

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

COMCAST CABLE COMMUNICATIONS, LLC,
Petitioner,

v.

ENTROPIC COMMUNICATIONS, LLC,
Patent Owner.

Case IPR2024-00452
Patent 7,889,759

EXHIBIT 2003

DECLARATION OF SAMUEL H. RUSS, PH.D.

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I. INTRODUCTION

1. My name is Samuel H. Russ. I have been retained as an expert witness to provide my independent opinion in regard to the matters at issue in *inter partes* review of U.S. Patent No. 7,889,759 (“the ’759 patent”) in IPR2024-00452. I have been retained by Entropic Communications, LLC (“Entropic”), the Patent Owner in this proceeding. Petitioner is Comcast Cable Communications LLC (“Comcast” or “Petitioner”).

2. I am being compensated \$450 per hour for my time spent working in connection with this case. My compensation is in no way related to the outcome of this litigation. If called as a witness, I would testify as to the statements and opinions contained in this report.

3. I am not a legal expert and offer no opinions on the law. However, I have been informed by counsel of the various legal standards that apply, and I have applied those standards in arriving at my conclusions.

II. QUALIFICATIONS

4. I have more than 20 years of experience in the fields of broadband cable networks and communications engineering. My professional career has been dedicated to issues relating to signal integrity, communication systems, and home networking more generally.

5. I received a Bachelor of Science in Electrical Engineering with Highest Honors from Georgia Institute of Technology in 1986 and a Ph.D. in Electrical Engineering from Georgia Institute of Technology in 1991. My Ph.D. dissertation was titled “An Information-Theoretic Approach to Analysis of Computer Architectures and Compression of Instruction Memory Usage.”

6. I am currently an Associate Professor in the Department of Electrical and Computer Engineering at the University of South Alabama. I joined the Electrical and Computer Engineering faculty in 2007. I have taught a number of classes including classes in signal integrity, embedded systems, and the design of high-speed digital systems. During that time, I won awards for excellent teaching and have been actively publishing research in signal integrity, home networking, and digital video recording (DVR) technologies.

7. I also have significant industry experience. From 1994 to 1999, I served on the faculty of Mississippi State University as an Assistant Professor in the Department of Electrical & Computer Engineering. I taught circuit board design and two-way interactive video classes, among other topics.

8. From 2000 to 2007, I was the manager in the Advanced Technologies R&D group for Scientific-Atlanta (later Cisco, now Technicolor). As part of this work, I explored major new technologies including home networking and multi-room video distribution and managed a cable set-top box (STB) design group that

designed four STB models for the cable television industry, including the Explorer 4200 (non-DVR) and 8300 (DVR) models. Both models were produced in high volumes and sold several million units. As the design-group manager, I was responsible for managing the design and prototyping activities of the group and for interfacing with other groups (especially integrated circuit design, procurement, software developers, the factory where prototypes were built, and product managers). I also maintained the hardware and mechanical development schedule.

9. While at Scientific-Atlanta, I became a staff expert in home networking, and conducted demonstrations of wireless video technology. I also managed a group that developed a new coaxial home networking system. This coaxial system won a Technology and Engineering Emmy Award in 2013. Further, I was a staff expert in digital video recorder (DVR) reliability, and led a team that improved the software, hardware, repair, and manufacturing processes.

10. I am the author of *Signal Integrity: Applied Electromagnetics and Professional Practice*, Springer, 1st ed. 2016, 2nd ed. 2022. I have also researched and written about video storage, multimedia broadcasting over networks, embedded systems, consumer electronics, set-top boxes, access of stored video from peer devices in a local network, electronic manufacturing systems, and other topics in video and image processing. I have authored or co-authored 32 journal articles and conference papers in these areas of video storage, video networking

and consumer electronics. One of my conference papers on digital video recording won second place in a “Best Paper” competition at the 2011 International Conference on Consumer Electronics in Las Vegas, Nevada.

11. I am a named inventor on 51 patent applications that were filed while I was at Scientific-Atlanta, many of which focus on cable technology. These applications have led to 29 issued U.S. patents and 9 as European patents, including U.S. Patent No. 7,908,625 (“Networked Multimedia System”).

12. A detailed record of my professional qualifications is set forth in the attached Exhibit A, which is my *curriculum vitae*, including a list of publications, awards, research grants, and professional activities. My *curriculum vitae* also lists the matters in which I have served as an expert.

III. BASES OF OPINIONS

13. In the course of conducting my analysis and forming my opinions, I have reviewed materials including those listed below:

- i. U.S. Patent No. 7,889,759 (Ex. 1001) (“the ’759 patent”);
- ii. The Declaration signed by James Bertonis in IPR2024-00452 (Ex. 1002) (the “Bertonis Declaration”);
- iii. The prosecution history of the ’759 Patent (Ex. 1004)
- iv. The Petition by Comcast in IPR2024-00452;
- v. U.S. Patent Application No. 10/778,505 (Ex. 1005);

- vi. U.S. Patent No. 7,295,518 (Ex. 1006);
- vii. U.S. Patent Application Publication No. 2002/0166124 (“Gurantz”) (Ex. 1007);
- viii. U.S. Patent No. 5,682,419 (“Grube”) (Ex. 1009);
- ix. U.S. Pub. No. 2002/0056066 (“Gesbert”) (Ex. 1010);
- x. U.S. Patent No. 7,418,043 (“Shattil”) (Ex. 1011);
- xi. Ciciora, Walter S. *Modern Cable Television Technology: Video, Voice, and Data Communications*. San Francisco, Calif: Morgan Kaufmann Publishers, 1999, Sections 4.1-4.3.3 (Chapter 4, pp. 161-192) (Ex. 1012);
- xii. European Patent Application No. 1087586 (“Mirfakhraei”) (Ex. 1013);
- xiii. U.S. Patent Application Publication No. 2009/0279498 (“Li”) (Ex. 1014);
- xiv. U.S. Patent Application Publication No. 2009/0323851 (“Ling”) (Ex. 1015);
- xv. U.S. Patent Application Publication No. 2005/00310444 (“Gesbert II”) (Ex. 1016);
- xvi. The exhibits and other documents cited herein.

IV. APPLICABLE LEGAL STANDARDS

A. Level Of Ordinary Skill In The Art

14. My opinions in this declaration are based on the understandings of a person of ordinary skill in the art, which I understand is sometimes referred to as an “ordinary artisan” or by the acronyms “POSITA” or “PHOSITA,” as of the time of the invention, which I understand is here asserted by Petitioner to be the filing date (July 12, 2004) of the ’759 patent. For the purposes of this declaration only, I accept Petitioner’s asserted time of the invention. I reserve the right to revisit the issue should the Petition be instituted. I understand that the person of ordinary skill in the art is a hypothetical person who is presumed to have known the relevant art at the time of the invention. By “relevant,” I mean relevant to the challenged claims of the ’759 patent.

15. I understand that factual indicators of the level of ordinary skill in the art include the various prior art approaches employed, the types of problems encountered in the art, the rapidity with which innovations are made, the sophistication of the technology involved, and the educational background of those actively working in the field. I understand that, in assessing the level of skill of a person of ordinary skill in the art, one should consider the type of problems encountered in the art, the prior solutions to those problems found in the prior art references, the rapidity with which innovations are made, the sophistication of the

technology, the level of education of active workers in the field, and my own experience working with those of skill in the art at the time of the invention.

16. In this case, Mr. Bertonis has asserted in his declaration that a person of ordinary skill in the art as of the time of the '759 patent would have had:

a bachelor's degree in electrical engineering, computer engineering, or a similar discipline, and three to four years of experience working in signal processing and/or communication systems/networks. Additional education may substitute for experience, and significant work experience may substitute for formal education.

Ex. 1002 [Bertonis-Decl.] ¶ 84.

17. For the purposes of this declaration, I accept Mr. Bertonis's proposed qualifications of a POSITA. I reserve the right to revisit the issue should the Petition be instituted.

18. As further discussed below, my opinions as stated in this declaration are valid even if the Board adopts a slightly different level of ordinary skill in the art. For example, as will be discussed throughout my report, even a person with the level of knowledge or experience described by Mr. Bertonis or adopted by the Board would not have a reasonable expectation of success in implementing certain aspects of the proposed combination as of the priority date of the '759 patent.

B. My Understanding Of Legal Standards

19. When considering the '759 patent and stating my opinions, I rely on the following legal standards as described to me by the attorneys for Entropic.

20. I understand that a patent claim is unpatentable if the claimed invention was anticipated by a prior art reference or would have been obvious to a person of ordinary skill in the art at the time of the purported invention.

21. I understand that anticipation requires that every limitation of the claim at issue be disclosed, either expressly or under principles of inherency, in a single prior art reference.

22. I understand that inherency may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. Instead, it must be proven that the claim limitation not expressly found in the reference necessarily follows from what is found there.

23. I understand that an obviousness analysis involves comparing a claim to the prior art to determine whether the claimed invention would have been obvious to a person of ordinary skill in the art at the time of the invention in view of the prior art and in light of the general knowledge in the art as a whole. I also understand that obviousness is ultimately a legal conclusion based on underlying facts of four general types, all of which must be considered: (1) the scope and content of the prior art; (2) the level of ordinary skill in the art; (3) the differences

between the claimed invention and the prior art; and (4) any objective indicia of non-obviousness, including any praise of the invention.

24. I also understand that obviousness may be established under certain circumstances by combining or modifying the teachings of the prior art. Specific teachings, suggestions, or motivations to combine any first prior art reference with a second prior art reference can be explicit or implicit, but must have existed before the date of purported invention. I understand that prior art references themselves may be one source of a specific teaching or suggestion to combine features of the prior art, but that such suggestions or motivations to combine art may come from the knowledge that a person of ordinary skill in the art would have had.

25. I understand that a reference may be relied upon for all that it teaches, including uses beyond its primary purpose, but also including teachings that lead away from the invention. I understand that a reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, although the mere disclosure of alternative designs does not teach away.

26. I further understand that whether there is a reasonable expectation of success in combining references in a particular way is also relevant to the analysis.

27. I understand that it is improper to use hindsight to combine references or elements of references to reconstruct the invention using the claims as a guide. My analysis of the prior art is made from the perspective of a person of ordinary skill in the art at the time of the invention.

28. I understand that in order to be eligible as prior art in obviousness and therefore form a reference in one of the instituted grounds, a reference must be analogous art to the '759 patent. I also understand that it is Petitioner's burden to prove that their asserted references are analogous art to the '759 patent. I am informed that in order to determine whether a reference is analogous art to the '759 patent, a two-part test is applied as follows:

Two separate tests define the scope of analogous prior art: (1) whether the art is from the same field of endeavor, regardless of the problem addressed and, (2) if the reference is not within the field of the inventor's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved.

In re Bigio, 381 F.3d 1320, 1325 (Fed. Cir. 2004); *see also In re Clay*, 966 F.2d 656, 658 (Fed. Cir. 1992). I have been informed and understand that to discern the field of endeavor, courts have looked to the specifications of the patent and the alleged prior art reference and particularly to the respective "Background of Invention" and/or "Field of the Invention" sections. *See, e.g., In re Wood*, 599 F.2d 1032, 1036 (CCPA 1979) (determining field of endeavor based on

“Background of Invention”); *Wyers v. Master Lock Co.*, 616 F.3d 1231, 1237-38 (Fed. Cir. 2010) (finding reference concerning padlocks to be in the same field of endeavor where the “patent itself refers to ‘the prior art padlock’ in the background of the invention”); *Airbus S.A.S. v. Firepass Corp.*, 941 F.3d 1374, 1381 n. 8 (Fed. Cir. 2019) (“[T]he specification of each reference includes a ‘Field of the Invention’ section that distinctly describes each applicable field of endeavor.”).

29. I am not offering any legal opinions in this declaration nor am I qualified to do so. I only consider such legal standards in framing my opinions and conclusions as well as placing assertions made by Petitioner in the Petition into the proper context. Additionally, from a subject matter perspective, I understand that the petitioner always has the burden of persuasion regarding a challenge of patentability of an invention under an inter partes review.

V. CLAIMS-AT-ISSUE (CLAIMS 1-23)

30. I understand that Petitioner has challenged the claims as follows:

- Claims 1, 4, 7-9, 11, 14-16, 20, and 21 based on obviousness over Gurantz in view of Grube (Ground A);
- Claims 2, 3, 5, 6, 12, 13, 22, and 23 based on obviousness over Gurantz in view of Grube and further view of Gesbert (Ground B);
- Claims 10 and 17 based on obviousness over Gurantz in view of Grube and further view of Shattil (Ground C); and

- Claims 18 and 19 based on obviousness over Gurantz in view of Grube and further view of Shattil and Gesbert (Ground D).

VI. OPINIONS

A. Overview Of The '759 Patent's And Grube's Fundamentally Different Systems.

31. Petitioner's grounds rely heavily upon Grube. Grube, however, concerns a fundamentally different communications system from the '759 patent's.

32. The '759 patent is directed towards a broadband cable network ("BCN") utilizing coaxial cable, as reflected throughout the '759 patent's title, abstract, and claims. Ex. 1001 ['759] Title ("**BROADBAND CABLE NETWORK UTILIZING COMMON BIT-LOADING**"); Abstract ("A **broadband cable network ('BCN')** for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in the BCN is disclosed"); cls. 1-23 ("determining a common bit-loading modulation scheme for communicating between a plurality of nodes in a **broadband cable network ...**"). As explained further below, the '759 patent is directed to facilitating node-to-node communications between various types of customer premises equipment (CPEs) within a BCN within building (*e.g.*, a home). Ex. 1001 ['759] 3:63-4:3 (the '759 patent addresses a need to "connect a variety of CPEs into a local network, such as a LAN, within a building such as a home or office while allowing the utilization of an existing coaxial cable network within the building.").

33. An important aspect of the '759 patent's BCNs is the fact that they implemented using coaxial cable. See Ex. 1001 ['759] 1:39-42 ("The invention relates to broadband communication networks, and in particular to broadband communication networks **utilizing coaxial cable.**"); 3:66-4:3 (the '759 patent addresses a need to "connect a variety of CPEs into a local network, such as a LAN, within a building such as a home or office while allowing **the utilization of an existing coaxial cable network** within the building."); see 1:45-63 (describing prior art broadband cable networks using "broadband cables and broadband cable splitters [which] are implemented utilizing **coaxial cables and coaxial cable splitters**, respectively.").

