IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of:	Anton Monk et al.	
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Title:	BROADBAND CABLE NETWORK UTILIZING COMMON BIT-LOADING	

DECLARATION OF TIM A. WILLIAMS, PH.D., IN SUPPORT OF DISH'S PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 7,889,759

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CHALLENGED CLAIMS

Claim Language – Claim 1	
[1pre]	1. A method for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in a broadband cable network ("BCN"), the method comprising:
[1a]	transmitting a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes;
[1b]	receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node; and
[1c]	determining the common bit-loading modulation scheme from the received plurality of response signals;
[1d]	receiving the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission;
[1e]	determining the transmission characteristics of the channel path at the one receiving node; and
[1f]	transmitting a response signal from the one receiving node to the transmitting node,
[1g]	wherein the transmission characteristics of the channel path are determined by measuring the signal-to-noise ("SNR") characteristics of the received probe signal at the one receiving node and
[1h]	wherein determining a common bit-loading modulation scheme includes:
[1i]	comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and
[1j]	determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.

Claim Language – Claim 2	
[2pre]	2. A method for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in a broadband cable network ("BCN"), the method comprising:
[2a]	transmitting a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes;
[2b]	receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node;
[2c]	determining the common bit-loading modulation scheme from the received plurality of response signals;
[2d]	receiving the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission;
[2e]	determining the transmission characteristics of the channel path at the one receiving node;
[2f]	transmitting a response signal from the one receiving node to the transmitting node, wherein the transmission characteristics of the channel path are determined by measuring the bit-error rate ("BER") characteristics of the received probe signal at the one receiving node and
[2g]	generating the response signal, wherein the response signal utilizes a bit-loading modulation scheme that is generated by the one receiving node in response to determining the transmission characteristics of the channel path,
[2h]	wherein determining a common bit-loading modulation scheme includes:
[2i]	comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and

Claim Language – Claim 2	
[2j]	determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.

Claim Language – Claim 3	
[3pre]	3. A method for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in a broadband cable network ("BCN"), the method comprising:
[3a]	transmitting a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes;
[3b]	receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node; and
[3c]	determining the common bit-loading modulation scheme from the received plurality of response signals;
[3d]	receiving the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission;
[3e]	determining the transmission characteristics of the channel path at the one receiving node; and
[3f]	transmitting a response signal from the one receiving node to the transmitting node,
[3g]	wherein the transmission characteristics of the channel path are determined by measuring the signal-to-noise ("SNR") characteristics of the received probe signal at the one receiving node,
[3h]	wherein the transmission characteristics of the channel path are determined by measuring the [packet]-error rate ("PER") characteristics of the received probe signal at the one receiving node, and

Claim Language – Claim 3	
[3i]	wherein determining a common bit-loading modulation scheme includes;
[3j]	comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and
[3k]	determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.

EXHIBIT LIST

DISH-1001	U.S. Patent No. 7,889,759 to Anton Monk et al. ("'759 patent")
DISH-1005	File History for the '759 patent
DISH-1006	U.S. Patent Appl. Pub. No. 2009/032851 to Fuyun Ling et al. ("Ling")
DISH-1007	U.S. Patent Appl. Pub. No. 2009/0279498 to Xiaodong Li et al. ("Li")
DISH-1008	U.S. Patent Appl. Pub. No. 2005/0031044 ("Gesbert")
DISH-1009	U.S. Patent No. 6,622,304 to Thomas W. Carhart ("Carhart")
DISH-1010	U.S. Patent No. 5,495,483 to Gary W. Grube et al. ("Grube")
DISH-1011	U.S. Non-Provisional Appl. No. 10/322,834 ("'834 priority application")
DISH-1012	U.S. Patent Appl. Pub. No. 2003/0002518 to Akira Shibutani ("Shibutani")
DISH-1013	U.S. Patent No. 6,205,410 to Lujing Cai ("Cai")
DISH-1014	U.S. Patent No. 6,480,497 to George H. Flammer, III et al. ("Flammer")
DISH-1015	Declaration of June Munford
DISH-1016	Microsoft Computer Dictionary, Fourth Ed., 1999 ("Microsoft")
DISH-1017	Newton's Telecom Dictionary, The Official Dictionary of Telecommunications Networking and Internet, July 2000 ("Newton")
DISH-1018	Sharda, Nalin K., Multimedia Information Networking, 1999 ("Sharda")

DISH-1019	Webster's New World Dictionary of Computer Terms, Eighth Edition, 2000 ("Webster")
DISH-1023	U.S. Patent No. 7,295,518 to Anton Monk et al. ("'518 patent")
DISH-1024	U.S. Patent No. 7,594,249 to Itzhak Gurantz et al. ("'249 patent")
DISH-1025	U.S. Patent No. 6,252,900 to Young Way Liu et al. ("Liu")
DISH-1026	U.S. Patent No. 4,679,227 to Dirk Hughes-Hartogs ("Hughes-Hartogs")
DISH-1027	U.S. Patent No. 6,259,746 to Howard E. Levin et al. ("Levin")
DISH-1028	U.S. Patent No. 6,072,779 to Marcos Tzannes et al. ("Tzannes")
DISH-1029	U.S. Patent No. 4,866,395 to G. Robert Hostetter ("Hostetter")
DISH-1030	U.S. Patent No. 6,298,092 to Robert W. Heath et al. ("Heath")

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 Appendix A, 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 **Appendix A**.

11. I have been retained on behalf of DISH to analyze and offer technical opinions relating to U.S. Patent No. 7,889,759 ("the '759 patent") and prior art references relating to its subject matter. In forming my opinions, I read and considered the '759 patent, its prosecution history, U.S. Patent No. 7,295,518 to Anton Monk et al. ("the '518 patent") (DISH-1023), U.S. Patent No. 7,594,249 to Itzhak Gurantz et al. ("the '249 patent") (DISH-1024), and the exhibits cited in the Exhibit List.[1]

[1] I understand that the '759 patent is a continuation of the '518 and '249 patents.

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. Figures that appear within this document have been prepared with the assistance of Counsel and present my understanding of the '759 Patent and the prior art discussed below.

II. LEGAL PRINCIPLES

A. Obviousness

14. 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 (A) the scope and content of the prior art, (B) the differences between the prior art and the claims, (C) the level of ordinary skill in the art, and (D) 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.

15. I understand that the application that would issue as the ’759 patent was filed on July 12, 2004 and that that application claims priority to several provisional applications, the earliest of which was filed on May 4, 2001.

16. For purposes of my analysis and because I know of no indication from the patent owner or others to the contrary, I have applied a date of May 4, 2001, as the date of invention in my obviousness analyses, although in many cases the same analysis would hold true even if the priority date was slightly earlier than May 4, 2001.[2] Likewise, my opinions would not change if the priority date were later, e.g., in July 2004, when the application that issued as the ’759 patent was filed. In other words, my opinions do not change regardless of whether the priority date is in May 2001 or July 2004.

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

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[2] The earliest-filed application to which the ’759 patent claims priority, U.S. Provisional Application No. 60/288,967, was filed on May 4, 2001. DISH-1001 (Face of Patent).

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.

18. I have been informed that a claim can be obvious if the prior art contained a base device, system, or method upon which the claim can be seen as an improvement; the prior art contained a known technique that is applicable to the base device, system or method; one of ordinary skill in the art would have been capable of applying the known technique to the base device, system, or method that was ready for improvement; and the results of applying the known technique to the base device, system or method would have been predictable to one of ordinary skill in the art.

III. OVERVIEW OF CONCLUSIONS FORMED

19. Based on my review of the materials considered and my knowledge and experience in the telecommunications field, it is my opinion that a person of ordinary skill in the art ("POSITA") would have found claims 1-3 of the '759 patent obvious at the time of the alleged invention.

20. Specifically, it is my opinion that a POSITA would have found claims 1-3 obvious over Carhart and Grube, and in view of their background knowledge of how to characterize a channel path, as reflected in the ’834 application, Shibutani, Cai, and Flammer, and other references discussed in this declaration.

21. Further, it is also my opinion that a POSITA would have found claims 1-3 obvious over Carhart, Grube, and Shibutani.

22. It is also my opinion that a POSITA would have found claim 1 obvious over Carhart, Grube, and Cai.

23. It is also my opinion that a POSITA would have found claims 2-3 obvious over Carhart in view of Grube, Shibutani and/or Cai, and Flammer.

IV. LEVEL OF ORDINARY SKILL IN THE ART

24. 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 ’759 Patent as of May 4, 2001 would have 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*.

25. For at least the reasons I explained in the sections about my qualifications, I consider myself to have qualified as a POSITA as of the earliest possible priority date for the ’759 patent, May 4, 2001.

V. CLAIM CONSTRUCTION

26. 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. 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).

27. Because I do not know the exact date the invention as claimed was made, I have used the earliest possible priority date of the ’759 patent as the point in time for claim interpretation purposes. That date is May 4, 2001.

VI. THE ’759 PATENT

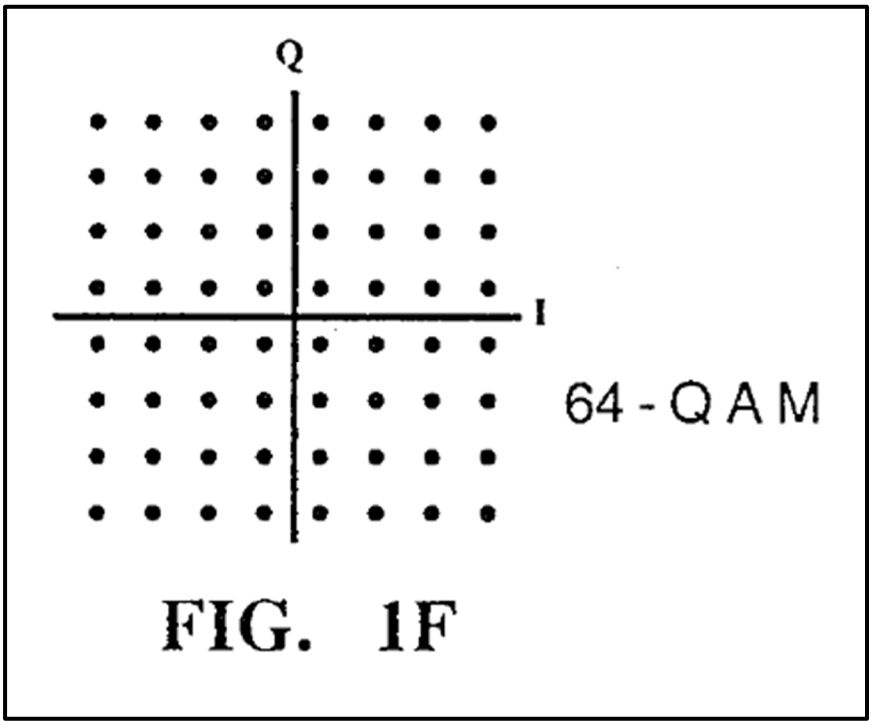
A. Overview of the Technology and the ’759 Patent (DISH-1001)

28. The technology described in the ’759 patent applies to a broadband cable network (“BCN”). The specification discloses a BCN with nodes that determine a

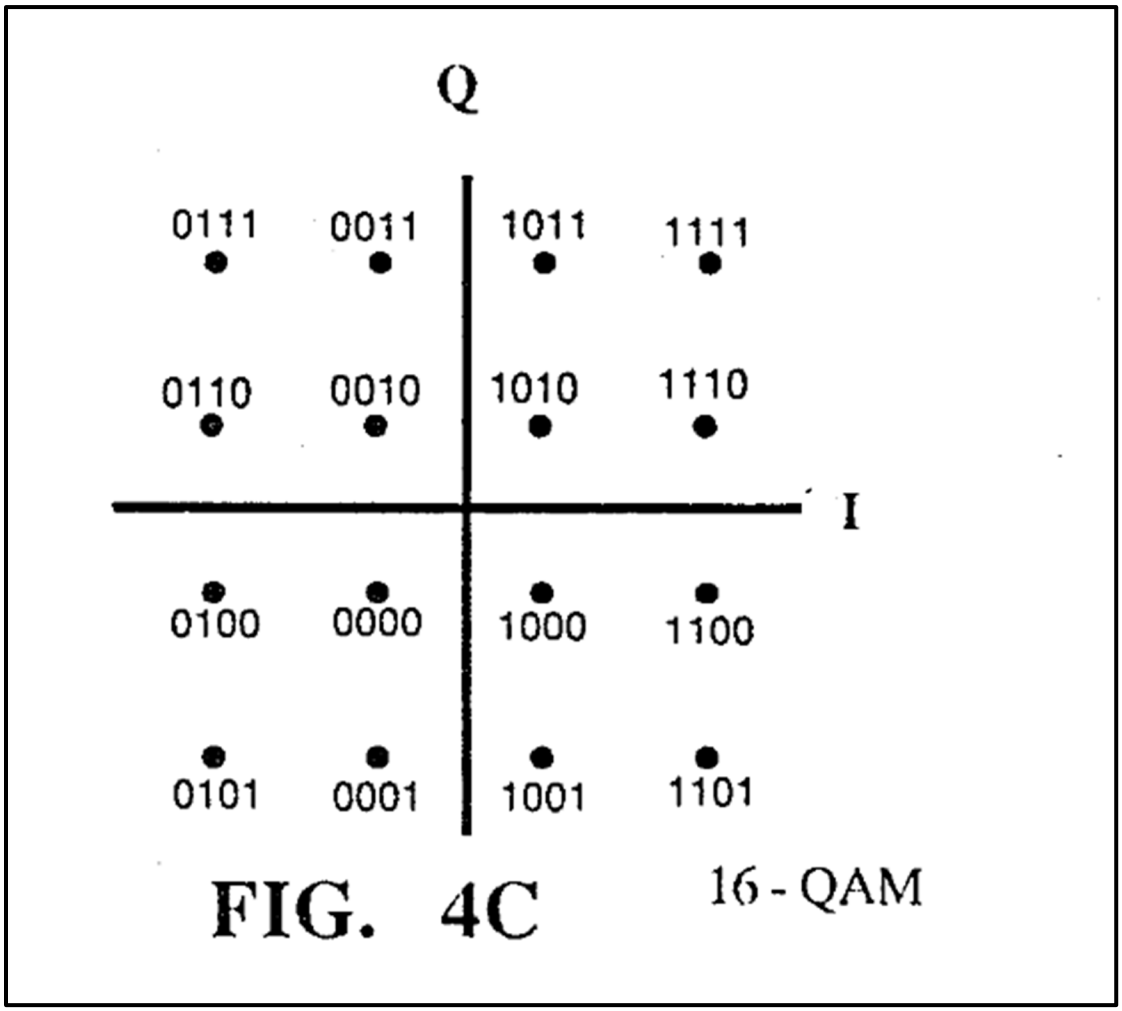
common bit-loading modulation scheme. The common bit-loading scheme may be used to encode communications between the nodes. See DISH-1001 at Abstract.

29. 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 ’759 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-1029) 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):



HOSTETTER FIGURE 1F



HOSTETTER FIGURE 4C

30. I note that in addition to discussing QAM, the ’759 patent mentions Binary Phase-Shift Keying (BPSK) once in the specification and Quadrature Phase Shift Keying (QPSK) twice in the claims only (the specification does not mention QPSK). These modulation types were also well-known prior to the earliest priority date of the ’759 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.[3]

31. Bit-loading was another well-known digital signal processing technique prior to the filing date of the ’759 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 be 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 conjunction with error correction coding to further ensure the reliability of the transmitted data.

[3] 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.

32. 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.

33. 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.

34. 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).

35. I note that a standard modulator available prior to the earliest priority date of the '759 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.

36. These concepts were well known in the art before the filing of the priority date of the '759 patent. For example, Liu (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-1025 at 8:14-31.

37. Similarly, the basic concepts of using coaxial cables and splitters for mutli-device communication was known prior to the '759 patent's earliest priority date. For example, the '518 patent, which the '759 patent continues from, acknowledges that several prior art references that disclose multi-carrier modulation with bit-loading on wired networks. DISH-1023 ('518 patent). For instance, the '518 patent explains that U.S. Pat. Nos. 6,438,174 and 6,259,746 describe selecting bit-loading parameters based on channel characteristics (e.g., SNR):

> 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.

DISH-1023 (’518 patent) at 8:19-26.

38. Similarly, Figure 2 of the ’759 patent explains that cable networks with splitters existed in the prior art:

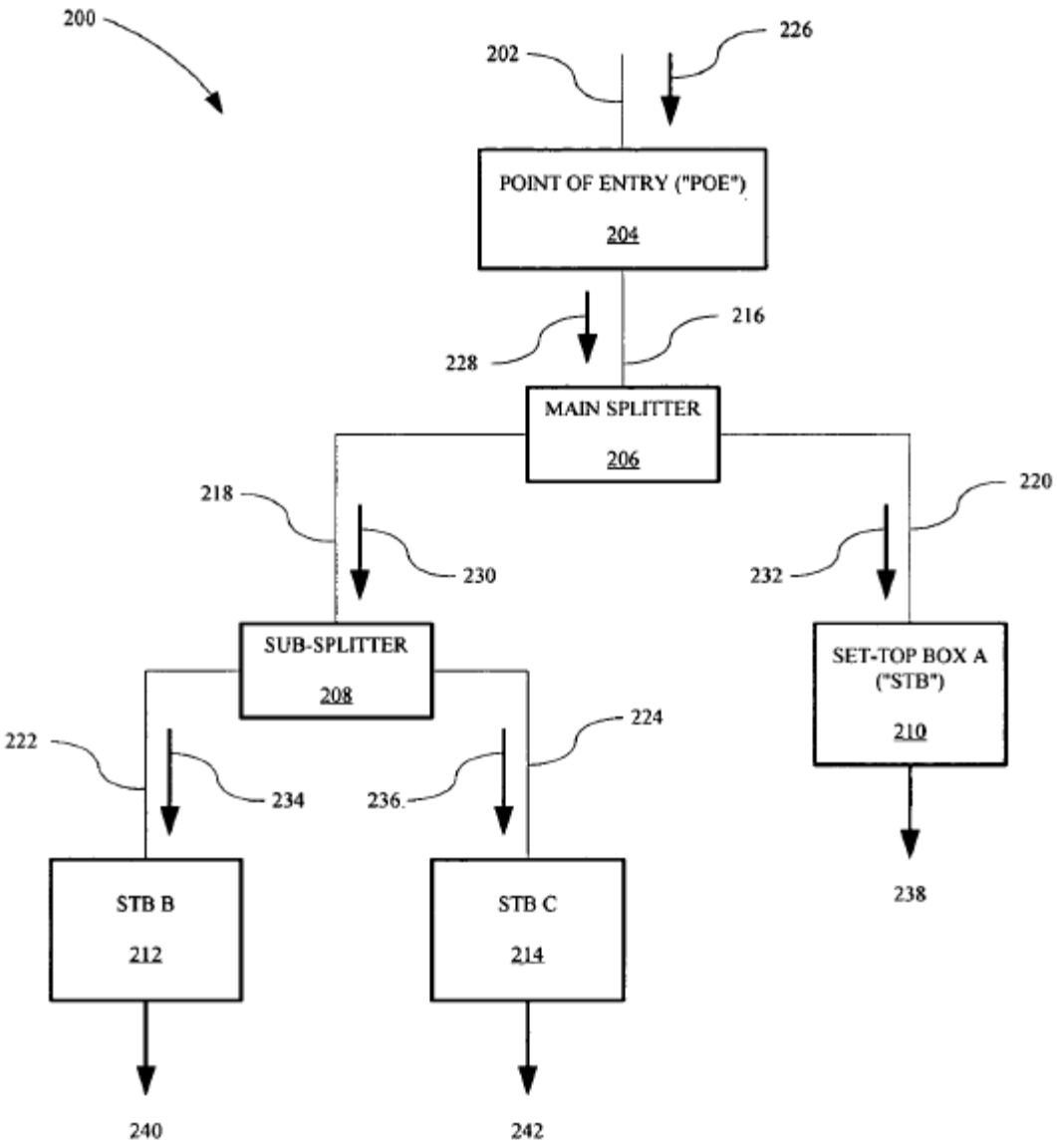


FIG. 2 (Prior Art)

FIGURE 2 OF THE '759 PATENT

39. With respect to Figure 2, the '759 patent explains:

> In FIG. 2, another example known broadband cable system is shown within a building (not shown) such as a typically 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 POE 204 and main splitter 206, a sub-splitter 208, and STBs A 210, B 212 and C 214.

DISH-1001 at 2:23-31.

40. Beyond admitted prior art, the '759 patent describes a network with multiple nodes. Three nodes are shown in Figure 6, although a POSITA would understand that the network can accommodate more nodes. Figures 3-8 each show a network with three nodes. Figure 3 depicts a block diagram of a BCN, and Figure 6 depicts "a block diagram of an example implementation of the BCN shown in FIG. 3 when node A is communicating to node B." DISH-1001 at 5:4-6.

41. Figure 6 shows this exemplary topology:

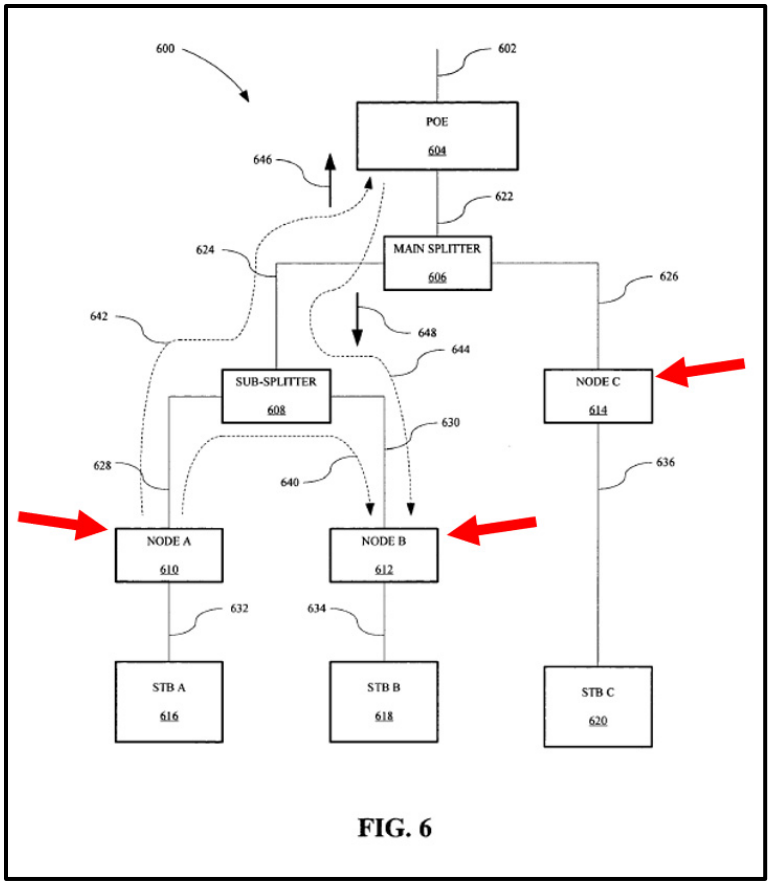


FIGURE 6 OF THE '759 PATENT[4]

Dashed line 640 in Figure 6 depicts the communication path between node A and node B.

42. Figures 7 depicts communication on the same network depicted in Figure 6. In Figure 7, dashed line 740 depicts communication between node A and node C (path 740). Figure 7 follows:

[4]Annotations and color have been added.

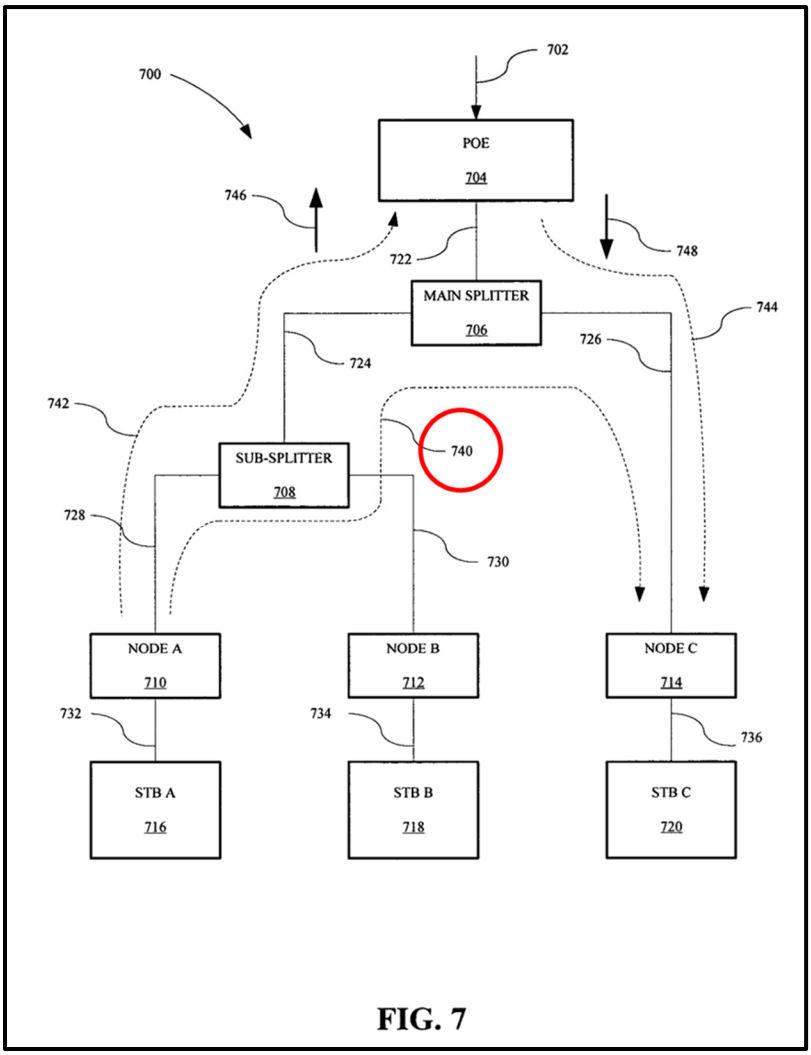


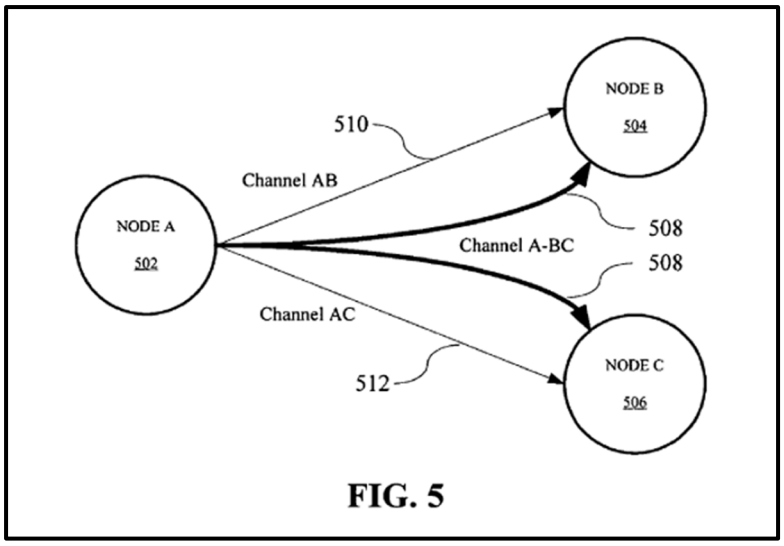
FIGURE 7 OF THE '759 PATENT

43. The '759 patent depicts broadcasting through Figures 6 and 7. In particular, node A broadcasts to node B and node C, through paths 640 and 740, because it sends the same message to both nodes. Each path, 640 and 740, has its own unique transmission characteristics that are determined in part by the physical attributes of the path (e.g., length of the path, composition of the cable, and the number of splitters in the path). These attributes determine the path's transmission

characteristics and dictate what modulation schemes can be used to transmit a message. In general, the quality of the path is proportional to the order of a QAM scheme that can be used on the path.

44. At a high level, the '759 patent explains that to obtain a "common bit loading scheme," the transmitting node first sends a probe signal to receiving nodes. DISH-1001 at 10:58-63 (step 1104). The receiving nodes reply with a modulation scheme. DISH-1001 at 11:15-18 (step 1112). Finally, the transmitting node selects a common scheme from the responses. DISH-1001 at 11:19-28 (steps 1114, 1116, and 1118). From this point, the transmitting mode can transmit broadcast messages. DISH-1001 at 11:29-36 (step 1120).

45. The '759 patent uses figures to illustrate what the patent calls a "common bit-loading modulation scheme." Figure 5 depicts a common bit-loading modulation scheme, which represents a scheme that facilitates communication between two node pairs, AB and AC. DISH-1001 at 10:6-14. Figure 5 and the '759 patent specification's explanation of a common bit-loaded modulation scheme follow:



FIGIURE 5 OF THE '759 PATENT

> Returning to FIG. 5, the BCN, in order to insure that both node B **504** and node C **506** are able to receive a broadcast signal transmitted from node A **502**, utilizes a bit-loading modulation scheme that is known as the common bit-loaded modulation scheme. The common bit-loaded modulation scheme transmitted via the A-BC channel, along signal path **508**, is a combination of the bit-loading modulation scheme transmitted via the AB channel, along signal path **510**, and the AC channel, along signal path **512**.

DISH-1001 at 10:6-14.

46. The '759 patent describes that Figures 10A and 10B depict "carrier frequency signals of various bit-loading constellations." DISH-1001 at 10:15-40. The '759 patent specification describes explains that Figure 10A is associated with the AB channel (path 640), and Figure 10B is associated with the AC channel (path 740). Figures 10A and 10B follow:

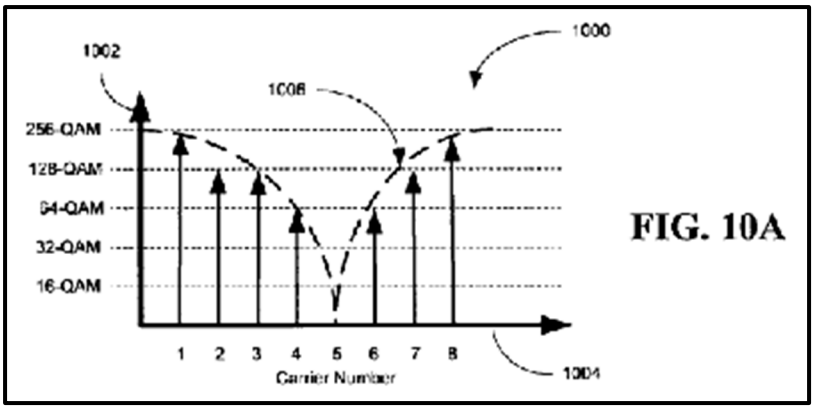


FIG. 10A

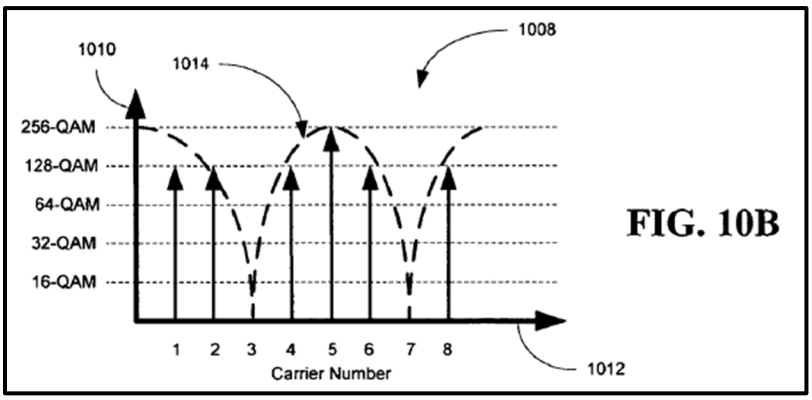


FIG. 10B

FIGURES 10A AND 10B OF THE '759 PATENT

47. The '759 patent explains that Figure 10C shows plots that "graphically represent signals utilizing the common bit-loaded modulation scheme." DISH-1001 at 5:23-26 and 10:54-56. Figure 10C depicts "the A-BC channel path between node A and nodes B and C." DISH-1001 at 10:43-44. Figure 10C follows:

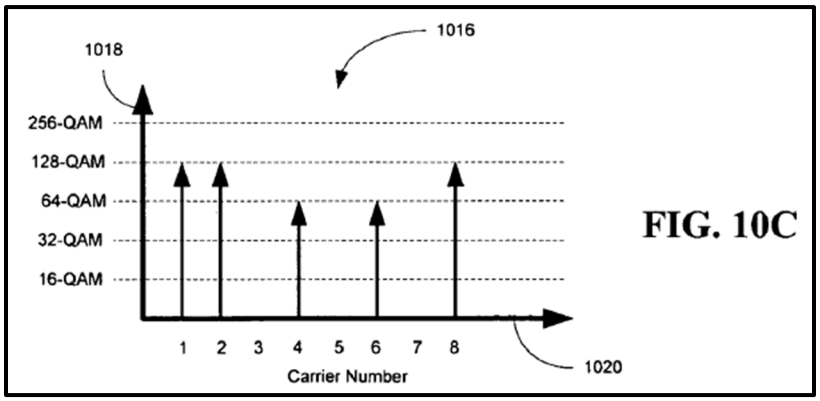


FIGURE 10C OF THE '759 PATENT

48. The Y-axis on Figure 10C (above) contains quadrature amplitude modulation (QAM) schemes.

49. In Figure 10C, 128-QAM is used for carriers 1, 2, and 8, because that is the greatest common scheme between Figures 10A and 10B for those channels. For carriers 4 and 6, 64-QAM is used because that is the greatest common scheme between those channels. Carrier 5 is not used because the AB channel has a null at carrier 5, and Carriers 3 and 7 are not used because the AC channel has nulls at those carriers. DISH-1001 at 9:65-10:5, 10:51-54.

