites in Grube further comprise the same components as the primary site that allow the primary site to

perform its claimed functions, thus enabling the secondary sites to be capable of performing the functions of the primary site in Grube. Also, the remote modems in Cioffi further comprise the same components as the central modem that allow the central modem to perform its claimed functions, thus enabling the remote modems to be capable of performing the functions of the central modem in Cioffi.

280. A POSITA would have also expected the implementation of Matsumoto's teaching that each communication device can operate as a "virtual master or a slave" to be successful because a POSITA would have understood that applying Grube's method or Grube-Cioffi's method to each node in a network neither alters Grube's or Grube-Cioffi's technique for determining a common bit-loading modulation scheme nor renders parts of Grube's or Grube-Cioffi's method redundant. Accordingly, a POSITA would have found this extension of Grube's method and Grube-Cioffi's method to each site in the network to be an obvious choice with a reasonable expectation of success, and a POSITA would have been motivated to pursue that choice to increase network connectivity.

3) Independent Claim 29

281. It is my opinion that the combination of Grube-Matsumoto and Grube-Cioffi-Matsumoto render obvious this claim. As I discussed above, Grube alone and the Grube-Cioffi combination renders obvious each limitation of claim 29, and claim

element [29h] is also rendered obvious by Grube-Matsumoto and Grube-Cioffi-Matsumoto, as described below.

[29h] "the transmitting node transmitting a broadcast signal relaying the common bit-loading modulation scheme to the plurality of receiving nodes"

282. It is my opinion that Grube-Matsumoto and Grube-Cioffi-Matsumoto render obvious this limitation.

283. As discussed above, Grube and Grube-Cioffi render obvious the transmission of a broadcast signal relaying the common bit-loading modulation scheme. *See supra* §§VII(A)(2)[29g], VII(B)(3)[29g]. To the extent that Grube and Grube-Cioffi do not explicitly disclose the transmission of a broadcast signal relaying the common bit-loading modulation scheme, Matsumoto further discloses the transmission of a broadcast signal relaying a "common bit-loading modulation scheme."

284. As explained above, the teachings in Matsumoto can be easily implemented in the method of Grube and Grube-Cioffi. *See supra* §VII(C)(1)-(2). This is particularly so since Matsumoto merely clarifies how the transmission of the common bit-loading modulation scheme may occur.

285. Like Grube and Grube-Cioffi, Matsumoto renders obvious a common bit-loading modulation scheme as well. Matsumoto teaches a "communication device serving as a virtual master" that "carries out training on all the other

communication devices." DISH-1007, 23:4-6. Indeed, the "tones" in Matsumoto are analogous to "channels" in Grube.

286. The "virtual master" compares the "training results" from each of the "slave device[s]" to determine the "common tones that can be used among the communication devices and the common number of bits that can be used for the tones." *Id.*, 23:11-21. As an example, the training results from the "first slave device" indicate zero bits for tone 1, eight bits for tone 2, nine bits for tone 3, and ten bits for tone 4, while the training results from the "second slave [device]" indicate five bits for tone 1, ten bits for tone 2, nine bits for tone 3, and seven bits for tone 4, and the training results from the "third slave [device]" indicate eight bits for tone 1, ten bits for tone 2, six bits for tone 3, and eight bits for tone 4. *Id.*, 23:14-25. Across the three "slave device[s]," the lowest number of bits for tone 1 is zero, the lowest number of bits for tone 2 is eight, the lowest number of bits for tone 3 is six, and the lowest number of bits for tone 4 is seven. *Id*. As such, tone 1 is determined to be unusable, and the common number of bits to be used for tones 2, 3, and 4 are eight, six, and seven, respectively. *Id*. The "commonly-used carrier among the communication devices and the commonly-used number of bits that can be assigned to each carrier" is also known as "mapping information." *Id.*, 6:24-7:4.

287. This is analogous to the "LCD outbound control channel bit loading table" disclosed in Grube-Cioffi, which is also analogous to the claimed "common

bit-loading modulation scheme," because all three teachings (the "mapping information," the "LCD outbound control channel bit loading table," and the claimed "common bit-loading modulation scheme") involve a listing of carrier channels and the corresponding number of bits allocated to each carrier channel. *See supra* §VII(A)(2)[29g].