34. Coaxial cable is shielded with precisely controlled geometries at manufacturing. See Ex. 2004 [Signal-Integrity] 82 ("The term 'coaxial' refers to the fact that it has a small center conductor surrounded by a cylinder of insulating material, which is in turn surrounded by a cylindrically shaped conductor. The two conductors are coaxial (get it?) and so they make a capacitor."). Because of this shielding, the '759 teaches large bandwidths of, *e.g.*, 50 MHz. Ex. 1001 ['759] 7:23-26. In fact, coaxial cable can have even high-frequency bandwidths of, *e.g.*, 900 MHz to 6 GHz. Ex. 2010 [Coaxial-Products] (coaxial cable "is designed to carry high-frequency signals, 900 MHz to 6GHz, and to protect those signals against electromagnetic interference (EMI) from external sources.").

35. As the '759 patent teaches, however, preexisting BCNs within buildings use splitters to distribute signals. Ex. 1001 ['759] 3:22-30 (“most broadband cable networks ... presently utilized within most existing buildings are not configured to allow for easy networking between CPEs because **most broadband cable networks utilize broadband cable splitters** that are designed to split an incoming signal from the POE into numerous split signals that are passed to the different nodes in different rooms.”). This preexisting network configuration using splitters is illustrated in the '759 patent's Figure 2, below:

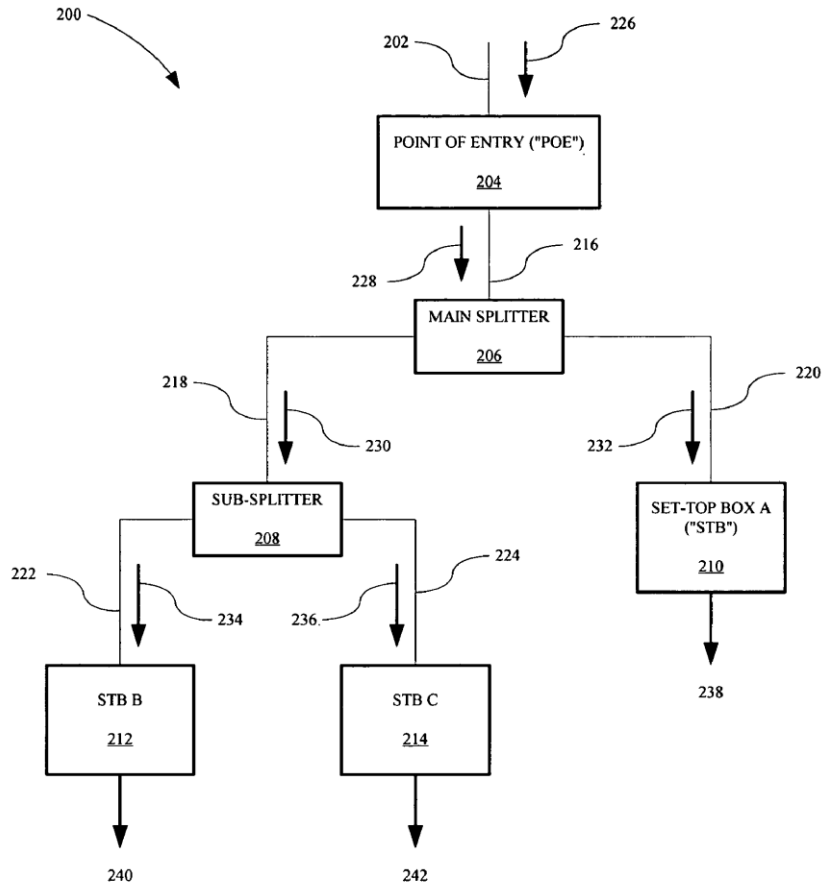


FIG. 2 (Prior Art)

Id., Fig. 2.

36. Splitters are radio-frequency devices designed to route signals from one input to multiple destinations with low signal distortion. As the '759 patent recognizes, one of the main problems with splitters is that two legs (outputs) of the splitter have a difficult time communicating because a splitter is purposely

designed to shield the outputs from one another. Ex. 1001 [’759] 3:50-62 (“splitters typically have a high level of isolation between the different connected terminals resulting in significant isolation between the various CPEs. ... ***The isolation creates a difficult environment to network between the different CPEs*** because the isolation results in difficulty for transmitting two-way communication data between the different CPEs.”).

37. Thus, the ’759 patent recognizes a need to “connect a variety of CPEs into a local network, such as a LAN, within a building such as a home or office while allowing ***the utilization of an existing coaxial cable network*** within the building.” Ex. 1001 [’759] 3:66-4:3. One difficulty with addressing this need is the fact that channel paths between different nodes “are physically and electrically different in the cable network.” *Id.*, 7:5-12. To this end, the ’759 patent “determin[es] a common bit-loading modulation scheme for communicating between” the CPEs. *Id.*, 4:7-9.

38. By contrast, Grube concerns an entirely different system which does not use coaxial cable. *See generally* Ex. 1009 [Grube]. Indeed, without coaxial cable, Grube has nothing to do with broadband, cable, or local area networks. Instead, Grube concerns a twisted-pair telephonic line system. Ex. 1009 [Grube] 7:9-12 (“Generally, the present invention provides a method and apparatus for establishing a communication system infrastructure utilizing low pass transmission

path, i.e. twisted pair telephone line.”); 7:20-22 (“The primary site communicates with the plurality of secondary sites via inbound and outbound low pass transmission paths.”); 9:61-66 (“FIG. 9 illustrates a communication system 160 having a two-wire infrastructure. As shown, the primary site 102 is operably coupled to a plurality of secondary sites 104-108 via a twisted pair low pass transmission path 162. The low pass transmission path is a twisted pair copper wire, which may be a telephone line.”); 12:56-57 (“In operation, the DMT receiver 122 receives information from an outbound twisted pair 150”); 13:61-63 (“In this mode, the DMT transmitter 124 places data on allocated carrier channels of the inbound twisted pair 148.”).

39. Twisted-pair telephonic lines are unshielded to save costs of manufacturing. See Ex. 2004 [Signal-Integrity] 121 (“This is what Ethernet uses – unshielded twisted pair (UTP). This is important because, as one might guess, the unshielded cable is cheaper than shielded.”). This lack of shielding, however, results in a loss of signal energy over distance and, consequently, lossy signal propagation. *Id.*, 107, 112-115. Electrically, therefore, the medium appears as a low-pass filter. In other words, the twisted-pair wiring causes higher frequencies to be filtered out, leaving only low frequencies successfully transmitted. See, e.g., Ex. 1009 [Grube] Fig. 4 (showing 1.1 MHz bandlimit). This is also the technical reason why nearly all phone lines are point-to-point connections—they cannot

carry enough information to distribute information to multiple users. *See id.*, 2:65-67, 3:10-12, 4:44-46.

40. As Grube teaches, phone companies wanted to develop techniques to take advantage of the widely ubiquitous telephone lines and “[t]o enhance the transmit capabilities of a twisted pair copper telephone line.” Ex. 1009 [Grube] 2:58-60. One such technique is “Asymmetrical Digital Subscriber Loop, or Link, (ADSL)” which “increases the bandwidth of the twisted pair telephone line up to 1.1 MHz.” Ex. 1009 [Grube] 3:5-10. Notably, however, this increased bandwidth is still much smaller than coaxial cable’s bandwidth, which can reach 900 MHz-6GHz. Ex. 2010 [Coaxial-Products] (coaxial cable “is designed to carry high-frequency signals, 900 MHz to 6GHz, and to protect those signals against electromagnetic interference (EMI) from external sources.”). Despite the increased bandwidth, however, ADSL is still only “used for one-to-one communications,” just like traditional twisted-pair telephone lines. Ex. 1009 [Grube] 3:10-12.

41. Moreover, Grube concerns a citywide telephonic one rather than one within a building as the ’759 patent does. As can be seen in Grube’s Figure 8 below, Grube’s primary site communicates with numerous secondary sites, including secondary site 108 which interfaces with a subscriber interface which, in turn, services pagers or a fax machine, a phone, and a TV:

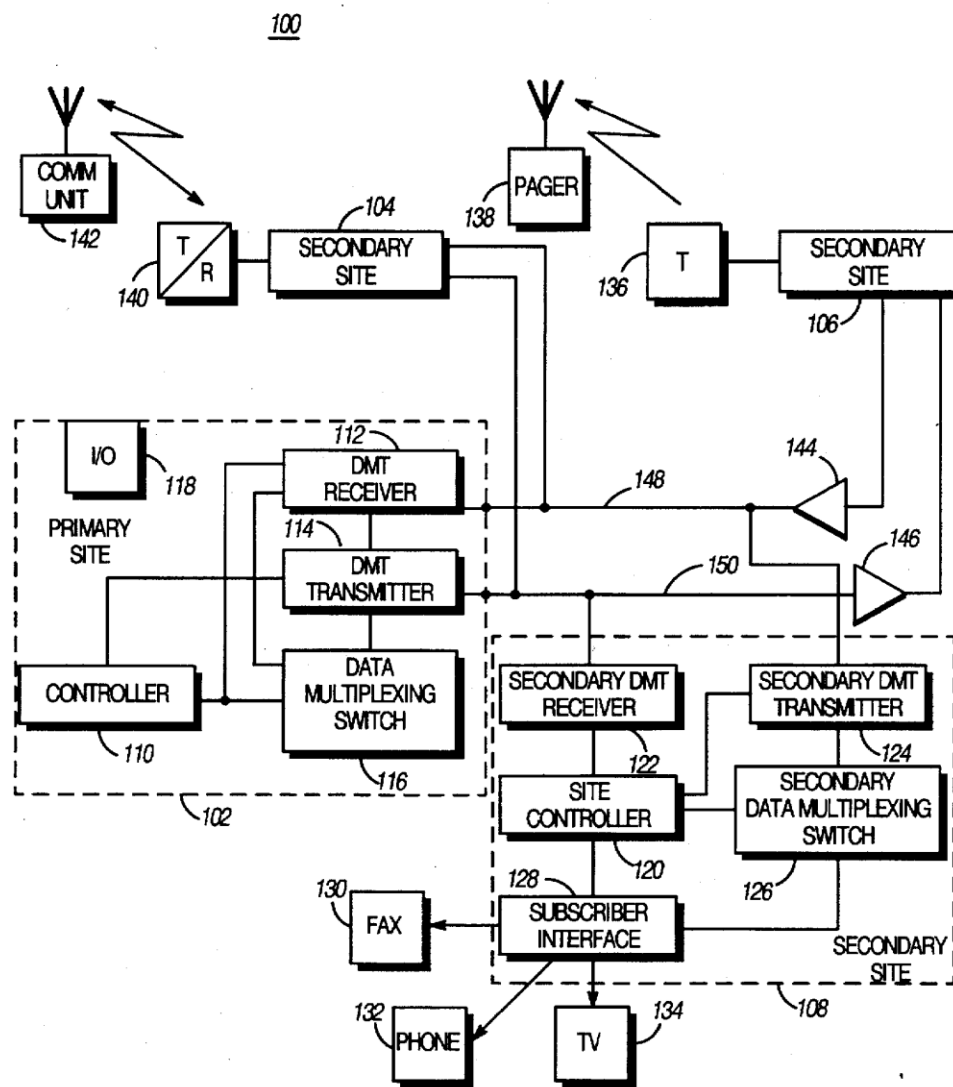


FIG.8

Ex. 1009 [Grube] Fig. 8. Grube thus teaches that its primary site communicates with receivers meant to service entire buildings. *Id.*; *cf. id.*, Figs. 1-2 (existing telephonic systems also have citywide coverage). Reinforcing the fact that Grube concerns a citywide system, Grube also teaches that its primary site may be miles away from the secondary sites. *Id.*, 8:46-49 (“Note that, if ***the secondary sites are***

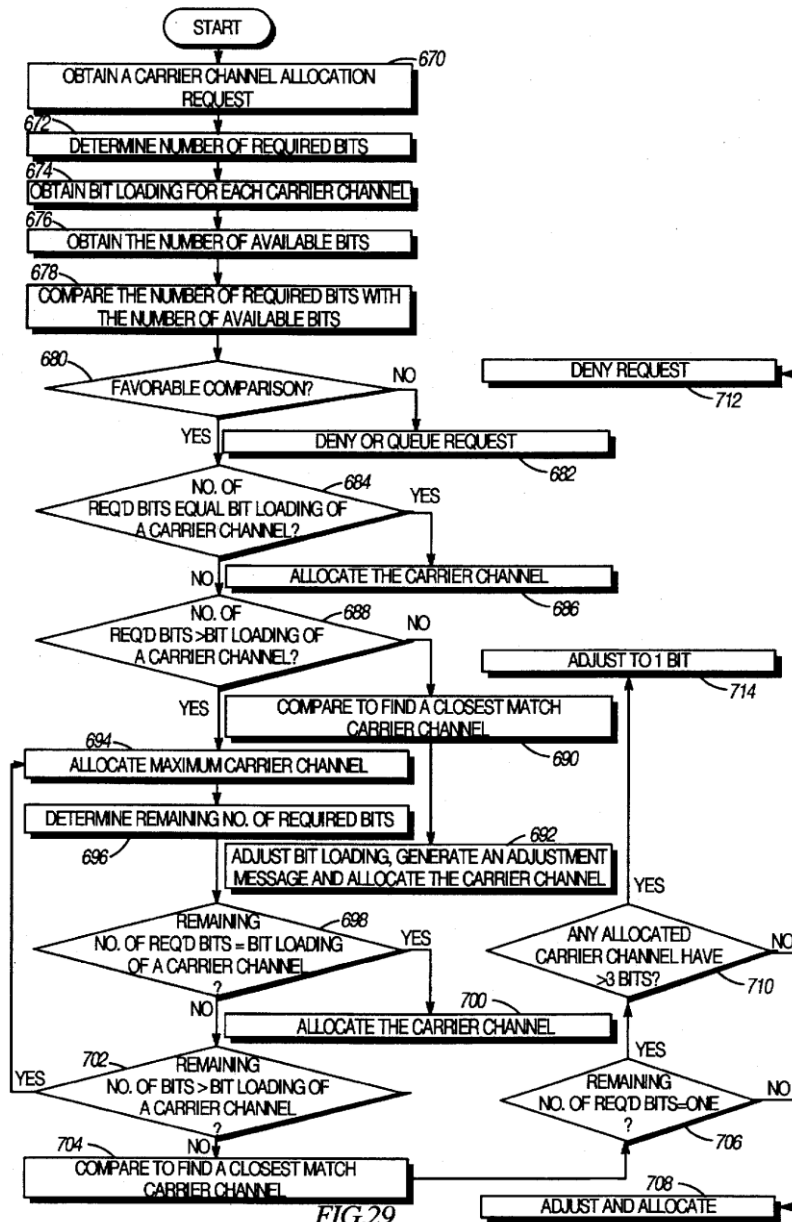
separated by more than a given geographic distance (12 Kft to 18Kft) from the primary site, repeaters 144, 146 may be required.”).