50. The '759 patent explains Figure 10C follows:

> In FIG. 10C, a plot 1016 of the common carrier frequency signals of various bit-loading constellations 1018 versus carrier number 1020 for the A-BC channel path between node A and nodes B and C is 1020. In this example, plot 1016 shows that within the A-BC channel, carrier number signals 1, 2 and 8 may transmit at a constellation size of 128 QAM, carrier number signals 4 and 6 may transmit at a constellation size of 64 QAM, and carrier number signals 3, 5 and 7 are OFF. These carrier number signal values are the result of comparing the carrier number signals from the AB channel in FIG. 10A and the

> corresponding carrier number signals from the AC channel in FIG. 10B and choosing the lowest corresponding modulation value for each carrier number. The resulting common carrier frequency signals in FIG. 10C graphically represent signals utilizing the common bit-loaded modulation scheme. These signals would be able to transmit information from node A to node B and node C simultaneously.

DISH-1001 at 10:41-57.

B. Overview of the Prosecution History (DISH-1005)

51. The ’759 patent’s inventors are Anton Monk, Brett Bernath, Yusuf Ozturk, and Ron Porat. DISH-1001 (Face of Patent); DISH-1005 at 137. Entropic Communications, Inc. is the Applicant/Assignee. DISH-1005 at 86.

52. The application that issued as the ’759 patent is Application No. 10/889,975, and it was filed on July 12, 2004. DISH 1001 (Face of Patent).

53. The ’759 patent claims priority to eight applications. DISH-1001 at 1:7-35; DISH-1005 at 137-138. The eight applications generally relate to two patents, U.S. Patent Nos. 7,594,249 and 7,295,518.

54. In the application that issued as the ’759 patent, Entropic filed 81 original claims. DISH-1005 at 172-192.

55. The Examiner issued a first Office Action on April 7, 2010. DISH-1005 at 90.

56. In the first Office Action, the Examiner rejected claims 1-6, 8-9, 11-2, 14-22, 24-25, 27-28, 30, 35-37, 39-40, 42-43, 45-46, 52-55, 57-59, 61-63, 65-71, 73-74, 76-77, and 79-81. This totals fifty-seven claims. DISH-1005 at 91.

57. The Examiner also objected to claims 7, 10, 13, 23, 26, 29, 31-34, 38, 41, 44, 47-51, 56, 60, 64, 72, 75, and 78. This totals twenty-four claims. DISH-1005 at 91.

58. The Examiner rejected many claims under § 103 over patent application publications by Ling et al. (DISH-1006) and Li et al. (DISH-1007). See DISH-1005, 94.

59. Ling is directed to a wireless network. Ling describes a wireless multiple-input multiple-output ("MIMO") network that uses orthogonal frequency division modulation ("OFDM"). MIMO and OFDM were known before Ling's publication. See DISH-1006 at ¶¶ 5, 8.

60. Li is directed to a wireless network that uses orthogonal frequency division multiple access ("OFDMA"). See DISH-1007 at Abstract, ¶ 2. Li recognizes that OFDM is "an efficient modulation scheme" and also explains that "[i]n OFDMA, multiple subscribers simultaneously use different subcarriers, in a fashion similar to frequency division multiple access (FDMA)." DISH-1007 at ¶¶ 3, 4.

61. In the first Office Action, the Examiner found that Ling discloses a broadband network, transmitting nodes, transmitting probe signals, receiving response signals, receiving nodes, receiving nodes that transmit response signals, and means for determining a common bit loading modulation scheme based on the response signals (including based on channel SNR). DISH 1005 at 94-95.

62. The Examiner also found that Ling does not "expressly disclose that each response signals includes a bit-loading modulation scheme determined by a corresponding receiving node." DISH-1005 at 95. The Examiner found that Li, however, disclosed a network where "each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node (see paragraphs 27-29, transmitting feedback information to the base station, where the modulation rates may be specified by the subscriber with the feedback information)." DISH-1005 at 95.

63. The Examiner also found that Ling discloses using signal-to-noise ratio (SNR) to characterize a channel path. DISH-1005 at 100; DISH-1006 at ¶ 116. The Examiner found that Ling and Li did not disclose using bit-error-rate (BER) or product-error-rate (PER)[5], but found that a patent application publication to Gesbert et al. (DISH-1008) did. DISH-1005 at 102.

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[5] The Applicant later corrected the claims to "packet" error rate.

64. In applying Gesbert, the Examiner wrote:

> However, Gesbert et al., from the same or similar fields of endeavor, disclose the system, wherein the transmission characteristics of the channel path are determined by measuring the bit-error rate ("BER") or the product-error rate ("PER") characteristics of the received probe signal (see paragraphs 13-15).
>
> Thus, it would have been obvious to the person of ordinary skill in the art at the time of the invention to implement the system, wherein the transmission characteristics of the channel path are determined by measuring the bit-error rate ("BER") or the product-error rate ("PER") characteristics of the received probe signal as taught by Gesbert et al. into the system of Ling et al. in view of Li et al. in order to maximize data capacity, signal quality, spectral efficiency or throughput of the channel (see paragraph 18).

DISH-1005 at 102.

65. The Applicant responded to the Office Action on July 7, 2010. DISH-1005 at 55. The Applicant responded to the rejection by amending each of the independent claims; the Applicant also canceled the rejected claims and added the canceled subject matter into the amended claims. DISH-1005 at 56-75.

66. With the amendments, the Applicant argued that the claims were allowable. DISH-1005 at 77. The Applicant did not present any arguments about the references the Examiner cited (Ling, Li, or Gesbert). DISH-1005 at 76-77.

67. The Examiner allowed the amended claims on October 6, 2010. DISH-1005 at 40-55.

68. On April 5, 2011, the Applicant requested a Certificate of Correction to replace those portions of the '759 patent (specification and claims) that referred to a "product error rate" with "packet error rate." DISH-1005 at 22-24.

VII. GROUND 1 – CARHART IN VIEW OF GRUBE

A. Carhart (DISH-1009)

69. Carhart is a U.S. patent entitled "Interface System for Computing Apparatus and Communications Stations." DISH-1009 (Face of Patent). It was filed on August 6, 1997.

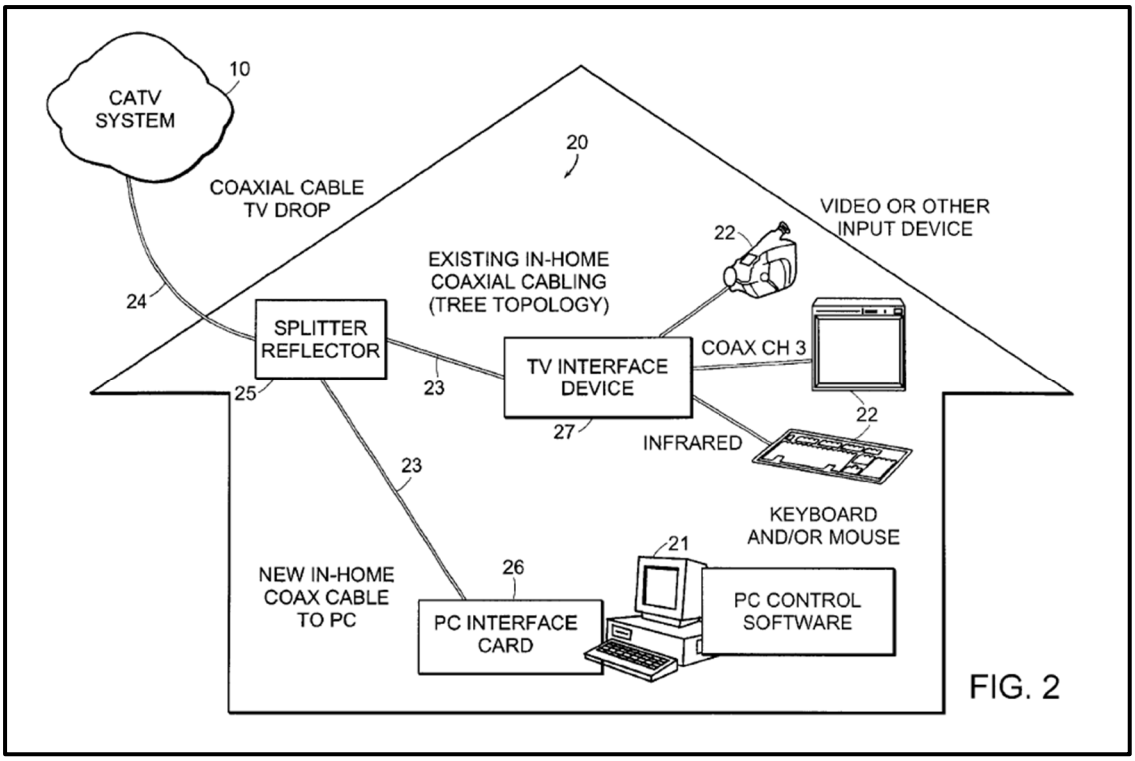
70. Carhart discloses a network that permits "a centralized in-home computing apparatus," like a personal computer, to communicate with a plurality of remote stations in a home. DISH-1009 at Abstract.

71. In the 1990's, telecommunications companies began using frequency division multiplexing to deliver telephone, data, and video services over broadband cable. See DISH-1009 at 2:4-8. As these services were introduced, engineers began to use the coaxial cables that were already installed in homes to establish local area networks (LANs) to connect devices within the home. DISH-1009 at 2:24-39. By connecting devices in the home, engineers enabled new in-home, connected multimedia and entertainment experiences. DISH-1009 at 6:14-27. As Carhart explains, installing new cables in a home was costly, and existing solutions

for interconnecting devices were inadequate because they required network modifications. DISH-1009 at 2:24-3:67.

72. To address these shortcomings, Carhart developed a network with a centralized computer that uses existing coaxial cables in a home to communicate with remote stations, *e.g.*, PCs or televisions. DISH-1009 at Abstract, 1:14-18, 2:24-27, 4:43-49, 7:24-26. To do so, Carhart utilizes a splitter/reflector to direct signals through the cable network, like the '759 patent. DISH-1009 at Abstract. For example, Carhart's Figure 2 depicts a PC that can communicate with multiple remote devices via a coaxial network. DISH-1009 at 8:13-22.

73. Figure 2 shows a personal computer communicating with various devices over coax wiring:



CARHART FIGURE 2

74. Carhart explains that connecting the devices as shown in Figure 2 (as well as other embodiments) allows the devices to connect to the Internet and realize additional functionality, such as multi-player videogaming, without incurring the costs of multiple computers. DISH-1009 at 2:13-36; 4:43-49, 16:23-40 (Carhart's "central computing apparatus . . . permit[s] an increase in the number of sites where the user may access the processing capability of the computer without having to provide a computing apparatus at each of the sites."), FIGS. 12A-12F.

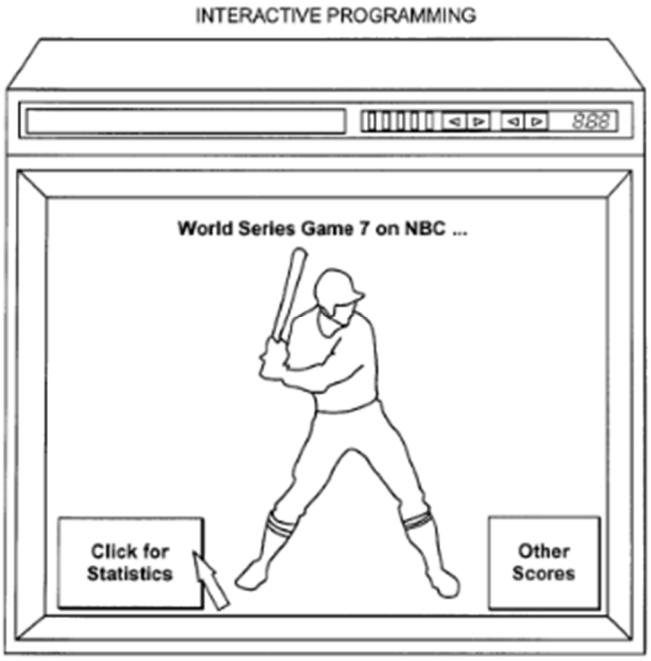


FIG. 12A

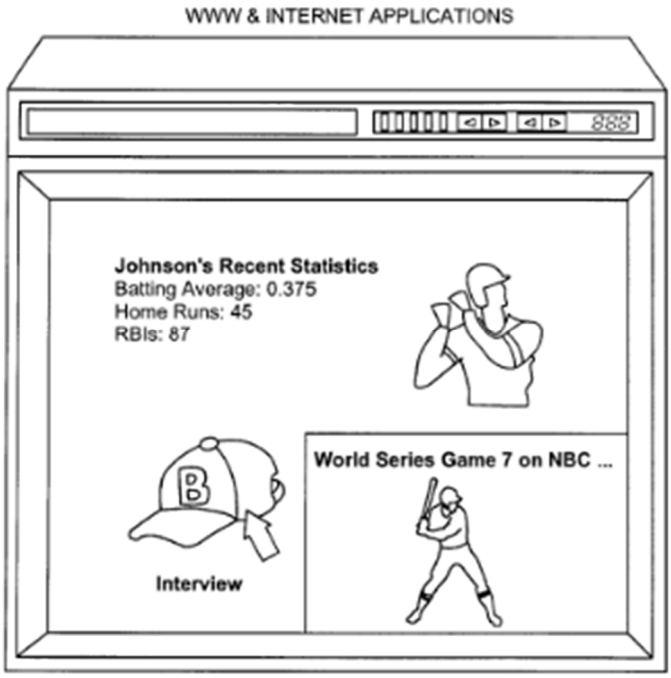


FIG. 12B

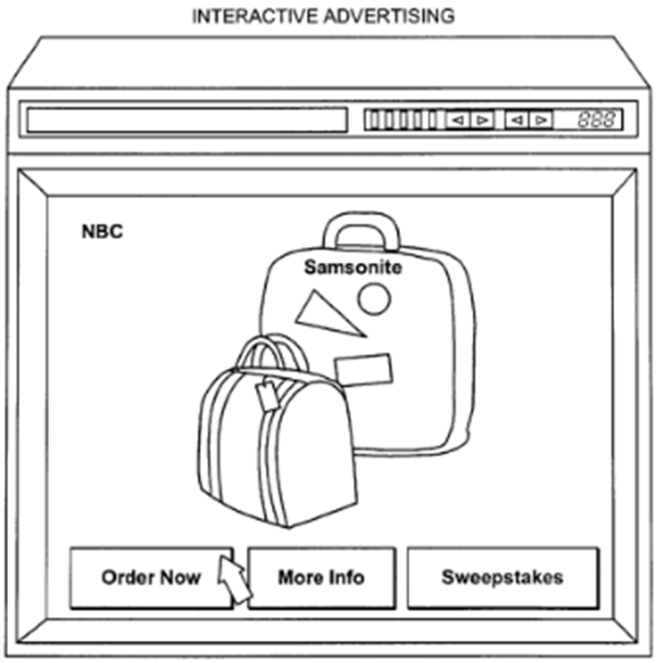


FIG. 12C

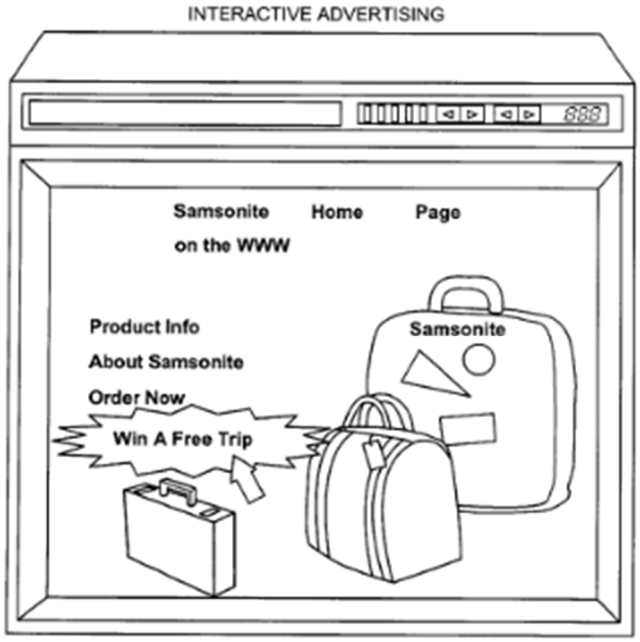


FIG. 12D

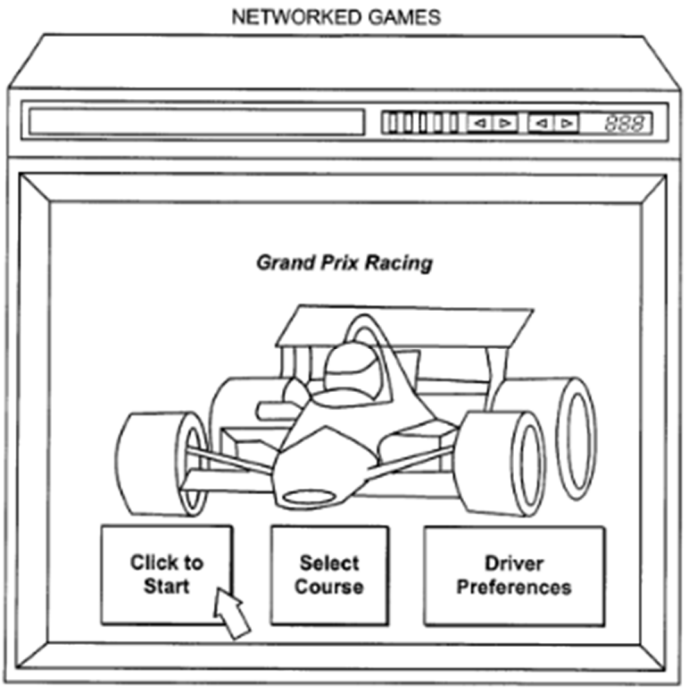


FIG. 12E

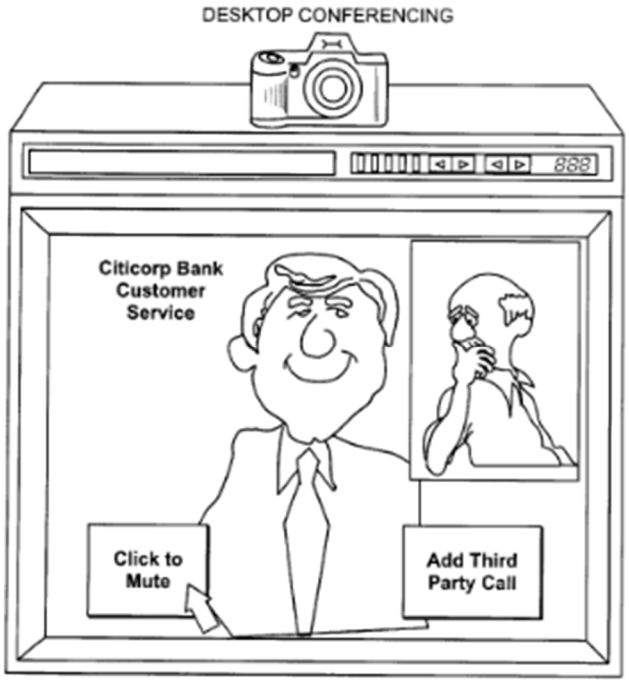


FIG. 12F

CARHART FIGURES 12A-12F

75. To summarize, Carhart discloses using the existing cable wiring in a home to facilitate communication between nodes in a home, and Carhart teaches using frequency division multiplexing on the network because it "allows each new channel or each new cable service to remain independent of the other signals or services present on the coaxial cable network." DISH-1009 at 2:8-13. This subject matter falls within the field of multiplex communication networking.

76. "Multiplexing" includes time division multiplexing, (TDM) frequency division multiplexing (FDM), orthogonal multiplexing techniques, phantom connections and plural channel adaptive systems. See https://www.uspto.gov/web/patents/classification/uspc370/defs370.htm (January 15, 2024).

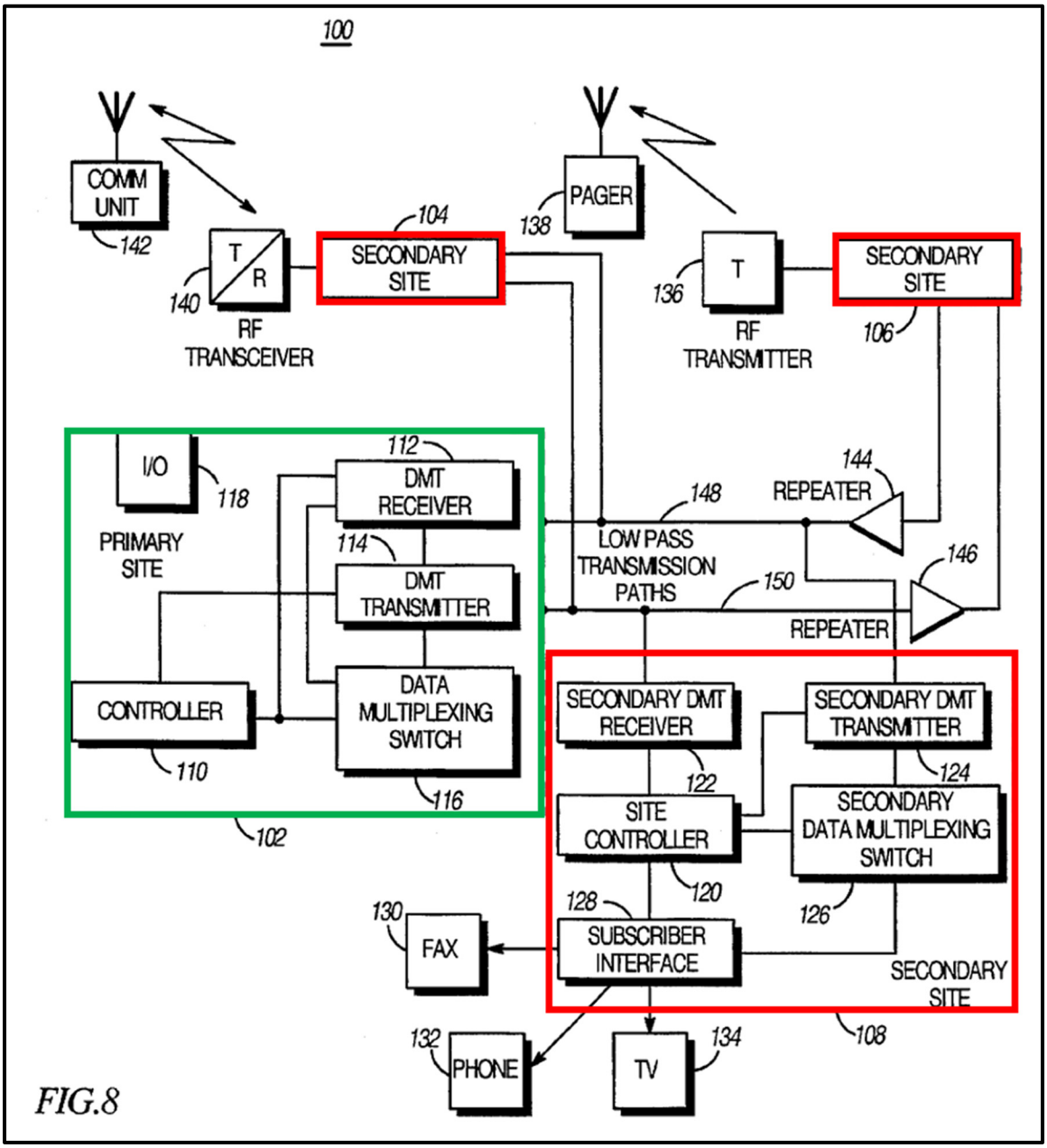
77. Consequently, Carhart is reasonably pertinent to the particular problem that the '759 patent's inventors is concerned with, i.e., facilitating communication between "a variety of CPEs [(customer premise equipment)]" over a "broadband communication networks utilizing coaxial cable." DISH-1001 at 3:66-67 ("there is a need for a system and method to connect a variety of CPEs into a local network"), 1:40-42 ("The invention relates to broadband communication networks, and in particular to broadband communication networks utilizing coaxial cable.").

B. Grube (DISH-1010)

78. Grube is a U.S. patent titled "Method and Apparatus for Allocating Carrier Channels." DISH-1010 (Face of Patent). Grube was filed on January 26, 1995, and it issued on February 27, 1996.

79. Grube focuses on improving reliability and bandwidth over existing telephone lines to facilitate data and video transmission without compromising telephone service. See DISH-1010 at 2:48-3:17. To do so, Grube uses frequency division multiplexing with discrete multi-tone (DMT) modulation to facilitate communication between a primary site and multiple secondary sites. DISH-1010 at 4:19-26 (explaining that Grube applies to systems with "one-to-many and/or many-to-one communications"), 6:54-67. Specifically, Grube's DMT system uses multicarrier modulation, with quadrature amplitude modulation ("QAM") as the modulation scheme, so that a central unit can communicate efficiently with multiple subscribers. See DISH-1010 at 3:34-42, 6:54-61, 34:45-52, Fig. 8, Fig. 51.

80. Figure 8 depicts a communications system with a primary site (green) connected to three secondary sites (red):



GRUBE FIGURE 8

81. Grube ensures that secondary sites in a multi-unit system have enough bandwidth by (a) determining the number of sites involved in a transmission, (b)

determining a lowest common denominator bit-loading table between each site, and (c) allocating channels based on bandwidth requirements. DISH-1010 at 14:33-46, 7:13-8:14.

82. In particular, "[b]efore any information can be transmitted" over the network," "an inbound control channel and an outbound control channel must be established over the low pass transmission paths." DISH-1010 at 7:13-15. "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." DISH-1010 at 7:32-42. "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." DISH-1010 at 7:32-42.

83. To provide more insight on Grube's table-generation, I note that U.S. Patent No. 4,679,227 ("Hughes-Hartogs"), DISH-1026, with Dirk Hughes-Hartogs as the inventor, provides an example of how bit loading tables can be generated based on "line parameters." DISH-1026 at 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. DISH-1026 at 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. DISH-1026 at 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. DISH-1026 at 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:

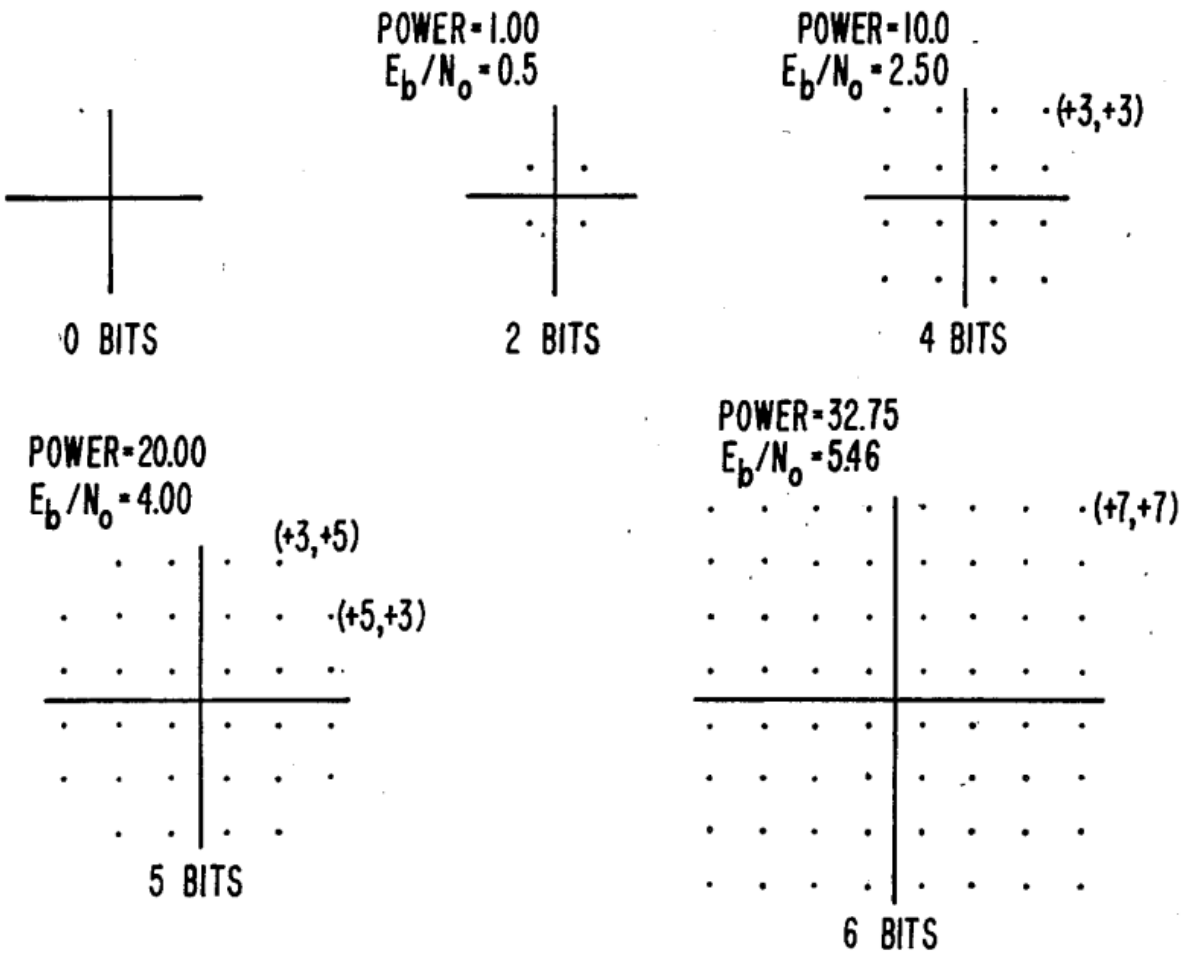
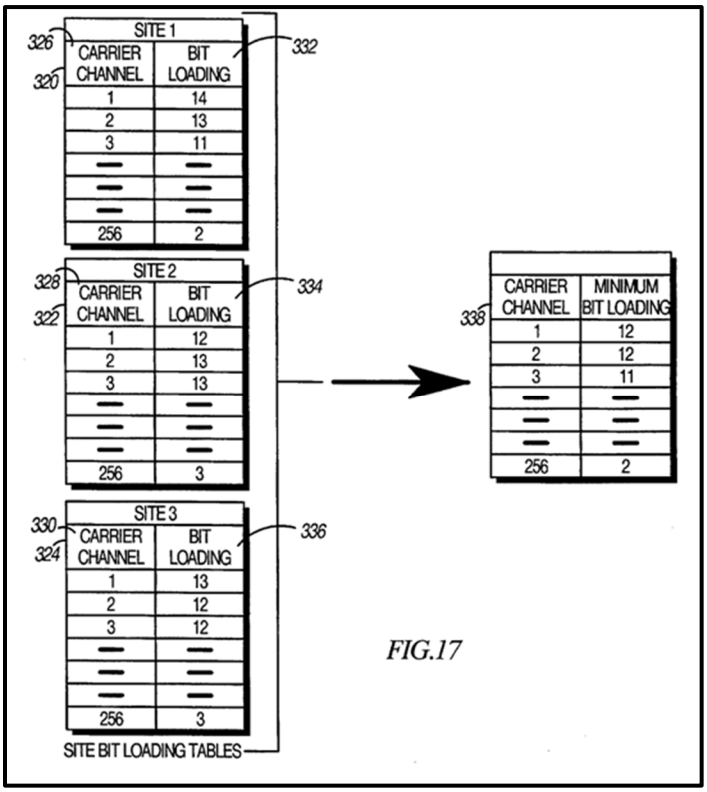


FIG.__5.

HUGHES-HARTOGS FIGURE 5

84. 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-1026 at 9:63-68.

85. With continued reference to Grube, 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." DISH-1010 at 7:43-50. "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-1010 at 7:43-50. Grube depicts an example of this process at Figure 17. DISH-1010 at 18:15-65.



GRUBE FIGURE 17

86. Grube describes a similar process for establishing the inbound control channel. DISH-1010 at 7:51-65.

87. "Once the control channels are established, the system may provide call services . . . includ[ing] the transmission of user information." DISH-1010 at 7:66-8:14. "When the primary site receives the call request, it determines the target sites involved in the requested call. Having identified the target sites, the primary site retrieves the site bit loading table for each target site and generates a lowest common denominator (LCD) call bit loading table for this particular call. From the call bit loading table and bandwidth requirements for this particular call, the

primary site allocates carrier channels to provide the infrastructure for this particular call. In other words, the primary site is selecting which outbound carrier channels will convey the user information from the primary site to the targeted secondary sites and the inbound carrier channels that will convey the user data from the targeted secondary sites to the primary site." DISH-1010 at 7:66-8:14.

88. Grube explains that its methodology can be used at a variety of "secondary sites," including sites equipped with wireless telephones, televisions and cable boxes, plain old telephone service (POTS), or "any other type of device that can receive digital information." DISH-1010 at 8:28-52,12:56-13:4, 23:49-60. Simply put, Grube is modulating digital data. A POSITA would understand that the modulation techniques are agnostic as to the contents of that data (audio, video, or otherwise). DISH-1010 at 8:28-52,12:56-13:4, 23:49-60.

89. Further, Grube explains 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." DISH-1010 at 4:21-26. By using existing telephone lines, Grube's method also avoids the need for costly expansions of infrastructure. DISH-1010 at 57:29-38.

90. To summarize, Grube discloses using frequency division multiplexing with DMT modulation to facilitate communication between a primary site and multiple

secondary sites (e.g., broadcasting). See DISH-1010 at 4:19-26 ("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"). This subject matter falls within the field of multiplex communication networking, and a POSITA would understand that Grube has utility in wired communication systems (e.g., BCNs) with multiple secondary sites. DISH-1010 at 1:6-8.

91. Consequently, Grube is reasonably pertinent to the particular problem that the '759 patent is concerned with, i.e., facilitating communication between "a variety of CPEs [(customer premise equipment)]" over a "broadband communication networks utilizing coaxial cable." DISH-1001 at 3:66-67 ("there is a need for a system and method to connect a variety of CPEs into a local network"), 1:40-42 ("The invention relates to broadband communication networks, and in particular to broadband communication networks utilizing coaxial cable.").

C. Motivation to Combine

92. As I explained at §VII.A above, Carhart presents a base system that uses a broadband cable network to facilitate communication between a central unit and multiple remote units.