288. Matsumoto then states that the "communication device serving as a virtual master simultaneously gives the mapping information thus determined to all the communication devices." DISH-1007, 24:1-4. Matsumoto thus teaches the transmission of a signal to relay the mapping information to the other nodes in the network, which includes the claimed plurality of receiving nodes.

289. For the reasons discussed above, and for the reasons discussed above regarding motivation to combine, Grube-Matsumoto and Grube-Cioffi-Matsumoto render obvious claim 29.

4) Independent Claim 34

290. It is my opinion that the combination of Grube-Matsumoto and Grube-Cioffi-Matsumoto render obvious this claim. As I discussed above, Grube alone and the Grube-Cioffi combination renders obvious each limitation of claim 34, and claim element [34j] is also rendered obvious by Grube-Matsumoto and Grube-Cioffi-Matsumoto, as described below.

[34j] "transmit a broadcast signal relaying the common bit-loading modulation

scheme to the plurality of controllers."

291. It is my opinion that Grube-Matsumoto and Grube-Cioffi-Matsumoto render obvious this limitation.

292. As discussed above, Matsumoto renders obvious the transmission of a broadcast signal relaying the common bit-loading modulation scheme to the plurality of controllers. *See* above §§VII(C)(3)[29h].

293. As a result, and for the reasons discussed above regarding motivation to combine, it is my opinion that Grube-Matsumoto and Grube-Cioffi-Matsumoto render obvious this limitation.

294. As a result, and for the reasons discussed above regarding motivation to combine, Grube-Matsumoto and Grube-Cioffi-Matsumoto render obvious claim 34.

5) Dependent Claim 30

[30] "The broadcasting method within the BCN of claim 29, wherein the broadcast signal comprises handshake data."

295. It is my opinion that the combinations of Grube-Matsumoto and Grube-Cioffi-Matsumoto render obvious this claim.

296. As I discussed above, Grube alone renders obvious a broadcast signal comprising handshake data. *See* above, §VII(A)(4)[30].

297. For the reasons explained above, it would be obvious to a POSITA that any broadcast signal rendered obvious by Grube-Matsumoto and Grube-Cioffi-Matsumoto would also comprise handshake data. *Id.*

298. For the reasons discussed above, Grube-Matsumoto and Grube-Cioffi-Matsumoto render obvious claim 30.

6) Dependent Claim 31

[31] "The broadcasting method within the BCN of claim 29, wherein the broadcast signal is a communication message comprising video data, music data, or voice data."

299. It is my opinion that the combinations of Grube-Matsumoto and Grube-Cioffi-Matsumoto render obvious this claim.

300. As I discussed above, Grube alone renders obvious a broadcast signal being a communication message comprising video data, music data, or voice data. *See* above, §VII(A)(5)[31].

301. For the reasons explained above, it would be obvious to a POSITA that any broadcast signal rendered obvious by Grube-Matsumoto and Grube-Cioffi-Matsumoto would also be a communication message comprising video data, music data, or voice data. *Id.*

302. For the reasons discussed above, Grube-Matsumoto and Grube-Cioffi-Matsumoto render obvious claim 31.

7) Dependent Claim 32

[32] "The broadcasting method within the BCN of claim 29, wherein each node

of the BCN determines a respective common bit-loading modulation scheme for broadcasting to the other nodes of the BCN."

303. It is my opinion that the combinations of Grube-Matsumoto and Grube-Cioffi-Matsumoto render obvious this claim.

304. Matsumoto discloses that "communication devices connected to the transmission path . . . to operate [as] either a virtual master or a slave" to enable "N-to-N communications." DISH-1007, 25:1-7. Indeed, each communication device in Matsumoto is configured to be able to interchangeably serve as a "virtual slave" or a "virtual master" to determine "mapping information," which is analogous to the claimed "common bit-loading modulation scheme." *See supra*, § VII(C)(1)-(2). Matsumoto thus teaches the ability of each node in its network to determine a respective common bit-loading modulation scheme. It would therefore have been obvious to a POSITA to apply this functionality taught in Matsumoto to each site in Grube or each modem in Grube-Cioffi to determine a respective common bit-loading modulation scheme.

305. For the reasons discussed above, Grube-Matsumoto and Grube-Cioffi-Matsumoto render obvious Claim 32.

8) Dependent Claim 33

[33] "The broadcasting method within the BCN of claim 29, further comprising the transmitting node broadcasting a signal based on the common bit-loading

modulation scheme to the plurality of receiving nodes simultaneously."