42. Grube thus seeks to take advantage of the increased bandwidth from ADSL and to utilize preexisting telephone lines. Ex. 1009 [Grube] 4:44-51 (“While the ADSL system increases the bandwidth of a telephone line, up to 1.1 megahertz, it is designed for one-to-one communications and not one-to-many or many-to-one communications. Therefore, 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.”).

43. To accomplish its goal of adding one-to-many/many-to-one communications in a twisted-pair telephonic system with limited bandwidth, Grube utilizes a “primary site” at the headend that communicates with Grube’s “secondary sites.” Ex. 1009 [Grube] 7:20-22 (“The primary site communicates with the plurality of secondary sites via inbound and outbound low pass transmission paths.”). To be clear, “headend” is a term of art in cable systems. The primary site of Grube sits at the same place on its telephonic network, architecturally speaking, as a headend in a cable system. These secondary sites in turn communicate with “subscribers” such as telephones or television. *Id.*, 8:50-58 (each secondary site includes “at least one subscriber interface” that “may be

coupled to a radio frequency (RF) transceiver 140, an RF transmitter 136, a facsimile device 130, a telephone 132, or a television monitor 134.”); 8:66-9:6 (similar).

44. This primary site transmits calls to the secondary sites, allocating channels to each call such that it occupies the minimum number of channels possible. Grube’s process can be seen illustrated in Figure 29:



Ex. 1009 [Grube] Fig. 29. As can be seen above, the primary site receives a “carrier channel allocation request” (also called a “call request” in Grube) (step 670) and “determines a number of required bits” based on the call type. *Id.*, 33:7-17. The primary site then “accesses an ordered bit loading table” (*id.*, 33:18-

19) and then, using the table, either “queues or denies the request,” “allocates the carrier channel having the bit loading which matches the number of required bits to the carrier channel request” if there is one, or “allocates the carrier channel[s] having the maximum bit loading, i.e., the maximum carrier channel, to the carrier channel request” until “the particular carrier channel allocation request has been allocated a sufficient number of carrier channels to fulfill the bandwidth requirements of the service being requested.” *Id.*, 33:50-34:28. Thus, Grube seeks to minimize the number of channels allocated to a particular call with the ultimate goal of servicing more than one call at a time.

45. Grube and the '759 patent are thus, in my opinion, fundamentally different.

B. Grube Is Not Analogous Art (All Claims, All Grounds).

46. Each of the grounds presented by the Petition, again, relies on the Grube reference. Pet., 11-12. Based on the law regarding analogous art as explained to me by Entropic’s attorneys and as summarized in Section IV.B above, it is my opinion that Petitioner and Mr. Bertonis have not shown Grube to be analogous art to the '759 patent. Indeed, in light of the fundamental difference between the two that I explained in Section VI.A, Grube does not share the '759 patent’s field of endeavor and is not reasonably pertinent to the problem the inventors of the '759 patent were trying to solve.

1. The '759 Patent And Grube Do Not Share A Field Of Endeavor.

47. I understand that Petitioner discusses analogous art as follows:

Grube is analogous art to the '759 patent, and to Gurantz, in that each pertains to data communications between network nodes employing multi-carrier modulation (e.g., OFDM or DMT) and bit-loading.

Pet., 32. I note that Petitioner cites Mr. Bertonis's declaration (*id.*) at paragraph 134 which argues as follows:

Initially, I note that Grube is analogous art to both the '759 patent and Gurantz. All three pertain to data communications between network nodes employing multi-carrier modulation (e.g., OFDM or DMT) and bit-loading.

Ex. 1002 [Bertonis-Decl.] ¶ 134. I disagree.

48. Rather, in my opinion, the traditional sources for identifying a field of endeavor confirm that the '759 patent's field is "broadband cable networks" and particularly those utilizing coaxial cable. This is reflected in the '759 patent's title "**BROADBAND CABLE NETWORK** UTILIZING COMMON BIT-LOADING" and Abstract ("A **broadband cable network ('BCN')** for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in the BCN is disclosed"). Ex. 1001 ['759] Title, Abstract. Notably, both Petitioner and Mr. Bertonis similarly seem to identify the '759 patent's field as concerning broadband cable networks. Ex. 1002 [Bertonis-Decl.] ¶ 59 ("The '759 patent is

directed to a broadband cable network ('BCN'.'); Pet., 2 ("The '759 patent describes a BCN with nodes ...").

49. The '759 patent's "Field of Invention" similarly identifies "broadband communication networks," particularly those "utilizing coaxial cable":

1. Field of Invention

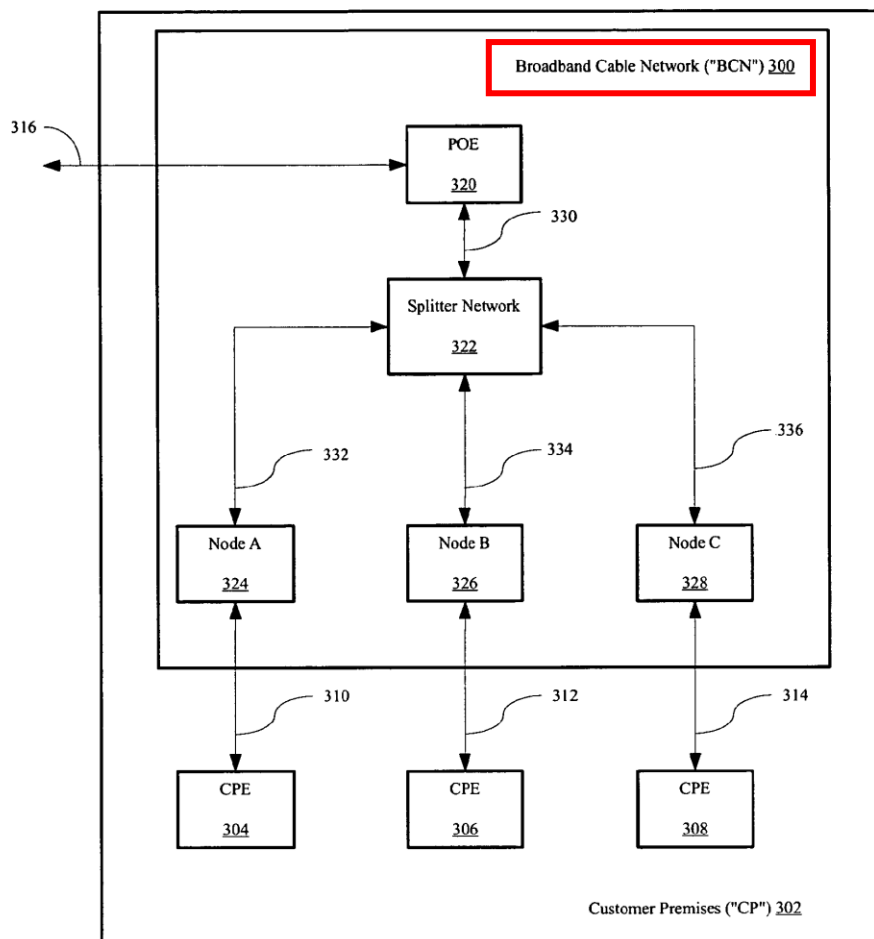
The invention relates to broadband communication networks, and in particular to broadband communication networks utilizing coaxial cable.

Ex. 1001 ['759] 1:39-42.

50. The Background of the Invention also focuses upon broadband cable networks utilizing coaxial cable. Ex. 1001 ['759] 1:45-63 (describing prior art broadband cable networks using "broadband cables and broadband cable splitters [which] are implemented utilizing **coaxial cables and coaxial cable splitters**, respectively."); 2:23-31 (describing another prior art system "in signal communication with a cable provider [], satellite TV dish [], and/or external antenna [] via a signal path 202 **such as a main coaxial cable** from the building to a cable connection switch [] outside of the building."). The '759 patent further addresses "a need for a system and method to connect a variety of CPEs into a local network, such as a LAN, within a building such as a home or office while allowing the utilization of **an existing coaxial cable network** within the building." *Id.*, 3:66-4:3. In other words, it is not only directed exclusively to broadband cable

networks, it is further directed even more exclusively to broadband cable networks connecting devices residing at a single building.

51. Similarly, each of the claims is directed towards “determining a common bit-loading modulation scheme for communicating between a plurality of nodes in a **broadband cable network** ...” *Id.*, cls. 1-23. Each of the ’759 patent’s embodiments, like the claims, is directed towards a “Broadband Cable Network,” as reflected in Figure 3 below:



Ex. 1001 [’759] Fig. 3. Similarly, the other figures either refer to prior art “broadcast cable system[s]” or refer back (directly or indirectly) to Figure 3’s “broadcast cable network”:

FIG. 1 shows a block diagram of an example implementation of a known broadband cable system within a building.

60 FIG. 2 shows a block diagram of another example implementation of a known broadband cable system within the building shown in FIG. 1.

FIG. 3 shows a block diagram of an example implementation of a broadband cable network (“BCN”) within a building.

65 FIG. 4 shows a functional diagram showing the communication between the different nodes shown in the BCN of FIG. 3 in a unicast mode.

FIG. 5 shows another functional diagram showing the communication between the different nodes shown in the BCN of FIG. 3 in a broadcast mode.

FIG. 6 shows a block diagram of an example implementation of the BCN shown in FIG. 3 when node A is communicating to node B.

FIG. 7 shows a block diagram of another example implementation of the BCN shown in FIG. 3 when node A is communicating to node C.

FIG. 8 shows a block diagram of an example implementation of the BCN shown in FIG. 3 when node C is communicating to node B.

FIG. 9 shows a plot of the transfer function versus frequency for the channel path between node A and node B and the channel path between node A and node C shown in both FIGS. 6 and 7.

FIG. 10A shows a plot of the bit-loading constellation versus carrier number for the channel path between node A and node B shown in FIG. 9.

FIG. 10B shows a plot of the bit-loading constellation versus carrier number for the channel path between node A and node C shown in FIG. 9.

FIG. 10C shows a plot of the bit-loading constellation versus carrier number for the resulting broadcast channel path between node A and node B and node A and node C based on the constellations shown in FIGS. 10A and 10B.

FIG. 11 shows a flowchart illustrating the method performed by the BCN shown in FIG. 3.

Id., 4:58-5:28. Not surprisingly, “broadband” and “broadband cable networks” (abbreviated as BCNs) are discussed pervasively throughout the disclosure and appear over 100 times in the ’759 patent. Similarly, “coaxial cable” appears dozens of times.

52. Thus, each of the traditional sources used to discern the field of endeavor—the title, the abstract, the “field of the invention,” the function and structure of the claims, the embodiments, and more—all confirm that the ’759 patent’s field of endeavor is “broadband cable networks,” particularly those utilizing “coaxial cable.” In accord, Petitioner’s expert, Mr. Bertonis, agrees that “[t]he ’759 patent is directed to a broadband cable network (‘BCN’).” Ex. 1002 [Bertonis-Decl.] ¶ 59.

53. In my opinion, Grube’s field is not “broadband cable networks.” Significantly, Grube does not mention “broadband” at all. *See generally* Ex. 1009 [Grube]. Nor is “cable” mentioned aside from a solitary reference to a “cable box” which can “interface with” Grube’s secondary site (an alleged “receiving node”). *See id.*, 13:23-25.

54. There is no reason to believe that Grube’s field has anything to do with “broadband cable networks.” Rather, Grube is directed to networks that use twisted pair telephone wires, not cable, much less coaxial cable. Ex. 1009 [Grube] 7:9-12 (“Generally, the present invention provides a method and apparatus for

establishing a communication system infrastructure utilizing **low pass transmission path, i.e. twisted pair telephone line.**”); see also 7:20-22 (“The primary site communicates with the plurality of secondary sites via inbound and outbound **low pass transmission paths.**”); 9:61-66 (“FIG. 9 illustrates a communication system 160 having a two-wire infrastructure. As shown, the primary site 102 is operably coupled to a plurality of secondary sites 104-108 via a **twisted pair low pass transmission path 162.** The low pass transmission path is a **twisted pair copper wire, which may be a telephone line.**”); 12:56-57 (“In operation, the DMT receiver 122 receives information from an outbound **twisted pair 150**”); 13:61-63 (“In this mode, the DMT transmitter 124 places data on allocated carrier channels of the inbound **twisted pair 148.**”); see also 1:44-47 (Grube’s wireline links 34-38 are typically **T1 links**”); Ex. 2005 [One-Ring-Networks] 1 (a “T1 link” is “a communications transmission service that uses 2 **twisted pair copper wires** to transmit and receive data or voice traffic.”). Petitioner and Mr. Bertonis similarly acknowledge Grube’s focus upon “twisted pair telephone” wires. See Pet., 32 (“Grube similar seeks to extend the usefulness of **twisted pair telephone line.**”); 27 (“A POSITA would have recognized that Grube’s teachings for improving bit-loaded data transmission over a network utilizing two-wire (**e.g., twisted pair) telephone line ...**”); Ex. 1002 [Bertonis-Decl.] ¶¶ 121, 134.

55. Twisted pair wires are substantially different from coaxial cable. See Ex. 2009 [Coaxial-vs-Twisted-Pair] (describing major differences between and advantages of coaxial cable over twisted pair). While both phone lines and coaxial cables are transmission lines (Ex. 2004 [Signal-Integrity] 82), the frequencies, and therefore wavelengths, involved are dramatically different due to coaxial cable's superior shielding and precisely controlled geometries at manufacturing. *Id.*, ("The term 'coaxial' refers to the fact that it has a small center conductor surrounded by a cylinder of insulating material, which is in turn surrounded by a cylindrically shaped conductor. The two conductors are coaxial (get it?) and so they make a capacitor."). A 1 MHz signal has a wavelength of roughly 300m or about 1000 feet ($\lambda = c/f$). Lower frequencies on a phone line have even longer wavelengths. Conversely, a cable signal at, *e.g.*, 900 MHz (the range of the '759 patent's home network) has a wavelength of 0.33m, or about one foot. This difference has physical significance—transmission-line effects, such as reflections, cause the frequency response of coaxial cable to be much more chaotic than telephone lines. Ex. 2004 [Signal-Integrity] 94-96, 99-101. Worse, these effects appear over much shorter cable lengths, such as those found inside homes, than telephone lines. Indeed, inside a home, it is clear that propagation over telephone lines is lumped, not distributed, and transmission-line effects such as reflections disappear. Phone line is fundamentally different from coaxial cable.