93. Similarly, Grube discloses a method for establishing a network with "one-to-many or many-to-one communications" that ensures sufficient bandwidth for

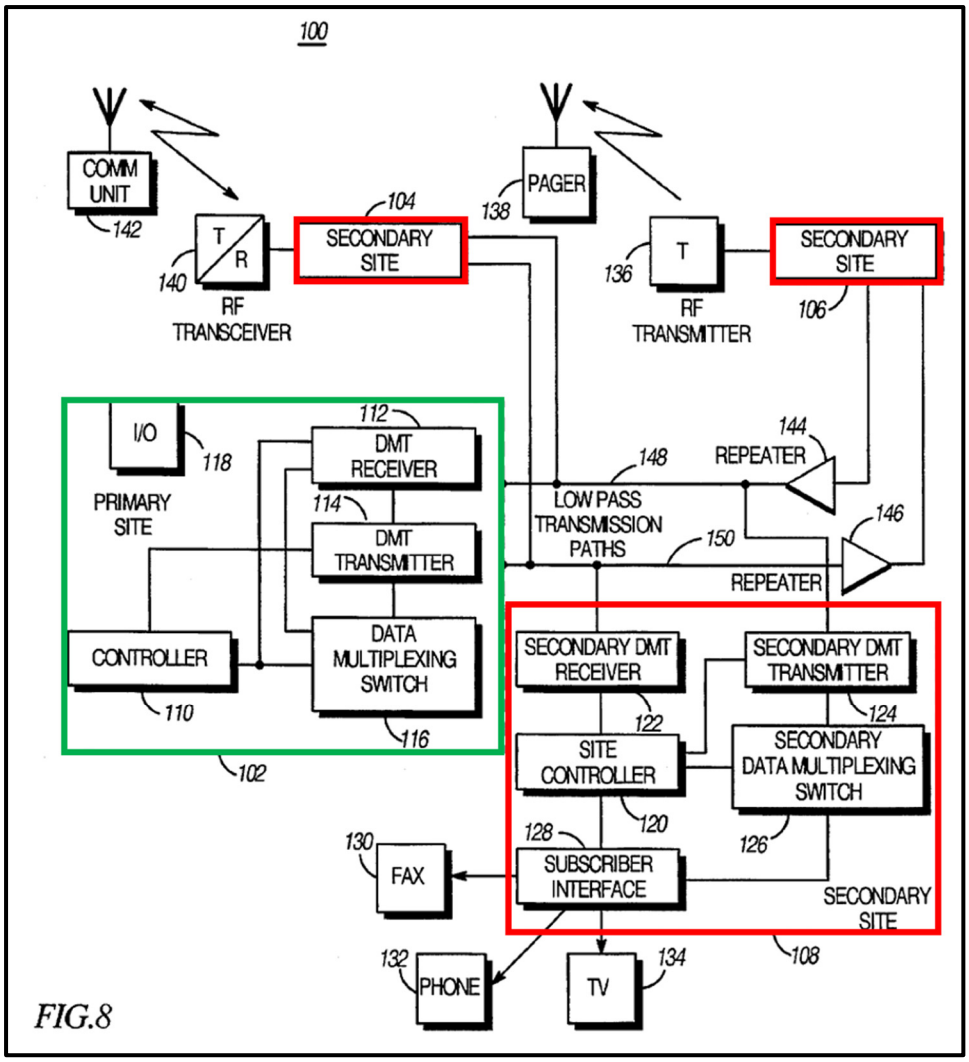
reliable communication between multiple sites. DISH-1010 at 4:21-26 and 6:54-67; §VII.B. Thus, it is my opinion that Grube represents a suitable, known technique for orchestrating digital communication between a central unit and multiple remote units in networks such as Carhart's.

94. A POSITA implementing Carhart's LAN would have had to decide what communication scheme(s) to use on the network. Carhart explains that the communication paths between devices in the LAN are "capable of supporting frequency division multiplexing of signals not traditionally used by CATV coaxial cables," and describes components for modulating and demodulating data transmitted through the LAN. See DISH-1009 at 8:56-9:28, 10:63-11:58, 12:24-13:11, 13:44-14:19. However, Carhart is silent as to the specific modulation scheme(s) to use to ensure reliable communications between devices. Further, a POSITA would have understood that Carhart's LAN requires high bandwidth, particularly if multiple remote devices use the network simultaneously (with each requiring separate bandwidth for communication). See DISH-1009 at 16:16-32 ("one central computing apparatus may be accessed remotely by one or more communications stations at a time"); DISH-1010 (Grube notes that video calls require large data rates, i.e., "digital video communications having, for example, a 100 Kbps requirements, a 1 Mbps requirements, or a 2 Mbps requirement"—these rates are higher than the audio and facsimile examples).

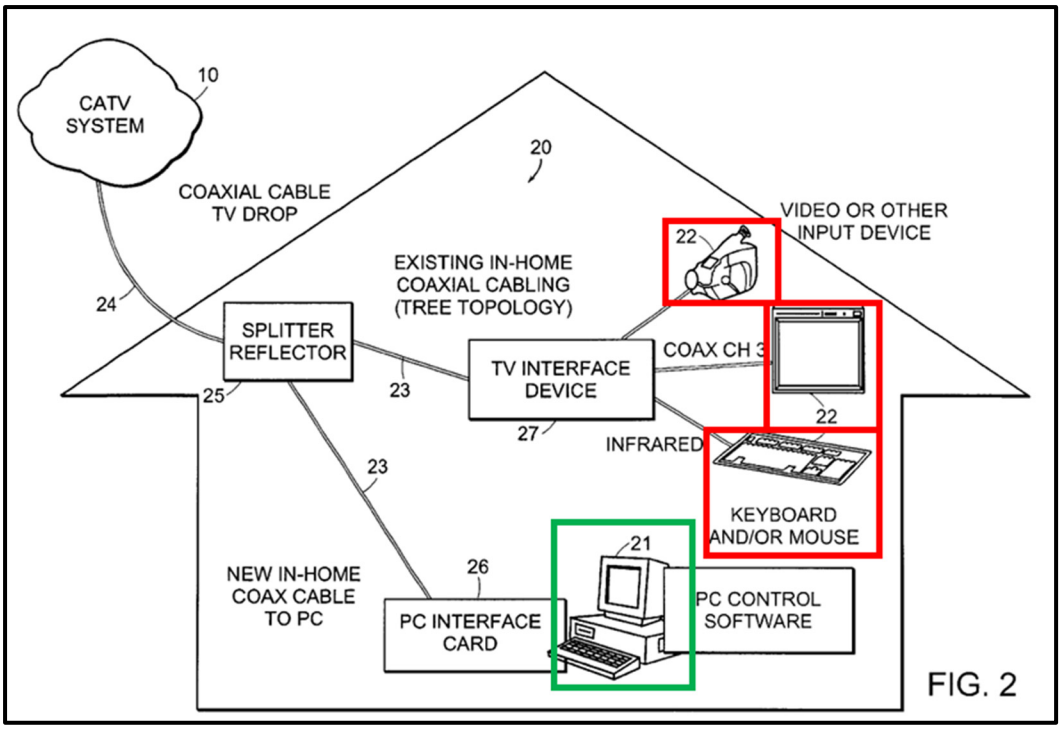
95. A POSITA would have realized that Grube's DMT modulation scheme addresses both needs, (i.e., reliable and efficient communications between Carhart's "central computing apparatus" and "remotely situated communications stations"), by providing transmission reliability between Carhart's central and remote units and optimizing the bandwidth of the communication channels. See DISH-1010 at 4:21-26 (Grube identifies a need for infrastructure that provides "highly reliable service"); 57:29-38 ("high data rate transmission path requirements are eliminated by the present invention"). Thus, a POSITA would have been motivated to improve Carhart's frequency division multiplexing scheme by implementing Grube's technique.

96. Specifically, a POSITA would have understood that Grube's use of DMT, channel characterization to determine common bit-loading table, and bandwidth allocation would ensure reliable and efficient communication between Carhart's "central computing apparatus" and "remotely situated communications stations." DISH-1009 at 8:13-55.

97. Further, a POSITA would have found implementing Grube's method in Carhart's system a predictable and routine exercise. In particular, Grube's secondary sites correspond to Carhart's remote units (in red below), and Grube's primary site corresponds to Carhart's centralized computing system (in green below).



GRUBE FIGURE 8



CARHART FIGURE 2

98. Although Carhart utilizes coaxial cables rather than twisted pair telephone wires or wireless links, as I explain below, it is my opinion that a POSITA would have understood that Grube's method would have functioned in Carhart's coaxial cables because switching the link medium would not alter Grube's method. Rather, a POSITA would have applied Grube's advantageous technique, as it was used for telephony, to Carhart's coaxial network. By employing Grube's process for establishing control channels and allocating bandwidth for data transmissions between nodes during data transmissions, Carhart's LAN would receive the same reliability and bandwidth improvements offered by Grube's network.

99. Specifically, a POSITA would have employed Carhart's "central computing apparatus" to send "training signals" as taught by Grube to the plurality of remote units in the LAN. See DISH-1009 at 8:13-9:28; DISH-1010 at 7:13-8:14. Based on the "training signal," Carhart's remote units and/or interface device would determine transmission characteristics of the communication channel, such as its spectral response for the carriers of that communication channel. See DISH-1010 at 7:32-42, 13:45-61, 14:47-58, 15:51-16:10. As Grube shows, measuring such channel characteristics was well-known to a POSITA at the time. DISH-1010 at 3:43-53; FIG. 5. From the channel characteristics, Carhart's remote units would each generate bit-loading information in the form of a bit-loading table, and send the bit-loading information back to the "central computing apparatus," just as performed in Grube's network. See DISH-1010 at 7:32-42, 15:51-16:23.

100. Upon collecting the bit-loading information from the remote nodes, Carhart's "central computing apparatus" would perform Grube's process of determining a "lowest common denominator (LCD) bit loading table as a compilation of all of the site bit loading tables." DISH-1010 at 7:43-50. Thus, Grube's process for determining an outbound control channel is readily incorporated into Carhart's network. Carhart's central and remote units would perform a similar process, as taught by Grube, to determine the inbound control

channel and complete the network setup. See DISH-1010 at 7:51-65, 13:62-14:6, 14:24-33.

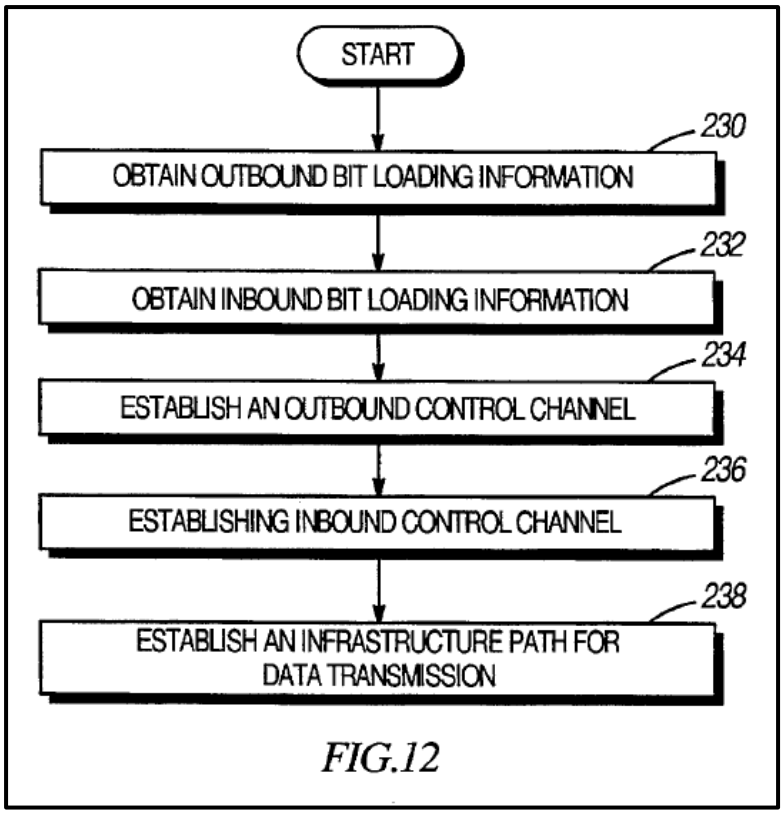
101. Thereafter, communications between specific devices in Carhart's network, such as the "central computing apparatus" and one or more remote units, would utilize the "inbound and outbound bit loading information to establish an infrastructure for a data transmission" as taught by Grube. DISH-1010 at 14:34-46. Just as Grube's "primary site retrieves the site bit loading table for each site and generates a lowest common denominator (LCD) call bit loading table for [a] particular call," Carhart's "central computing apparatus" would utilize the bit-loading tables determined for its LAN to determine a common bit-loading table for a particular transmission between remote units and/or the central unit. DISH-1010 at 7:65-8:14.

102. Given the straightforward application of Grube's method to Carhart's coaxial network, it is my opinion a POSITA would have found the application yielded predictable results, and would have reasonably expected the application to succeed. Moreover, a POSITA would have found implementing Grube's method in Carhart's system predictable because it neither renders parts of Carhart's system redundant nor renders Grube or Carhart inoperable for their intended purposes.

103. Additionally, Carhart and Grube confront the same basic problem to be solved: orchestrating data transmission between a central unit and secondary units.

See DISH-1009 at 4:52-5:3, 8:61-65 (noting Carhart's invention can be used on a coaxial or wireless network); DISH-1010 at 4:18-26, 6:54-64. This commonality, coupled with Grube's optimized one-to-many and many-to-one technique, further demonstrates that a POSITA would have been motivated to apply Grube's technique in Carhart. Accordingly, a POSITA would have found using Grube's modulation techniques in Carhart's network an obvious choice, and a POSITA would have been motivated to pursue that choice given that Grube optimizes communications between a central unit and multiple remote units.

104. After a POSITA had determined to implement Grube's method in Carhart, the POSITA would have understood that an initial step in implementing Grube's method would be to characterize the transmission paths between Carhart's centralized computer and remote units. DISH-1010 at 13:45-60. Indeed, Grube's "overall system operation function" logic diagram shows obtaining bit-loading information (steps 230 and 232) as initial steps in the process:



GRUBE FIGURE 12

DISH-1010 at 13:45-60, 2:62-66 (in ADSL, an initial step is "to establish a spectral response" for the line). In particular, Grube explains that as part of step 230, a training signal is provided, and then the "secondary sites calculate the bit loading information from a spectral response of the output transmission path." DISH-1010 at 13:45-57. The process repeats for the inbound path. DISH-1010 at 13:62-14:1.

105. 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. DISH-1010 at 15:55-65 ("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."); DISH-1016 (Microsoft) (defining "spectral response" as "[i]n relation to sensing devices, the relationship between the device's sensitivity and the frequency of the detected energy").

106. 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-1010 at 3:34-53 (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 specifically 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-1010 at 15:51-16:10.

107. While Grube, as well as Carhart, 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. By way of example, Hughes-Hartogs uses "signal loss" to measure the spectral response of the channel. DISH-1026 at 8:9-20. Similarly,

Levin uses "channel analysis" to measure the spectral response of the channel.

DISH-1027 at 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-1027 at 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.

DISH-1027 at 3:15-35.

108. Tzannes is another example of a reference that uses SNR as a "channel characteristic" to set the bit-loading values for a given channel. DISH-1028. 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-1028 at 1:33-58. Tzannes later explains that the relationship between BER and SNR is well known and that BER-SNR concordance tables 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.

DISH-1028 at 6:28-39.

109. Accordingly, Hughes-Hartogs and Levin reinforce that "spectral response" is simply a broad term that is generally synonymous with other terms used to describe channel performance, such as "signal loss" (Hughes-Hartogs), "channel analysis" (Levin), or "channel characteristic" (Tzannes).

110. Further, U.S. Patent Application No. 10/322,834 ("the '834 priority-application"), which the '759 patent claims priority to, admits that the measurement techniques recited in claims 1-3 were well known. See DISH-1001 (Face of Patent) (showing priority claim). The '834 priority-application discloses that adaptive bit-loading can facilitate communication between two devices. DISH-1011 at 6. The '834 priority-application discloses selecting a bit-loading scheme based on characteristics of the communication channel. DISH-1011 at 6 ("Based on the estimate of the channel [characteristics], bit loading is applied to increase the modulation order at carriers with high signal to noise ratio and lower the modulation order at carriers with low signal to noise ratio."). The '834 priority-application explains that measuring the SNR is one way to determine the channel characteristics. See DISH-1011 at 14 ("The SNR in each frequency bin is calculated and the bit loading profile is generated. Determination of a channel

response, multipath, and SNR profile from a known signal is well known in the art."). The '759 patent's specification omits this admission. *Compare* DISH-1011 at 13-16 ("Channel Probing Message" section) *with* DISH-1001 (admission and "Channel Probing Message" section omitted).

111. If additional references are needed to confirm the Applicant's acknowledgement, Shibutani and Flammer evince this background knowledge. Both references discuss a variety of well-known techniques for characterizing a transmission path. DISH-1012 at ¶ 46 (noting a POSITA would be able to measure SNR or "b[i]t error rate (BER)" to ascertain channel conditions); DISH-1014 at 3:16-35 (noting that, *inter alia*, observable signal characteristics include, "probability of a bit error," "probability of a packet error" and a "signal strength of the signal at the receiving node."). Further, both references teach using channel conditions to optimize data transmission rates. DISH-1012 at ¶ 46 ("With the channel condition information reported . . . [the controller] determines a maximum data rate for the [access terminal ("AT")], and a combination of coding rate and modulation scheme that achieves the data rate."); DISH-1014 at 2:64-3:5 ("net throughput is optimized . . . in response to performance metrics which have been determined from analysis at the receivers for the corresponding links"). Thus, Shibutani and Flammer confirm what the '759 patent's priority application (DISH-

1011) admitted was known in the art, and merely fill in background information that Carhart and Grube may omit.

D. Claim 1

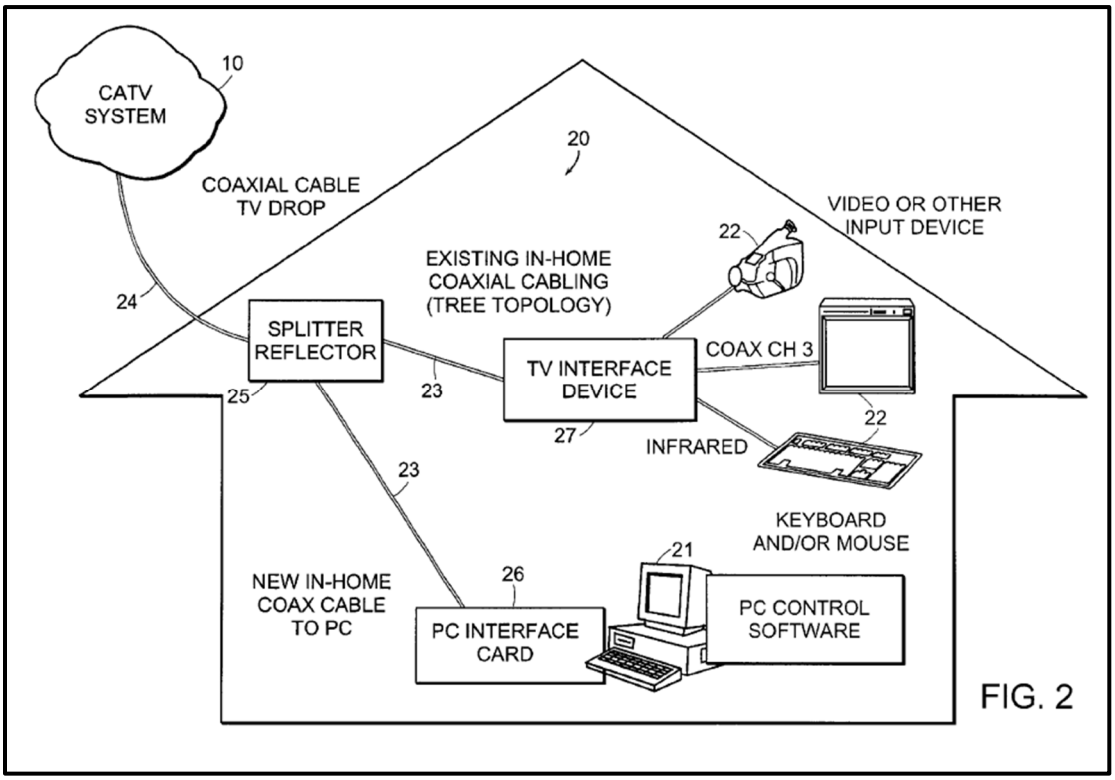
1. Preamble

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

112. I have been asked to consider whether the Carhart-Grube combination renders obvious the preamble of claim 1, but I have not been asked to render an opinion on whether the preamble should be considered a limitation. If the preamble of claim 1 is deemed to be a limitation, it is my opinion that the Carhart-Grube combination renders this limitation obvious.

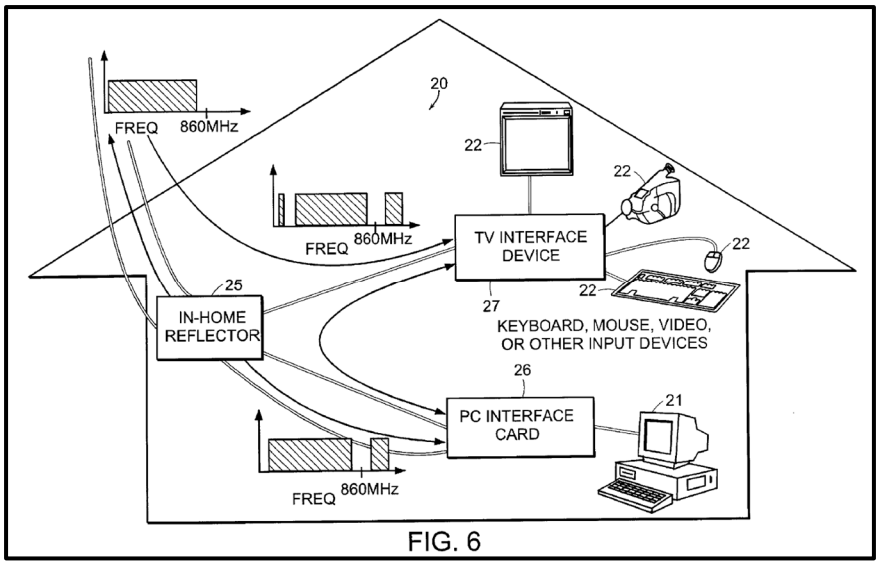
113. Carhart discloses a broadband cable network with a plurality of nodes. For instance, Carhart explains that broadband cable networks have existed for decades and that cable companies have "widely employed" them. See DISH-1009, 1:21-34 (describing a typical coaxial network), 2:40-54 (discussing U.S. Pat. No. 4,893,326 (filed May 4, 1987), which discloses transmitting data over a coaxial network), Figs. 1A-1D, 7:20-8:12.

114. As depicted in Figure 2, Carhart's broadband cable network includes coaxial cables 23, which form a broadband cable network:



CARHART FIGURE 2

115. Carhart depicts a plurality of nodes—central computing apparatus 21, PC interface card 26, TV interface device 27, and communications stations 22—communicating in the broadband cable network over its various frequency bands. DISH-1009 at 8:56-9:28 ("frequency band f_1 generally falls . . . from about 50 MHz to about 550 MHz"); 10:63-11:32 ("frequency band f_2 that is, for example, greater than about 860 MHz"), 13:44-58, 14:20-37 ("frequency band f_3, selected for user input, is different than frequency band f_2"); DISH-1009 at Figs. 5-6, 11.



CARHART FIGURE 6

116. Grube, for the reasons provided under elements 1c and 1h-1j, *below*, discloses the feature of "determining a common bit loading modulation scheme for communicating between a plurality of nodes."

117. As a result, it is my opinion that the Carhart-Grube combination renders this limitation obvious.

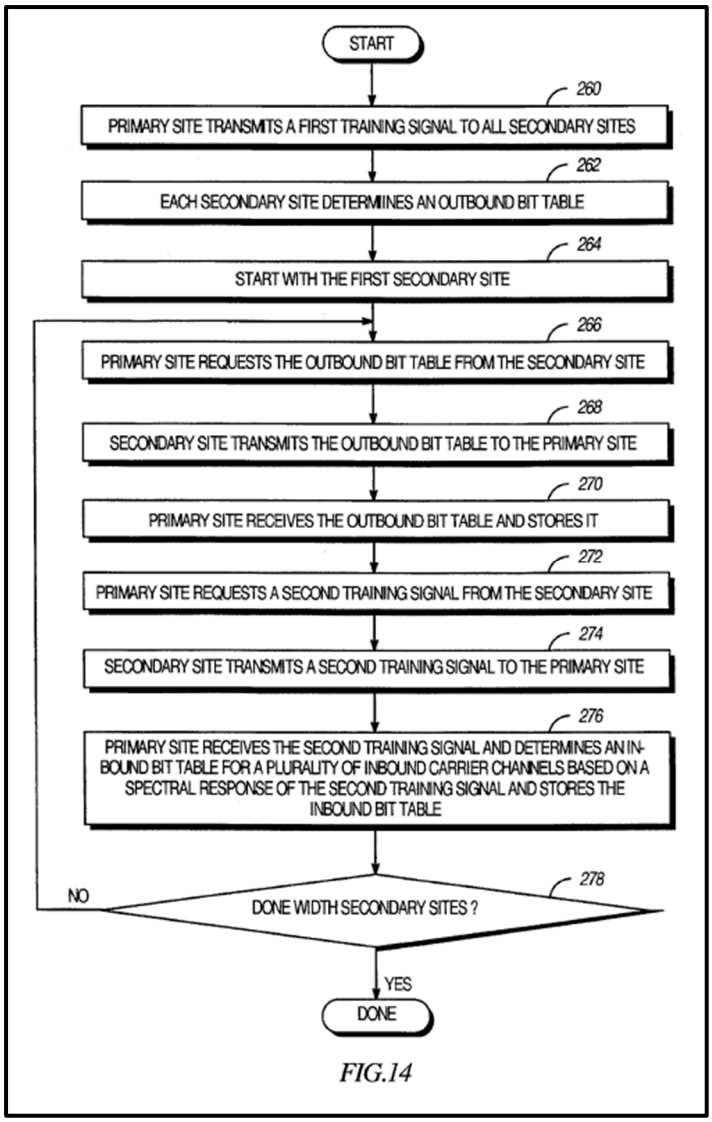
2. <u>Element 1a</u>

[1a] transmitting a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes;

118. It is my opinion that the Carhart-Grube combination renders this limitation obvious.

119. Grube discloses transmitting a training signal, corresponding to element 1a's probe signal, from a primary site to a plurality of secondary sites in its network.

DISH-1010 at 7:32-42. Grube's secondary sites use the training signals to determine the "spectral response" of the paths between the primary and secondary sites. DISH-1010 at 7:32-42. Based on the "spectral response" of the channel, i.e., the response measured on the carriers of that channel, each secondary site determines a bit-loading table that is provided to the primary site and used to determine a "lowest common denominator (LCD) bit loading table" for the network. See DISH-1010 at 7:32-50. Grube's Figure 14 presents a flowchart showing that training signals are transmitted from the primary to secondary sites (step 260), ultimately to determine bit-loading information:



GRUBE FIGURE 14

120. Grube explains that these training signals are sent from a primary site to secondary sites (i.e., from a transmitting node to a sub-plurality of receiving nodes). DISH-1010 at 15:34-16:10 ("At step 260, the primary site transmits a first training signal to all secondary sites."). Given that Grube's network includes both primary and secondary sites, the secondary sites are a sub-plurality of nodes in the

network. Further, by supplying the training signals to all secondary sites, a POSITA would have understood that the training signals are also sent to a sub-plurality of the secondary sites. DISH-1010 at 15:34-16:10.

121. Additionally, in an alternative embodiment, Grube's system identifies targeted secondary sites associated with subscribers and transmits just to that sub-plurality of targeted secondary sites. See DISH-1010 at 29:27-53.

122. Grube further teaches that the training signals are used to determine a spectral response, and ultimately, a bit-loading table based on the spectral response. DISH-1010 at 15:38-16:6. In other words, Grube's training signals are used for the purpose of characterizing the transmission paths in the network and determining the modulation schemes to use on those paths. See *also* §§VII.B-VII.C. It is my opinion that a POSITA would have therefore understood that Grube's "training signal" corresponds to the '759 patent's "probe signal." In particular, the '759 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 1110." DISH-1001 at 10:58-11:5. As I noted above, Grube transmits multiple training signals to secondary sites, for the same purpose of characterizing a transmission path and determining a bit-loading modulation scheme.

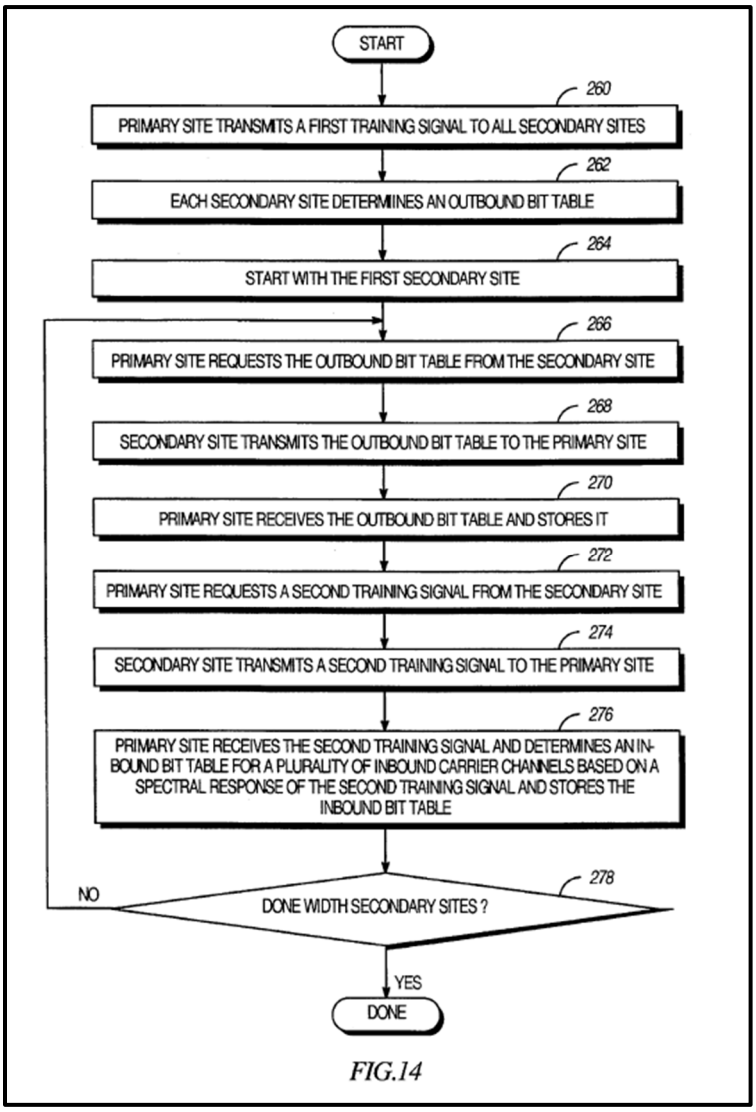
123. As a result, it is my opinion that the Carhart-Grube combination renders this limitation obvious.

3. Element 1b

[1b] receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node; and

124. It is my opinion that the Carhart-Grube combination renders this limitation obvious because, in my opinion, Grube discloses this limitation to a POSITA.

125. Grube discloses that the primary site receives responses to the training probe that include bit-loading information, which discloses element 1b's "bit-loading modulation scheme" (as I discuss in greater detail below). DISH-1010 at 7:32-42, 13:45-61, 16:11-23. After Grube's primary site sends a training signal, the secondary sites generate bit-loading information and send that information back to the primary site. DISH-1010 at 7:32-42, 13:45-61, 16:11-23. For example, Figure 14 of Grube, below, "illustrates a logic diagram that the primary site may utilize to determine the inbound bit loading information and the outbound bit loading information." DISH-1010 at 15:34-36.

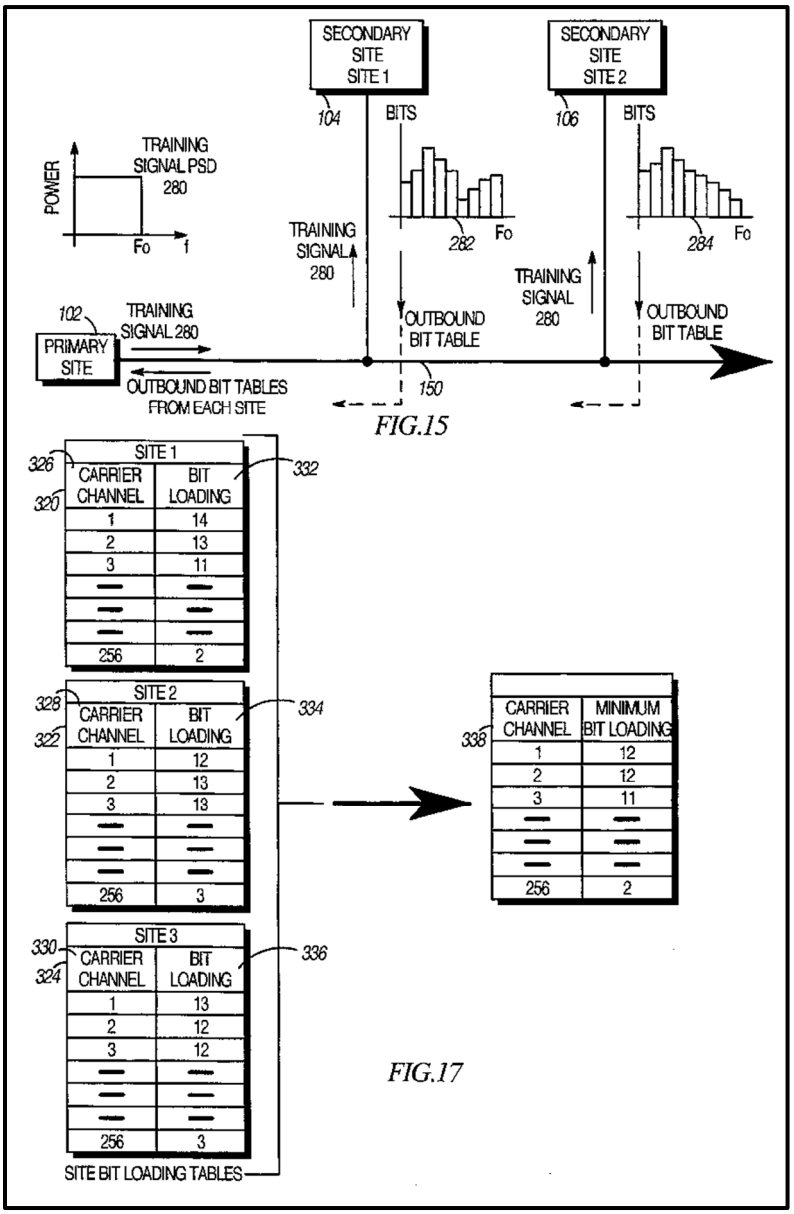


GRUBE FIGURE 14

126. In discussing steps 264-274, Grube explains that the secondary sites send response signals including bit-loading modulation scheme information. DISH-1010 at 16:11-34 ("[T]he primary site sends a request message to the secondary site wherein . . . the secondary site responds with its bit loading table."). As I discussed at element [1a], because each secondary site provides a response signal

to the primary site, a POSITA would understand that the primary site receives response signals from a sub-plurality of nodes.