306. It is my opinion that the combinations of Grube-Matsumoto and Grube-Cioffi-Matsumoto renders obvious this claim.

307. Matsumoto recognizes that "mapping information" (which is analogous to the claimed "common bit-loading modulation scheme") may be provided to "all the communication devices simultaneously" to allow "all the communication devices" to operate "based upon the mapping information." DISH-1007, 5:9-14. Matsumoto thus renders obvious the transmission of a signal to relay the mapping information (i.e., the common bit-loading modulation scheme) simultaneously to the other nodes in the network.

308. It would therefore have been obvious to a POSITA to implement Matsumoto's disclosure of simultaneous transmission of "mapping information" to Grube(-Cioffi)'s system and method, such that Grube(-Cioffi)'s "LCD outbound control channel bit loading table" (claimed "common bit-loading modulation scheme") is transmitted to Grube's secondary sites (or Cioffi's remote modems) simultaneously.

309. For the reasons discussed above, Grube-Matsumoto and Grube-Cioffi-Matsumoto render obvious claim 33.

9) Dependent Claim 35

[35] "The BCN of claim 34, wherein the broadcast signal comprises handshake

data."

310. It is my opinion that the combinations of Grube-Matsumoto and Grube-Cioffi-Matsumoto render obvious this claim.

311. As I discussed above, Grube alone renders obvious a broadcast signal comprising handshake data. *See* above, §VII(A)(6)[35].

312. For the reasons explained above, it would be obvious to a POSITA that any broadcast signal rendered obvious by Grube-Matsumoto and Grube-Cioffi-Matsumoto would also comprise handshake data. *Id.*

313. For the reasons discussed above, Grube-Matsumoto and Grube-Cioffi-Matsumoto render obvious claim 35.

10) Dependent Claim 36

[36] "The BCN of claim 34, wherein the broadcast signal is a communication message comprising video data, music data, or voice data."

314. It is my opinion that the combinations of Grube-Matsumoto and Grube-Cioffi-Matsumoto render obvious this claim.

315. As I discussed above, Grube alone renders obvious a broadcast signal being a communication message comprising video data, music data, or voice data. *See* above, §VII(A)(7)[36].

316. For the reasons explained above, it would be obvious to a POSITA that any broadcast signal rendered obvious by Grube-Matsumoto and Grube-Cioffi-

Matsumoto would also be a communication message comprising video data, music data, or voice data. *Id.*

317. For the reasons discussed above, Grube-Matsumoto and Grube-Cioffi-Matsumoto render obvious claim 36.

11) Dependent Claim 37

[37] "The BCN of claim 34, wherein each controller of the plurality of controllers determines a respective common bit-loading modulation scheme for broadcasting to the other controllers of the plurality of controllers and the first controller."

318. It is my opinion that the combinations of Grube-Matsumoto and Grube-Cioffi-Matsumoto render obvious this claim.

319. As I discussed above, Matsumoto renders obvious each node determining a respective common bit-loading modulation scheme for broadcasting to other nodes of the BCN. *See* above, §VII(C)(7)[32].

320. For the reasons discussed above, Grube-Matsumoto and Grube-Cioffi-Matsumoto render obvious claim 37.

12) Dependent Claim 38

[38] "The BCN of claim 34, wherein the first controller is further configured to broadcast a signal based on the common bit-loading modulation scheme to the plurality of controllers simultaneously."

321. It is my opinion that the combinations of Grube-Matsumoto and Grube-Cioffi-Matsumoto render obvious this claim.

322. As I discussed above, Matsumoto renders obvious the broadcasting of a signal based on the common bit-loading modulation scheme to the plurality of controllers simultaneously. *See* above, §VII(C)(9)[33].

323. For the reasons discussed above, Grube-Matsumoto and Grube-Cioffi-Matsumoto render obvious claim 38.

VIII. ADDITIONAL REMARKS/CONCLUSION

324. At this time, I am not aware of any secondary considerations of non-obviousness regarding the claims of the '450 Patent.

325. I currently hold the opinions expressed in this Declaration. But my analysis may continue, and I may acquire additional information and/or attain supplemental insights that may result in added observations.

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

Tim Arthur Williams

Date: February 7, 2024 _____

TIM A. WILLIAMS