56. Moreover, Grube's network using twisted pair wires (rather than coaxial cable) would not be considered broadband, at least at the time of the '759 patent's invention. Grube describes that "wireline links 34-38 are typically **T1 links** which have a bandwidth of approximately **1.5 megahertz** and a capacity of 1.5 Mbps." *Id.*, 1:44-47. A "bandwidth of approximately **1.5 megahertz** and a capacity of 1.5 Mbps" would not be considered to be "broadband," at least in the sense of the '759 patent's usage. The '759 patent refers to a bandwidth of, *e.g.*, 50 MHz, *i.e.*, over 33 times broader than Grube. Ex. 1001 ['759] 7:23-26.

Petitioner's other reference, Gurantz refers to broadband systems with frequencies that extend to 550–750 MHz (*i.e.*, 366–500x broader). *See, e.g.*, Ex. 2006 [CTC]

7. The rest of Grube's disclosure confirms that Grube is not directed towards "broadband" as used by the '759 patent and employs twisted pair telephone lines with a bandwidth of "up to 1.1 MHz." Ex. 1009 [Grube] 16:3-10 ("For example, one sinusoidal signal will have a frequency of 25 kilohertz, a second signal will have a frequency of approximately 29 kilohertz, a third signal will have a frequency of approximately 33 kilohertz, wherein each of the remaining sinusoidal signals will be increased by approximately four kilohertz up to approximately 1.1 megahertz."); 16:54-57 ("The second training signal is similar to the first training signal in that it contains a plurality of sinusoidal signals separated in frequency by approximately 4 kilohertz starting at 25 kilohertz **up to a frequency of 1.1**

megahertz.”); 52:28-30 (“As previously mentioned, the ADSL system incorporates 256 carrier channels, **beginning at 25 kilohertz up to 1.1 MHz** at increments of 4 kilohertz.”).

57. Further, the ’759 patent’s BCN is fundamentally different from Grube’s phone line network. For example, the ’759’s BCN contains splitters, radio-frequency devices designed to route signals from one input to multiple destinations with low signal distortion. Ex. 1001 [’759] 3:22-30 (“most broadband cable networks ... presently utilized within most existing buildings are not configured to allow for easy networking between CPEs because **most broadband cable networks utilize broadband cable splitters** that are designed to split an incoming signal from the POE into numerous split signals that are passed to the different nodes in different rooms.”); Fig. 2. One of the main problems with splitters is that two legs (outputs) of the splitter have a difficult time communicating because a splitter is purposely designed to shield the outputs from one another. See Ex. 1001 [’759] 3:50-62. Phone networks have no such issue due to the low frequencies involved, and devices are simply wired together. See Ex. 1009 [Grube] Figs. 8, 9 (splitters are noticeably absent).

58. Consequently, Grube is not directed toward “broadband cable networks,” much less “broadband cable networks” using coaxial cable and thus, is

not in the same field of endeavor as the '759. Likewise, while Grube's focus is upon twisted pair telephone wires, the '759 never even mentions "twisted pairs."

59. Thus, in my opinion, Petitioner and Mr. Bertonis's asserted field is misleading, given the significant differences between the '759 patent and Grube's respective technologies. Therefore, I do not believe that "data communications between network nodes employing multi-carrier modulation ... and bit-loading" is the field of endeavor for either the '759 patent or Grube. Significantly, for example, Petitioner makes no mention of "broadband" or "coaxial cable" which are prevalent in the '759 patent's disclosures and claims. *E.g.*, Ex. 1001 ['759] Title, Abstract, cls. 1-4, 7, 14, 20. Nor does Petitioner's proffered field mention twisted pair telephonic systems that are the foundation for Grube's invention. *E.g.*, Ex. 1009 [Grube] 7:9-12 ("Generally, the present invention provides a method and apparatus for establishing a communication system infrastructure ***utilizing low pass transmission path, i.e. twisted pair telephone line.***"). Petitioner's omissions are not surprising as "broadband" and "coaxial cable" are only mentioned in the '759 patent, and twisted-pair telephonic systems are only addressed by Grube.

60. While Grube and the '759 patent both discuss bit-loading, not everything mentioned in a lengthy reference would be its "field," and I do not believe any POSITA would consider "bit-loading" and/or "multi-carrier modulation" to constitute the "field of endeavor" for either reference. In this way,

Petitioner and Mr. Bertonis mistake the trees for the forest. The '759 patent and Grube are focused on overcoming the shortcomings particular to the physical media involved (coaxial cable and twisted-pair phone lines, respectively), two different fields which require different solutions.

2. Grube Is Not Reasonably Pertinent To The '759 Patent's Problem

61. I understand that Petitioner argues reasonable pertinence as follows:

Additionally, *Grube shares the goal of Gurantz* to allow communication infrastructure to be placed in areas where it was not achievable before. Gurantz seeks to extend the usefulness of existing home cable wiring for use in broadband local area networking. Ex. 1007, ¶ [0020]. Grube similarly seeks to extend the usefulness of twisted pair telephone line. Ex. 1009, 58:4-14; Ex. 1002, ¶134.

Pet., 32. I also note that Mr. Bertonis argues as follows:

Additionally, *Grube shares the goal of Gurantz* to allow communication infrastructure to be placed in areas where it was not achievable before. Gurantz seeks to extend the usefulness of existing home cable wiring for use in broadband local area networking. Ex. 1007, ¶ [0020]. Grube similarly seeks to extend the usefulness of twisted pair telephone line. *See, e.g.*, Ex. 1009, 58:4-14.

Ex. 1002 [Bertonis-Decl.] ¶ 134.

62. Mr. Bertonis and Petitioner, thus, argue that “Grube shares the goal of *Gurantz*.” But that is not the question. Significantly, I do not see any assertion

from either Petitioner or Mr. Bertonis that Grube “shares the goal” of the **’759 patent**. And Grube does not “share[] the goal” of the ’759 patent.

63. The ’759 patent addresses a problem with broadband cable networks (“BCNs”) within a building. As the ’759 patent explains, current BCNs within a building typically receive broadcast signals “at **a point-of-entry (‘POE’)**.” Ex. 1001 [’759] 1:47-51. That signal is then distributed from the POE to **“nodes”** **“connected to various types of customer premise equipment (‘CPE’)** such as cable converter boxes, televisions, video monitors, cable modems, cable phones and video game consoles” via broadband cable splitters. *Id.*, 1:51-61.

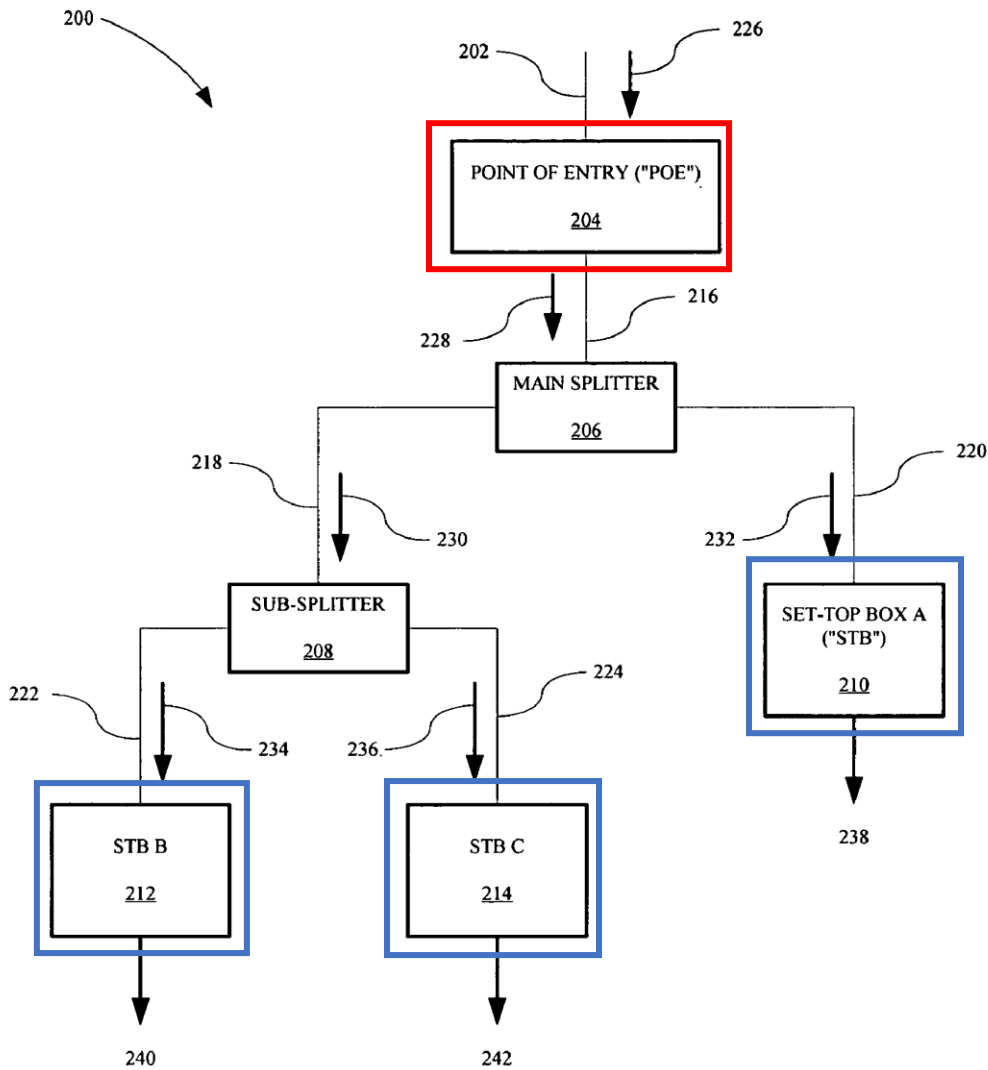


FIG. 2 (Prior Art)

Id., Fig. 2 (annotated).

64. One major source of the difficulty in peer-to-peer communications is the necessary use of splitters to route cable network access to each device, as seen

in Figure 2 above. As a result of this configuration, “most broadband cable networks ... presently utilized within most existing buildings are not configured to allow for easy networking **between CPEs** because most broadband cable networks utilize broadband cable splitters that are designed to split an incoming signal from the POE into numerous split signals that are passed to the different nodes in different rooms.” Ex. 1001 [’759] 3:22-30. As the ’759 patent further explains:

Usually, most of the energy from the upstream signals is passed from the CPEs to the POE because the splitters typically have a high level of isolation between the different connected terminals resulting in significant isolation between the various CPEs.

The isolation creates a difficult environment to network between the different CPEs because the isolation results in difficulty for transmitting two-way communication data between the different CPEs.

Id., 3:50-62. Thus, the ’759 patent addresses a need to “connect a variety of CPEs into a local network, such as a LAN, within a building such as a home or office while allowing the utilization of an existing coaxial cable network within the building.” *Id.*, 3:63-4:3; *see also id.*, 3:8-14 (“As the utilization of the numbers and types of CPEs in buildings increase (such as the number of televisions, video monitors, cable modems, cable phones, video game consoles, etc., increase in a typical home or office environment), there is a growing need **for different CPEs to**

communicate between themselves in a network type of environment within the building.”).

65. The isolation and transmission line effects in BCNs within a building also make it more difficult for a node to simultaneously transmit a message to multiple other nodes. The channel paths between different nodes “are physically and electrically different in the cable network. Physically the channels typically vary in length between nodes and electrically vary because of the paths through and reflections from the various cables, switches, terminals, connections, and other electrical components in the cable network.” Ex. 1001 [’759] 7:5-12. In other words, the physical medium of coaxial cable carrying high-frequency signals causes unique signal-propagation issues. These issues are not found in phone wiring. Consequently, in order to transmit a message from node A to nodes B and C simultaneously, a “common bit-loading modulation scheme” is necessary. *Id.*, 6:63-7:4.

66. Grube addresses a need “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.” *Id.*, 4:47-51.

67. To address this need, Grube teaches the use of a “primary site” which routes calls to various secondary sites (receivers) which are in turn affiliated with

various subscribers (e.g., pagers, phones, faxes). Ex. 1009 [Grube] Abstract, Fig. 8, 7:9-8:37. Importantly, the secondary sites receive all communication from the primary site and not from each other. *Id.*, Fig. 8, 8:38-43.

68. The problems the '759 patent and Grube address are simply entirely different from each other, dealing with different parts of signal transmission and the different issues that arise due to the different wires the '759 patent (coaxial cable) and Grube (twisted pair) use, respectively. Again, the '759 patent addresses issues with devices within a building communicating with each other, in a peer-to-peer manner, at high frequencies (*e.g.*, 900 MHz). Grube addresses issues with a single citywide-scale headend transmitting signals to multiple receivers or receiving signals from those receivers at much lower frequencies (*e.g.*, 1 MHz). *See, e.g.*, Ex. 1009 [Grube] Fig. 4 (showing 1.1 MHz limit); 8:46-49 (“if the secondary sites are separated by more than a given geographic distance (**12 Kft to 18Kft**) from the primary site, repeaters 144, 146 may be required.”). Grube’s receivers or secondary sites are more akin to the points of entry to buildings described in the '759 patent rather than the terminal devices within those buildings the '759 patent allows to communicate with each other.

69. Petitioner and Mr. Bertonis overlook that the physical media involved (coaxial cable versus twisted-pair phone lines) are substantially different and so a POSITA would know that a solution for one (*e.g.*, twisted-pair phone lines) would

not be relevant to the other (*e.g.*, coaxial cable). To illustrate this point, consider the language of Grube. It consistently (over 27 times) refers to the phone line as a “low pass transmission path.” *E.g.*, Ex. 1009 [Grube] 7:14-16 (“The primary site is coupled to a plurality of secondary sites via ***low pass transmission paths***.”). This is correct—a twisted pair phone line acts like a low pass filter over distance. The twisted-pair structure is unshielded (for cost reasons), which leads to a loss of signal energy over distance. Electrically, therefore, the medium appears as a low-pass filter. In other words, the twisted-pair wiring causes higher frequencies to be filtered out, leaving only low frequencies successfully transmitted. This is why the diagrams in Grube (*e.g.*, Fig. 4) show a 1.1 MHz bandlimit. This is also the technical reason why nearly all phone lines are point-to-point connections—they cannot carry enough information to distribute information to multiple users. Grube attempts to address the lack of point-to-multipoint connections but cannot address the more fundamental issue that twisted-pair is unsuitable for it.