127. For each response signal, the secondary site determines the bit-loading information for the carrier channel it utilizes to communicate with the primary site and includes the determined bit-loading information in its response. DISH-1010 at 15:60-16:17 ("the secondary site can then calculate the bit loading"). As I explain below, a POSITA would have understood that the bit-loading tables, when read in conjunction with the corresponding discussion in the specification, disclose a constellation encoding scheme (i.e., a "bit-loading modulation scheme"), e.g., QAM orders. DISH-1010 at 3:51-53 ("The bit loading table includes, for each carrier channel, a number of bits that the carrier channel can support."), 25:17-49, 51:43-61, Fig. 51. For example, Figures 15 and 17 of Grube provide exemplary bit-loading tables received from multiple secondary sites. As shown, for each carrier channel, the secondary site determines a bit-loading field indicating "a number of bits that the carrier channel can support." DISH-1010 at 3:51-53.



GRUBE FIGURES 15 AND 17

Likewise, Figure 51 of Grube depicts using 16-QAM:

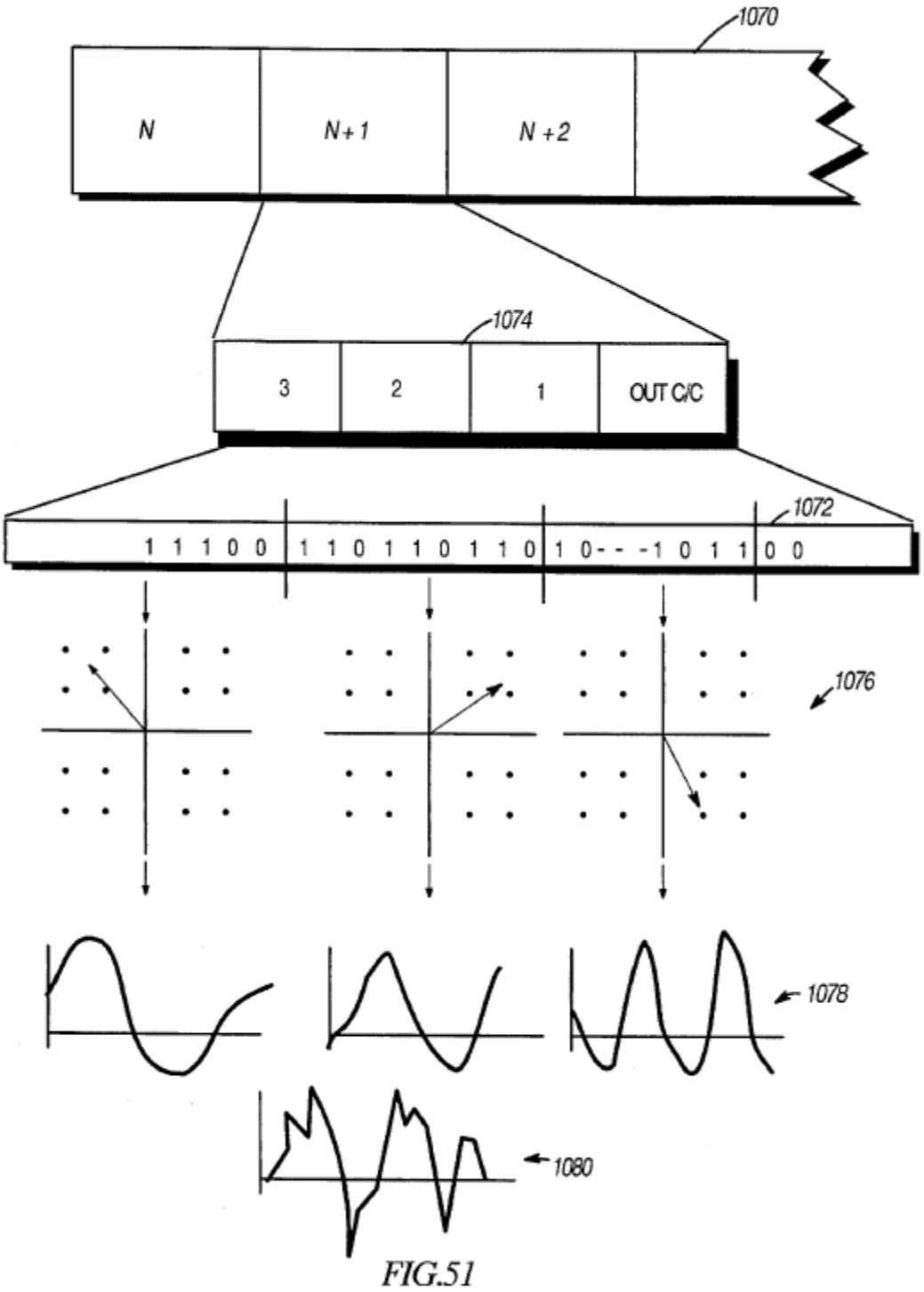


FIG.51

GRUBE FIGURE 51

DISH-1010 at 51:62-52:6.

128. It is my opinion that a POSITA would have understood that Grube's bit-loading table and accompanying explanations in the specification disclose a modulation scheme that is compatible with the channel between that secondary site and primary site. Like the '759 patent, Grube discloses using QAM as the modulation scheme. See DISH-1001 at 7:19-30; DISH-1010 at 3:34-42, 34:45-52, 51:43-52:6 and FIG. 51 (showing a 16-QAM constellation diagram). Grube explains that the "bit loading table includes, for each carrier channel, a number of bits that the carrier channel can support." DISH-1010 at 3:51-53. Grube also explains that "[t]he bit loading of a carrier channel indicates the number of constellation points" associated with that carrier channel. DISH-1010 at 51:51-54.[6] Specifically, Grube explains that the relationship between the number of bits supported by a carrier (n) and the modulation scheme, which equals the number of points in the constellation grid, x, is x-QAM = 2^n. DISH-1010 at 51:52-61 (". . . For example; if the bit loading of a carrier channel is 2, the number of constellation points is 4 (2^2). . . ."). As another example, a POSITA would have understood that, if the number of bits supported by a carrier is 6, the modulation scheme to be used

[6] I note that a "constellation point" refers to each point on a QAM grid, like the ones shown in Grube (DISH-1010, FIG. 51), Hostetter (DISH-1029, FIGs. 1F and 4C), and Hughes-Hartogs (DISH-1026, FIGs. 2 and 5). A constellation point represents a different combination of amplitude and phase shift of the carrier. The number of points on a given QAM grid represents the number of bits that each symbol can carry.

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-1010 at 3:34-35.

129. As I explained previously, in systems like Grube's 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. Hostetter (DISH-1029) illustrates the concept. In particular, Hostetter Figures 1F and 4C graphically depict the number of constellation points used for a given QAM order, namely 64-QAM and 16-QAM:

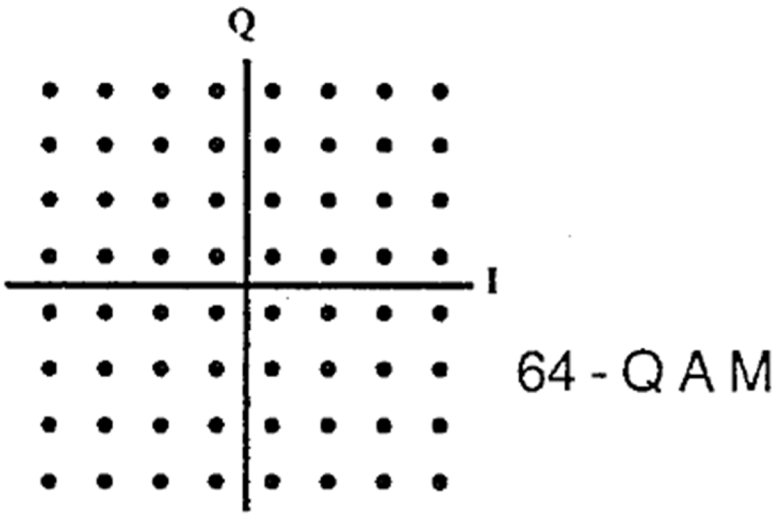
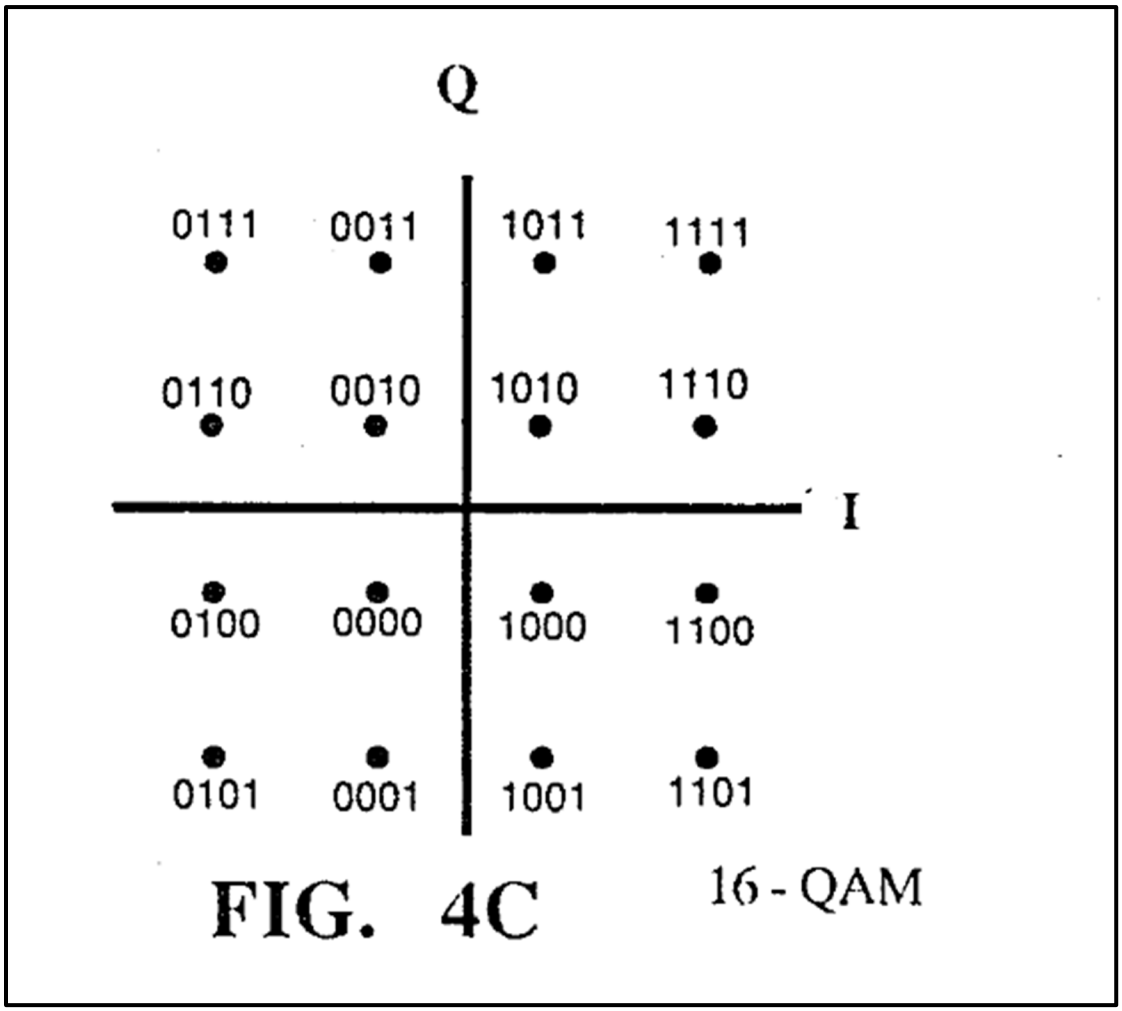


FIG. 1F

HOSTETTER FIGURE 1F



HOSTETTER FIGURE 4C

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

130. Thus, it is my opinion that in Carhart-Grube, a POSITA would understand that Grube discloses using QAM modulation schemes, and it also discloses the '759 patent's claimed common bit-loading approach. In the event that the Patent Owner argues that Grube does not explicitly disclose sending a response signal that "includes a bit-loading modulation scheme," and the Board agrees, it is my opinion that a POSITA would have found selecting bit-loading modulation schemes from Grube's bit-loading information, which is conveyed on a channel-by-channel basis, an obvious and ordinary endeavor. See DISH-1010 at 15:51-16:49. A POSITA would have found this selection obvious because the bit-loading information for a given carrier channel indicates the modulation scheme to use (as explained in paragraph 128 above).

131. 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-1010 at 16:11-23. Grube repeats this process for every secondary site in the network (steps 268 and 278). DISH-1010 at 16:20-24, 16:42-49.

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 30 above).

132. It is my opinion that if one were to argue that Grube does not disclose the claimed "bit-loading modulation scheme," a POSITA would have understood such a "bit-loading modulation scheme" to have been obvious in view of the Grube-Carhart combination. Specifically, a POSITA would have understood that including a modulation scheme in the Grube-Carhart system would allow the system to improve the efficiency, e.g., maximize the efficiency, of its signal transmissions. For example, the Grube-Carhart system would do so by allocating modulation schemes to carrier channels based on the bit-loading capabilities of those carrier channels. A POSITA would have understood that doing so would enhance signal strength and improve the reception quality of signals transmitted on those carrier channels, particularly those signals that are transmitted over long distances.

133. It is also my opinion that a POSITA would have experienced a reasonable expectation of success in implementing a "bit-loading modulation scheme" in the Grube-Carhart system. As I discussed previously, Grube already disclosed determining "bit loading information" for each carrier channel. A POSITA would

have understood that determining "bit loading information" for each carrier channel discloses a QAM constellation scheme, e.g., a QAM order for each carrier. A POSITA would have understood this to be a combination of prior art elements (modulation scheme; Grube-Carhart's communication system with bit-loading capabilities) according to known methods (implementing a modulation scheme in such a communication system) to yield predictable results (a communication system that uses a bit-loading modulation scheme to regulate signal transmissions).

134. The '759 patent's discussion of response signals, and the role that receiving nodes play in formulating them, is sparse. See DISH-1001 at 11:15-28. There, response signals from the receiving nodes merely "inform[] the transmitting node of the corresponding bit-loaded modulation scheme determined by each of the plurality of receiving nodes." DISH-1001 at 11:21-23. But as I have shown above, Grube's secondary sites do just that.

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

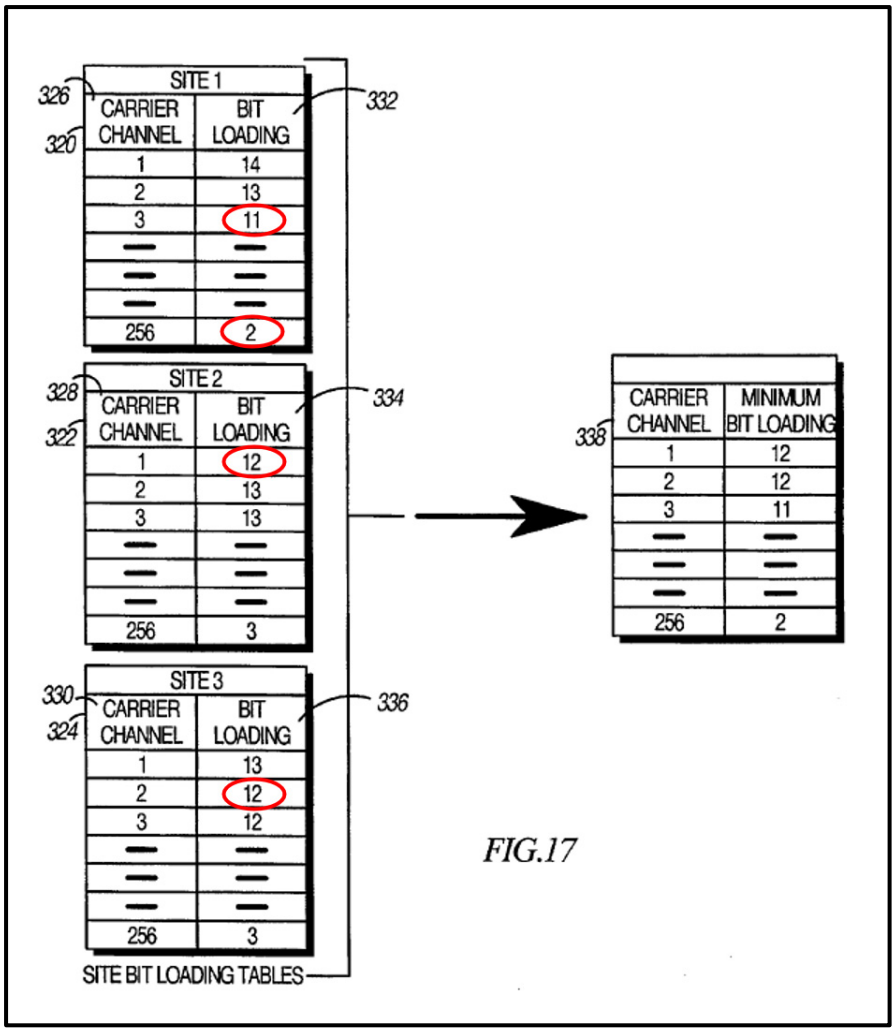
4. Element 1c

> [1c] determining the common bit-loading modulation scheme from the received plurality of response signals;

136. It is my opinion that the Carhart-Grube combination renders this limitation obvious.

137. Grube determines a common bit-loading scheme for communicating between its plurality of sites from the bit-loading information responses transmitted by the secondary sites. DISH-1010 at 7:32-50; 18:16-65. Specifically, Grube determines a common bit-loading scheme by comparing the bit-loading information[7], on a channel-by-channel basis, received from each secondary site. DISH-1010 at 18:24-42. The "common" scheme is determined by selecting the lowest bit-loading value reported for each channel and combining those bit-loading values into a single common bit-loading table. DISH-1010 at 7:42-50; 18:43-55. Figure 17 depicts this process:

[7] Bit-loading information can be compiled in a bit-loading table. Occasionally "bit-loading information" and "bit-loading table" are used interchangeably, but they are not true synonyms.



GRUBE FIGURE 17

138. As shown, the lowest bit-loading value for each channel from the bit-loading tables on the left (red) are combined into the "outbound control channel bit loading table" on the right. For example, in Site 1, channel 3 the bit loading value is 11—this is the lowest bit-loading value for channel 3 amongst Sites 1, 2, and 3—so that value is recorded in the "minimum bit loading" column on the far right of Fig. 17. Likewise, in Site 2, channel 1, the bit loading value is 12—this is the lowest bit-loading value for channel 1 amongst Sites 1, 2, and 3—so "12" is recorded in the

"minimum bit loading" column on the far right of Fig. 17. Grube uses the same process for outbound and inbound bit-loading schemes. *Compare* DISH-1010 at 18:16-65 (establishing an outbound control channel) with DISH-1010 at 19:55-31 (establishing an inbound control channel) and DISH-1010 at 7:66-8:14 ("[T]he primary site retrieves the site bit loading table for each target site and generates a lowest common denominator (LCD) call bit loading table for this particular call."). Further, Grube explains that when updating a common bit-loading table (such as "outbound control channel bit loading table 338"), the lowest bit-loading value for each channel should be used. DISH-1010 at 36:29-46. Grube consistently teaches utilizing the "lowest common denominator (LCD) bit loading table as a compilation of all of the site bit loading tables." See*, e.g.*, DISH-1010 at 8:5-11, 14:11-15, 21:53-58. As discussed at element [1b], the "number of bits that the carrier channel can support" corresponds to a compatible QAM order for each channel. DISH-1010 at 3:51-53. In Figure 17, for instance, channel 256 has a lowest common denominator bit-loading of 2 bits, such that channel 256 would use a 4-QAM order (2^2=4). See element 1b, above.

139. Thus, it is my opinion Grube's method aligns with the '759 patent's claimed approach to generating a "common bit loading modulation scheme." For example, the '759 patent describes "common bit loading" schemes in relation to Figure 10C, which explains that the "carrier number signal values [shown in FIG. 10C] are the

result of comparing the carrier number signals from the AB channel in FIG. 10A and the corresponding carrier number signals from the AC channel in FIG. 10B and **choosing the lowest corresponding modulation value** for each carrier number." DISH-1001 at 10:49-53, 6:65-7:5.

140. To the extent one might argue that Grube does not disclose performing operations on a "bit-loading modulation scheme," it is my opinion that a POSITA would have understood that it would have been obvious to include such a "scheme" in Grube-Carhart as I discussed above. See element [1b], above.

141. As a result, it is my opinion that the Carhart-Grube combination renders this limitation obvious.

5. Element 1d

> [1d] receiving the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission;

142. It is my opinion that my opinion that the Carhart-Grube combination renders this limitation obvious.

143. Grube discloses that its secondary sites (i.e., receiving nodes) each receive a training signal (i.e., a probe signal) through a transmission path (i.e., a "channel path of transmission"). See element 1b, above; DISH-1010 at 16:11-50.

144. As a result, it is my opinion that the Carhart-Grube combination renders this limitation obvious.

6. Element 1e

> [1e] determining the transmission characteristics of the channel path at the one receiving node; and

145. It is my opinion that the Carhart-Grube combination renders this limitation obvious.

146. Grube discloses that its secondary sites each determine the transmission characteristics of a transmission path. Specifically, Grube explains that a secondary site determines a spectral response (one type of a transmission characteristic) for each carrier by comparing a received signal against the known magnitude and phase of the signal that was sent on that carrier. DISH-1010 at 3:43-53, 7:32-41, 15:51-16:10, FIG. 5. The observed spectral response is then used to determine how many bits each carrier on a transmission path can handle. DISH-1010 at 15:65-16:1, 16:61-17:4. The spectral response of the carriers in a transmission path includes the response of each carrier in that path (transmission characteristic). DISH-1010 at 15:65-16:1, 16:61-17:4. The transmission characteristics of the carriers in sum are the "transmission characteristics of the channel path."

147. If the Patent Owner argues that element [1e] requires determining multiple characteristics, I note that the references I have discussed in my declaration

disclose multiple characteristics in addition to Grube's spectral response, including SNR, BER, and PER.

148. As a result, it is my opinion that the Carhart-Grube combination renders this limitation obvious.

7. Element 1f

> [1f] transmitting a response signal from the one receiving node to the transmitting node,

149. It is my opinion that the Carhart-Grube combination renders this limitation obvious.

150. As I explained under element 1b, in the Carhart-Grube combination, Grube's secondary sites transmit a response signal to the primary site. See element 1b, above; DISH-1010 at 16:11-38 ("[T]he primary site sends a request message to the secondary site wherein . . . the secondary site responds with its bit loading table.").

151. As a result, it is my opinion that the Carhart-Grube combination renders this limitation obvious.

8. Element 1g

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

152. It is my opinion that the Carhart-Grube combination renders this limitation obvious.

153. As I explained previously in paragraph 105, a POSITA would have understood that Grube's "spectral response" is a measure of a transmission characteristic of a channel. Grube discloses determining a spectral response (i.e., transmission characteristics) of a training signal (i.e., probe signal) at a secondary site, and one way to do so is by measuring the SNR of the training signal. It is my opinion that a POSITA would have understood SNR as one of a number of measurable characteristics of the training signal, as shown by Shibutani (and Cai as discussed in Ground 3 below, and Heath as discussed in paragraph 207 below). DISH-1010 at 15:51-16:50; DISH-1012 at ¶ 46 (Shibutani explains that "[t]hose skilled in the art will appreciate that the channel condition detector 157 may measure other channel condition indicators, such as signal to noise ratio (SNR), signal to noise and interference ratio (SNIR) and signal energy to noise ratio (E/N). Alternatively, an error rate, such as a frame error rate (FER) or a bet [*sic*, bit] error rate (BER), may be used as channel condition information.").

154. Specifically, SNR refers to the strength of a signal relative to the strength of the interference (background noise). See DISH-1017 (Newton's Dictionary defines SNR as "[t]he ratio of the usable signal being transmitted to the noise or undesired signal. . . . This ratio is a measure of the quality of a transmission."); DISH-1018 (Sharda Textbook defines SNR as "[t]he relative amplitude of the signal to that of the noise present in the system. Given a signal of strength S that

includes noise of strength N: SNR = 20 $\log_{10}$ (S/N)dB."). To calculate the SNR of the training signal, the strength of the training signal is obtained from the training signal's spectral response. DISH-1018.

155. I have reviewed Ms. Munford's declaration (DISH-1015). I understand that Ms. Munford's declaration establishes that the references discussed were available to the public before May 2001.

156. As I explained under element 1a, Grube's secondary sites receive a training signal from the primary site. See element 1a, above; DISH-1010 at 15:51-53. The secondary site measures a spectral response of the received training signal by comparing the received signal to a known signal. DISH-1010 at 15:51-16:10. The secondary site then calculates the bit-loading information for a carrier channel based on that channel's spectral response (which corresponds to aspects of elements 1b, 2b, and 3b). DISH-1010 at 15:51-16:10. Grube notes that channels with better transmission characteristics can support higher bit-loading capabilities. See DISH-1010 at 16:61-17:4. Thus, Grube measures the characteristics of a received probe signal to determine the channel's transmission characteristics. DISH-1010 at 15:51-16:10.

157. While Grube determines its bit-loading tables based on a spectral response to a training signal, Grube does not limit the metrics that may be used to determine the channel path transmission characteristics. Indeed, a POSITA would have

known that numerous metrics for measuring the characteristics of a communication channel were known at the time, and that any one of which would be adequate to determine Grube's bit-loading table. See DISH-1011 at 14 ("[d]etermination of a channel response, multipath, and SNR profile from a known signal is well known in the art.").

158. By way of example, Levin demonstrates how a POSITA would use channel analysis (e.g., what the '759 patent refers to as transmission characteristics) to construct a bit-loading table. DISH-1027 (Levin). Specifically, Levin explains that SNR in a channel can be measured, and then an SNR bit-capacity reference table is used to determine the maximum number of bits that can be used on a given channel. DISH-1027 at 3:15-35.

159. Because these metrics are well known, a POSITA would be able to select a suitable metric and use it to determine the "transmission characteristics" associated with each channel (which would then be used to determine bit loading for that channel). To be clear, the transmission characteristics are determined by measurement, and potential subsequent calculation/processing.

160. Similarly, during prosecution of the '759 patent, the Examiner found that Ling and Gesbert disclosed measuring SNR, BER, and PER to determine the transmission characteristics of the channel and rejected all claims directed to these concepts. See DISH-1005, 101-02; DISH-1006; DISH-1008. Rather than contest

these findings, the Applicant canceled claims directed solely to SNR, BER, and PER and incorporated those limitations into other claims. DISH-1005, 55-78.

161. Other prior art to the ’759 patent similarly acknowledged the use of SNR to determine channel characteristics during the training of a network. Shibutani discloses several well-known metrics that a POSITA would use to determine channel characteristics. DISH-1012 at ¶ 46. Specifically, Shibutani discloses sending “pilot symbols,” which correspond to the “probe” and “training” signals of the ’759 patent and Grube, to a channel condition detector that “measures a channel condition, such as an SIR (signal to interference ratio), based on the received the pilot symbol.” DISH-1012 at ¶ 46. Shibutani adds that “[t]hose skilled in the art will appreciate that the channel condition detector 157 may measure other channel condition indicators, such as signal to noise ratio (SNR).” DISH-1012 at ¶ 46.

162. As with Grube’s spectral response determination, Shibutani’s access terminals (AT), which are equivalent of Grube’s secondary sites and the ’759 patent’s receiving nodes, send the “channel condition information” to an access point (AP), which is equivalent to Grube’s primary site and the ’759 patent’s transmitting node. DISH-1012 at ¶ 46. Shibutani’s system then uses the channel condition to determine a data rate for the AT, which involves selecting a modulation scheme. DISH-1012 at ¶ 46 (Table 2 depicting modulation schemes).

In other words, Shibutani not only utilizes the same techniques as Grube and the ’759 patent, but also discloses in greater detail the specific metrics used to determine the transmission characteristics of the channel path.

163. As I explained at §VII.C above, the ’834 priority-application admits that determining channel characteristics by measuring SNR was well-known in the art. It therefore would have been obvious to a POSITA in view of Grube to determine the channel characteristics by measuring SNR, as further exemplified by Shibutani.

164. As a result, it is my opinion that the Carhart-Grube combination renders this limitation obvious.

9. Element 1h

> [1h] wherein determining a common bit-loading modulation scheme includes:

165. It is my opinion that the Carhart-Grube combination renders this limitation obvious.

166. As I noted above in [1c], Grube discloses or at least renders obvious “determining a common bit-loading modulation scheme.” The implementations of this determination in Carhart-Grube are described in more detail below with respect to [1i] and [1j].

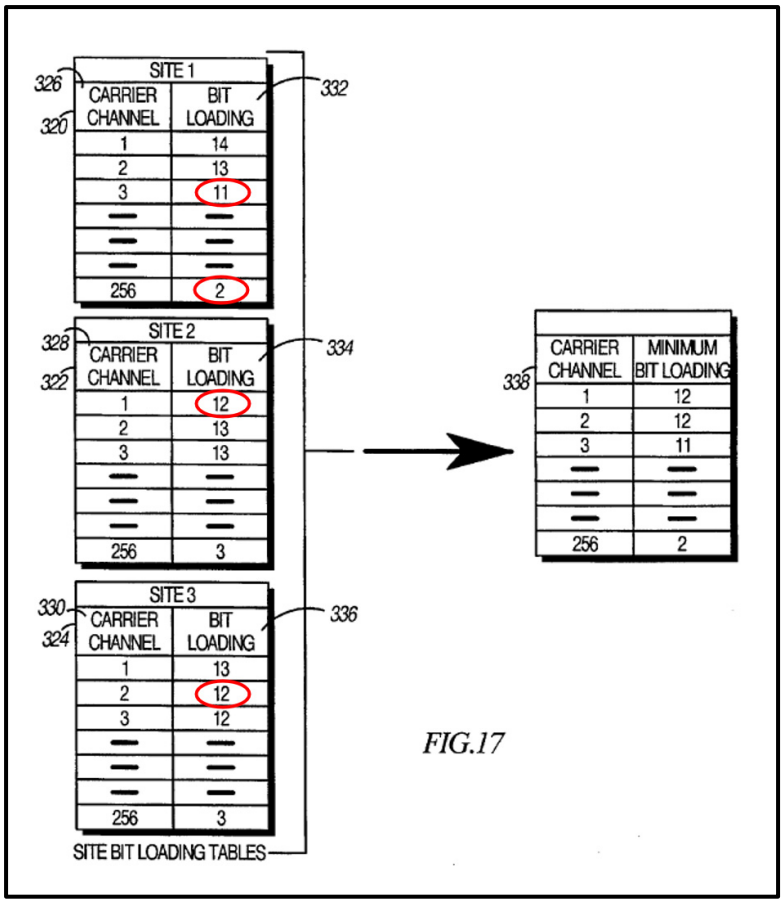
167. As a result, it is my opinion that the Carhart-Grube combination renders this limitation obvious.

10. Element 1i

> [1i] comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and

168. It is my opinion that the Carhart-Grube combination renders this limitation obvious.

169. As I discussed above, in the Carhart-Grube combination, Grube's primary site receives a plurality of bit-loading schemes from its secondary sites. See element 1b, above; DISH-1010 at 18:16-65. Grube's primary site then compares the bit-loading information received from the secondary sites. DISH-1010 at 18:24-26 ("The outbound control channel bit loading table 338 is generated **by comparing** the bit loading, on a carder [sic] channel by carder [sic] channel basis, of all of the site bit loading tables."). Figure 17 depicts comparing bit-loading information from secondary sites. As shown, Grube's method compares the values from the bit-loading tables from the secondary sites (left)—the large arrow in the middle of the figure depicts the comparison—and the results of the comparison are incorporated into the "outbound control channel bit-loading table 338" (right):



GRUBE FIGURE 17

170. As I explained with respect to element [1b], to a POSITA, the bit-loading tables disclose or at least render obvious a constellation encoding scheme, e.g., QAM. DISH-1010 at 3:51-53, 25:17-49. Specifically, the bit-loading of each channel indicates the "number of bits that the carrier channel can support," which corresponds to a compatible QAM order for that channel (particularly under the *x*-QAM = 2^n formula). DISH-1010 at 3:51-53. Thus, to be clear, a POSITA would have understood that Grube's comparison of bit-loading values compares, and thus discloses, "a plurality of bit-loading modulation schemes" as element 1i recites.

171. To the extent one might argue that Grube does not disclose performing operations on a "bit-loading modulation scheme," a POSITA would have understood that it would have been obvious to include such a "scheme" in Grube-Carhart as discussed previously. See element [1b], above.

172. As a result, it is my opinion that the Carhart-Grube combination renders this limitation obvious.

11. Element 1j

> [1j] determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.