70. Conversely, coaxial cable, because of its shielding and tightly controlled impedance, can carry signals at a much higher frequency. *Contrast*, *e.g.*, Ex. 1007 [Gurantz] Fig. 4 (showing signal-carrying capacity above 750 MHz) with Ex. 1009 [Grube] Fig. 4 (showing a 1.1 MHz bandlimit). The differences between the physical properties of coaxial and telephone cabling are particularly noticeable at high frequency. Transmitting signals at a higher frequency over

telephone lines actually results in higher losses and drops in signal strength. *See* Ex. 1009 [Grube] Fig. 2 (drops in bit-loading as frequency goes up). Meanwhile, at high frequencies, the behavior of coaxial cable is well-known to be chaotic, with sharp increases in attenuation at very specific frequencies. When we were developing our own in-home coaxial video distribution system, we referred to the sudden drop in signal propagation at very specific frequencies as “deep nulls”. This is seen, *e.g.*, in Fig. 9 of the ’759 patent. Thus, the fact that Grube “seeks to extend the usefulness of twisted pair telephone line” (Ex. 1002 [Bertonis-Decl.] ¶ 134) would actually be evidence to a POSITA that Grube would offer nothing of value to one working with coaxial cables.

71. Beyond the very significant difference between the media (*i.e.*, coaxial cable versus twisted pair), in deployments utilizing coaxial cable, Grube is likewise irrelevant. There is no indication that cable systems lacked mechanisms to transport content between anything resembling the primary sites in Grube. Certainly, to the extent that one considers the cable operator’s connection to cable modem connection, the DOCSIS standard was long since established and addressed certain issues addressed by Grube in the twisted-pair context in the context of communications between cable providers and customers (*e.g.*, one-to-many and many-to-one communications). Significantly, the problems that Grube seeks to address in the context of citywide telephonic infrastructure had already

long been solved at a macro level in cable infrastructure, *i.e.*, at the operator-to-premises level. Indeed, the industry standard for one-to-many/many-to-one communications in cable between a headend and buildings had already been established in 1997, well before the time of the invention. Ex. 2007 [Cable-Television-Laboratories] 150 (discussing such broadcasting). To be sure, however, Grube (and DOCSIS for that matter), are one further step removed from—and share no relevant characteristics with—a local BCN much less any communications between devices within that BCN. Cable networks were quite capable of connecting devices such as cable set-top boxes and television sets to broadcast video while, at the same time, permitting hundreds of users to use cable modems for two-way interactive communications.

72. Thus, the '759 patent's and Grube's problems are entirely distinct and in my opinion, Petitioner and Mr. Bertonis fail to demonstrate that Grube is analogous art to the '759 patent.

C. “Bit-Loading Modulation Scheme[s]” (All Claims, All Grounds).

73. Each of the independent claims require a “bit-loading modulation scheme” and a “common bit-loading modulation scheme”:

Limitation 1[pre]/2[pre]/3[pre] “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:”

Limitation 1[b]/2[b]/3[b] “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”

Limitation 4[pre]/5[pre]/6[pre] “A non-transitory computer-readable medium having software for determining a ***common bit-loading modulation scheme*** for communicating between a plurality of nodes in a broadband cable network (‘BCN’), the non-transitory computer-readable medium comprising:”

Limitation 4[b]/5[b]/6[b] “logic configured for 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;”

Limitation 7[pre]/14[pre]/20[pre]/22[pre] “A broadband cable network (‘BCN’) for determining a ***common bit-loading modulation scheme*** for communicating between a plurality of nodes in the BCN, the BCN comprising:”

Limitation 7[b] “a sub-plurality of receiving nodes within the plurality of nodes wherein the sub-plurality of receiving nodes are capable of transmitting a sub-plurality of response signals in response to receiving the probe signal, wherein the sub-plurality of response signals includes a plurality of ***bit-loading modulation schemes***, wherein each ***bit-loading modulation scheme*** of the plurality of ***bit-***

loading modulation schemes is determined by a receiving node within the sub-plurality of receiving nodes,”

Limitation 14[b]/20[b] “a sub-plurality of receiving nodes within the plurality of nodes, wherein the sub-plurality of receiving nodes have means for transmitting a sub-plurality of response signals in response to receiving the probe signal, wherein the sub-plurality of response signals includes a plurality of **bit-loading modulation schemes**, wherein each **bit-loading modulation scheme** of the plurality of **bit-loading modulation schemes** is determined by a receiving node within the sub-plurality of receiving nodes; and”

Limitation 22[b] “means for 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”

74. I note that Petitioner contends that Gurantz teaches use of a “bit-loading modulation scheme,” but concedes that Gurantz “does not specifically describe that scheme being determined by a corresponding receiving node and included in a plurality of received response signals (responsive to the transmitted probe signal).” Pet, 27-28. Instead, Petitioner argues that “Grube teaches such an arrangement and would have suggested to a POSITA its use in Gurantz.” Pet., 28. Specifically, Petitioner relies on Grube’s “bit loading table” as the claimed “bit-loading modulation scheme” and Grube’s lowest common denominator (LCD) bit loading table as the claimed “common bit-loading modulation scheme.” Pet., 28.

In my opinion, Petitioner fails to demonstrate that Grube's (LCD) bit loading tables are (common) bit-loading modulation schemes.

75. Significantly, while Grube mentions a "bit loading table," Grube never refers to the "bit loading table" as a "bit-loading ***modulation scheme***," Petitioner and Mr. Bertonis never recognize this difference, nor explain why the two are the same. Rather, Petitioner argues:

Grube teaches in detail a *common* bit-loading methodology for use in a multicast scenario where the same data (e.g., control data) is to be transmitted simultaneously to multiple receiving nodes. Therein, multiple receiving nodes ("secondary sites") of a communication network determine and inform a transmitting node ("primary site") of ***a bit-loading scheme (table)*** for the respective receiving node, responsive to receiving the probe ("training") signal sent by the transmitting node. Ex. 1009, 14:3-19, 17:10-45, Figs. 12, 15; Ex. 1002, ¶128.

The tables are compared by the primary site (transmitting node) in order to determine a *common* bit-loading scheme for outgoing multi-carrier data transmissions, which Grube terms lowest common denominator (LCD) bit-loading. Ex. 1009, 14:64-15:5, 18:44-19:26, Fig. 17; Ex. 1002, ¶129.

Pet., 28-29. I simply see no explanation of why Grube's "tables" are "modulation schemes."

76. Thus, in my opinion, Petitioner and Mr. Bertonis fail to demonstrate that their combinations teach “bit-loading modulation scheme[s].”

D. “Determining A Common Bit-Loading Modulation Scheme For Communicating Between A Plurality Of Nodes In” “A Broadband Cable Network (‘BCN’)” (All Claims, All Grounds).

77. Each of the independent claims require a “determining a common bit-loading modulation scheme for communicating between a plurality of nodes in” a “broadband cable network (‘BCN’)”:

Limitation 1[pre]/2[pre]/3[pre] “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:”

Limitation 4[pre]/5[pre]/6[pre] “A non-transitory computer-readable medium having software for determining ***a common bit-loading modulation scheme for communicating between a plurality of nodes in a broadband cable network (‘BCN’)***, the non-transitory computer-readable medium comprising:”

Limitation 7[pre]/14[pre]/20[pre]/22[pre] “A broadband cable network (‘BCN’) for determining ***a common bit-loading modulation scheme for communicating between a plurality of nodes in the BCN***, the BCN comprising:”

78. I note that the claimed “common bit-loading modulation scheme” appears elsewhere in the body of each claim. Ex. 1001 [’759] cls. 1-7, 14, 20, 22. Consequently, the preambles provide antecedent basis for the bodies of the claims.

79. Notably, “determining a common bit-loading modulation scheme for communicating between a plurality of nodes in” a “broadband cable network (‘BCN’)” lies at the heart of the claims.

80. As previously explained, the ’759 patent’s field is “broadband cable networks” and the ’759 patent is directed towards enabling peer-to-peer communication among terminal devices (“nodes”) within a BCN. Due to the configuration of prior art BCNs and the inherent properties of coaxial cable “most broadband cable networks ... presently utilized within most existing buildings are not configured to allow for easy networking *between CPEs* because most broadband cable networks utilize broadband cable splitters that are designed to split an incoming signal from the POE into numerous split signals that are passed to the different nodes in different rooms.” Ex. 1001 [’759] 3:22-30. The ’759 patent addresses a need to “*connect a variety of CPEs* into a local network, such as a LAN, within a building such as a home or office while allowing the utilization of an existing coaxial cable network within the building.” *Id.*, 3:63-4:3; *see also id.*, 3:8-14 (“there is a growing need *for different CPEs to communicate between themselves in a network type of environment within the building.*”); 7:5-12 (“Physically the channels typically vary in length between nodes and electrically vary because of the paths through and reflections from the various cables,

switches, terminals, connections, and other electrical components in the cable network.”).

81. To solve this problem, the ’759 patent teaches an inventive “common bit-loading modulation scheme” which is used “for communicating between a plurality of nodes in the BCN.” Ex. 1001 [’759] Abstract; 4:5-40 (describing determination of “common bit-loading modulation scheme for communicating between a plurality of nodes in the BCN” in summary of invention); 6:63-67 (“in order to [e]nsure that both *node B 504 and node C 506 receive the transmissions broadcast signal from node A 502, node A 502 utilizes a* bit-loading modulation scheme that is known as a *common bit-loaded modulation scheme.*”); 10:6-14 (similar).

82. Thus, “determining a common bit-loading modulation scheme for communicating between a plurality of nodes in” a “broadband cable network” goes to the heart of the ’759 patent’s inventions.

83. Petitioner argues that “Gurantz in view of Grube teaches” the preambles. *E.g.*, Pet., 22. Petitioner, however, concedes that Gurantz does not disclose a “common bit-loading modulation scheme” and relies on Grube for it. *See id.*, 24. Critically, Petitioner never argues that Grube’s LCD bit-loading table is “for communicating.” Nor could it.

84. Grube teaches that its “LCD bit-loading tables” (or “ordered bit-loading tables”) are used to minimize the number of carrier channels used to support each call. *See* Ex. 1009 [Grube] 22:9-32 (“From these bit loading tables 434, 436, a carrier channel or carrier channels is selected to support the inbound control channel for each set.”). This is because of twisted-pair’s shortcoming of having a limited frequency bandwidth with which to deliver transmissions. Grube’s process can be seen illustrated in Figure 29:

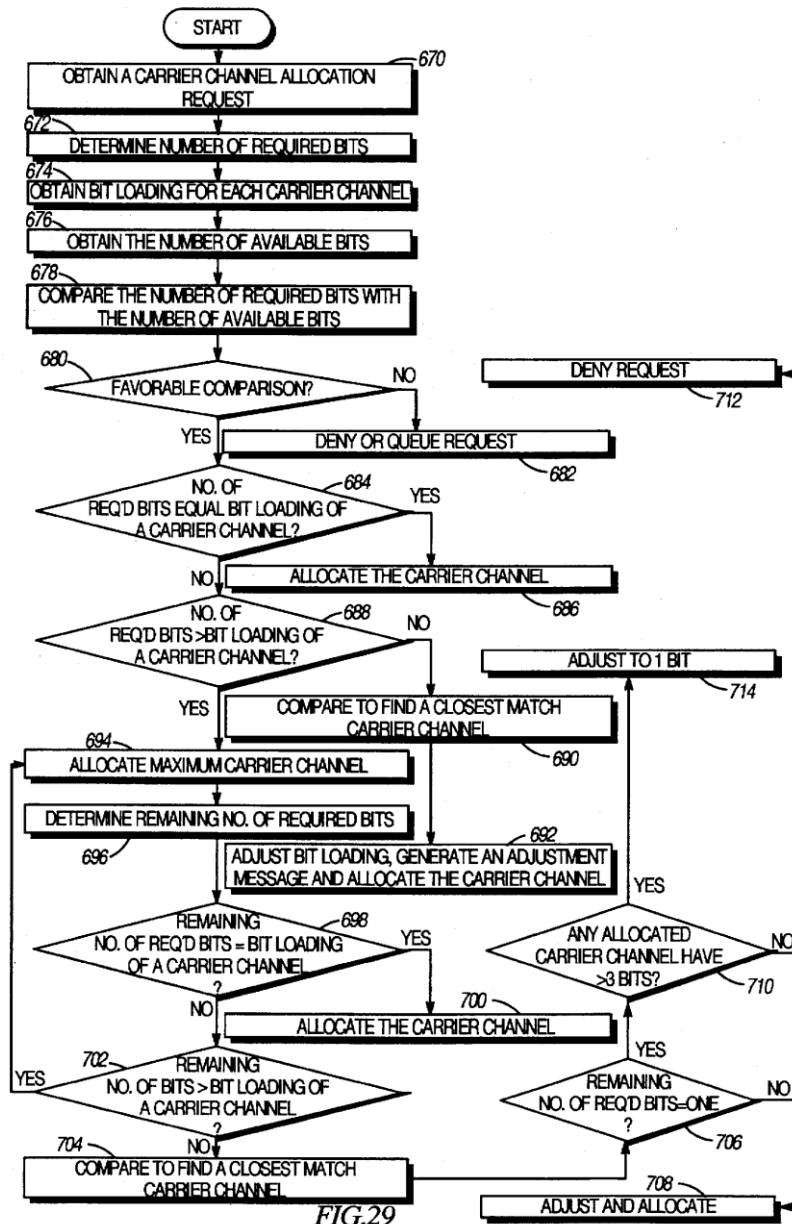


FIG. 29

Id., Fig. 29. As can be seen above, the primary site receives a “carrier channel allocation request” (also called a “call request” in Grube) (step 670) and “determines a number of required bits” based on the call type. *Id.*, 33:7-17. The primary site then “accesses an ordered bit loading table” (*id.*, 33:18-19) and then,

using the table, either “queues or denies the request,” “allocates the carrier channel having the bit loading which matches the number of required bits to the carrier channel request” if there is one, or “allocates the carrier channel[s] having the maximum bit loading, i.e., the maximum carrier channel, to the carrier channel request” until “the particular carrier channel allocation request has been allocated a sufficient number of carrier channels to fulfill the bandwidth requirements of the service being requested.” *Id.*, 33:50-34:28. Thus, Grube’s alleged common bit-loading scheme is not used to enable peer-to-peer communication between secondary sites, but rather simply to minimize the number of channels allocated to a particular call with the ultimate goal of servicing more than one call at a time. These calls are routed between a primary site and a secondary site, not between two secondary sites. Significantly, this is the opposite of what the ’759 patent teaches its bit-loading is for. Ex. 1001 [’759] 7:12-14 (“Bit-loading is the process of optimizing the bit distribution to each of the channels to **increase throughput.**”).