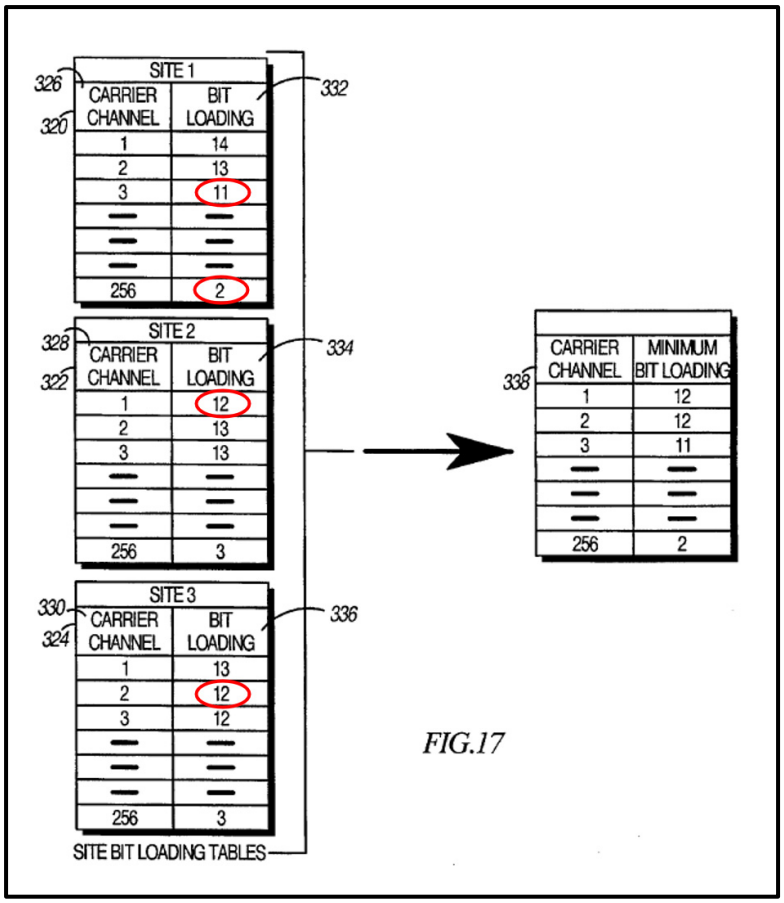
173. It is my opinion that the Carhart-Grube combination renders this limitation obvious.

174. Element 1j merely reiterates, with extremely minor differences in word choice, the substantive concepts that have already been presented in elements 1b, 1c, and 1i.

175. As I discussed above, in the Carhart-Grube combination, Grube's primary site determines a common bit-loading scheme in response to comparing the bit-loading information it receives from the secondary sites. See elements 1b, 1c, and 1i, above. Grube's primary site determines the common bit-loading modulation scheme by comparing the schemes each channel can use and selecting the lowest common denominator scheme that all secondary sites can use. DISH-1010 at

18:16-65, Fig. 17. Put differently, Grube selects the fastest scheme that all the secondary schemes can use on a given channel—and the fastest scheme that all of the secondary sites can use on a given channel is dictated by the worst-performing secondary site. Thus, from each of the bit-loading tables received from the sites, the lowest common denominator bit-loading value is chosen for a particular carrier channel, and that lowest-common value is inserted into the common bit-loading table to determine bit-loading values to be used on each carrier channel.

176. Again, the result of the comparison is shown in table 338 on the right side of Figure 17. DISH-1010 at FIG. 17 (the annotated values from the bit-loading tables on the left are incorporated into the "outbound control channel bit loading table" on the right).



GRUBE FIGURE 17

177. Grube explains the comparison process shown in Figure 17 as follows:

> The outbound control channel bit loading table 338 is generated by comparing the bit loading, on a carder [sic] channel by carder [sic] channel basis, of all of the site bit loading tables. Thus, to begin producing the outbound control channel bit loading table 338, the bit loading table for the first site 320 is copied as the outbound control channel bit loading table 338. Next, a carrier channel by carrier channel comparison is made between the information stored in the outbound control channel bit loading table 338 and the outbound bit loading table of the remaining two sites 322 324. Thus, comparing the bit loading of carder [sic] channel 1 of site two with the bit loading information of carrier channel 1 in the outbound control channel bit loading table 338, it is seen that the bit loading of carrier channel 1 in site two is less than the bit loading of channel 1 in site one. Thus, the outbound control channel bit loading table 338 is updated with the lessor of the two bit

> loading values, or in this case, 12 bits as indicated in the site bit loading table 322 of site two.

DISH-1010 at 18:24-42.

178. As I explained with respect to element [1b], to a POSITA, the bit-loading tables disclose a constellation encoding scheme, e.g., QAM. DISH-1010 at 3:51-53, 25:17-49. Specifically, the bit-loading of each channel indicates the "number of bits that the carrier channel can support," which corresponds to a compatible QAM order for that channel (particularly under the x-QAM = 2^n formula). DISH-1010 at 3:51-53 ("The bit loading table includes, for each carrier channel, a number of bits that the carrier channel can support."), 25:17-49.

179. The '759 patent uses the same approach Grube discloses—choosing the "lessor" of two values—to determine a common bit-loading scheme. For example, compare DISH-1010 at 18:24-42 with DISH-1001 at 10:49-53 (the "carrier number signal values [shown in FIG. 10C] are the result of comparing the carrier number signals from the AB channel in FIG. 10A and the corresponding carrier number signals from the AC channel in FIG. 10B and **choosing the lowest corresponding modulation value** for each carrier number.").

180. To the extent one might argue Grube does not disclose performing operations on a "bit-loading modulation scheme," a POSITA would have

understood that it would have been obvious to include such a "scheme" in Grube-Carhart. See element [1b], above.

181. As a result, it is my opinion that the Carhart-Grube combination renders this limitation obvious.

182. In sum, it is my opinion that the Carhart-Grube combination renders obvious claim 1.

E. Claim 2

1. Preamble and Elements 2a-2e

> [2pre] A method for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in a broadband cable network ("BCN"), the method comprising:
>
> [2a] transmitting a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes;
>
> [2b] receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node;
>
> [2c] determining the common bit-loading modulation scheme from the received plurality of response signals;
>
> [2d] receiving the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission;
>
> [2e] determining the transmission characteristics of the channel path at the one receiving node;

183. I have been asked to consider whether the Carhart-Grube combination renders obvious the preamble of claim 2, but I have not been asked to render an

opinion on whether the preamble should be considered a limitation. If the preamble of claim 2 is deemed to be a limitation, it is my opinion that the Carhart-Grube combination renders this limitation obvious.

184. It is my opinion that the Carhart-Grube combination also renders the other limitations listed above obvious.

185. The preamble and elements 2a-2e are verbatim copies of the preamble of claim 1 and elements 1a-1e. Further, neither the additional elements of claim 2, nor any other claim, impart any substantive nuance upon the preamble of claim 2 and elements 2a-2e. Thus, in the Carhart-Grube combination, Carhart and Grube render obvious the preamble of claim 2 and elements 2a-2e for the reasons I provided above. See the preamble and elements 1a-1e, above.

2. Element 2f

> [2f] transmitting a response signal from the one receiving node to the transmitting node, wherein the transmission characteristics of the channel path are determined by measuring the bit-error rate ("BER") characteristics of the received probe signal at the one receiving node and

186. It is my opinion that the Carhart-Grube combination renders this limitation obvious.

187. The first phrase in element 2f—"transmitting a response signal from the one receiving node to the transmitting node"—is a verbatim copy from element 1f. Neither the additional elements of claim 2, nor any other claim, impart any

substantive nuance upon this phrase. Thus, in the Carhart-Grube combination, Grube discloses this aspect of element 2f for the reasons provided above. See element 1f, above.

188. The remainder of element 2f differs from element 1g only in that element 2f determines transmission characteristics by measuring BER rather than SNR. BER refers to the total number bits received in error in relation to the total number of bits transmitted. DISH-1017 (Netwon) (defining BER as "[t]he percentage of received bits in error compared to the total number of bits received"); DISH-1018 (Sharda). BER, like SNR, was well-known in the art as a channel assessment technique. DISH-1017 (Netwon); DISH-1018 (Sharda); DISH-1012 at ¶ 46; DISH-1014 at 3:16-27. As such, measuring BER to determine the characteristics of the transmission path represents a simple choice between well-known techniques, and the water-filling techniques discussed above with respect to Hughes-Hartogs and Tzannes also apply to using BER. See §VII.C (Motivation to Combine) above; DISH-1028 (Tzannes) at 1:33-58, DISH-1028 at 6:28-39 (explaining that the relationship between BER and SNR is well known and that BER-SNR concordance tables exist).

189. For example, during prosecution of the '759 patent, the Examiner found that Ling and Gesbert disclosed measuring SNR, BER, and PER to determine the transmission characteristics of the channel and rejected all claims directed to

specific concepts. See DISH-1005, 101-02; DISH-1006; DISH-1008. Likewise, Shibutani discloses several metrics for measuring channel quality (i.e., "transmission characteristics of the channel path") that would have been well known to a POSITA, including BER. See Element 1g, above; DISH-1012 at ¶¶ 46 ("an error rate, such as a frame error rate (FER) or a [bit] error rate (BER), may be used as channel condition information"), 64. Similar to element 1g, Shibutani's discussion of BER uses the same basic technique described in Grube and the '759 patent—measuring channel condition to ensure service quality—and describes BER as one of a finite number of suitable measurement techniques for measuring the channel condition.

190. As a result, it is my opinion that the Carhart-Grube combination renders this limitation obvious.

3. Element 2g

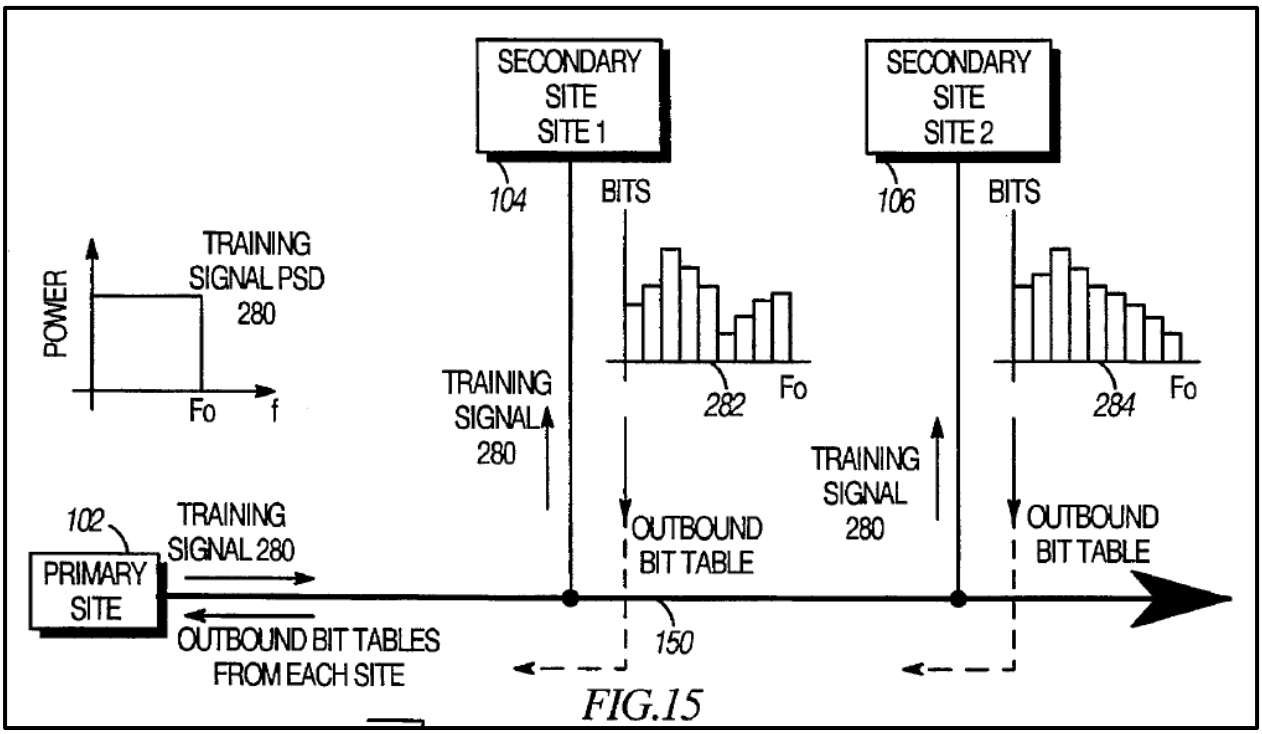
> [2g] generating the response signal, wherein the response signal utilizes a bit-loading modulation scheme that is generated by the one receiving node in response to determining the transmission characteristics of the channel path,

191. It is my opinion that the Carhart-Grube combination renders this limitation obvious.

192. In the Carhart-Grube combination, Grube's secondary sites generate response signals, which include bit-loading information, based on the

characteristics of the paths that connect the primary site and each secondary site. DISH-1010 at 7:32-42, 13:45-61, 16:11-23. Grube's secondary devices do so after measuring the spectral response of the training signal, i.e., "in response to determining the transmission characteristics of the channel path." DISH-1010 at 7:32-42, 13:45-61, 16:11-23.

193. Grube discloses a method "for obtaining bit loading information." DISH-1010 at 4:61-64, FIG. 15. Figure 15 "illustrates the process of obtaining the outbound bit loading tables from a plurality of secondary sites." DISH-1010 at 16:51-52.



GRUBE FIGURE 15

194. Grube explains that:

> The first secondary site 104, upon receiving the training signal, **generates a spectral response** for each of the sinusoidal signals of the training signal 280. **From the spectral response, the secondary site determines a bit loading** for each of the carrier channel to produce a bit loading table 282.

DISH-1010 at 16:61-65. Thus, Grube's secondary sites, which correspond to the claimed receiving nodes, generate a response signal that includes bit-loading information in response to determining the transmission characteristics of a channel. DISH-1010 at 16:61-65. Bit-loading information determined at a secondary site is transmitted "back to the primary site 102." See DISH-1010 at 17:5-8. A POSITA would have understood and found obvious that Grube's response signal from the secondary sites to the primary site would have utilized the bit-loading determine for the channel by including the bit-loading information in the response signal. Specifically, Grube's secondary sites analyze the training signal to determine the channel's capability to carry information. A POSITA would have found it obvious for the response signal from the secondary sites to the primary sites to use the bit-loading determined for the channel, to improve the primary site's ability to receive the bit-loading table information included in the response.

195. As a result, it is my opinion that the Carhart-Grube combination renders this limitation obvious.

4. Elements 2h-2j

> [2h] wherein determining a common bit-loading modulation scheme includes:
>
> [2i] comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and
>
> [2j] determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.

196. It is my opinion that the Carhart-Grube combination renders these limitations obvious.

197. Elements 2h-2j are verbatim copies of elements 1h-1j. Further, neither the additional elements of claim 2, nor any other claim, impart any substantive nuance upon elements 2h-2j. Thus, in the Carhart-Grube combination, Grube discloses or renders obvious elements 2h-2j for the reasons provided above. See elements 1h-1j, above.

198. As a result, it is my opinion that the Carhart-Grube combination renders this limitation obvious.

199. In sum, it is my opinion that the Carhart-Grube combination renders obvious claim 2.

F. Claim 3

1. Preamble and Elements 3a-3g

[3pre] A method for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in a broadband cable network ("BCN"), the method comprising:

[3a] transmitting a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes;

[3b] receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node; and

[3c] determining the common bit-loading modulation scheme from the received plurality of response signals;

[3d] receiving the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission;

[3e] determining the transmission characteristics of the channel path at the one receiving node; and

[3f] transmitting a response signal from the one receiving node to the transmitting node,

[3g] wherein the transmission characteristics of the channel path are determined by measuring the signal-to-noise ("SNR") characteristics of the received probe signal at the one receiving node,

200. I have been asked to consider whether the Carhart-Grube combination renders obvious the preamble of claim 3, but I have not been asked to render an opinion on whether the preamble should be considered a limitation. If the preamble of claim 3 is deemed to be a limitation, it is my opinion that the Carhart-Grube combination renders this limitation obvious.

201. It is my opinion that the Carhart-Grube combination also renders the other limitations obvious.

202. Elements 3pre-3g are verbatim copies of elements 1pre-1g. Further, neither the additional elements of claim 3, nor any other claim, impart any substantive nuance upon these elements. Thus, in the Carhart-Grube combination, Carhart and Grube, in light of the knowledge of a POSITA (as shown, for example, by Shibutani), render obvious elements 3pre-3g for the reasons I provided above. See elements 1pre-1g, above.

2. Element 3h

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

203. It is my opinion that the Carhart-Grube combination renders this limitation obvious.

204. Element 3h differs from elements 1g and 2f in that it measures PER rather than SNR or BER. PER measures the number of packets received with errors in relation to the total number of packets transmitted. DISH-1018 (Sharda).

205. Is it my opinion that there would be no conflict between implementing both elements 3g and 3h, as multiple measurements of the channel characteristics would be able to be used to determine Grube's bit-loading information.

206. PER, like SNR and BER, was well-known in the art such that measuring PER to determine the characteristics of the transmission path represents a simple choice between well-known techniques. DISH-1014 (Flammer) at 3:16-31. Because these metrics are well known for determining transmission characteristics, a POSITA would be able to choose a suitable metric and use it to determine transmission characteristics (and a bit-loading scheme), by using, for example, a water-filling algorithm like Hughes-Hartogs's. See DISH-1018 (Sharda); DISH-1017 (Newton's); § VII.C (Motivation to Combine); DISH-1026 (Hughes-Hartogs) at 8:9-9:38, 10:31-11:20, 9:63-68.

207. By way of example, U.S. Patent No. 6,298,092 ("Heath"), with Robert W. Health, Jr. and others as the inventors, shows that 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 and to select a mapping (modulation) scheme. DISH-1030 (Heath) at 3:46-4:8. While Heath focuses on wireless communication, its principles apply to wired medium as well. DISH-1030 at 1:12-15; 16:49-52 ("Communication systems employing the metrics of the invention to select applied mapping schemes from proposed mapping schemes can be based on any multiple access technique including TDMA, FDMA, CDMA and OFDMA."). Heath reflects a POSITA's

understanding that SNR, BER, and PER were known concepts (they are "spectral responses" in Grube's vocabulary) and that these concepts can be used to select a modulation scheme.

208. Flammer also discloses using PER to characterize a channel. Specifically, Flammer discusses characterizing communication between two nodes with various "performance metric[s]" including "a probability of a packet error in the signal at the receiving node"—i.e., PER. DISH-1014 at 3:20-28. Further, Flammer discloses an "interconnected mesh of data-packet sending and receiving nodes" that each develop "performance metrics between itself and other regularly-linked nodes." DISH-1014 at 4:21-44. Based on the performance metrics—including PER—the nodes "dynamically vary one or more signal characteristics of signals transmitted to other nodes . . . to maintain the highest possible network speed." DISH-1014 at 4:21-44. Thus, like the '759 patent, Flammer measures the "probability of a packet error in the signal" to optimize net throughput on a link, which is consistent with selecting a higher-order QAM. DISH-1014 at 2:64-3:5 ("probability of a packet error in the signal" is discussed at 3:24-26).

209. At bottom, Flammer, like Grube, Shibutani, and the '759 patent, uses channel characterization to ensure reliable communication and optimize throughput on a network. Flammer's disclosure of PER simply reflects one well-

known metric available to determine the transmission characteristics of the channel.

210. As a result, it is my opinion that the Carhart-Grube combination renders this limitation obvious.

3. Elements 3i-3k

> [3i] wherein determining a common bit-loading modulation scheme includes;
>
> [3j] comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and
>
> [3k] determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.

211. It is my opinion that the Carhart-Grube combination renders these limitations obvious.

212. Elements 3i-3k are verbatim copies of elements 1h-1j, respectively. Neither the additional elements of claim 3, nor any other claim, impart any substantive nuance upon these elements. Thus, in the Carhart-Grube combination, Grube discloses or renders obvious elements 3i-3k for the reasons I provided above. See elements 1h-1j, above.

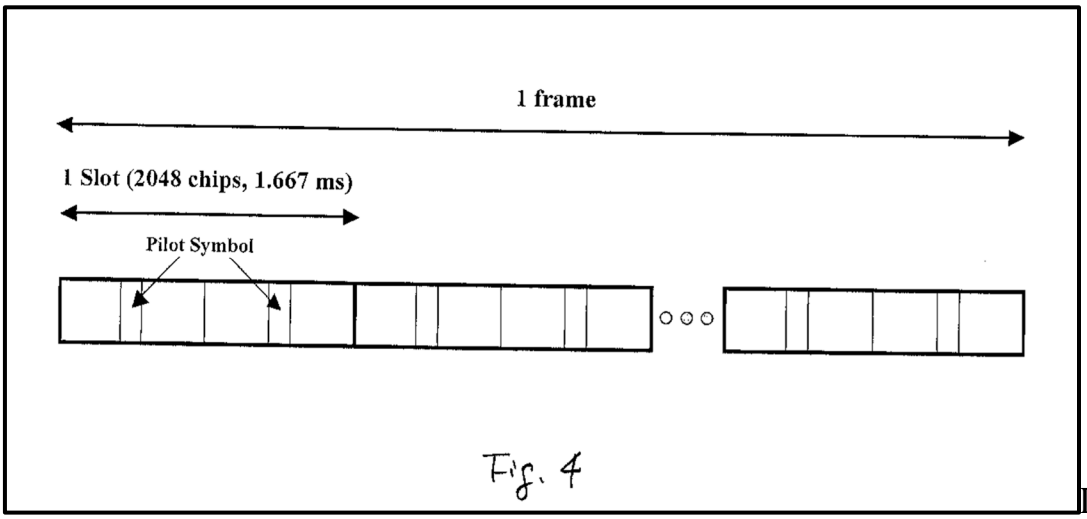
213. In sum, my opinion that the Carhart-Grube combination renders obvious claim 3.

VIII. GROUND 2 – CARHART IN VIEW OF GRUBE AND SHIBUTANI

A. Shibutani (DISH-1012)

214. Shibutani is a U.S. Patent Application Publication entitled "Slot assignment algorithm." DISH-1012 (Face of Publication). It was filed on April 5, 2001 and published on 2003-01-02. DISH-1012 (Face of Publication).

215. Shibutani discloses a method for ensuring access terminals (ATs, cell phones) receive a minimum quality of service from an access point (AP, a base station). DISH-1012 at Abstract. Shibutani, like Grube, involves characterizing channel conditions between primary and secondary sites. DISH-1012 at ¶ 11. To do so, Shibutani's AP partitions a "wireless digital data communication" frame to include multiple slots, including several "pilot symbol" slots. DISH-1012 at ¶¶ 37, 44. An exemplary frame having "pilot symbols" is shown in Figure 4.



DISH-SHIBUTANI FIGURE 4

216. Shibutani explains that its "pilot symbols" may be combined in a frame with user data, or "[w]hen there is no data to be sent, the only transmissions from the AP 140 over the downlink channel are those of the pilot symbols and periodic transmissions of control information." DISH-1012 at ¶ 44.

217. When an AT receives a frame, "the pilot symbols are separated" and "supplied to a channel condition detector 157." DISH-1012 at ¶¶ 45-46. "[T]he channel condition detector 157 measures a channel condition, such as an SIR (signal to interference ratio) based on the received pilot symbol and provides the channel condition information to an AT controller." DISH-1012 at ¶ 46. Shibutani further explains that "[t]hose skilled in the art will appreciate that the channel condition detector 157 may measure other channel condition indicators, such as signal to noise ratio (SNR), signal to noise and interference ratio (SNIR) and signal energy to noise ratio (E/N). Alternatively, an error rate, such as a frame error rate (FER) or a bet [*sic*, bit] error rate (BER), may be used as channel condition information." DISH-1012 at ¶ 46.

218. The channel condition information is used to determine a data rate that the channel can support as well as a corresponding modulation scheme that achieves the data rate. DISH-1012 at ¶¶ 46-47. To do so, Shibutani explains that one of the AT or AP maintains a table like that shown below that maps the channel condition

to a "maximum data rate for the AT, and a combination of coding rate and modulation scheme that achieves the data rate." DISH-1012 at ¶¶ 46-47.

TABLE 2

SIR (dB)	Maximum Data Rates	Modulation Schemes	Coding Rates	DRC
–7	689.4 kbps	QPSK	1/3	1
7–11	1033 kbps	8PSK	1/3	2
11–14	1378 kbps	QPSK	2/3	3
14–16	1378 kbps	16QAM	1/3	4
16–18	2070 kbps	8PSK	2/3	5
18–	2761 kbps	16QAM	2/3	6

SHIBUTANI TABLE 2

219. The coding rate and modulation scheme information is provided to the AP, which uses the determined coding rate and modulation scheme to transmit data to the AT moving forward. For example, in order to deliver data to multiple ATs, the AP groups ATs based on the channel conditions, such as the SNR, BER, FER, or other metrics. DISH-1012 at ¶¶ 11, 46, 48. The channel is then partitioned into slot groups, which are allocated to the access terminal groups. DISH-1012 at ¶¶ 11, 48. For example, "[m]ore slot groups may be allocated to allocated to the receiver groups having receivers with better channel conditions." DISH-1012 at ¶¶ 11, 48.

220. Shibutani explains that its channel characterization techniques can be used in networks having a combination of wired and wireless devices. DISH-1012 at ¶ 37, FIG. 2. For instance, Shibutani describes a network configuration having a number

of access terminals 150 that communicate with a server 120 via the access point 140. DISH-1012 at ¶ 37, FIG. 2. The server 120 communicates with the access point 140 via wired connections to router 130, Internet 110, and router 131. DISH-1012 at ¶ 37, FIG. 2. The access point 140 then communicates wirelessly with the access terminals 150.

221. To summarize, Shibutani discloses a method of ensuring that even poor-performing access terminals can receive service on a network that is serving multiple access terminals. DISH-1012 at Abstract. To facilitate communication, Shibutani discloses adapting data rates "according to the channel condition of the receiver." DISH-1012 at ¶ 15. To adapt and optimize data rates, Shibutani ascertains channel conditions using SNR, FER, or BER. DISH-1012 at ¶ 46. Altogether, this subject matter falls within the field of multiplex communication networking, and a POSITA would understand that Shibutani would have utility in wired communication systems (e.g., BCNs) with multiple secondary sites.

222. Shibutani is also reasonably pertinent to the problems that the '759 patent's inventors faced, i.e., a need for facilitating communication between "a variety of CPEs [(customer premise equipment)]" over a "broadband communication networks utilizing coaxial cable." DISH-1001 at 3:66-67 ("there is a need for a system and method to connect a variety of CPEs into a local network"), 1:40-42 ("The invention relates to broadband communication networks, and in particular to

broadband communication networks utilizing coaxial cable.”). Additionally, Shibutani’s teachings, with respect to using SNR, BER, and FER, are highly pertinent to characterizing the transmission characteristics over a channel path of transmission. This aspect of Shibutani is also highly pertinent to the channel-characterization issues the ’759 patent’s inventors had to resolve. DISH-1001 at 10:66-11:5 (“The receiving node then determines the transmission characteristics of the channel path from the transmitting node to the receiving node in step 1108 and in response to the determined transmission characteristics of the channel path, the receiving node determines a bit-loaded modulation scheme for the transmission characteristics of the channel path in step 1110.”).

B. Motivation to Combine

223. As explained at §VII.C, a POSITA would have been motivated to combine Carhart’s coaxial network with Grube’s method of establishing a common bit-loading modulation scheme for the network to improve network reliability and bandwidth. In particular, Grube’s method of determining channel conditions between its primary and secondary nodes, generating bit-loading tables based on the channel conditions, and determining a common bit-loading table for the network from the individual tables, ensures that devices in the network are able to communicate using the highest bandwidth possible given the network channel conditions. See §VII.C.

224. While Grube discloses one metric for determining the condition of the channel—spectral response—a POSITA would have understood that spectral response is but one way of measuring a channel condition. A POSITA would have understood that there were multiple known ways of measuring a channel condition at the time, each providing different information about the channel and therefore serving a related but distinct purpose.

225. For example, the ’834 priority-application admits that determining “a channel response, multipath, and SNR profile from a known signal is well known in the art.” DISH-1011 at 14. And the Ling and Gesbert references cited during prosecution of the ’759 patent were found to disclose measuring SNR, BER, and PER to determine the transmission characteristics of a channel path. See DISH-1005 at 101-02; DISH-1006; DISH-1008.

226. In Grube, the “spectral response” is determined by transmitting a “training signal” (e.g., a “wide band test signal”) from the primary node/site to a secondary node/site in the network. DISH-1010 at 3:43-53,15:51-16:10, FIG. 5. The secondary node receives the training signal and “analyz[es] each of the plurality of sinusoidal signals of the training signal” to determine the “spectral response.” DISH-1010 at 15:51-16:10. “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." DISH-1010 at 15:51-16:10. Since each of the "plurality of sinusoidal signals of the training signal" corresponds to a particular channel, the spectral response for each signal can be used to determine the bit-loading for the particular channel. DISH-1010 at 15:51-16:10.

227. Thus, Grube's "spectral response" effectively provides a measure of the attenuation and phase shift that results from the transmission path between a primary and secondary site. DISH-1010 at 15:51-16:10. However, a POSITA would have understood that other factors may impact the ability of the channel to reliably transmit data, such as the amount of noise in the channel. Thus, while Grube's "spectral response" may provide an estimate of the ability of the channel to carry a certain amount of data, selecting a bit-loading modulation scheme based on the "spectral response" alone may not ensure reliable transmissions between the primary and secondary nodes—this would prompt a POSITA to use another channel-characterization metric, such as SNR, BER, or PER.

228. Additionally, the spectral analysis proposed by Grube is computationally intensive, requiring a comparison of the magnitude and phase of each sinusoid in the test signal. A POSITA would have therefore understood that the "spectral response" proposed by Grube would impose overhead in terms of processing time,

and require that the secondary nodes have specific processing capabilities for determining the magnitude and phase shifts of each sinusoid.

229. Given the attributes of Grube's "spectral response," a POSITA would have been motivated to substitute or supplement Grube's "spectral response" with additional measurements of the channel condition. For networks with devices that have lower-performing or inexpensive processors, such as those Carhart describes, a POSITA would have been motivated to look for other characterization techniques to reduce computational complexity. Thus, a POSITA would have looked to other references in the art to identify alternative or additional channel condition measurements. Shibutani discloses several of the measurements that would have been known to a POSITA at the time.

230. In particular, Shibutani discloses several "channel condition indicators," including "SIR (signal to interference ratio)," "signal to noise ratio (SNR), signal to noise and interference ratio (SNIR)[,] signal energy to noise ratio (E/N)," and "error rate[s], such as a frame error rate (FER) or a b[i]et error rate (BER)." DISH-1012 at ¶ 46. Each of these measurement techniques was well-known at the time (e.g., before Shibutani published). As I discussed at §VIII.A above, Shibutani uses these measurements to select an optimal modulation scheme for communications between an AP and AT. DISH-1012 at ¶¶ 15, 46-47 (Shibutani discloses adapting data rates "according to the channel condition of the receiver" and to adapt and

optimize data rates, Shibutani ascertains channel conditions using SNR, FER, or BER). Given Shibutani's similar use of channel condition measurements to select a modulation scheme, a POSITA would have looked to Shibutani to improve on the capability of the Carhart-Grube system to determine a common bit-loading modulation scheme.

231. A POSITA would have further understood that Shibutani's proposed metrics for determining the channel condition offer insight that is not provided by Grube's "spectral response." For example, SNR is a measure of the strength of the desired signal relative to background noise. See DISH-1017; DISH-1018. A POSITA would have understood that increased noise in a communication channel lowers the ability of the receiver to properly decode the transmission and increases the likelihood that clipping of the data signal will occur. Thus, even where a communication path does not result in significant attenuation of a signal or phase shift of the signal, excessive noise may still limit the ability of the channel to carry a large number of bits.

232. BER and FER are other measurements of the channel that focus on the ability of the receiver to properly decode data received over the channel. For example, BER involves comparing a training signal received over the channel to a known signal, to determine how many bit errors occurred in the transmission. See DISH-1017. A channel with a higher BER cannot reliably carry as many bits as a

channel with a lower BER. Thus, even where a channel may have limited attenuation, phase shifting, or noise, other factors such as a receiver filter response may limit the modulation scheme used for a given channel. Moreover, because BER and FER merely require comparison of a received bits or frames to known bits or frames, the processing required to determine BER or FER is less than that needed to measure SNR or Grube's "spectral response."

233. A POSITA therefore would have been motivated to employ Shibutani's other channel condition measurements, such as SNR or BER, into the Carhart-Grube system to obtain the benefits of these alternate measurements. Further, a POSITA would have readily understood how to substitute or supplement Grube's "spectral response" measurement with those taught by Shibutani.

234. As the '834 priority-application acknowledged, methods for measuring SNR were well-known at the time. DISH-1011, 14 ("[d]etermination of a channel response, multipath, and SNR profile from a known signal is well known in the art.").[8] Measurements of BER and FER are even more simplistic, as they require a simple comparison of decoded bits or frames to a known sequence. DISH-1017 (Newton). Thus, a POSITA would have readily understood how to implement

[8] I note that "SNR profile" is generally synonymous with SNR.

such measurements in the combined Carhart-Grube system with a reasonable expectation of success.

235. Further, a POSITA would have readily understood how to modify the Carhart-Grube system to generate bit-loading tables based on SNR, BER, or FER/PER (similarities between FER/PER are discussed in further detail below) instead of the "spectral response," or in addition to the "spectral response." As explained above, each of these measurements is an indication of the "number of bits that the carrier channel can support." DISH-1010 at 3:51-53. While Shibutani describes that its access terminals measure SNR or BER based on "pilot symbols" in a frame, a POSITA would understand that the same measurement can be performed on Grube's "training signal." DISH-1012 at ¶ 46. Indeed, Grube's "training signal" and Shibutani's "pilot symbols" are both known signals that are compared to a received signal to perform the channel measurements. DISH-1012 at ¶ 44 ("When there is no data to be sent, the only transmissions from the AP 140 over the downlink channel are those of the pilot symbols and the periodic transmission of control information."); DISH-1010 at 15:51-16:10.

236. Thus, a POSITA would have been able to readily modify the combined Carhart-Grube system to generate a bit-loading table based on SNR, BER, FER/PER or a combination of multiple measurements (e.g., by choosing the lowest bit-loading the channel can support as indicated by the multiple measurements).

237. Because each of these metrics was well-known at the time, it would have been obvious to a POSITA to implement one or more of these metrics in the Carhart-Grube combination.

238. A POSITA would have made such a modification with predictable results and a reasonable expectation of success, given the similarity between Grube's use of the "spectral response" Grube and Shibutani's use of SNR, BER, or other metrics to choose an optimal modulation scheme.

239. Specifically, a POSITA would have predictably found that modifying the Carhart-Grube combination to use Shibutani's SNR or BER channel measurements would allow for the selection of an appropriate bit-loading modulation scheme (using, for example, Hughes-Hartogs's water-filling method, discussed above), just as Shibutani used those metrics to select an appropriate modulation scheme.

C. Claim 1

1. Preamble and Elements 1a-1f

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

[1a] transmitting a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes;

[1b] receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-

loading modulation scheme determined by a corresponding receiving node; and

[1c] determining the common bit-loading modulation scheme from the received plurality of response signals;

[1d] receiving the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission;

[1e] determining the transmission characteristics of the channel path at the one receiving node; and

[1f] transmitting a response signal from the one receiving node to the transmitting node,

240. I have been asked to consider whether the Carhart-Grube-Shibutani combination renders obvious the preamble of claim 1, but I have not been asked to render an opinion on whether the preamble should be considered a limitation. If the preamble of claim 1 is deemed to be a limitation, it is my opinion that the Carhart-Grube combination renders this limitation obvious.

241. It is my opinion that the Carhart-Grube-Shibutani combination also renders the other limitations obvious.

242. The preamble and elements 1a-1f are rendered obvious by Carhart and Grube for the same reasons provided at the preamble and elements 1a-1f of Ground 1.

243. Further, Shibutani makes clear that the bit-loading table in Grube represents a bit-loading modulation scheme that is compatible with the channel between the

secondary site and primary site. Shibutani explains that each of its ATs, which correspond to Grube's secondary sites, determines a maximum data rate for a channel that maps to a particular modulation scheme, as shown in Table 2 of Shibutani. For example, a channel that can support a data rate of 1378 kbps (kilo-bits per second) uses a corresponding modulation scheme of 16QAM. DISH-1012 at ¶¶ 46-47.

TABLE 2

SIR (dB)	Maximum Data Rates	Modulation Schemes	Coding Rates	DRC
–7	689.4 kbps	QPSK	1/3	1
7–11	1033 kbps	8PSK	1/3	2
11–14	1378 kbps	QPSK	2/3	3
14–16	1378 kbps	16QAM	1/3	4
16–18	2070 kbps	8PSK	2/3	5
18–	2761 kbps	16QAM	2/3	6

SHIBUTANI TABLE 2

244. Thus, a POSITA would understand that Grube's determination of "a number of bits that [a] carrier channel can support" is a determination of a modulation scheme, e.g., QAM. For example, Grube explains:

> As previously described, when a data entry cannot be supported by a single carrier channel, the data entry is broken down into data blocks, wherein a data block is allocated to a particular carrier channel. As shown, the partitioning of the data entry into data blocks equates data blocks of the third data call to particular carrier channels. As is known in the ADSL art, a carrier channel can be represented as a vector 1076, wherein the magnitude and phase of the vector is based on the data which the carrier channel is carrying and the bit loading of the carrier channel. The bit loading of a carrier channel indicates the number of constellation points, i.e., the number of magnitude and phase

> combinations for the vector. 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. Thus one constellation point equates to the binary number 00, a second point to binary number 01, etc. From this, one skilled in the art will readily appreciate how the bit loading of a carrier channel equates to the number of bits the carrier channel can support, or carry.

DISH-1010 at 51:43-61. Further, Grube Fig. 51 shows a QAM constellation:

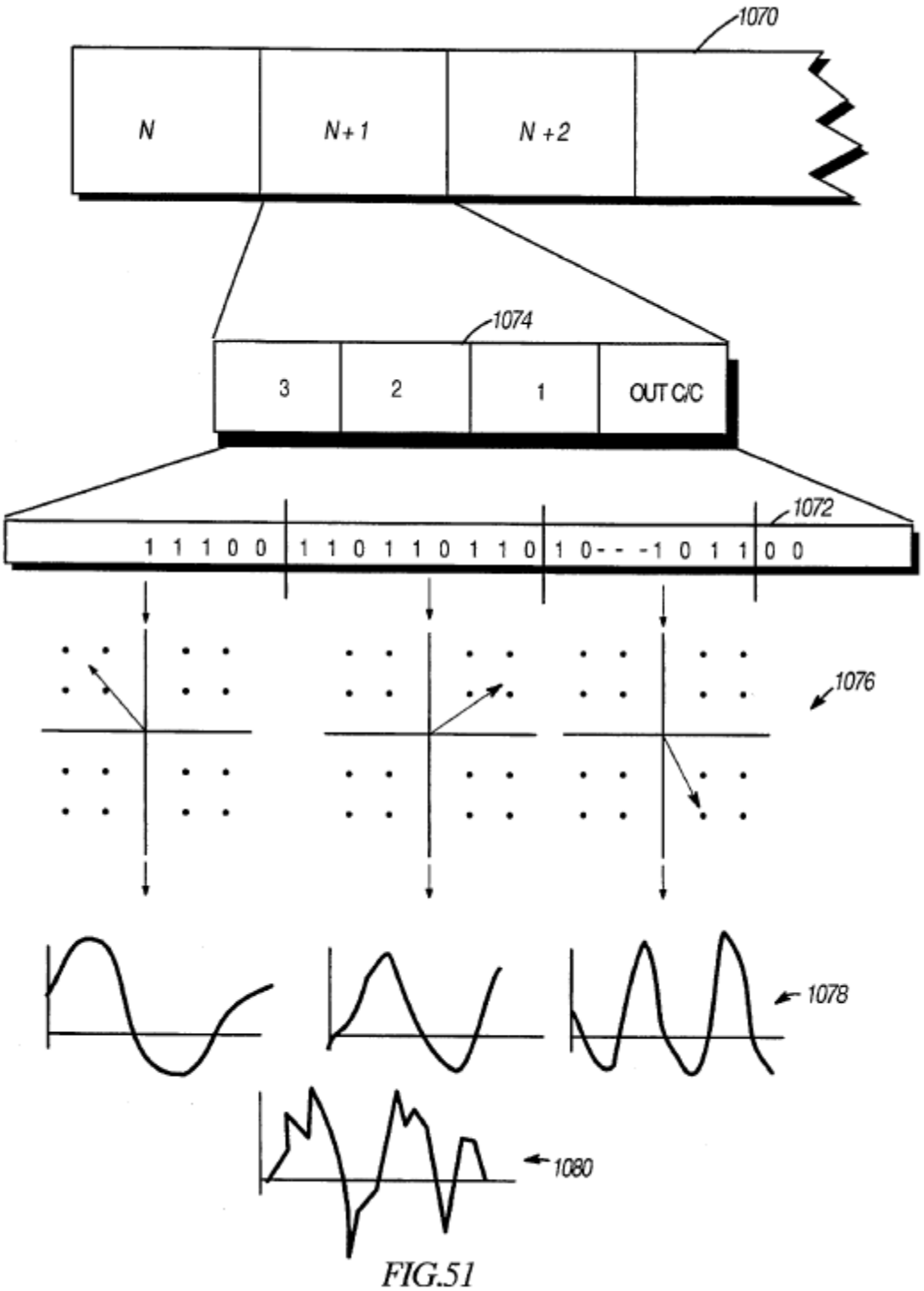


FIG.51

GRUBE FIGURE 51

245. As a result, it is my opinion that the Carhart-Grube-Shibutani combination renders these limitations obvious.

2. Element 1g

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

246. It is my opinion that the Carhart-Grube-Shibutani combination renders this limitation obvious.

247. To the extent that the Carhart-Grube combination does not render obvious element 1g, Shibutani in the Carhart-Grube-Shibutani combination discloses determining transmission characteristics of the channel by measuring SNR characteristics of a probe signal at a receiving node. DISH-1012 at ¶¶ 46 ("[t]hose skilled in the art will appreciate that the channel condition detector 157 may measure other channel condition indicators, such as signal to noise ratio (SNR)").

248. Thus, a POSITA would understand that in the Carhart-Grube-Shibutani combination, each of Grube's secondary sites would measure the SNR characteristics of the "training signal" received from the primary site and use the SNR to determine the bit-loading table for the secondary site. Specifically, as I explained at §VIII.B above, a POSITA would have understood that each remote device would measure SNR in place of or in addition to a "spectral response" to

determine a bit-loading table for the channel path between the remote device and central device. See §VIII.B above. Such a system would advantageously determine the bit-loading table that accounts for the limitations on the channel caused by noise, thereby further improving the reliability of transmissions over the channel. See §VIII.B above.

249. As a result, it is my opinion that the Carhart-Grube-Shibutani combination renders this limitation obvious.

3. Elements 1h-1j

[1h] wherein determining a common bit-loading modulation scheme includes:

[1i] comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and

[1j] determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.

250. It is my opinion that the Carhart-Grube-Shibutani combination renders these limitations obvious.

251. Elements 1h-1j are rendered obvious by Carhart and Grube for the same reasons provided at elements 1h-1j of Ground 1.

252. Thus, it is my opinion the Carhart-Grube-Shibutani combination renders obvious claim 1.

D. Claim 2

1. Preamble and Elements 2a-2e

[2pre] A method for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in a broadband cable network ("BCN"), the method comprising:

[2a] transmitting a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes;

[2b] receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node;

[2c] determining the common bit-loading modulation scheme from the received plurality of response signals;

[2d] receiving the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission;

[2e] determining the transmission characteristics of the channel path at the one receiving node;

253. I have been asked to consider whether the Carhart-Grube-Shibutani combination renders obvious the preamble of claim 2, but I have not been asked to render an opinion on whether the preamble should be considered a limitation. If the preamble of claim 2 is deemed to be a limitation, it is my opinion that the Carhart-Grube-Shibutani combination renders this limitation obvious.

254. It is my opinion that the Carhart-Grube-Shibutani combination also renders the other limitations obvious.

255. The preamble and elements 2a-2e are rendered obvious by Carhart and Grube for the same reasons provided at the preamble and elements 2a-2e of Ground 1. Further, as explained at §VIII.B above, Shibutani makes clear that the bit-loading table in Grube represents a bit-loading modulation scheme that is compatible with the channel between the secondary site and primary site.

2. Element 2f

[2f] transmitting a response signal from the one receiving node to the transmitting node, wherein the transmission characteristics of the channel path are determined by measuring the bit-error rate ("BER") characteristics of the received probe signal at the one receiving node and

256. It is my opinion that the Carhart-Grube-Shibutani combination renders this limitation obvious.

257. To the extent that Patent Owner might argue that the Carhart-Grube combination does not render obvious element 2f, Shibutani in the Carhart-Grube-Shibutani combination discloses determining transmission characteristics of the channel by measuring BER characteristics of a probe signal at a receiving node. DISH-1012 at ¶ 46 ("Alternatively, an error rate, such as a frame error rate (FER) or a [bit] error rate (BER), may be used as channel condition information.").

258. Thus, a POSITA would have understood that in the Carhart-Grube-Shibutani combination, each of Grube's secondary sites would measure BER characteristics of the "training signal" received from the primary site and use the BER to

determine the bit-loading table for the secondary site. Specifically, as explained at §VIII.B above, a POSITA would have understood that each remote device would be able to measure BER in place of or in addition to a "spectral response" to determine a bit-loading table for the channel path between the remote device and central device. See §VIII.B above. Such a system would advantageously determine the bit-loading table based on the errors received in the data transmitted by the "training signal," thereby further improving the reliability of transmissions over the channel. See §VIII.B above.[9] Further, compared to Grube's "spectral response," measuring BER is less computationally intensive. Thus, implementing a BER measurement could enable the remote devices to more efficiently determine the bit-loading table. See §VIII.B above. As a result, it is my opinion that the Carhart-Grube-Shibutani combination renders this limitation obvious.

3. Elements 2g-2j

[2g] generating the response signal, wherein the response signal utilizes a bit-loading modulation scheme that is generated by the

[9] Bit-loading tables can be generated using BER rather than SNR, as Tzannes explains. See DISH-1028 at 9:62-10:36. In particular, BER can be used to construct a bit-loading table based on the minimum SNR required for a given constellation size, which involves simply looking up concordance values in textbooks. DISH-1028 at 9:62-67.

one receiving node in response to determining the transmission characteristics of the channel path,

[2h] wherein determining a common bit-loading modulation scheme includes:

[2i] comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and

[2j] determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.

259. Elements 2g-2j are rendered obvious by Carhart and Grube for the same reasons provided at elements 2g-2j of Ground 1.

260. Thus, it is my opinion the Carhart-Grube-Shibutani combination renders obvious claim 2.

E. Claim 3

1. Preamble and Elements 3a-3g

[3pre] A method for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in a broadband cable network ("BCN"), the method comprising:

[3a] transmitting a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes;

[3b] receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-

loading modulation scheme determined by a corresponding receiving node; and

[3c] determining the common bit-loading modulation scheme from the received plurality of response signals;

[3d] receiving the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission;

[3e] determining the transmission characteristics of the channel path at the one receiving node; and

[3f] transmitting a response signal from the one receiving node to the transmitting node,

[3g] wherein the transmission characteristics of the channel path are determined by measuring the signal-to-noise ("SNR") characteristics of the received probe signal at the one receiving node,

261. I have been asked to consider whether the Carhart-Grube-Shibutani combination renders obvious the preamble of claim 3, but I have not been asked to render an opinion on whether the preamble should be considered a limitation. If the preamble of claim 3 is deemed to be a limitation, it is my opinion that the Carhart-Grube-Shibutani combination renders this limitation obvious.

262. It is my opinion that the Carhart-Grube-Shibutani combination also renders the other limitations obvious.

263. Elements 3pre-3g are rendered obvious by Carhart and Grube, or Carhart, Grube, and Shibutani, for the same reasons provided at elements 3pre-3g of Ground 1 and elements 1pre-1g of Ground 2.

2. Element 3h

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

264. It is my opinion that the Carhart-Grube-Shibutani combination renders this limitation obvious.

265. To the extent that the Carhart-Grube combination does not render obvious element 3h, Shibutani in the Carhart-Grube-Shibutani combination renders obvious determining transmission characteristics of the channel by measuring PER characteristics of a probe signal at a receiving node.

266. Specifically, Shibutani discloses that "an error rate, such as a frame error rate (FER) . . . may be used as channel condition information" to determine a modulation scheme for a channel between network devices. DISH-1012 at ¶ 46. A POSITA would have understood that a frame is a data construct including a packet for transmitting data over a network.

267. For example, DISH-1019 (Webster's) defines a frame "[i]n data communications" as "a unit (packet) of data that is transmitted via the network" and defining a packet "[i]n a packet-switching unit" as "a unit of data of a fixed size … that has been prepared for network transmission"). DISH-1017 (Newton's) defines "frame error rate" as follows:

Frame Error Rate FER. The ratio of errored data frames to the total number of frames transmitted. If the FER gets too high, it might be worth while stepping down to slower baud rate. Otherwise, you would spend more time retransmitting bad frames than getting good ones through. In other words, throughput would suffer. The theory is that the faster the speed of data transmission the more likelihood of error. This is not always so. But if you are getting lots of errors, the first — and easiest — step is to drop the transmission speed. Frame Error Rate is thus a measure of transmission quality. It is generally shown as a negative exponent, (e.g., 10 to the minus 2 power (10^-2) means one out of 100 frames are in error.) The FER is directly related to the Bit Error Rate (BER). See also Bit Error Rate.

NEWTON DICTIONARY, "FRAME ERROR RATE"

268. Thus, FER is a measure of the rate of errors detected in frames. DISH-1017 (Newton's).

269. Similar to FER, PER is determined by calculating frames corrupted per unit time. DISH-1018 (Sharda) ("**Packet error rate (PER):** The number of packets corrupted per unit time. PER = Packets in error/Total packets transmitted."). Based on Shibutani's disclosure of measuring a channel's transmission characteristics using FER, it would have been similarly obvious to determine the

channel's transmission characteristics by looking at the packet rate of errors (i.e., PER) rather than frames (i.e., FER).

270. Thus, a POSITA would have understood that in the combined Carhart-Grube-Shibutani combination, each of Grube's secondary sites would measure PER characteristics of the "training signal" received from the primary site and use the PER to determine the bit-loading table for the secondary site. Specifically, as explained at §VIII.B above, a POSITA would have understood that each remote device would be able to measure PER in addition to SNR, and further in addition to or in place of a "spectral response," to determine a bit-loading table for the channel path between the remote device and central device. Such a system would advantageously determine the bit-loading table based on the errors in the packets transmitted by the "training signal," thereby further improving the reliability of transmissions over the channel.

271. As a result, it is my opinion that the Carhart-Grube-Shibutani combination renders this limitation obvious.

3. Elements 3i-3k

[3i] wherein determining a common bit-loading modulation scheme includes;

[3j] comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and

[3k] determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.

272. It is my opinion that the Carhart-Grube-Shibutani combination renders these limitations obvious.

273. Elements 3i-3k are rendered obvious by Carhart and Grube for the same reasons provided at elements 3i-3k of Ground 1.

274. Thus, it is my opinion the Carhart-Grube-Shibutani combination renders obvious claim 3.

IX. GROUND 3 – CARHART IN VIEW OF GRUBE AND CAI

A. Cai (DISH-1013)

275. Cai is a U.S. patent entitled "System and Method for Bit Loading with Optimal Margin Assignment." DISH-1013 (Face of Patent). It was filed on October 13, 1998.

276. Cai explains that in conventional DMT systems, SNR is measured to determine optimal bit loading for each channel. DISH-1013 at 1:33-43, 2:62-3:3.

Conventionally, once SNR is measured, a fixed margin is subtracted to achieve a desired bit-error rate. DISH-1013 at 1:44-48.

277. Cai notes that this traditional approach "suffer[s]" because the fixed margin may be too great, thus slowing transmission in a channel, or too little, thus yielding a high bit-error rate in a channel. DISH-1013 at 1:48-62. To solve this problem, Cai teaches using a variable margin for each DMT channel. DISH-1013 at 1:65-67, 3:11-13 (" varying margins allow the DMT channels to be used with a maximum of efficiency, while ensuring a low bit error rate."). To obtain a variable margin, Cai observes how SNR changes relative to (1) mean channel SNR, (2) the last measured SNR value, (3) the initial measured SNR value, or (4) a periodic sampling. DISH-1013 at 5:15-34, 6:61-7:13, 8:1-7, 8:16-21. When the variation has been determined, "the optimum margins are calculated for each DMT channel, which in turn translates into an optimum bit rate for each DMT channel while ensuring a desired bit error rate which is, for example, 10^{-7}." DISH-1013 at 9:39-49. Cai thus uses SNR measurements to optimize bit rate while minimizing error.

278. To summarize, Cai discloses methods for optimizing bit loading modulation schemes by varying the margin that is subtracted from an SNR threshold. DISH-1013 at 1:33-67, 2:62-3:3, 3:11-13. In this respect, Cai ascertains channel conditions using SNR, which is a technique that is used in frequency division

multiplexing—DMT in particular. DISH-1013 at 1:13-15. Thus, Cai is from the multiplex-communication-networking field.

279. Consequently, Cai is reasonably pertinent to the problems that the '759 patent's inventors faced, i.e., facilitating communication between "a variety of CPEs [(customer premise equipment)]" over a "broadband communication networks utilizing coaxial cable." DISH-1001 at 3:66-67 ("there is a need for a system and method to connect a variety of CPEs into a local network"), 1:40-42 ("The invention relates to broadband communication networks, and in particular to broadband communication networks utilizing coaxial cable."), 10:66-11:5 ("The receiving node then determines the transmission characteristics of the channel path from the transmitting node to the receiving node in step 1108 and in response to the determined transmission characteristics of the channel path, the receiving node determines a bit-loaded modulation scheme for the transmission characteristics of the channel path in step 1110."); DISH-1009 (Carhart) at 2:8-13 (Carhart discloses using the existing cable wiring in a home to facilitate communication between nodes in a home, and Carhart teaches using frequency division multiplexing on the network because it "allows each new channel or each new cable service to remain independent of the other signals or services present on the coaxial cable network."); DISH-1010 (Grube) at 4:19-26 (Grube discloses using frequency

division multiplexing with DMT modulation to facilitate communication between a primary site and multiple secondary sites (e.g., broadcasting)).

B. Motivation to Combine

280. A POSITA starting with Carhart's coaxial network would have been motivated to use it with Grube's method of establishing a common bit-loading modulation scheme to improve network reliability and bandwidth. See §VII.C. A POSITA would have been motivated to optimize Carhart-Grube by using alternative channel measurements, such as SNR, BER, or FER to determine the bit-loading modulation scheme. See §VII.C.

281. Cai shows that using SNR to optimize bit rate, while minimizing transmission error, over a channel was well-known and desired. In particular, Cai explains that it enables the "optimum bit rate for each DMT channel while ensuring a desired bit error rate which is, for example, 10^{-7}" is determined. DISH-1013 at 9:46-49. Accordingly, a POSITA would have been motivated to use, or to try, Cai's method of using SNR to characterize a channel path, and ultimately determine a bit-loading modulation scheme based on SNR. A POSITA would have readily understood how to modify Carhart-Grube to use Cai's method(s) because Cai improves DMT systems, and Grube is a DMT system. Thus, a POSITA would have found implementing Cai in Grube a predictable exercise, and would have had a reasonable expectation of success in implementing Cai because

both references are directed to DMT. In doing so, a POSITA would achieve a system that optimizes per symbol while reducing bit errors.

C. Claim 1

1. Preamble and Elements 1a-1f

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

[1a] transmitting a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes;

[1b] receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node; and

[1c] determining the common bit-loading modulation scheme from the received plurality of response signals;

[1d] receiving the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission;

[1e] determining the transmission characteristics of the channel path at the one receiving node; and

[1f] transmitting a response signal from the one receiving node to the transmitting node,

282. I have been asked to consider whether the Carhart-Grube-Cai combination renders obvious the preamble of claim 1, but I have not been asked to render an opinion on whether the preamble should be considered a limitation. If the

preamble of claim 1 is deemed to be a limitation, it is my opinion that the Carhart-Grube combination renders this limitation obvious.

283. It is my opinion that the Carhart-Grube combination also renders the other limitations obvious.

284. The preamble and elements 1a-1f are rendered obvious by Carhart and Grube for the same reasons provided at the preamble and elements 1a-1f of Ground 1.

2. Element 1g

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

285. It is my opinion that the Carhart-Grube-Cai combination renders this limitation obvious.

286. To the extent that the Carhart-Grube combination does not render obvious element 1g, Cai in the Carhart-Grube-Cai combination discloses determining transmission characteristics of the channel by measuring SNR characteristics of a probe signal at a receiving node.

287. Cai renders obvious determining transmission characteristics of Carhart-Grube's channel by measuring SNR characteristics of a probe signal at a receiving

node. DISH-1013 at 1:19-62, 2:62-3:3. Cai teaches that conventional DMT systems use SNR to determine transmission characteristics:

> Referring to FIG. 1, shown is a graph 50 which details the signal-to-noise ratio (SNR) of the channels of a conventional discrete multi-tone (DMT) data link. For each DMT channel, a measured SNR 53 is shown. A common SNR margin 56 is subtracted from the measured SNR 53 for each DMT channel resulting in an SNR threshold 59. The SNR threshold 59 is the signal-to-noise ratio employed to achieve a 10^{-7} bit error rate at the selected bit rate per each DMT channel.

DISH-1013 at 2:62-3:3.

288. Cai improves on the conventional approaches of using SNR by varying the SNR margin in each channel, which would motivate a POSITA to use Cai's improvements in Carhart-Grube. See DISH-1013 at 3:4-13, 5:15-34, 6:61-7:13, 8:1-7, 8:16-21, 9:39-49 (explaining Cai's advantages).

289. As a result, it is my opinion that the Carhart-Grube-Shibutani combination renders this element obvious.

3. Elements 1h-1j

[1h] wherein determining a common bit-loading modulation scheme includes:

[1i] comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and

[1j] determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.

290. Elements 1h-1j are rendered obvious by Carhart and Grube for the same reasons provided in Ground 1.

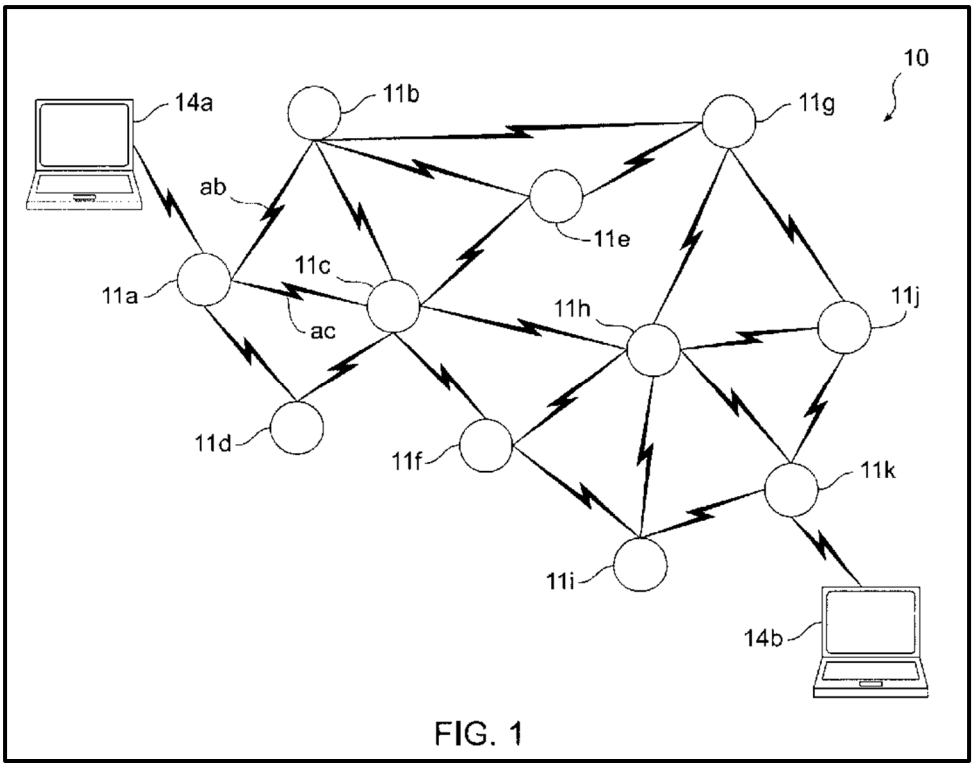
291. Thus, Carhart-Grube-Cai renders obvious claim 1.

X. GROUND 4 – CARHART IN VIEW OF GRUBE, SHIBUTANI AND/OR CAI, AND FLAMMER

A. Flammer (DISH-1014)

292. Flammer is a U.S. patent entitled "Method and Apparatus for Maximizing Data Throughput in a Packet Radio Mesh Network." DISH-1014 (Face of Patent). It was filed on November 23, 1998.

293. Flammer discloses a "mesh network communication system" as shown in Figure 1. DISH-1014 at Abstract. In the network, "throughput is optimized on the link between the communicating nodes by dynamically modifying signal characteristics of the signals transmitted between nodes in response to performance metrics which have been determined from analysis at the receivers for the corresponding links." DISH-1014 at Abstract, 2:64-3:5.



FLAMMER FIGURE 1

294. Initially, "each node 11 (for example, Nodes A and B) operates at a default data rate in order to establish a pair of links, such as Link A=>B and Link B=>A." DISH-1014 at 4:30-45. "Each . . . node 11 monitors traffic and the success of traffic, as indicated by repetitions, information on lost packets, and the like, and constantly develops performance metrics between itself and other regularly-linked nodes." DISH-1014 at 4:30-45. The "performance metrics" may include "a probability of successful transmission between the two nodes, a probability of a bit error in the communication upon receipt at a receiving node, a probability of a packet error in the signal at the receiving node, and a signal strength of the signal at the receiving node." DISH-1014 at 3:6-30. Based on the performance metrics,

"[e]ach node 11 may . . . vary one or more signal characteristics of signals transmitted to other nodes 11 on a per-link basis to maintain the highest possible network speed." DISH-1014 at 4:30-45. The "signal characteristics" may include data rate, modulation type, etc. DISH-1014 at 3:16-31.

295. While Flammer provides an exemplary "on-air" network application, Flammer is not limited to such networks. Indeed, Flammer states that its "method is very general in its application to semi-autonomous nodes communicating within a data communications network." DISH-1014 at 7:66-8:11.

296. To summarize, Flammer discloses optimizing throughput over a link by dynamically modifying the signal based on performance metrics, including BER and PER. DISH-1014 at 2:64-3:36. More simply, Flammer determines determining communications parameters over a link and then optimizes transmissions based on the determination. Further, Flammer implements its methods in a network that has a plurality of nodes. This subject matter falls within the field of multiplex communication networking because multiplexed networks benefit from optimized transmissions in discrete channels.

297. Consequently, Flammer is reasonably pertinent to the problems that the '759 patent's inventors faced, i.e., facilitating communication between "a variety of CPEs [(customer premise equipment)]" over a "broadband communication networks utilizing coaxial cable." DISH-1001 at 3:66-67 ("there is a need for a

system and method to connect a variety of CPEs into a local network"), 1:40-42 ("The invention relates to broadband communication networks, and in particular to broadband communication networks utilizing coaxial cable.").

B. Motivation to Combine

298. As I explained at §VII.C, a POSITA would have been motivated to combine Carhart's coaxial network with Grube's method of establishing a common bit-loading modulation scheme to improve network reliability and bandwidth. And as explained at §VIII.B, a POSITA would have been motivated to improve the Carhart-Grube combination to use channel measurements other than "spectral response," such as Shibutani's SNR, BER, or FER, for selecting the bit-loading modulation scheme, or Cai's use of SNR for selecting a bit-loading modulation scheme.

299. In addition to the Carhart-Grube-Shibutani and/or Cai measurements of "spectral response," SNR, BER, and FER, a POSITA would have known that there were yet other channel measurements that provided different insights than the Carhart-Grube-Shibutani measurements. The POSITA would have sought to employ these measurements to capture the channel assessments not captured by the Carhart-Grube-Shibutani measurements. For example, Flammer discloses several channel performance metrics including a probability of a packet error in a signal at the receiving node (PER). DISH-1014 at 3:6-30. Similar to Shibutani's FER

measurement, a POSITA would have understood that Flammer's PER assesses the number of packets received with errors in relation to the total number of packets transmitted in the signal. A POSITA would have further understood that Flammer's PER, like Shibutani's FER, provides a higher level of granularity of channel assessment than other metrics, such as BER (which assesses the channel on a bit level).

300. A POSITA therefore would have been motivated to employ Flammer's PER into the Carhart-Grube-Shibutani and/or Cai combination to obtain the benefits of these alternate measurements for the purposes of determining a bit-loading modulation scheme. Indeed, Flammer explains that PER can be used to determine the modulation type for a channel. See DISH-1014 at 3:16-31, 4:30-45.

301. It is my opinion that a POSITA would have readily understood how to substitute or supplement the Carhart-Grube-Shibutani and/or Cai metrics with Flammer's PER. A POSITA would have understood that Carhart's coaxial LAN communicates using data packets, and Grube and Shibutani disclose specific frame formats for their packet-switched networks. See DISH-1010 at 3:18-4:26 (describing a packet-switched network), FIGS. 20-21, 34, 40, 51, 55-57, 62; DISH-1012 at ¶ 38, FIG. 4. Thus, instead of measuring the error rate in the bits or frame of a training signal, a POSITA would have found it obvious to also measure the error rate in the packets of the training signal. The PER measurement is as simple

as the BER and FER measurements described previously. See §VIII.A, VIII.B, and VIII.E (PER is an obvious variant of BER and FER). Put another way, SNR, BER, FER, and PER were known measurements, and it is within a POSITA's skill to use any one of these approaches to determine bit-loading information.

302. Further, a POSITA would have readily understood how to modify the Carhart-Grube-Shibutani and/or Cai combination to generate bit-loading tables based on PER instead or in addition to the Carhart-Grube-Shibutani and/or Cai metrics. As explained above, channel characteristics are an indication of the "number of bits that the carrier channel can support." DISH-1010 at 3:51-53. Thus, a POSITA would readily modify the combined Carhart-Grube-Shibutani and/or Cai combination to generate a bit-loading table based on PER, SNR, BER, FER, or a combination of multiple measurements (e.g., by choosing the lowest bit-loading the channel can support as indicated by the multiple measurements). Because each of these metrics was well-known at the time, it would have been obvious to a POSITA to implement one or more of these metrics in the Carhart-Grube-Shibutani and/or Cai-Flammer combination.

303. A POSITA would have made such a modification with predictable results and a reasonable expectation of success, given the similarity between different metrics to choose an optimal modulation scheme. Specifically, a POSITA would have predictably found that modifying the Carhart-Grube-Shibutani and/or Cai

combination to use Flammer's PER channel measurements would allow for the selection of an appropriate bit-loading modulation scheme.

C. Claim 3

1. Preamble and Elements 3a-3g

[3pre] A method for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in a broadband cable network ("BCN"), the method comprising:

[3a] transmitting a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes;

[3b] receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node; and

[3c] determining the common bit-loading modulation scheme from the received plurality of response signals;

[3d] receiving the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission;

[3e] determining the transmission characteristics of the channel path at the one receiving node; and

[3f] transmitting a response signal from the one receiving node to the transmitting node,

[3g] wherein the transmission characteristics of the channel path are determined by measuring the signal-to-noise ("SNR") characteristics of the received probe signal at the one receiving node,

304. I have been asked to consider whether the Carhart-Grube-Shibutani-Flammer combination renders obvious the preamble of claim 3, but I have not been

asked to render an opinion on whether the preamble should be considered a limitation. If the preamble of claim 3 is deemed to be a limitation, it is my opinion that the Carhart-Grube-Shibutani combination renders this limitation obvious.

305. It is my opinion that the Carhart-Grube-Shibutani-Flammer combination also renders the other limitations obvious.

306. Elements 3pre-3g are rendered obvious by Carhart and Grube, or Carhart, Grube, and Shibutani, for the same reasons provided at elements 3pre-3g of Ground 1 and elements 1pre-1g of Ground 2.