85. Grube teaches a primary site at the headend which allocates call resources for secondary sites. Ex. 1009 [Grube] 7:9-8:37 (Grube’s invention “accomplished by providing a primary site” which “select[s] 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 dam from the targeted secondary sites to the primary site.”).

86. Notably, Grube makes no mention of secondary sites communicating with one another, let alone using the LCD or ordered bit-loading tables to do so. *See generally* Ex. 1009 [Grube]. The concept of “determining a common bit-loading modulation scheme *for* communicating between a plurality of nodes in” a “broadband cable network” as a whole is entirely missing from Grube.

87. Thus, in my opinion, Petitioner and Mr. Bertonis fail to demonstrate that their combinations disclose or render obvious “determining a common bit-loading modulation scheme for communicating between a plurality of nodes in” a “broadband cable network (‘BCN’).”

E. Motivation To Combine Gurantz And Grube (All Claims, All Grounds).

1. Gurantz And Grube Are Fundamentally Different Systems.

88. As “Gurantz is in the same family as the ’759 patent” (Pet., 8; Ex. 1001 [’759] Cover), it too is directed toward allowing communication between devices in a building’s broadband network using coaxial cable. *See, e.g.*, Ex. 1007 [Gurantz] Title (“NETWORK INTERFACE DEVICE AND **BROADBAND LOCAL AREA NETWORK USING COAXIAL CABLE**”); Abstract (“A local area network uses *coaxial cable wiring* for interconnection of terminal devices.”); [0002] (“This invention relates to *broadband communication networks*”); [0003] (“In a *coaxial cable* based local area network (LAN), communication between nodes occurs over a shared *coaxial cable*.”); [0012] (“None of these [prior art]

references addresses the problem of tap port-to-port isolation and providing a suitable signal path for terminal-to-terminal **communication in a coaxial cable wired building.**”).

89. By contrast, as explained, Grube is directed to twisted pair telephone networks covering a citywide area; it is not directed to cable, much less coaxial cable, within a building. Ex. 1009 [Grube] 7:9-12 (“Generally, the present invention provides a method and apparatus for establishing a communication system infrastructure utilizing **low pass transmission path, i.e. twisted pair telephone line.**”); 7:20-22 (“The primary site communicates with the plurality of secondary sites via inbound and outbound **low pass transmission paths.**”); 8:46-49 (“Note that, if **the secondary sites are separated by more than a given geographic distance (12 Kft to 18Kft) from the primary site**, repeaters 144, 146 may be required.”); 9:61-66 (“FIG. 9 illustrates a communication system 160 having a two-wire infrastructure. As shown, the primary site 102 is operably coupled to a plurality of secondary sites 104-108 via a **twisted pair low pass transmission path 162**. The low pass transmission path is a **twisted pair copper wire, which may be a telephone line.**”); 12:56-57 (“In operation, the DMT receiver 122 receives information from an outbound **twisted pair 150**”); 13:61-63 (“In this mode, the DMT transmitter 124 places data on allocated carrier channels of the inbound **twisted pair 148.**”); see also 1:44-47 (Grube’s wireline links 34-38 are typically **T1**

links”); Ex. 2005 [One-Ring-Networks] 1 (a “T1 link” is “a communications transmission service that uses 2 *twisted pair copper wires* to transmit and receive data or voice traffic.”).

90. As explained, systems using coaxial cable and systems using phone lines/twisted pair wires are fundamentally different. The difference between cable and a phone line, even at the time of the ’759 patent, was profound. A single phone line carried signal energy up to about 1 MHz and, according to Grube, this led to about 10 Mbit/s of data capacity. Ex. 1009 [Grube] 3:7-10. By contrast, a single cable line on an 860 MHz cable plant carried about 125 6-MHz channels. A single 6-MHz channel can carry 38 Mbit/s using the DOCSIS standard (and 256-QAM modulation). Thus, this single cable could carry 4,750 Mbit/s or about 475 times the data capacity of Grube’s twisted pair wire. A POSITA would not be motivated to improve signaling on coaxial cable via Grube’s far more primitive twisted pair system.

91. I note that Petitioner and Mr. Bertonis argue that “[a] POSITA would have recognized that Grube’s teachings for improving bit-loaded data transmission over a network utilizing two-wire (e.g., twisted pair) telephone line would have similar application, with similar benefits, as applied to Gurantz’s BCN employing coaxial cable,” as “both types of networks are subject to similar interference and

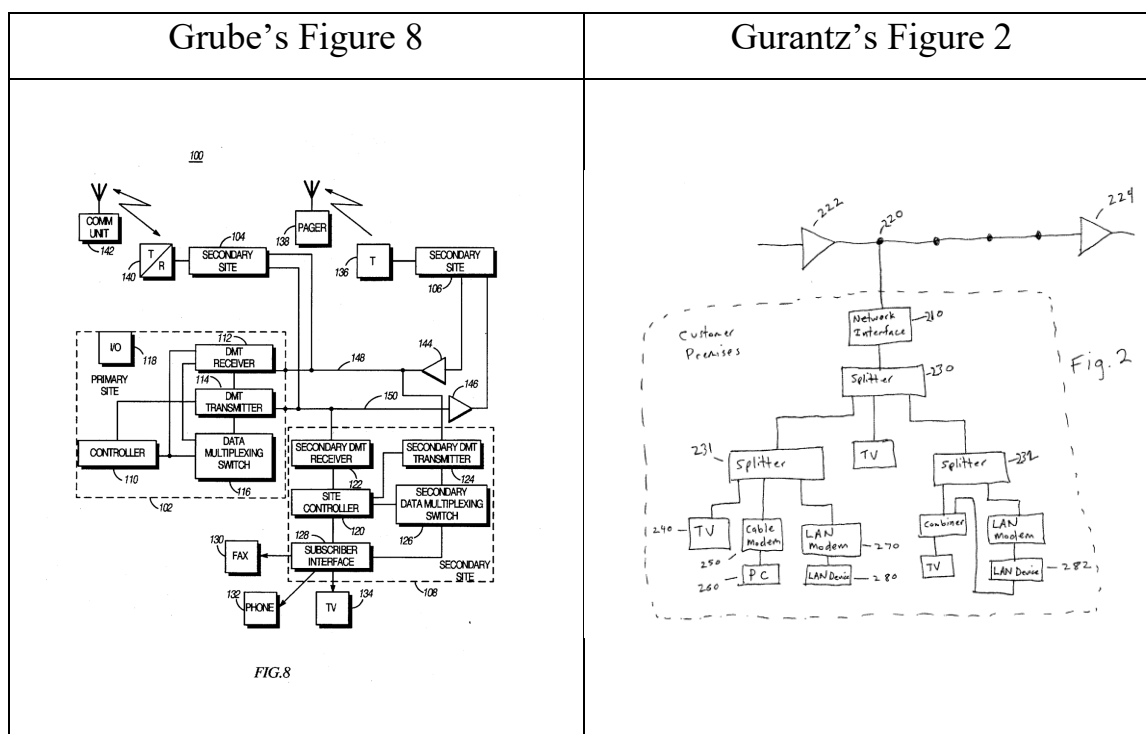
signal reflections.” Pet., 27 (citing Ex. 1002 [Bertonis-Decl.] ¶¶121-124). I disagree.

92. The physical differences between coaxial cable and twisted pair systems manifest themselves in the different problems each system faces. As seen in Gurantz (and the ’759 patent), the higher frequency transmission results in shorter wavelengths, which in turn cause negative transmission-line effects, even inside buildings. Ex. 2004 [Signal-Integrity] 94-96, 99-101. Consequently, devices on a local coaxial cable network have a difficult time communicating with each other. Ex. 1007 [Gurantz] [0012] (Gurantz “addresses the problem of tap port-to-port isolation and providing a suitable signal path for terminal-to-terminal communication in a coaxial cable wired building.”).

93. Grube’s twisted-pair system, by contrast, does not face this problem. The twisted pair wire’s transmission frequency is lower, and thus, its wavelength is longer. The negative transmission-line effects seen in coaxial cable networks are simply not seen in twisted-pair wiring. This lower transmission frequency, however, means that twisted pair wiring cannot carry enough information to distribute information to multiple users. In accord, Grube addresses a need “for a one-to-many and/or many-to-one communication system infrastructure that utilizes existing telephone lines.” Ex. 1009 [Grube] 4:47-51. Coaxial cable’s higher frequency has no such problem. A POSITA simply would not consider solutions

meant for twisted pair wiring's lack of bandwidth to be relevant to the problem of coaxial cable's transmission-line effects within buildings.

94. Gurantz and Grube also have fundamentally different topology (local area vs citywide). This difference can be seen when comparing Grube's Figure 8 with Gurantz's Figure 2:



As can be seen above, Grube's invention concerns the hierarchy between the primary site at the headend and secondary sites. See Ex. 1009 [Grube] 7:20-22. The secondary sites in turn communicate with multiple "subscribers," such as faxes, phones, and televisions. See *id.*, 8:50-58, 8:66-9:6. By contrast, Gurantz's invention concerns the network within, *e.g.*, a given home and between the consumer premises equipment, such as the TV, cable modem, and PC within that

home. Ex. 1007 [Gurantz] [0020]. In other words, whereas Grube has a citywide focus and concerns the interface between a citywide primary site at the headend and an entry point with particular buildings, Gurantz concerns local networks, *e.g.*, within a home, and communications within that network amongst consumer premises equipment within that home, which Grube is entirely unconcerned with. Grube's secondary sites are, moreover, one step removed from the nodes that are the subject of the '759 patent.

2. Implementing Gurantz's Nodes As Grube's Primary Sites.

95. Each of the independent claims require “transmitting a probe signal from a transmitting node,” which also “receiv[es] a plurality of response signals” and “determin[es] the common bit-loading modulation scheme from the received plurality of response signals”:

Limitation 1[a]/2[a]/3[b] “***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;”

Limitation 1[b]/2[b]/3[b] “***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”

Limitation 1[c]/2[c]/3[c] “***determining the common bit-loading modulation scheme from the received plurality of response signals;***”

Limitation 4[a]/5[a]/6[a] “logic configured for ***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;”

Limitation 4[b]/5[b]/6[b] “logic configured for ***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;”

Limitation 4[c]/5[c]/6[c] “logic configured for ***determining the common bit-loading modulation scheme from the received plurality of response signals,***”

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

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

Limitation 14[a]/20[a] “***a transmitting node*** within the plurality of nodes, ***the transmitting node having means for sending a probe signal;*** and”

Limitation 14[c] “wherein ***the transmitting node includes means for determining the common bit-loading modulation scheme from the sub-plurality of response signals***, wherein the transmitting node further includes means for determining the common bit-loading modulation scheme in response to comparing all bit-loading modulation schemes within the plurality of bit-loading modulation schemes.”

Limitation 20[c] “wherein the ***transmitting node includes means for determining the common bit-loading modulation scheme from the sub-plurality of response signals***,”

Limitation 21[a]/22[a] “means for ***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;”

Limitation 21[b]/22[b] “means for ***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;”

Limitation 21[c]/22[c] “means for ***determining the common bit-loading modulation scheme from the received plurality of response signals***,”

96. I understand that Petitioner argues that Gurantz-Grube teaches the transmitting node because it, allegedly, would have been obvious to configure Gurantz's LAN modem/device pair as a primary site as taught by Grube:

It would have been obvious to a POSITA to have configured Gurantz's LAN modem/device pair 270/280 as a primary site as taught by Grube, while configuring other LAN modem/device pairs, such as LAN modem/device pair (unlabeled)/282, as secondary sites on the LAN. *Cf.*, Ex. 1007, Fig. 2 with Ex. 1009, Fig. 9 (each above). *See*, §VI.A.1.c, *supra*. In this obvious configuration, it would be Gurantz's LAN modem/device pair 270/280 that determines a common bit-loading modulation scheme, from the plurality of response signals received from the plurality of secondary sites exemplified by Gurantz's LAN modem/device pair (unlabeled)/282. Ex. 1002, ¶144.

Pet., 36-37. I disagree.

97. As an initial matter, I see no explanation of why or how Gurantz's nodes could be configured as Grube's primary site. Petitioner merely asserts that it would be an "obvious configuration," citing only Mr. Bertonis's declaration. I note, however, that Mr. Bertonis's declaration merely says the same thing. Ex. 1002 [Bertonis-Decl.] ¶ 144.

98. Moreover, I do not believe that a POSITA would have been motivated or able to configure one of Gurantz's LAN modem/device pairs as Grube's primary site with a reasonable likelihood of success.