2. Element 3h

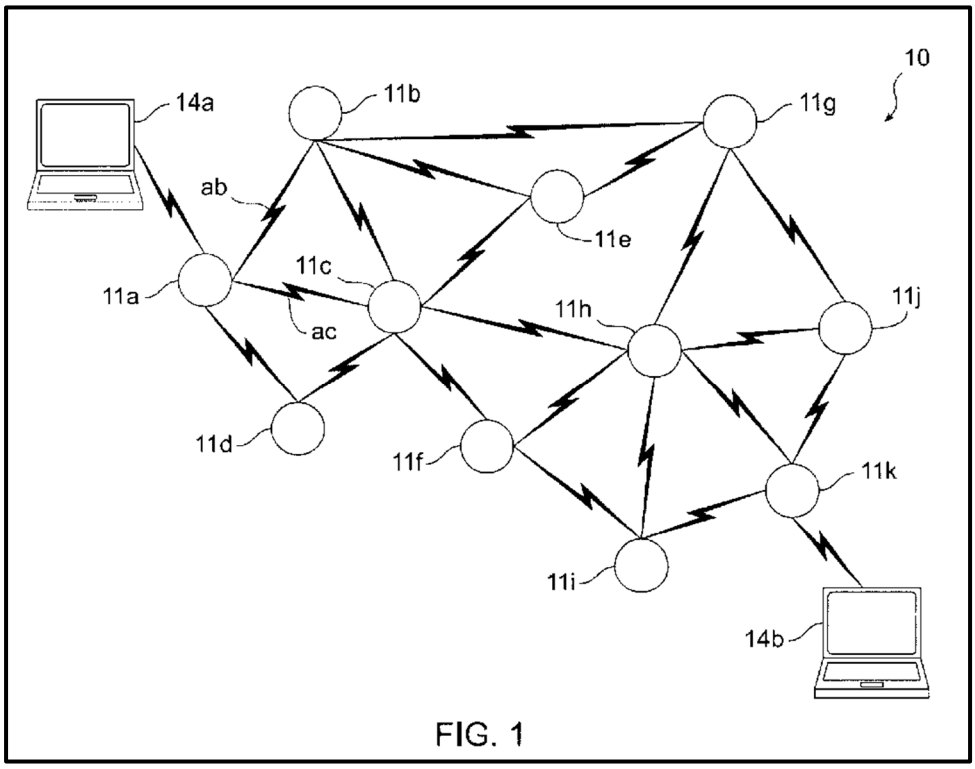
> **[3h] wherein the transmission characteristics of the channel path are determined by measuring the [packet]-error rate ("PER") characteristics of the received probe signal at the one receiving node, and**

307. It is my opinion that the Carhart-Grube-Shibutani-Flammer combination renders this limitation obvious.

308. To the extent that the Carhart-Grube-Shibutani combination does not render obvious element 3h, Flammer in the Carhart-Grube-Shibutani-Flammer combination discloses determining transmission characteristics of the channel by measuring PER at a receiving node. DISH-1014 at 3:6-30.

309. Specifically, Flammer discloses a "mesh network communication system" as shown in Figure 1. DISH-1014 at Abstract. In the network, "net throughput is

optimized on the link between the communicating nodes by dynamically modifying signal characteristics of the signals transmitted between nodes in response to performance metrics which have been determined from analysis at the receivers for the corresponding links. DISH-1014 at Abstract, 2:64-3:5.



FLAMMER FIGURE 1

310. "Each . . . node 11 monitors traffic and the success of traffic, as indicated by repetitions, information on lost packets, and the like, and constantly develops performance metrics between itself and other regularly-linked nodes." DISH-1014 at 4:30-38. The "performance metrics" may include "probability information," such as "a probability of a packet error in the signal at the receiving node." DISH-1014 at 3:6-30.

311. A POSITA would have understood that in the Carhart-Grube-Shibutani-Flammer combination, each of Grube's secondary sites would measure PER characteristics of the packets received in the training signal from the primary site and use the PER to determine the bit-loading table for the secondary site. Specifically, as explained at §X.B above, a POSITA would have understood that each remote device would be able to measure PER in addition to SNR, and further in addition to or in place of a "spectral response," to determine a bit-loading table for the channel path between the remote device and central device. See §X.B above. Such a system would advantageously determine the bit-loading table based on the errors actually received in the packets in the training signal transmitted over the channel, thereby further improving the reliability of transmissions over the channel. See §X.B above.

312. Thus, it is my opinion the Carhart-Grube-Shibutani and/or Cai-Flammer combination renders obvious this claim limitation.

3. Elements 3i-3k

[3i] wherein determining a common bit-loading modulation scheme includes;

[3j] comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and

[3k] determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.

313. It is my opinion that the Carhart-Grube-Shibutani-Flammer combination renders these limitations obvious.

314. Elements 3i-3k are rendered obvious by Carhart and Grube for the same reasons provided at elements 3i-3k of Ground 1.

315. Thus, it is my opinion that the combination of Carhart, Grube, Shibutani, and Flammer renders obvious claim 3.

D. Claim 2

1. Preamble and Elements 2a-2e

[2pre] A method for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in a broadband cable network ("BCN"), the method comprising:

[2a] transmitting a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes;

[2b] receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-

loading modulation scheme determined by a corresponding receiving node;

[2c] determining the common bit-loading modulation scheme from the received plurality of response signals;

[2d] receiving the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission;

[2e] determining the transmission characteristics of the channel path at the one receiving node;

316. I have been asked to consider whether the Carhart-Grube-Shibutani/Cai-Flammer combination renders obvious the preamble of claim 2, but I have not been asked to render an opinion on whether the preamble should be considered a limitation. If the preamble of claim 2 is deemed to be a limitation, it is my opinion that the Carhart-Grube-Shibutani/Cai-Flammer combination renders this limitation obvious.

317. It is my opinion that the Carhart-Grube-Shibutani/Cai-Flammer combination also renders the other limitations obvious.

318. The preamble and elements 2a-2e are rendered obvious by Carhart-Grube, for the same reasons provided at the preamble and elements 2a-2e of Ground 1.

2. Element 2f

[2f] transmitting a response signal from the one receiving node to the transmitting node, wherein the transmission characteristics of the channel path are determined by measuring the bit-error rate

("BER") characteristics of the received probe signal at the one receiving node and

319. In addition to Carhart-Grube or Carhart-Grube-Shibutani/Cai, Flammer's teachings establish it would have been obvious to determine transmission characteristics of Carhart's channel by measuring BER at a receiving node. DISH-1014 at 3:6-30.

320. As noted above, Flammer teaches the benefits of having the "performance metrics" include "probability information," and Flammer discloses using BER or PER. See DISH-1014 at 3:6-30 ("a probability of a bit error in the communication upon receipt at a receiving node"—BER packet error in the signal at the receiving node"—PER—is listed as an viable alternative to PER). Thus, a POSITA would have understood that Carhart's remote stations would be able to measure BER characteristics of the packets received in the training signal from the primary site and use BER to determine the bit-loading table for the remote stations. DISH-1014 at 3:6-30. A POSITA would have been motivated to use BER for largely the same reasons as using PER, e.g., to improve the reliability of transmissions over the channel. DISH-1014 at 3:6-30.

321. As a result, it is my opinion that the Carhart-Grube-Shibutani/Cai-Flammer combination renders this limitation obvious.

3. Elements 2g-2j

[2g] generating the response signal, wherein the response signal utilizes a bit-loading modulation scheme that is generated by the one receiving node in response to determining the transmission characteristics of the channel path,

[2h] wherein determining a common bit-loading modulation scheme includes:

[2i] comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and

[2j] determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.

322. Elements 2g-2j are rendered obvious by Carhart and Grube for the same reasons provided above in Ground 1.

323. Thus, the Carhart-Grube-Shibutani/Cai-Flammer combination renders obvious claims 2 and 3.

XI. RESERVATIONS

324. If I am called to testify at the hearing, I may rely on demonstrative exhibits that illustrate and help explain the bases of my opinions (including those presented above).

325. Other than as provided or referenced in this declaration, I have not yet prepared any exhibits to support my opinions.

326. If new information becomes available, or new arguments are presented, I may revise or supplement my analysis.

XII. CONCLUSION

327. For the reasons discussed above, in my opinion a person of ordinary skill in the art would have found claims 1, 2, and 3 of the ’759 patent obvious over the references presented in Ground 1.

328. Likewise, for the reasons discussed above, in my opinion a person of ordinary skill in the art would have found claims 1, 2, and 3 of the ’759 patent obvious over the references presented in Ground 2.

329. I declare that all statements made herein of my knowledge are true and that all statements made on information and belief are believed to be true. I also 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 18 U.S.C. § 1001. I declare under the penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Date: 22Jan2024

Tim Arthur Williams

Tim A. Williams, Ph.D.

APPENDIX (CV)

Tim Arthur Williams, Ph.D.
Curriculum Vitae

Dr. Williams has 45 years of professional experience in wireless communications, networking and telecom technology. He is an entrepreneur who has participated in the organization and operation of start up companies that brought wireless LAN, software VoIP PBX, and 2-way paging technology to the marketplace. Dr. Williams holds numerous patents in wireless and signal processing technology. He is an experienced litigation support consultant with experience in patent infringement matters. Dr. Williams is also a registered Patent Agent.

- Wireless LAN
- Cellular and PCS Standards
- Cellular Telephone Architecture
- Digital Signal Processing
- Telecommunications Technology
- VoIP Technology
- Computer Networking
- Wireless Networks & Protocols

Year	University	Degree
1991	University of Texas at Austin	MBA
1985	University of Texas at Austin	Ph.D., Dissertation: "Digital Signal Processing Techniques for Acoustic Log Data"
1982	University of Texas at Austin	MSEE, Thesis: "Cepstral Processing of Speech Signals"
1976	Michigan Technological University	BSEE

Professional Experience

From: 2008
To: 2010
Organization: Expressume, Inc / Montage Inc. – Milwaukee, WI
Title: Board Member
Summary: This company sells software for human resource recruiting. This company was sold in June 2019.

From: 2008
To: 2014
Organization: Faculte, Inc. – San Jose, CA
Title: Board Member
Summary: This company provided SaaS (Software as a Service) web video based communication products.

From: 2008
To: 2010
Organization: BitRail Networks Inc. – Miami, FL
Title: Founder, Board Member
Summary: This company sold computer networking solutions.

From: 2008
To: Present
Organization: Calumet Venture Management – Madison, WI
Title: Member
Summary: This company provides seed capital and management expertise to small companies.

From: 2006
To: 2015
Organization: BEEcube Inc. – Fremont, CA
Title: Founder, Board Member, Board Advisor
Summary: This company built high speed processing solutions. This company was sold to National Instruments, Inc. in Feb 2015.

From: 2006
To: 2015
Organization: Topaz Equity, LLC – Danville, CA
Title: Founder, Board Member
Summary: This is a private equity investment company. It owned AtomAMPD which develops, markets and sells software based network solutions.

From: 2004
To: Present
Organization: DoceoTech Inc. – Danville, CA
Title: Founder, Chairman
Summary: This was a training company that provides training for engineers in Wireless, Networking, and Telephony technologies. It is currently owned by Beach Technologies, LLC.

From: 2004
To: 2006
Organization: SiBEAM, Inc. – Sunnyvale, CA
Title: Founder, Chief Executive Officer
Summary: This is a fabless semiconductor company that develops high-speed wireless networking ICs. This company was sold to Silicon Image, Inc. in Apr 2011.

From: 2001
To: 2004
Organization: JetQue, Inc. – Danville, CA
Title: Founder, Chief Executive Officer
Summary: This company created messaging solutions for the mobile professional.

From: 1999
To: 2000
Organization: Atheros Communications, Palo Alto, CA
Title: Interim CEO, Advisory Board Member
Summary: This company builds wireless LAN ICs. Atheros became a public company in May 2004. (ATHR) This company was sold to QCOM in Jan 2011.

From: 1998
To: 2000
Organization: Picazo Communications, Inc. – San Jose, CA
Title: Chief Technology Officer, Advisory Board Member
Summary: This company built and sold software PBXs Telephony equipment using VoIP and Circuit Switched Technologies. The company was purchased by Intel.

From: 1996
To: Present
Organization: Beach Technologies, LLC – Danville, CA
Title: Chief Executive Officer
Summary: This is a consulting company that provides IP services. It owns DoceoTech LLC and Streaming Knowledge LLC, which perform the same services.

From: 1991
To: 1998
Organization: Wireless Access, Inc. – Santa Clara, CA
Title: Co-Founder, Chief Technical Officer, Vice President of Engineering, Vice President of Business Strategy
Summary: This was a startup company focusing on the Narrow Band PCS equipment market. The company developed the over the air protocols, the subscriber equipment and the ICs to deploy 2-way paging services. The company was sold to Glenarye Electronics.

From: 2014
To: 2021
Organization: Through Technology, LLC. – Chicago, IL
Title: Partner
Summary: This is a private equity investment company. It owns Through Technology Group, PTE LTD, which is registered in Singapore.

From: 1979
To: 1991
Organization: Motorola, Inc. – Austin, TX – Semiconductor Sector

Title: Sr. Engineer, Member Technical Staff, Sr. MTS

Summary: Business manager, project leader, and senior technical member of the teams which were responsible for product development of the following systems:

- ADPCM transcoder,
- ISDN U-reference point transceiver,
- CT-2 voice codec and channel modem,
- GSM voice codec and channel modem,
- TDMA voice codec and channel modem
- CDMA voice codec and channel modem, and
- Japanese Digital Cellular voice codec and channel modem.

From: 1976

To: 1979

Organization: Motorola Inc. - Chicago, IL - Communications Sector - Digital Voice Privacy Group

Title: Engineer

Summary: This group built the first commercial digitally encrypted two-way FM land mobile radio system.

Professional Certifications

- Patent Agent – U.S. Patent and Trademark Office #50,790 (Jan 2002)

Issued Patents

Patent	Date	Description
9,787,471	2017	Data Enciphering or Deciphering using a Hierarchical Assignment System
7,904,117	2011	Wireless Communication Device using Adaptive Beamforming
6,781,962	2004	Apparatus and Method for Stored Voice Message Control
6,600,481	2003	Data entry apparatus and method
6,088,457	2000	Method and apparatus for over the air programming a communication device
5,854,595	1998	Communications apparatus and method with a computer interchangeable integrated circuit card
5,557,642	1996	Direct conversion receiver for multiple protocols

5,428,638	1995	Method and apparatus for reducing power consumption in digital communications devices
5,345,406	1994	Bandpass sigma delta converter suitable for multiple protocols
5,101,344	1992	Data processor having split level control store
5,001,661	1991	Data processor with combined adaptive LMS and general multiplication functions
4,989,169	1991	Digital tone detector using a ratio of two demodulators of differing frequency
4,972,356	1990	Systolic IIR decimation filter
4,965,762	1990	Mixed size radix recoded multiplier
4,947,363	1990	Pipelined processor for implementing the least-mean-squares algorithm
4,876,542	1989	Multiple output oversampling A/D converter with each output containing data and noise
4,862,169	1989	Oversampled A/D converter using filtered, cascaded noise shaping modulators
4,843,585	1989	Pipelineable structure for efficient multiplication and accumulation operations
4,843,390	1989	Oversampled A/D converter having digital error correction
4,796,219	1989	Serial two's complement multiplier
4,737,925	1988	Method and apparatus for minimizing a memory table for use with nonlinear monotonic arithmetic functions
4,734,876	1988	Circuit for selecting one of a plurality of exponential values to a predetermined base to provide a maximum value
4,727,508	1988	Circuit for adding and/or subtracting numbers in logarithmic representation
4,722,067	1988	Method and apparatus for implementing modulo arithmetic calculations
4,682,302	1987	Logarithmic arithmetic logic unit
4,618,946	1986	Dual page memory system having storage elements which are selectively swapped between the pages
4,406,010	1983	Receiver for CVSD modulation with integral filtering
4,398,262	1983	Time multiplexed n-ordered digital filter

Patent Applications and Continuation Applications

Appl. Num.	Pub. Date	Description
20070037528	2007	Wireless Communication Device using Adaptive Beamforming
20040252679	2004	Stored Voice message Control Extensions
15/711,590	2017	Data Enciphering or Deciphering using a Hierarchical Assignment

Published Papers

6 Sept 2016 Putnam, Jonathan D. and Williams, Tim A., The Smallest Salable Patent-Practicing Unit (SSPPU): Theory and Evidence.
Available at SSRN: https://ssrn.com/abstract=2835617

19 Sept 2022 Williams, Tim A, A Study of IPlytics Standard Essential Patent Tool.
Available at SSRN: https://ssrn.com/abstract= 4223782

Litigation Experience

See attached.

Dr Tim A Williams Case History

Case Type	Firm	Case Name	Client	Status	Deposition	Trial Testimo	Engagement L	Venue	Case Number(s)
Patent Infringement wireless LANs	Morgan Miller and Blair	Proxim v. 3Com	3Com.	Complete			2001	D. Del.	1:2001-cv-00155; 1:2001-cv-00755
Patent Infringement Networking ICs	Simpson Thacher & Bartlett LLP	3Com Inc. v. D-Link/ Realtek Inc.	3Com	Complete			2002	N.D. CA	03-cv-02177
Patent Infringement Wireless LANs	Weil Gotshal & Manges	Agere Systems v. Broadcom Inc.	Broadcom	Complete			2003	E.D. PA	03-cv-03138
Patent Infringement Digital Subscriber Loop (DSL)	Heller Ehrman White & McAuliffe	GlobespanVirata v. Texas Instruments	Texas Instruments; Stanford University	Complete	Y	Y	2003	D.N.J.	03-cv-02854
Patent Infringement Cellular Phones	McKool Smith	Ericsson Inc v. Samsung Inc.	Ericsson	Complete	Y		2004	ITC	337-TA-577
Patent Infringement PBX services	Howrey	Foundry Networks v. Alcatel Inc.	Foundry Networks	Complete			2004	E.D. TX	2:04-cv-00040
Patent Infringement PBX services	Howrey	Foundry Networks v. Lucent Technologies Inc.	Foundry Networks	Complete	Y		2004	E.D. TX	2:04-cv-00040
Patent Infringement Wireless ICs	Kirkland and Ellis LLP	Intel Corp. v. Wi-LAN Inc.	Intel	Complete			2004	N.D. CA	08-cv-04555
Patent Infringement VoIP Recording	Fish and Richardson	STS Networks v. Witness Systems	Witness Systems	Complete	Y	Y	2004	N.D. Ga.	04-cv-02111
Patent Infringement Telephone Systems	Sidley Austin LLP	C2 Comm. Tech Inc. v. AT&T Inc.	AT&T	Complete			2006	E.D. TX	2:06-cv-00241
Patent Infringement Networking ICs	Simpson Thacher & Bartlett LLP	Commil USA LLC v. Cisco Systems Inc.	Cisco	Complete			2006	E.D. TX	2:07-cv-341; 2:11-cv-00417; 2:11-cv-00265
Patent Infringement PBX services	Fish and Richardson	Microsoft Inc. v. Alcatel Inc.	Microsoft	Complete			2006	ITC	337-TA-598

Dr Tim A Williams Case History

Case Type	Firm	Case Name	Client	Status	Deposition	Trial Testimo	Enagement L	Venue	Case Number(s)
Patent Infringement and Trade Secret Cellular Phones	Heller Ehrman White & McAuliffe	Qualcomm Inc v. Broadcom Inc.	Qualcomm	Complete			2006	S.D. CA	06-cv-0660
Patent Infringement Telephone Systems	Jones Day LLP	in re Katz Patents	Experian	Complete			2007	C.D. CA	07-ml-01816
Patent Infringement Telephone Systems	Howrey	in re Katz Patents	General Electric	Complete	Y		2007	C.D. CA	07-ml-01816
Patent Infringement Wireless Networks	Heller Ehrman LLP and Covington & Burling LLP	Intermec Tech. V. Palm Inc.	Palm	Complete	Y		2007	D. Del.	1:2007-cv-00272
Patent Infringement Cellular Phones	Cooley Godward Kronish LLP	Qualcomm Inc. v. Broadcom Inc.	Qualcomm	Complete			2007	S.D. CA	08-cv-01607; 08-cv-01829_
Patent Infringement Cellular Phones	DLA Piper	Qualcomm Inc. v. Nokia Inc.	Qualcomm	Complete			2007	W.D. WI; S.D. CA; S.D. CA	3:07-cv-00187; 3:07-cv-01366; 3:05-cv-02063
Patent Infringement	Howrey LLP	Minerva Inc. v Motorola Inc. et al.	Research in Motion	Complete			2007	E.D. TX	2:2007-cv-00229
Patent Infringement	Covington & Burling; Cooley; Howrey; DLA Piper	Saxon Innovations LLC. v. Nokia Corp. et al.	Samsung; Nintento; RIM; Palm	Complete			2007	E.D. TX	6:2007-cv-00490
Patent Infringement	Baker Botts LLP	AT&T v Airbiquity	AT&T	Complete			2008	N.D. TX	08-cv-01637
Patent Infringement	Quinn Emanuel LLP	ESN v Cisco	Cisco	Complete			2008	E.D. TX	5:08-cv-00020
Patent Infringement Telephone Call Processing	Jones Day LLP	in re Katz Interactive Call Processing	Citizens Communications	Complete	Y		2008	C.D. CA	07-ml-01816

Dr Tim A Williams Case History

Case Type	Firm	Case Name	Client	Status	Deposition	Trial Testimo	Enagement L	Venue	Case Number(s)
Patent Infringement VoIP	Kilpatrick Stockton LLP	Verizon Corp. v. Cox Inc.	Cox	Complete	Y	Y	2008	E.D. VA	1:08-cv-00157
Patent Infringement	Latham & Watkins LLP	Freedom Wireless Inc. v. Cricket Communications Inc et al.	Cricket Comm.	Complete	Y		2008	E.D. TX	2:06-CV-504
Patent Infringement	Irell & Manella LLP	eBay Inc. v. IDT Corp. et al.	eBay.	Complete	Y		2008	W.D. AR	4:08-cv-04015
Patent Infringement	Foley & Lardner LLP	SPH America LLC v. Kyocera Wireless Corp. et al.	Kyocera.	Complete			2008	S.D. CA	3:08-cv-02146; 3:09-cv-00299; 3:09-cv-00572
Patent Infringement Wireless Devices	Ropes & Grey LLP	Motorola Inc. v. Research in Motion Inc.	Motorola	Complete			2008	N.D. TX	3:08-cv-00284
Patent Infringement	Banner & Witcoff	Paradox Ltd. v. ADT Ltd.	Paradox	Complete	Y		2008	E.D. TX	2:06-cv-00462
Patent Infringement	Gibson Dunn LLP	Broadcom v Emulex	Emulex	Complete			2009	C.D. CA	09-cv-01058
Patent Infringement Wireless ICs	Keker & Van Nest LLP	Intel Corp. v. CSIRO Inc.	Intel	Complete	Y		2009	E.D. TX	06-cv-00551
Patent Infringement	Foley and Lardner LLP	SPH v Nokia	Nokia	Complete			2009	S.D. CA	3:2009-cv-02535
Patent Infringement	Fish and Richardson LLP	Tekelec v Performance Technologies Inc.	Performance Technologies; Inc.	Complete			2009	E.D. NC	09-cv-00531
Patent Infringement	McDermott Will & Emery LLP	Telecommunications Systems Inc. v Sybase 365 Inc.	Sybase	Complete			2009	E.D. VA	09-cv-00387
Patent Infringement	Kecker & Van Nest LLP	Kodak v HTC	HTC	Complete			2010	ITC	337-TA-831
Patent Infringement	Howrey LLP	WiAV v Motorola	Motorola	Complete	Y		2010	E.D. VA	3:09-cv-00447
Patent Infringement	Quinn Emanuel LLP	WiAV v Sony	Sony	Complete	Y		2010	E.D. VA	3:09-cv-00447
Patent Infringement	Covington LLP	Fujitsu v Belkin et al.	Fujitsu	Complete	Y	Y	2011	N.D. CA	10-cv-03972-LHK
Patent Infringement	Finnegan Henderson LLP Keker & Van Nest LLP	HTC v Apple Inc.	HTC	Complete	Y	Y	2011	ITC	337-TA-721

Dr Tim A Williams Case History

Case Type	Firm	Case Name	Client	Status	Deposition	Trial Testimo	Engagement L	Venue	Case Number(s)
Patent Infringement	Hogan Lovells LLP	MOSAID v Cisco Inc.	MOSAID	Complete	Y		2011	ITC	337-TA-778
Patent Infringement	Quinn Emanuel LLP	Motorola v Apple Inc.	Motorola	Complete	Y		2011	S.D. FL; D. Del.	1:2010-cv-23580 1:2010-cv-00867
Patent Infringement	Finnegan Henderson LLP	HTC v Apple Inc.	HTC	Complete	Y		2012	ITC	337-TA-808
Patent Infringement	Proskauer LLP	MMI v Apple Inc.	MMI	Complete	Y		2012	D. Del.	1:10-cv-00258
Patent Infringement	Ropes and Grey LLP	Motorola v Microsoft Inc.	Motorola	Complete	Y	Y	2012	W.D. WA.	10-cv-01823
Patent Infringement	Quinn Emanuel LLP	Samsung v Apple Inc.	Samsung	Complete	Y	Y	2012	N.D. CA	11-cv-01846
Patent Infringement	Fish and Richardson LLP	VirneTX v Avaya	Avaya	Complete	Y		2013	E.D. TX	6:11-cv-00018
Patent Infringement and Trade Secret Cellular Phones	Heller Ehrman White & McAuliffe	Broadcom Inc. v Qualcomm Inc.	Qualcomm	Complete	Y		21-Jan-03	S.D. CA	05-cv-1392
Patent Infringement	Baker & McKenzie LLP and Kilpatrick Stockton LLP	Data Treasury Corp. v. Wells Fargo. et al.	Wells Fargo and Wachovia.	Complete	Y		6/27/05	E.D. TX	2:2005-cv-00291; 2:2005-cv-00293
Patent Infringement	Morrison & Foerster	Class v Apple	Apple	Complete			9/22/06	Unknown	Unknown
Patent Infringement	Cravath Swaine & Moore	Broadcom Inc. v Qualcomm Inc.	Qualcomm	Complete			10-Jan-07	C.D. CA	05-cv-00467
Patent Infringement	Cooley Godward Kronish LLP	Broadcom Inc. v Qualcomm Inc.	Qualcomm	Complete	Y	Y	13-Jan-08	ITC	337-TA-543
Arbitration	Cooley, Godward, Kronish LLP	Qualcomm v Panasonic	Qualcomm	Complete			6/24/09	Arbitration	None
Arbitration	Sidley Austin LLP	AT&T v. Intrado	AT&T Mobility LLC (f/k/a Cingular Wireless LLC) (_AT&TÓ);	Complete	Y		3-Nov-09	Arbitration	

Dr Tim A Williams Case History

Case Type	Firm	Case Name	Client	Status	Deposition	Trial Testimo	Enagement L	Venue	Case Number(s)
Patent Infringement	Nixon Peabody; K&L Gates; Altson and Bird; Greenberg Traurig; Spotts Fain; Winston & Strawn; Goodwin Proctor	SPH America v Acer Inc. et al	Sierra Wireless; Novatel; Nokia; Hewlett Packard; UT Starcom; Motorola Solutions; Motorola Mobility.	Complete	Y		4/14/10	S.D. CA	3:2009-cv-02535
Patent Interference	Foley and Lardner LLP	Application Serial No 10/304,121 and U.S. Patent No. 7,084,529, Patent Interference No. 105,755(RES)	EnOcean GMBH	Complete			21-Jul-10	USPTO	Application Serial No 10/304,121 and U.S. Patent No. 7,084,529, Patent Interference No.
Patent Infringement	Mayer Brown LLP	MOSAID v Cisco	MOSAID	Complete	Y		9/10/10	D. Del.	10-cv-00687
Patent Infringement	Kilpatrick Townsend LLP	Golden Bridge v Motorola.	Motorola	Complete			5/20/11	D. Del.	1:2010-cv-00428
Patent Infringement	Quinn Emanuel LLP	Barnes & Noble v LSI	Barnes & Noble	Complete			6/14/11	N.D. CA	11-cv-02709
Patent Infringement	Covington LLP;Fish and Richardson LLP; Brinks Hofer Gilson & Lione LLP; Alston & Bird LLP	Interdigital v Huawei et al.	Huawei; LG; ZTE; Nokia	Complete	Y	Y	8/18/11	ITC	337-TA-800
Patent Infringement	Cravath LLP	Parkervision v Qualcomm	Qualcomm	Complete	Y	Y	11/2/11	MDFL	11-cv-00179
Patent Infringement	Latham & Watkins LLP	Sprint Communications v Time Warner Cable et al.	Time Warner Cable	Complete			1/30/12	D. KS	2:2011-cv-02686
Patent Infringement	Kilpatrick Townsend LLP	Digitude v Motorola	Motorola	Complete			14-Feb-12	ITC.	337-TA-827

Dr Tim A Williams Case History

Case Type	Firm	Case Name	Client	Status	Deposition	Trial Testimo	Engagement L	Venue	Case Number(s)
Patent Infringement	Dechert LLP	Intellectual Ventures I LLC and Intellectual Ventures II LLC v. AT&T Mobility LLC; AT&T Mobility II LLC; New Cingular Wireless Services Inc.; SBC Internet Services Inc.; Wayport Inc.; T-Mobile USA Inc.; Nextel Operations Inc.; Sprint Spectrum L.P.; United States Cellular Corporation; and Telephone and Data Systems Inc.	Intellectual Ventures I LLC and Intellectual Ventures II LLC	Complete	Y		7/5/12	D. Del.	1:2012-cv-00193
Patent Infringement	McKenna Long & Aldridge LLP	Comerica v Maxim Integrated Products	Comerica	Complete			8/1/12	W.D. PA	12-mc-00244
Patent Infringement	DLA Piper LLP	Technology Properties Limited LLC ("TPL");Phoenix Digital Solutions LLC ("PDS") and Patriot Scientific Corporation ("PTSC") v Samsung Electronics Co. ltd. And Samsung Electronics America Inc.	Samsung	Complete			11/7/12	ITC	337-TA-853
Patent Infringement	Goodwin Procter LLP	WIAV Solutions v. ZTE Corporation. et at.	ZTE Corporation and ZTE (USA)	Complete			17-Dec-12	E.D. VA	1:12CV907
Patent Infringement	Fish and Richardson LLP	Ericsson v Samsung	Samsung	Complete			10-Jan-13	ITC	337-TA-862
Patent Infringement	Kirkland & Ellis LLP	SimpleAir Inc. v. Microsoft Corp. et al.	Samsung Electronics Co.; Ltd.; Samsung Electronics America; Inc.; and Samsung Telecommunications America LLC	Complete			19-Mar-13	E.D. TX	2:11-cv-00416-JRG
Patent Infringement	Winston & Strawn LLP	Adaptix v Motorola Mobility LLC et al.	Motorola Mobility	Complete			22-Mar-13	E.D. TX Tyler	6:12-cv-00016-MHS
Patent Infringement	Winston & Strawn LLP	Adaptix v Motorola Mobility LLC et al.	Motorola Mobility	Complete			22-Mar-13	N.D. CA	5:13-cv-01774-PSG
Patent Infringement	Bunsow De Mory Smith & Allison LLP	Cassidian Communications v. microData GIS Inc.; microData LLC; and TeleCommunications Systems Inc.	Cassidian Communications	Complete	Y	Y	1-Apr-13	E.D. TX Marshall	2:09-cv-00395-JRG
Patent Infringement	Kilpatrick Townsend & Stockton LLP	SimpleAir Inc. v. Microsoft Corporation et al.	Google Inc.	Complete	Y	Y	2-Apr-13	E.D. TX	2:11-cv-00416-JRG

Dr Tim A Williams Case History

Case Type	Firm	Case Name	Client	Status	Deposition	Trial Testimo	Enagement L	Venue	Case Number(s)
Patent Infringement	Ropes & Gray LLP	InterDigital Technology Corp.IPR Licensing Inc. and InterDigital Holdings Inc	Samsung Electronics Co.; LTD.; Samsung Electronics America; Inc.; and Samsung Telecommunications America; LLC	Complete	Y		8-Apr-13	ITC Del.	337-TA-868 and Case No. 13-cv-OOO I I
Patent Infringement	Covington & Burling LLP	InterDigital Technology Corp.IPR Licensing Inc. and InterDigital Holdings Inc	Huawei	Complete	Y		12-Jun-13	ITC Del.	337-TA-868 and Case No. 13-009 (RGA)).
Patent Infringement	Covington & Burling LLP	InterDigital Technology Corp.IPR Licensing Inc. and InterDigital Holdings Inc	Huawei	Complete			12-Jun-13	Arbitration	
Patent Infringement	Brinks Hofer Gilson & Lione	InterDigital Technology Corp.IPR Licensing Inc. and InterDigital Holdings Inc	ZTE Corporation and ZTE (USA) Inc.	Complete			12-Jun-13	ITC Del.	337-TA-868 and Case No. 13-009 (RGA)).
Patent Infringement	Alston & Bird LLP	InterDigital Technology Corp.IPR Licensing Inc. and InterDigital Holdings Inc	Nokia Corporation and Nokia Inc	Complete			20-Jun-13	ITC Del.	337-TA-868 and Case No. 13-010 (RGA)).
Patent Infringement	Tensegrity Law Group LLP	Intellectual Ventures I LLC and Intellectual Ventures II LLC v Canon Inc. Canon U.S.A. Inc. and Canon Solutions America Inc.	Intellectual Ventures I LLC and Intellectual Ventures II LLC	Complete	Y		12-Jul-13	Del.	1:13-CV-00473-SLR (D. Del.)
Patent Infringement	Tensegrity Law Group LLP	Intellectual Ventures I LLC and Intellectual Ventures II LLC v Ricoh Company Ltd. Ricoh Americas Corporation and Ricoh Electronics Inc	Intellectual Ventures I LLC and Intellectual Ventures II LLC	Complete			12-Jul-13	Del.	1:13-CV-00474-SLR (D. Del.)
Patent Infringement	OMelveny & Myers LLP	Commonwealth Scientific and Industrial Research Organisation v. MediaTek Inc. et al.	Samsung Electronics Co.; Ltd.; Samsung Semiconductor Inc.; and Samsung Telecommunications America; LLC	Complete			19-Jul-13	E.D. TX	6:12-cv-578-LED

Dr Tim A Williams Case History

Case Type	Firm	Case Name	Client	Status	Deposition	Trial Testimo	Enagement L	Venue	Case Number(s)
Patent Infringement	Feinberg Day Alberti & Thompson LLP	Intellectual Ventures v PNC Bank, Capital One, First National Bank of Omaha, JP Morgan Chase, Fifth Third Bank, Bank of America, BBVA Compass Bank, Commerce Bank, Suntrust, and M&T	Intellectual Ventures	Complete	Y		30-Aug-13	E.D. VA	1:13-cv-740-AJT/TRJ
Patent Infringement	Feinberg Day Alberti & Thompson LLP	Intellectual Ventures v PNC Bank, Capital One, First National Bank of Omaha, JP Morgan Chase, Fifth Third Bank, Bank of America, BBVA Compass Bank, Commerce Bank, Suntrust, and M&T	Intellectual Ventures	Complete			30-Aug-13	W.D. PA	2: 13-cv-00740-AJS
Patent Infringement	Gibson Dunn	AIP Acquisition LLC v. Cablevision Systems Corporation, et al.	CSC Holdings LLC	Complete			3-Sep-13	D. Del.	1:12-cv-01688-GMS)
Patent Infringement	Cooley LLP	Monec Holding AG v. Motorola Mobility LLC, et al.,	Exedea, Inc	Complete			27-Sep-13	CA	11-798-LPS-SRF
Patent Infringement	Cooley LLP	Monec Holding AG v. Motorola Mobility LLC, et al.,	HTC Corporation	Complete	Y		27-Sep-13	CA	11-798-LPS-SRF
Patent Infringement	Kilpatrick Townsend & Stockton	Monec Holding AG v. Motorola Mobility LLC, et al.,	Motorola Mobility LLC	Complete	Y		27-Sep-13	CA	11-798-LPS-SRF
Patent Infringement	Fish & Richardson P.C.	Monec Holding AG v. Motorola Mobility LLC, et al.,	Samsung Electronics America, Inc. and Samsung Electronics, Inc.	Complete	Y		27-Sep-13	CA	11-798-LPS-SRF
Arbitration	Covington & Burling LLP	Sasken Communication Technologies Limited v. Spreadtrum Communications, Inc. and Spreadtrum Communications USA Inc	Spreadtrum	Complete	Y	Y	30-Sep-13	American Arbitration Association International Centre for Dispute Resolution	50-117-T-00924-12
Patent Infringement	FINNEGAN, HENDERSON,LLP and HOLLAND & HART LLP	Cellport v. ZTE et al.	HTC Corp., et al	Complete			27-Oct-13	CO	1:13-cv-173 - RBJ
Patent Infringement	Dickstein Shapiro LLP, Lathrop & Gage, LLP	Cellport v. ZTE et al.	LG Electronics, Inc., et al	Complete			27-Oct-13	CO	1:13-cv-175 - RBJ

Dr Tim A Williams Case History

Case Type	Firm	Case Name	Client	Status	Deposition	Trial Testimo	Enagement L	Venue	Case Number(s)
Patent Infringement	FOX ROTHSCHILD LLP, KING & SPALDING LLP	Cellport v. ZTE et al.	Nokia Corp., et al.	Complete			27-Oct-13	CO	1:13-cv-178 - RBJ
Patent Infringement	McKENZIE LLP	Cellport v. ZTE et al.	Pantech Co. Ltd., et al	Complete			27-Oct-13	CO	1:13-cv-179 - RBJ
Patent Infringement	GREENBERG TRAURIG, LLP	Cellport v. ZTE et al.	Samsung Electronics Co., Ltd., et al	Complete			27-Oct-13	CO	1:13-cv-180 - RBJ
Patent Infringement	Sheppard Mullin Richter &	Cellport v. ZTE et al.	ZTE Corporation and ZTE	Complete			27-Oct-13	CO	1:12-cv-3296
Patent Infringement	Ropes & Gray LLP	Broadcom Corp. v. NXP Semiconductors USA, Inc.	Broadcom	Complete			11-Feb-14	CDCA	CV SA 8:13-829-MRP(MANx)
Patent Infringement	Quinn Emanuel LLP	GENBAND US LLC v. Metaswitch Networks Ltd., et. al.	Metaswitch Networks Ltd.	Complete	Y	Y	27-Feb-14	E.D. TX	2:14-CV-33-JRG-RSP
Patent Infringement	O'Melveny & Myers LLP	Concinnitas, LLC and George Hindman v. Samsung Telecommunications America, LLC, et al,	Electronics America, Inc. and Samsung	Complete			22-Apr-14	E.D. TX	2: 13-CV-824-JRG-RSP
IPR	Hill, Kertscher & Wharton,	Regarding the U.S. Patent No. 8,400,926 B2	HTC Corporation	Complete			9-May-14	USPTO	U.S. Patent No. 8,400,926 B2
IPR	Hill, Kertscher & Wharton, LLP	Regarding the U.S. Patent No. 8,134,600, 8,477,197, 8581,991	HTC Corporation	Complete			9-May-14	USPTO	U.S. Patent No. 8,134,600, 8,477,197, 8581,991
IPR	Morgan, Lewis & Bockius_LLP	Regarding the U.S.Patent No. 6,819,923	NEC Casio Mobile Communications Ltd. and NEC Corp of America	Complete			25-Jun-14	USPTO	U.S.Patent No. 6,819,923
IPR	Everett Upshaw, PLLC	Regarding the U.S.Patent No. 7,215,962	ZTE Corporation and ZTE (USA)	Complete	Y		25-Jun-14	USPTO	U.S.Patent No. 7,215,962
Patent Infringement	Fenwick & West LLP	Cellular Communications Equipment LLC v. Amazon.com, Inc. et al	Amazon Inc.	Complete			1-Jul-14	E.D. TX	TXED-6-13-cv-00569; consolidated with Case No. 6-13-cv-00507
Patent Infringement	Winthrop Shaw Pittman	Cellular Communications Equipment LLC v. HTC Corporation et al	HTC Corporation	Complete			1-Jul-14	E.D. TX	6:13-cv-00507

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Case Type	Firm	Case Name	Client	Status	Deposition	Trial Testimo	Enagement L	Venue	Case Number(s)
IPR	H.C. Park & Associates, PLC	Regarding the U.S.Patent No. 7,218,923	Pantech Co. Ltd., et al	Complete			2-Jul-14	USPTO	U.S.Patent No. 7,218,923
Patent Infringement	Pillsbury Winthrop Shaw Pittman	SPH America LLC v. ZTE Corp et. al.	ZTE Corporation and ZTE (USA) Inc.	Complete			10-Jul-14	ED TX	3:13-cv-02326
Patent Infringement	Pillsbury Winthrop Shaw Pittman	Novatel Wireless, Inc. v. ZTE Corp. et. al.	ZTE Corporation and ZTE (USA) Inc.	Complete			16-Jul-14	ED TX	3:12-cv-02576
Patent Analysis	Qualcomm	Analysis of Qualcomm portfolio	Qualcomm	Complete			6-Aug-14	Consulting	Analysis of Qualcomm portfolio
IPR	Pillsbury Winthrop Shaw Pittman	Regarding Vringo patents	ZTE Corporation and ZTE (USA) Inc.	Complete			21-Aug-14	USPTO	U.S. Patents
Patent Infringement	Finnegan, Henderson, Farabow,Garrett & Dunner, L.L.P.	OpenTV Inc. et. al. v. Apple, Inc.	OpenTV, Inc. and Nagravision, SA of the Kudelski Group	Complete			22-Sep-14	N.D. CA	14-cv-01622-JST
IPR	Foley and Lardner LLP	Regarding the U.S. Patent No. 8,532,231, 8,565,346	Huawei Technologies Co., Ltd., Futurewei Technologies, Inc. and Huawei Device USA,	Complete			14-Oct-14	USPTO	Regarding the U.S. Patent No. 8,532,231, 8,565,346
Patent Infringement	Desmarais LLP	Intellectual Ventures I LLC and Intellectual Ventures 11 LLC v. Nikon Corp., et al	Intellectual Ventures I LLC and Intellectual Ventures II LLC	Complete			11-Nov-14	Del.	1:11-CV-1025-SLR
Patent Infringement	Cooley LLP	ParkerVision, Inc. v Qualcomm Incorporated, et al	Qualcomm	Complete			15-Dec-14	MDFL	6:14-cv-00687
Patent Infringement	DLA Piper LLP	Technology Properties Ltd LLC et al. v. Samsung Electronics Co., Ltd	Samsung Electronics Co., Ltd.	Complete			22-Jan-15	N.D. CA	3:12-cv-03879
Patent Analysis	Cravath, Swaine & Moore LLP	Patent Investigation	Qualcomm	Complete			6-Mar-15		
Patent Infringement	Paul Hastings	Summit 6 LLC v. HTC Corp.	HTC Corp and HTC America	Complete			3-Apr-15	NDTX	7:14-cv-00014

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Case Type	Firm	Case Name	Client	Status	Deposition	Trial Testimo	Enagement L	Venue	Case Number(s)
Patent Infringement	Kolpatrick Townsend & Stockton LLP	Summit 6 LLC v. Motorola	Google/Motorola	Complete			8-Apr-15	NDTX	7:14-cv-00014
Patent Infringement	Quinn Emanuel LLP	Cellular Communications Equipment LLC v. Samsung Electronics Co.Ltd et al	Samsung Electronics Co., Ltd.,	Complete			8-Jun-15	E.D. TX	6:14-cv-759-JRG
IPR	Sterne, Kessler, Goldstein& Fox PLLC	Int'l Bus. Machines Corp. v IV	IV	Complete	Y		10-Jun-15	USPTO	2015-00089, 2015-00092
Patent Infringement	Novak, Druce Connolly Bove + Quigg LLP	Sonus Networks, Inc. v Inventergy, Inc. and Inventergy Global, Inc	Inventergy, Inc. and Invetergy Global, Inc	Complete			24-Jul-15	N.D. CA	15-cv-00322
Patent Infringement	Novak, Druce Connolly Bove + Quigg LLP	Sonus Networks, Inc. v Inventergy, Inc. and Inventergy Global, Inc	Inventergy, Inc. and Invetergy Global, Inc	Complete			24-Jul-15	MA	15-cv-10207
Patent Infringement	Novak, Druce Connolly Bove + Quigg LLP	Sonus Networks, Inc. v Inventergy, Inc. and Inventergy Global, Inc	Inventergy, Inc. and Invetergy Global, Inc	Complete			24-Jul-15	E.D. TX	14-cv612
Arbitration	Mayer Brown LLP	Nokia Technologies Ltd and LG Electronics, Inc.	LG Electronics, Inc.	Complete	Y		25-Sep-15	Arbitration	None
IPR	Sterne, Kessler, Goldstein& Fox PLLC	LM Ericsson v IV	Intellectual Ventures I LLC and Intellectual Ventures II LLC	Complete	Y		18-Dec-15	USPTO	2015-01872
IPR	Sterne, Kessler, Goldstein& Fox PLLC	Old Republic Group Inc. v IV	Intellectual Ventures I LLC and Intellectual Ventures II LLC	Complete	Y		18-Dec-15	USPTO	IPR2015-01992, CBM2015-00184
IPR	Sterne, Kessler, Goldstein& Fox PLLC	LM Ericsson v IV	Intellectual Ventures I LLC and Intellectual Ventures II LLC	Complete	Y		26-Dec-15	USPTO	2015-01873

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Case Type	Firm	Case Name	Client	Status	Deposition	Trial Testimo	Enagement L	Venue	Case Number(s)
Patent Infringement	Cooley LLP	ParkerVision, Inc. v Qualcomm Incorporated, et al	Qualcomm	Complete			1-Feb-16	ITC	337-TA-982
Patent Analysis	Norton Rose Fulbright US LLP	Patent Investigation	Qualcomm	Complete			22-Feb-16		
Patent Infringement	Fish & Richardson P.C.	TiVo Inc. v. Samsung Electronics Co., Ltd., et al.,	Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc.	Complete			14-Mar-16	EDTX	2:15-CV-1503
Patent Infringement	RuyakCheria n LLC	Brocade Communications Systems, Inc.	Communicati ons Systems, Inc.	Complete			4-May-16	None	None
IPR	Bragalone Conroy PC	Securus Technologies, Inc. v. Global Tel*Link Corporation	Securus Technologies, Inc	Complete	Y		6-May-16	USPTO	IPR2016-01123
Patent Infringement	Cooley LLP	Skky, LLC v. Facebook, Inc. et al.	Facebook, Inc.	Complete			7-Jun-16	?	16-cv-00094-WMW-FLN
IPR	Winthrop Shaw Pittman	Cellular Communications Equipment LLC v. AT&T et al	HTC Corporation, HTC America	Complete	Y		7-Jul-16	USPTO	Regarding U.S. Patents 8,457,676 and 8,570,957
IPR	Pillsbury Winthrop Shaw Pittman	Cellular Communications Equipment LLC v. AT&T et al	ZTE Corporation and ZTE (USA), Inc.	Complete			7-Jul-16	USPTO	Regarding U.S. Patents 8,457,676 and 8,570,957
Patent Infringement	Desmarais LLP	Uniloc USA, Inc. and Uniloc Luxembourg S.A. v. Cisco Systems, Inc.	Cisco Systems, Inc.	Complete			15-Jul-16	E.D. TX	6:15-CV-1175-JRG
Patent Infringement	Quinn Emanuel LLP	GENBAND US LLC v. Metaswitch Networks Ltd., et. al.	Metaswitch Networks Ltd.	Complete	Y		15-Jul-16	E.D. TX	2:16-cv-582-JRG-RSP
Patent Infringement	Duanne Morris	Ruckus Wireless, Inc. v Chrimar Systems d/b/a CMS Technologies and Chrimar Holding Company LLC	Ruckus Wireless	Complete			27-Jul-16		
Patent Infringement	Singularity IP & Foster Pepper PLLC	CommScope Technologies LLC v. Dali Wireless, Inc.,	CommScope Technologies LLC	Complete			17-Aug-16	N.D. Tx	3:16-cv-00477

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Case Type	Firm	Case Name	Client	Status	Deposition	Trial Testimo	Engagement L	Venue	Case Number(s)
Patent Infringement	Quinn Emanuel LLP	Huawei Technologies, Co. Ltd et al v. Samsung Electronics Co, Ltd. et al	Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc.	Complete	Y		23-Aug-16	NDCA	3:16-cv-02787
Patent Infringement	Foster Pepper PLLC	CommScope Technologies LLC v. Dali Wireless, Inc.,	CommScope Technologies LLC	Complete			15-Oct-16	N.D. Tx	3:16-cv-00477
Technology Review	Foster Pepper PLLC	Dali Wireless, Inc.	Dali Wireless, Inc.	Complete			28-Oct-16	None	None
Patent Analysis	Foster Pepper PLLC	Dali Wireless, Inc v. Fiplex Communications, Inc.	Dali Wireless, Inc	Complete			29-Oct-16		
Patent Infringement	Finnegan, Henderson, Farabow,Garrett & Dunner, L.L.P.	Certain Digital Cable and Satellite Products, Set-Top Boxes, Gateways, and Components Thereof	Sony Corporation	Complete			8-Dec-16	ITC	337-TA-1049
Patent Infringement	Irell & Manella, LLP	various patent disputes involving Mobile Telecommunications Technology, LLC ("MTel") and regarding United States Patents Nos. 5,590,403, 5,659,891, and 5,915,210.	Juniper Networks, Inc.	Complete			29-Dec-16		
Patent Infringement	Dechert, LLP, Winston & Strawn	Tech Pharmacy Services, LLC v. Alixa RX LLC., et al.	Alixa RX LLC	Complete	Y		6-Jan-17	EDTX	4:15-cv-766
Patent Infringement	Sheppard Mullin Richter & Hampton LLP	Papst Licensing GMBH & Co. KG v. ZTE Corporation and ZTE (USA), Inc.	ZTE (USA), Inc.	Complete	Y		27-Jan-17	EDTX	6: 15-cv-1100
Antitrust	Freitas Angell & Weinberg LLP	Intellectual VenturesI LLC v Capital One	Intellectual Ventures	Complete			15-Feb-17	MD	8:14-cv-111 (PWG)
IPR	Knobbe, Martens, Olson, & Bear LLP	Symantec Corporation ("Symantec") v, IV's U.S. Patent No. 7,757,298	IV	Complete			16-Feb-17	USPTO	2016-01433
Patent Infringement	Cooley LLP	Uniloc USA, Inc. et al. v. Facebook, Inc. et al.	Facebook, Inc.	Complete			17-Feb-17	EDTX	2:16-cv-00728

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Case Type	Firm	Case Name	Client	Status	Deposition	Trial Testimo	Enagement L	Venue	Case Number(s)
Patent Infringement	Feinberg Day Alberti & Thompson LLP	OpenTV Inc. v. NFL Enterprises, LLC	OpenTV, Inc.	Complete			23-Mar-17	EDTX	6:17-cv-00031
IPR	Finnegan, Henderson, Farabow,Garrett & Dunner, L.L.P.	Unified Patents (6,014,089, 7,346,313)	Unified Patents	Complete			4/8/17	USPTO	(6,014,089, 7,346,313
Patent Infringement	Irell & Manella, LLP	Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. v. Sirius XM Radio, Inc.,	Fraunhofer	Complete			17-May-17		17-184-VAC-SRF
Technology Review	RuyakCherian LLC	XR Communications, LLC., dba Vivato Technologies v. Ruckus Wireless, Inc.	Ruckus Wireless	Complete			13-Jun-17	CDCA	2:17-cv-02961
Patent Infringement	DLA Piper LLP	Mobile Telecommunications Technologies, LLC v. Aruba Networks, Inc., et al.,	Aruba/HPE and HP	Complete			25-Aug-17	MD	16-md-2722
Patent Infringement	Dechert, LLP	Intellectual Ventures I LLC v. T-Mobile USA, Inc., T-Mobile US, Inc., Ericsson Inc., and Telefonaktiebolaget LM Ericsson	IV	Complete	Y	Y	29-Aug-17	EDTX	2:17-cv-00577-JRG
Patent Infringement	Cooley LLP	Silver State Intellectual Tech., Inc. v. Facebook, Inc. et al.	Facebook, Inc.	Complete			19-Sep-17	ND CA	4:17-cv-03349-JSW
Patent Infringement	Quinn Emanuel LLP	QCOM v Apple SD Cal	Qualcomm	Complete	Y		15-Nov-17	SD. Cal,	5:17-cv-0108-GPC-MDD,
Patent Infringement	Norton Rose	QCOM v Apple	Qualcomm	Complete	Y		15-Nov-17	ND Cal	5:17-md-02773-LHK,
Patent Infringement	Norton Rose	QCOM v Apple	Qualcomm	Complete	Y		15-Nov-17	ND Cal	5:17-cv-00220-LHK
Patent Infringement	Quinn Emanuel LLP	In the Matter of CERTAIN MOBILE ELECTRONIC DEVICES AND RADIO FREQUENCY	Qualcomm	Complete	Y		10-Jan-18	ITC	U.S. PATENT NO. 9,608,675
Patent Infringement	Paul Hastings	3G Licensing, S.A. et al v. HTC Corporation	HTC Corporation	Complete			7-Mar-18	Del.	1:17-cv-00083-LPS-CJB
Patent Infringement	Fish & Richardson P.C.	Sonus Networks, Inc. v. Metaswitch Networks Ltd. et al,	Metaswitch Networks Ltd.	Complete			19-Jun-18	EDTX Marshall	l 8-cv-00057-RWS, l 8-cv-00058-RWS, IPR
Request for Reexam	Dentons US LLP	Request for Reexam re: patent 7,814,216	Dentons	Complete			6-Sep-18	USPTO	US Patent 7,814,216
Contract Dispute	Jones Day	Qualcomm, Inc. v. Apple, Inc.	Qualcomm	Complete	Y		28-Sep-18	San Diego Supperior Ct	37-2017-00041389-CU-BC-NC
Patent Infringement	O'Melveny & Myers LLP	Top Victory Electronics (Taiwan) Co. Ltd. v. American Patents LLC	Top Victory Electronics	Complete			13-Dec-18	EDTX	4:18-cv-00768-ALM

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Case Type	Firm	Case Name	Client	Status	Deposition	Trial Testimo	Enagement L	Venue	Case Number(s)
Patent Infringement	Birch, Stewart, Kolasch & Birch, LLP	Blitzsafe Texas LLC v Mitsubishi Electric Corp, et al.	Mitsubishi	Complete			19-Feb-19	EDTX	2:17-cv-00430-JRG
IPR	Jones Day	Qualcomm/Intel PTAB Matters (U.S. Patent No. 9,608,675)	Qualcomm	Complete	Y		20-Feb-19	USPTO	IPR2018-01326 to 01330 and IPR2018-01340
Patent Infringement	Finnegan, Henderson, Farabow,Garrett & Dunner, L.L.P.	Uniloc Luxembourg S.A., Uniloc 2017 LLC ("Uniloc") v LG Electronics Inc., LG Electronics U.S.A., Inc., and LG Electronics MobileComm U.S.A., Inc. ("LG")	LG	Complete			11-Mar-19	NDCA	3:18 cv-06737-JST, 5:18-cv-06738-LHK, 3:18-cv-06739-JST, 3:18-cv-06740-JST) and PTO
Ex Parte	Finnegan, Henderson, Farabow,Garrett & Dunner, L.L.P.	TCL Communication Technology Holdings Ltd. ("TCL").	TCL	Complete			13-Mar-19	USPTO	U.S. Patent No. 7,149,510
Patent Infringement	Mayer Brown LLP	Maxell, Ltd., et al., v. Apple Inc.	Maxell	Complete	Y		15-Apr-19	EDTX	5:19-cv-00036-RWS
Patent Infringement	Maschoff Brennan	ICON Health & Fitness,I nc. v. Tme Fitness Technology, Inc	ICON	Complete			29-May-19	Missouri	4:18-cv-00439
Patent Infringement	Gibson Dunn	Sprint Communications Co. L.P. v. Cequel Communications, UC et al.	Altice USA	Complete	Y		17-Jun-19	Del.	I: 18-cv-01752-RGA
Patent Infringement	Charhon Callahan Robson & Garza, PLLC	United Access Technologies, LLC ("UAT") in connection with UAT's lawsuits against AT&T, Verizon, Frontier and CenturyTel,	UAT	Complete	Y		17-Jun-19		1:05-cv-00866-LPS, 1.11-cv-00338-LPS, 1:11-cv-00341-LPS
Patent Infringement	Susman Godfrey l.l.p.	Sol IP, LLC v. AT&T Mobility LLC, et al.	Sol IP	Complete	Y		24-Jul-19	E.D. Tex.	2:18-cv-00526; 2:18-cv-00527; 2:18-cv-00528
IPR	Kelley Drye & Warren LLP	Zomm / Apple PTAB Matters (U.S. Patent No. 9,608,675)	Zomm, LLC	Complete	Y		30-Jul-19	USPTO	IPR2019-275, IPR2019-277, IPR2019-1030
Patent Infringement	Fish & Richardson P.C.	Bell Northern Research, LLC v. LG Electronics Inc., et al.,	LG Electronics, Inc.	Complete			6-Aug-19	SD. Cal	18-cv-2864-CAB-BLM
Technology Consulting	Rose Fulbright US LLP	Sanyo v. Intel	Sanyo	Complete	Y		3-Dec-19	Chancery of Delaware	C.A. No. 2018-0723-MTZ
Patent Infringement	Sidley Austin LLP	LG Electronics Inc. v. Hisense Electronics Manufacturing Company of America	LG	Complete			15-Jan-20	CDCA	2:19-cv-09474-SJO-E

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Case Type	Firm	Case Name	Client	Status	Deposition	Trial Testimo	Enagement L	Venue	Case Number(s)
Patent Infringement	Ahmad, Zavitsanos, Anaipakos, Alavi, Mensing	Cellular Evolution, LLC v. AT&T Mobility, LLC and Cricket Wireless, LLC	Cellular Evolution	Complete			30-Jan-20	EDTX	19-cv-00228
Patent Infringement	Ahmad, Zavitsanos, Anaipakos, Alavi, Mensing	Cellular Evolution, LLC v. T-Mobile, US, Inc. and T-Mobile USA, Inc.,	Cellular Evolution	Complete			30-Jan-20	EDTX	19-cv-00232
Patent Infringement	Cooley LLP	ParkerVision v. Apple	Qualcomm	Complete			11-Feb-20	MDFL	3:15-cv-01477
Patent Infringement	Cooley LLP	ParkerVision v. Qualcomm	Qualcomm	Complete	Y		11-Feb-20	MDFL	6:14-cv-00687
IPR	Wolf Greenfield LLP	MediaTek v NTT	MediaTek	Complete	Y		2-Jul-20	USPTO	Re U.S. Patent Nos. 7,280,551 and 7,400,616
Patent Infringement	Mintz, Levin	Parus Holdings, Inc.	Parus Holdings	Complete			31-Aug-20	WDTX	Not specified
Patent Infringement	Venable LLP	Blitzsafe Texas LLC v. Fiat Chrysler Automobiles N.V., FCA US LLC et al.	Maserati North America Inc. and FCA US LLC	Complete	Y		8-Sep-20	EDTX	2:19-cv-00378-JRG
IPR	Wolf Greenfield LLP	Bose Corporation v. KOSS Corporation	Bose	Complete	Y		20-Oct-20	USPTO	U.S. Patent No. 10,368,155
Patent Infringement	Shearman & Sterling LLP	StratosAudio, Inc. v. Volkswagen Group of America, Inc	Volkswagen	Complete	Y		13-Jan-21	WDTX	6:20-cv-1131
Patent Infringement	Fish & Richardson P.C.	Ericsson Inc v. Samsung Electronics Co.	Samsung	Complete			11-Mar-21	ITC and EDTX	337-TA-1248 and No. 2:20-cv-380 (E.D. Tex),
Patent Infringement	Dechert, LLP	IPCom v AT&T Inc, Verizon, Sprint	IPCom	Settled	Y		17-Mar-21	EDTX	PCom Gmbh & Co. KG v. AT&T Inc. et al., Case No. 2:20-cv-00322 (E.D. Tex.); IPCom Gmbh & Co. KG v. Verizon Communications Inc. et al., Case No. 2:20-cv-00323 (E.D. Tex.); and IPCom Gmbh & Co. KG v. Sprint Spectrum L.P. et al., Case No. 2:20-cv-00321 (E.D. Tex.)

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Case Type	Firm	Case Name	Client	Status	Deposition	Trial Testimo	Engagement L	Venue	Case Number(s)
Patent Infringement	Sidley Austin LLP	WSOU v. Hewlett Packard	Hewlett Packard	Settled			4-Jun-21	WDTX	U.S. Patent Nos. 7,280,534; 7,386,630; 7,443,832; 7,519,056; 7,646,729; 8,462,774; and 9,398,629
Patent Infringement	Desmarais LLP	Cellspin Soft, Inc. v. Google Fitbit, Inc.	Google / Fitbit	Complete			1-Jun-21	NDCA	4:17-cv-05928-YGR
Patent Infringement	Fish & Richardson P.C.	Cellspin Soft, Inc. v. Fossil, Inc.	Fossil	Complete			18-Aug-21	NDCA	4:17-cv-05933-YGR
Patent Infringement	DLA Piper LLP	Cellspin Soft, Inc. v. Nike Inc	Nike	Complete			28-Jul-21	NDCA	4:17-cv-05931-YGR
Patent Infringement	Harness Dickey	Cellspin Soft, Inc. v. Under Armour, Inc.	Under Armor	Complete			4-Aug-21	NDCA	4:17-cv-05932-YGR
Patent Infringement	Lamkin IP	Cellspin Soft, Inc. v. Garmin, Inc.	Garmin	Complete			6-Aug-21	NDCA	4:17-cv-05934-YGR
Patent Infringement	Morrison & Foerster	Cellspin Soft, Inc. v. Nikon, Inc.	Nikon	Complete			23-Aug-21	NDCA	4:17-cv-05936-YGR
Patent Infringement	Fish & Richardson P.C.	Smart Mobile Technologies, LLC v. Samsung Electronics	Samsung	ongoing			1-Oct-21	CDTX	6:21-cv-00701-ADA
Patent Infringement	Ruyak Cherian LLP	Bright Data Ltd. v. NetNut Ltd.	Bright Data	Complete	Y		7-Oct-21	EDTX	2:21-cv-00225-JRGRSP
Patent Infringement	Quinn Emanuel LLP	Verkada, Inc. v. Motorola Solutions Inc.	Verkada	Complete	Y	Y	25-Oct-21	ITC	Inv. No. 337-TA-1281
Patent Infringement	Mayer Brown LLP	Maxell, Ltd., v. Lenovo Group Ltd., Lenovo (United States) Inc., and Motorola Mobility LLC	Maxell	Complete			9-Nov-21	WDTX	6:21-cv-01169
Patent Infringement	Mayer Brown LLP	Maxell, Ltd., v. Lenovo Group Ltd., Lenovo (United States) Inc., and Motorola Mobility LLC	Maxell	Complete			9-Nov-21	ITC	Inv. No. 337-TA-1324
Patent Review		Collision Communications	Collision	Complete			1-Feb-22		
Patent Infringement	Kasowitz Benson Torres LLP	IV v GM	IV	Complete			18-Feb-22	WDTX	6:21-cv-01088-ADA
Patent Infringement	Kasowitz Benson Torres LLP	IV v Toyota	IV	Complete			18-Feb-22	WDTX	2:21-CV-00389-JRG-RSP
Patent Infringement	Kasowitz Benson Torres LLP	IV v Honda	IV	Complete			18-Feb-22	WDTX	2:21-CV-03090-JRG-RSP
Patent Infringement	LTL Attorneys LLP	Howlink Global LLC v. Verizon Comm'ns, et al.	Howlink	Complete			21-Mar-22	EDTX	22-cv-00040

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Case Type	Firm	Case Name	Client	Status	Deposition	Trial Testimo	Enagement L	Venue	Case Number(s)
Patent Infringement	LTL Attorneys LLP	Howlink Global LLC v. AT&T, Inc.,et al.	Howlink	Complete			21-Mar-22	EDTX	22-cv-00042
Patent Infringement	Heim Payne Chorush LLP	Telecom Network Solutions v. AT&T	Telecom Network Solutions	Complete			20-Apr-22	EDTX	2:21-cv-00415-JRG,
Patent Infringement	Heim Payne Chorush LLP	Telecom Network Solutions v. Verizon,	Telecom Network Solutions	Complete			20-Apr-22	EDTX	2:21-cv-00416-JRG,
Patent Infringement	Heim Payne Chorush LLP	Telecom Network Solutions v. T-Mobile	Telecom Network Solutions	Complete			20-Apr-22	EDTX	2:21-cv-00418-JRG,
Patent Infringement	Baker Botts LLP	LG Electronics Inc. v. TCL Electronics Holdings Ltd. et al.,	LG Electronics, Inc.	Complete			17-May-22	EDTX	2:22-cv-00122
Patent Infringement	Ruyak Cherian LLP	Bright Data Ltd. Various IPRs	Bright Data	Ongoing	Y		1-Jun-22	USPTO	IPR 2022-00861, IPR 2022-00862
Patent Infringement	K&L Gates LLP	Competitive Access Systems, Inc. v. Oracle Corporation	CAS	Complete			23-Sep-22	EDTX	2:22-cv-00287
Patent Infringement	Jones Day	BJ's Wholesale Club Holdings, Inc. v. Walmart Apollo, LLC	Walmart	Complete			11-Nov-22	USPTO	IPR2022-01471, IPR2022-01528, IPR2022-01561, IPR2022-01563, IPR2022-01564
Patent Infringement	Ruyak Cherian LLP	Metacluster LT, UAB v. Bright Data Ltd.	Bright Data	Ongoing	Y		1-Feb-23	EDTX	2:22-cv-11-JRG-RSP
Patent Infringement	Sterne, Kessler, Goldstein& Fox PLLC	Roku, Inc. v Dolby International AB	Roku	Complete			8-Feb-23	USPTO	IPR - '757 Patent
Patent Infringement	Baker Botts, LLP	AGIS Software Development, LLC v Samsung Electronics Co, Ltd.	Samsung	Ongoing			16-May-23	EDTX	2:22-cv-00263-JRG-ADA
Patent Infringement	BartlitBeck LLP	General Access Solutions Ltd. V. Verizon, et. al.	GAS	Complete			7-Feb-23	USPTO	IPR
Patent Infringement	Susman Godfrey l.l.p.	Koninklijke KPN N.V. v Ericsson	KPN	Complete			7-Mar-23	EDTX	2:22-cv-282
Patent Infringement	Mintz, Levin	Mullen Industries v Apple Inc.	Mullen	Complete			3-May-23	USPTO	IPR
Patent Infringement	Fish & Richardson P.C.	Entropic Communications, LLC v DISH Network Corp.	DISH	Ongoing			30-Jun-23	USPTO	IPR
Patent Infringement	Jones Day	The Talisman Group, LLC. v Light and Wonder (LNW Gaming, Inc)	LNW	Ongoing			14-Apr-23	USPTO	IPR

Dr Tim A Williams Case History

Case Type	Firm	Case Name	Client	Status	Deposition	Trial Testimo	Enagement L	Venue	Case Number(s)
Patent Infringement	Russ August &Kabat	Headwater Research LLC	Headwater	Ongoing			8-Sep-23		
Patent Infringement	Russ August &Kabat	Cobblestone Wireless, LLC v. T-Mobile USA, Inc.,	Cobblestone	Ongoing			1-Dec-23	EDTX	2:22-cv-477
Patent Infringement	Russ August &Kabat	Cobblestone Wireless, LLC v. Cellco Partnership d/b/a Verizon Wireless,	Cobblestone	Ongoing			1-Dec-23	EDTX	2:23-cv-382
Patent Infringement	Anand & Anand	LG Electronics Inc. versus Vivo Mobile India Private Limited & Ors.	LG	Ongoing			12-Dec-23	Delhi High C	CS. (Comm) 665 of 2023