99. Grube's primary site is at the headend of the telephone system, providing citywide coverage. As can be seen in Grube's Figure 8 below, Grube's primary site communicates with numerous secondary sites, including secondary site 108 which services a fax machine, a phone, and a TV:

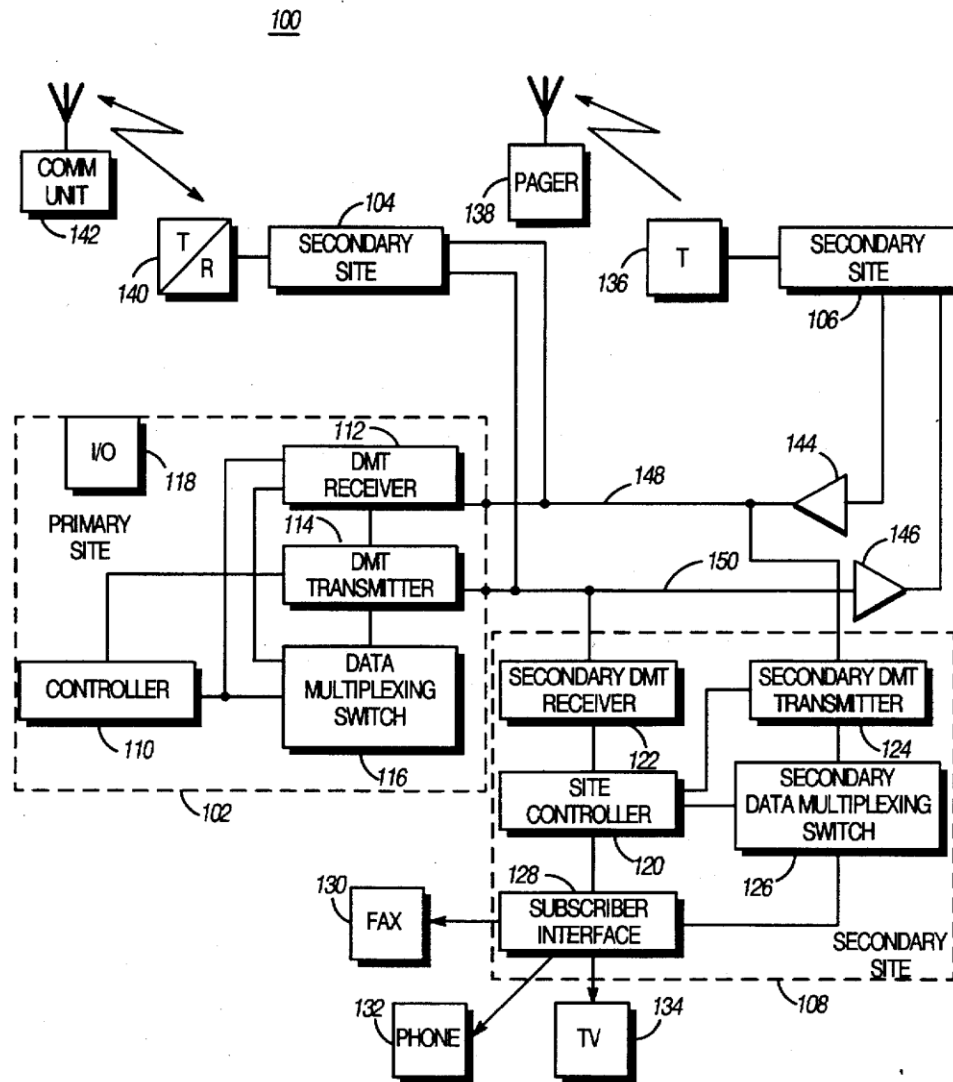
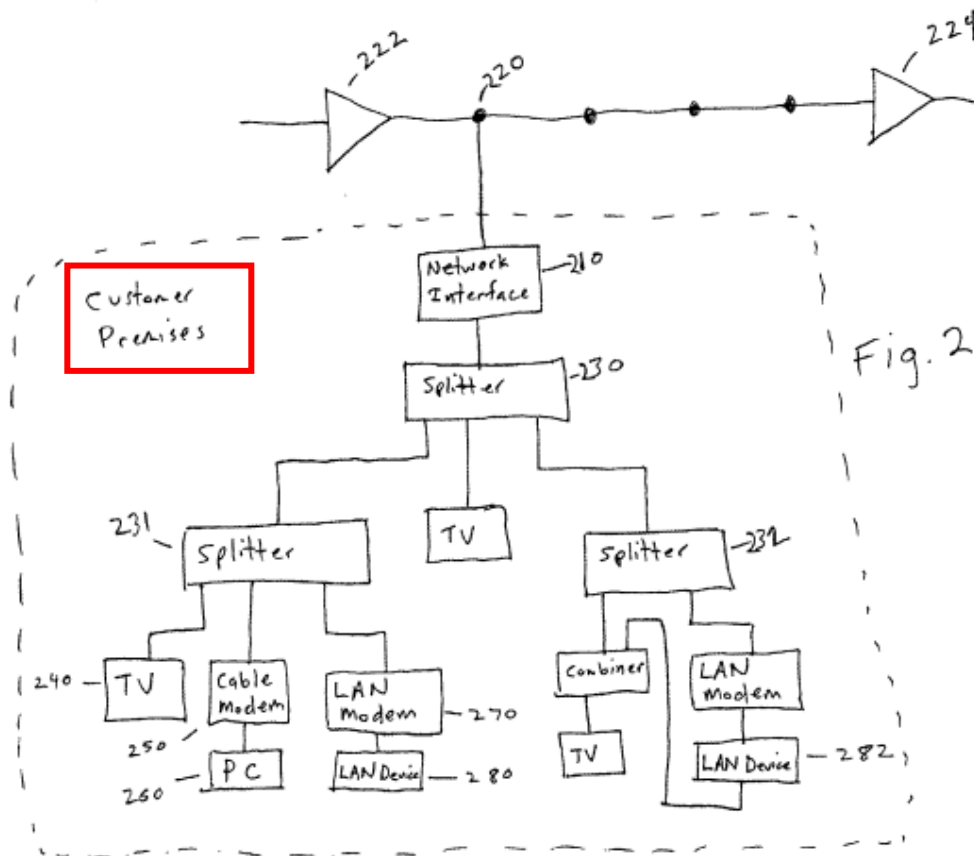


FIG.8

Ex. 1009 [Grube] Fig. 8. Grube thus teaches that its primary site communicates with receivers meant to service entire buildings. Indeed, Grube teaches that its primary site is responsible for receiving call requests, determining which secondary site should receive a particular call, and then allocating available channel resources to the call. See Ex. 1009 [Grube] 8:22-8:37 (describing how Grube’s primary site handles call requests). In accord, Grube teaches that its primary site “would ***include a public switched telephone network (PSTN) interconnection*** to support telephone interconnect operations and to transceive facsimiles.” *Id.*, 10:47-50; see also *id.*, 8:43-46 (“The primary site 102 includes a controller 110, a DMT (Discrete Multi Tone) receiver 112, a DMT transmitter 114, a data multiplexing switch 116, and an input/output port 118.”). Grube also teaches that its primary site may be miles away from the secondary sites. *Id.*, 8:46-49 (“Note that, if ***the secondary sites are separated by more than a given geographic distance (12 Kft to 18Kft) from the primary site***, repeaters 144, 146 may be required.”).

100. By contrast, Gurantz’s LAN modem/devices are simply devices within a building, meant only to support the limited number of users in the building. As seen in Gurantz’s Figure 2 below, the LAN modem/device pairings are within a “customer premises”:



Ex. 1007 [Gurantz] Fig. 2 (annotated); *see also id.*, [0020]. In accord, Gurantz teaches that the “LAN device” can be a “personal computer” or “a modulator to produce a signal for driving a TV through a signal combiner.” *Id.*, [0020].

101. There is no reason to believe that a “LAN modem,” “personal computer,” or a “modulator to produce a signal for driving a TV” could be configured as one of Grube’s much more powerful and capable expansive primary sites. A device meant for an individual’s use is simply not as capable as a site meant to provide communications to buildings in a citywide area. One reason is the cost and complexity of developing a system that can generate the training

signal described in Grube and measure (or collect) responses. A POSITA would not be motivated to implement Gurantz's in-home devices, such as set-top boxes and cable modems, to have the necessary additional circuits that Grube's primary site has. Keeping in mind that service providers buy these devices in multi-million-unit quantities and based on my experiences designing such products, there is no way that service providers would pay extra for pieces of customer premises equipment to be able to operate as Grube's primary site.

102. Thus, Petitioner and Mr. Bertonis fail to demonstrate that a POSITA would have been motivated and able to implement one of Gurantz's nodes as Grube's primary site with a reasonable likelihood of success.

3. Gurantz's Broadband Cable Network Has No Need For Grube's Telephone System Solutions

103. I understand that Petitioner argues that a POSITA would have been motivated to combine Gurantz and Grube because:

In the combination, parts of the channel with higher SNR would be used to transmit more bits, while frequencies having a lower SNR would use "lower order constellations," in accordance with Gurantz's teachings Ex. 1007, ¶[0050]. This would have furthered Gurantz's objective of overcoming "frequency selective channel impairments." *Id.*, ¶[0048]; Ex. 1002, ¶126.

Pet., 26. I disagree.

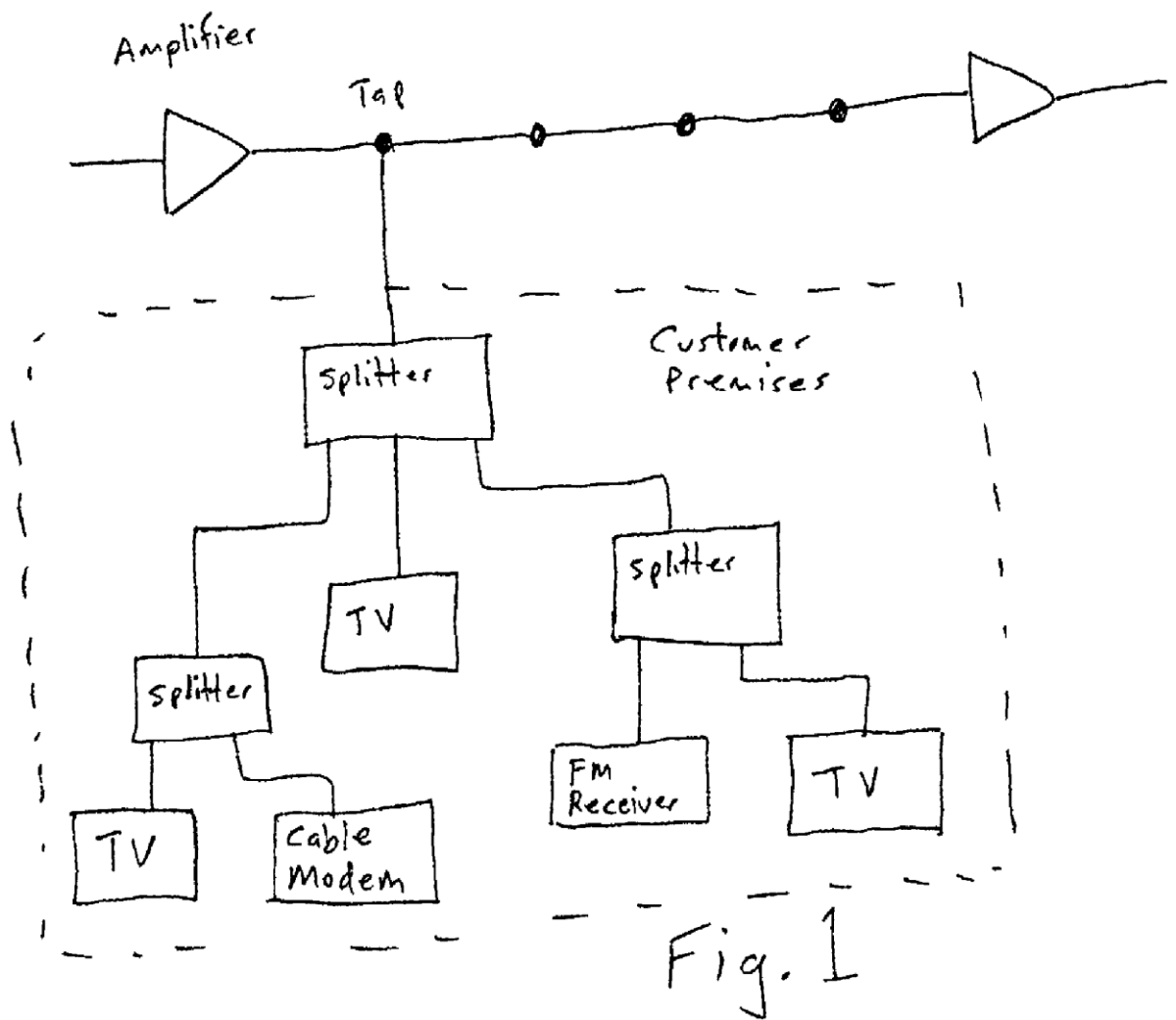
104. Gurantz teaches that “***OFDM provides a mechanism to overcome*** the frequency selective channel impairments present in coaxial building wiring when employing a network interface device according to the present invention.” Ex. 1007 [Gurantz] [0048]. Consequently, Gurantz has no need for Grube’s alleged technique to “further[.]” overcome an issue Gurantz’s invention already overcomes by itself.

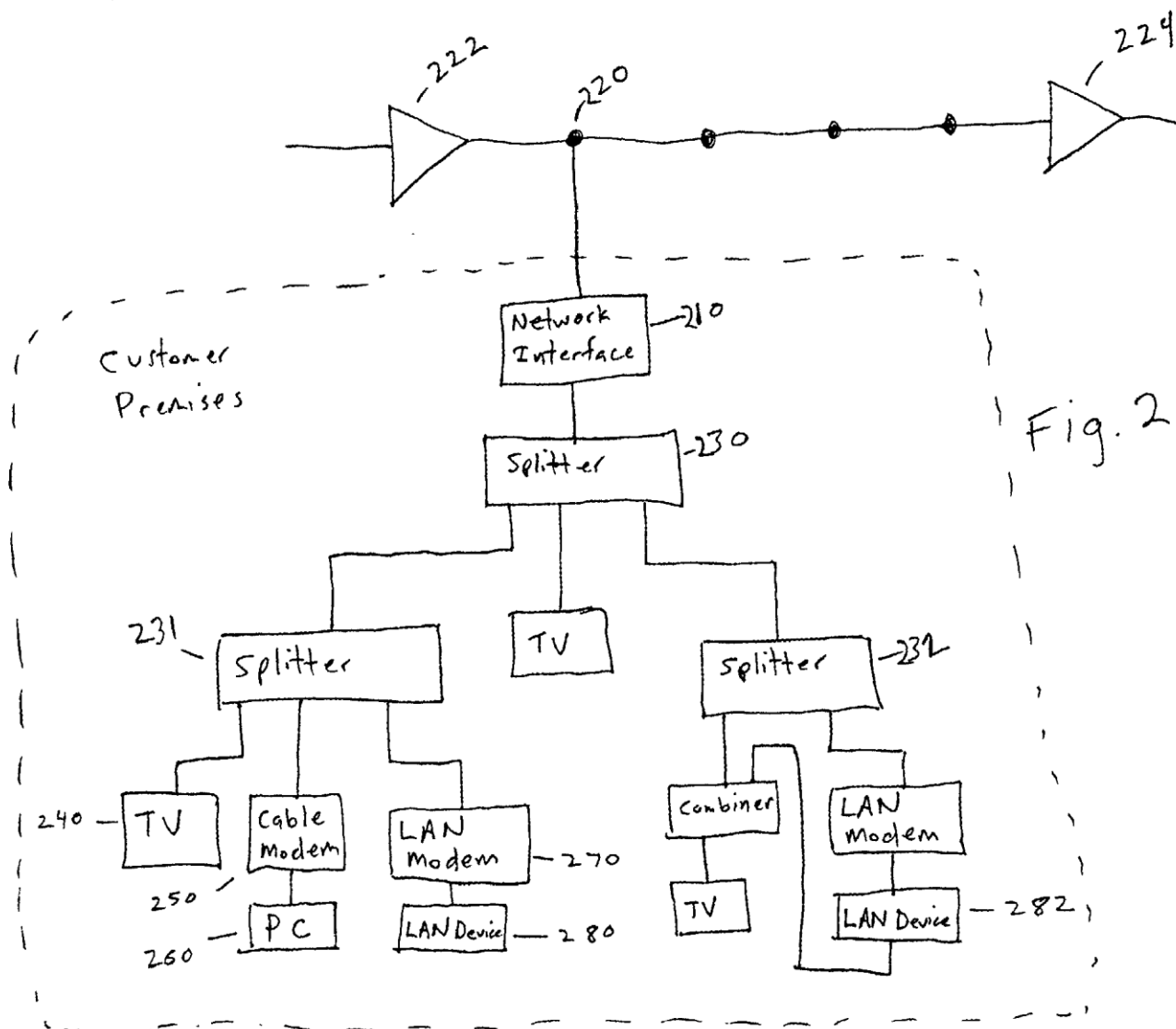
105. Similarly, Petitioner also argues that a POSITA would have been motivated to combine Gurantz and Grube because Grube would have allowed for “‘one-to-many and/or many-to-one’ communications”:

Further, Grube presents an improvement over the known use of bit-loading, extending it to provide an architecture that allows for “one-to-many and/or many-to-one” communications, i.e., a multi-cast scenario. Ex. 1009, 4:43-50. Combination with Gurantz would have been motivated in order to achieve a similar improvement in data networking over coaxial cable. Ex. 1002, ¶135.

Pet., 32-33. I disagree.

106. Not only does Gurantz already teach a multi-cast scenario, Gurantz teaches that one-to-many communication from the POE to the nodes was taught in prior art BCN systems. As can be seen illustrated in the figures below, Gurantz teaches that the signal propagates throughout the customer premises to various devices from a point of entry:





Ex. 1007 [Gurantz] Figs. 1, 2; [0004] (“Signal splitters, shown in FIG. 2, are commonly used in home and other building type coaxial cable wiring. **They have an input port and multiple output ports.**”). Moreover, Gurantz teaches that these pathways are bi-directional, allowing for many-to-one communications. *Id.*, [0005] (“Splitters are generally bi-directional.”); [0013] (“A bidirectional signal

distribution network is create[d] from existing building wiring”). Gurantz thus has no further need for the one-to-many or many-to-one communications described in Grube.

107. Although Petitioner argues that Grube’s invention improved bit-loaded data transmission, Grube did not actually present an improvement in the use of bit-loading. Rather, Grube re-architects an ADSL over twisted-pair telephonic system to include “one-to-many and/or many-to-one” communications. Ex. 1009 [Grube] 4:44-51. Grube says nothing about improving bit-loading. *See generally id.* Rather, Grube’s system is designed to efficiently allocate bandwidth for given calls in view of the limited bandwidth (1.1 MHz) available in Grube’s twisted-pair telephone lines while also minimizing channels for any given call so that Grube’s system can accommodate the ever-shifting needs of its dense citywide system. But neither of these is a concern in the context of Gurantz. As previously explained, Gurantz’s BCN accommodates far higher bandwidths. Additionally, Gurantz’s local BCN has no need to balance the competing and ever-shifting needs of the very large number of sites serviced by a citywide network like that disclosed in Grube.

108. Moreover, Petitioner’s conclusory assertion that “[c]ombination with Gurantz would have been motivated in order to achieve a similar improvement in data networking over coaxial cable” is unsubstantiated. Grube’s improvements are

to add “one-to-many and/or many-to-one” broadcast from a headend (the primary site) to secondary sites (*e.g.*, buildings) to its ADSL system. Ex. 1009 [Grube] 4:44-51. But cable networks have been broadcasting between the headend and buildings since the 1960’s. Ex. 2008 [Cable-History-Timeline] 7. In other words, these are problems that were solved literally decades earlier.

109. In essence, Petitioner appears to argue that a POSITA would be motivated to add broadcasting functionality to Gurantz (which applies to coaxial in-home network with no need for broadcasting). Even if this were correct, which it is not for the reasons I explained above, a POSITA would not turn to Grube which provides broadcasting functionality (1) ***outside the home***, (2) ***over twisted pair***, (3) ***for an ADSL system***. There is no other reason to make this combination other than to reconstruct the claims of the ’759 patent with the benefit of hindsight.

4. Gurantz and Grube’s Systems Are Incompatible.

110. Grube and Gurantz’s systems are simply incompatible, and Petitioner fails to explain why a POSITA would believe Grube’s teachings to be applicable to Gurantz’s system. As explained, coaxial cable and twisted-pair wire systems operate on different frequencies. Gurantz teaches that “[t]he frequencies used by [its] LAN can be located above the standard cable use frequencies, which extend to **550 MHz or 750 MHz**. ... The filter cut-off frequencies are selected according to the frequencies bands used.” Ex. 1007 [Gurantz] [0031]. By contrast, Grube

teaches that its “ADSL system incorporates 256 carrier channels beginning at 25 kilohertz up to 1.1 MHz at so increments of 4 kilohertz.” Ex. 1009 [Grube] 52:25-30.

111. This difference in frequencies is significant because Gurantz’s invention relies heavily on reflecting signals. Ex. 1007 [Gurantz] [0013]. The reflecting device is “frequency selective,” utilizing a “low pass filter.” *Id.*, [0022]. This frequency selection allows low frequency signals to pass to the head-end (*i.e.*, out of the building) while high frequency signals originating from the terminal devices are reflected back among the terminal devices (*i.e.*, in the building). Grube’s method uses low frequencies, which would only pass to the head-end instead of back among the terminal devices. But, Grube’s low-frequency signals, if applied in Gurantz’s system, would pass through Gurantz’s system without being reflected and, thus, render Gurantz’s system for communication among the terminal devices completely inoperable.

112. If more is needed, even if Gurantz and Grube’s systems were compatible, implementing Grube’s teachings in Gurantz would interfere with Gurantz’s goal of enabling peer-to-peer communication within a network.

113. Again, Gurantz makes clear that its intended purpose is to allow “terminal devices” on a “local area network using coaxial cable” “to transmit to and receive from other devices.” *E.g.*, Ex. 1007 [Gurantz] Abstract. Indeed,

Gurantz addresses the issue in prior art “LAN system[s],” where “terminal devices communicate directly with each other, [and] therefore attenuation between tap ports in the signal splitters results in an undesirable signal loss.” *Id.*, [0008]; *see also* [0010] (“The tap port isolation of splitters used in a typical cable TV distribution configuration presents a problem to shared usage of the cable for a LAN system.”), [0012] (“None of these [prior art] references addresses the problem of tap port-to-port isolation and providing a suitable signal path for terminal-to-terminal communication in a coaxial cable wired building.”). Consequently, Gurantz teaches a “network interface device [which] provides a path for terminal devices to transmit to and receive from other terminal devices.” *Id.*, [0013]. This results in a “bidirectional signal distribution network” among the terminal devices and created “from existing building wiring.” *Id.*

114. Thus, Gurantz’s principle of operation is to allow terminal devices on a coaxial LAN within a building to communicate with each other.

115. Grube operates by utilizing a “primary site” which “communicates with [a] plurality of secondary sites.” Ex. 1009 [Grube] 7:20-21. The primary site is responsible for “receiv[ing a] call request,” “determin[ing] the target sites involved in the requested call,” “retriev[ing] the site bit loading table for each target site and generat[ing] a lowest common denominator (LCD) call bit loading table for this particular call,” and “allocat[ing] carrier channels to provide the

infrastructure for this particular call.” *Id.*, 8:22-36. Thus, in other words, Grube’s primary site functions as a hub which transmits calls to secondary sites along allocated spokes (carrier channels). This hub-and-spoke model can be seen illustrated in Grube’s Figure 8, which demonstrates that each secondary site communicates directly with the primary site, not with other secondary sites:

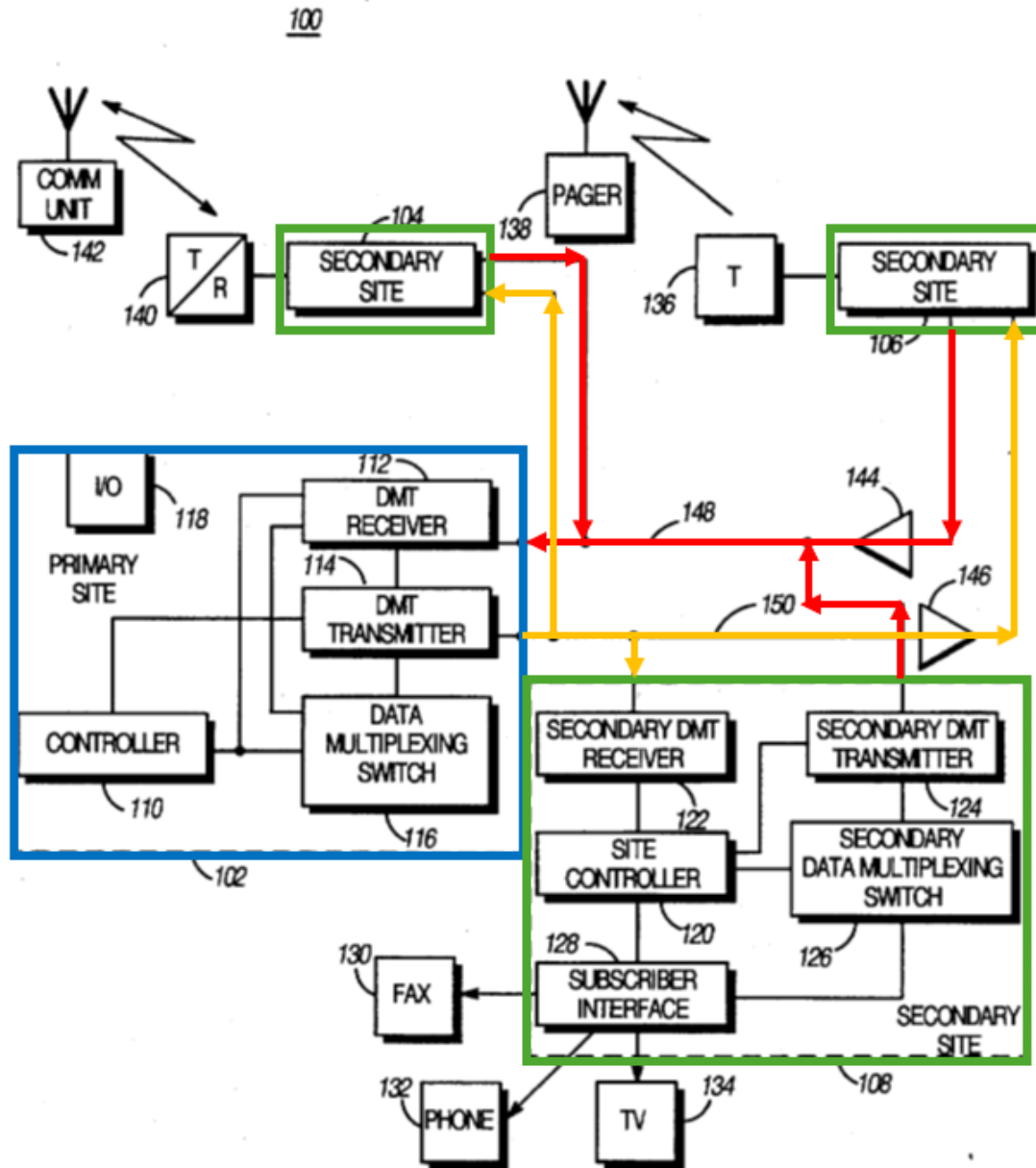


FIG.8

Id., Fig. 8 (annotated). As can be seen above, the **primary site** communicates with the **secondary sites**, but the secondary sites do not communicate with each other.

See also *id.*, 8:39-43 (“The communication system 100 includes a primary site 102,

a plurality of secondary sites 104-108 interoperably coupled to the primary site ...”).

116. Grube’s hub-and-spoke system does not allow for secondary sites to communicate with each other. Rather, communication is solely with the primary site, rather than secondary site-to-secondary site. This directly contradicts Gurantz’s stated benefit of “[a] bidirectional signal distribution network [created] from existing building wiring intended only for headend to terminal device communication.” Ex. 1007 [Gurantz] [0013]. Configuring one of Gurantz’s nodes to operate in the manner that Grube’s primary site does, as Petitioner proposes (Pet., 33-34), would force Gurantz’s system to change from devices communicating with each other to devices only being able to communicate with the primary site.

117. In my opinion, for at least these reasons, Petitioner and Mr. Bertonis fail to demonstrate that a POSITA would have been motivated or able to combine Gurantz and Grube with a reasonable likelihood of success.

VII. CONCLUSION

118. At this stage of the proceedings, my opinions are preliminary and limited to the issues on which I have been asked to form an opinion. I may further

develop these opinions or offer additional opinions after a decision to institute, should the Board decide to do so.

119. Although my complete opinions are set forth above, for convenience I summarize several points of my opinions in conclusion. For the foregoing reasons, based on my expertise and experience and the record of this case that I have reviewed, it is my opinion that:

- Claims 1, 4, 7-9, 11, 14-16, 20, and 21 are not obvious over Gurantz in view of Grube;
- Claims 12, 3, 5, 6, 12, 13, 22, and 23 are not obvious over Gurantz in view of Grube and further view of Gesbert;
- Claims 10 and 17 are not obvious over Gurantz in view of Grube and further view of Shattil;
- Claims 18 and 19 are not obvious over Gurantz in view of Grube and further view of Shattil and Gesbert.

120. I understand that my opinions discussed above support a legal conclusion that claims 1-23 are nonobvious.

In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required, I will appear for cross-examination within the United States during the time allotted.

I hereby declare that all statements made herein of my own knowledge are true and all statements made herein on information and belief were and are believed by me to be true, and that all statements herein were and are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code and that any such willful false statements may jeopardize the validity of the application or any patents issued thereon.

Respectfully submitted,

Dated: May 22, 2024



Samuel H. Russ, Ph.D.

EXHIBIT A

Curriculum Vitae of Dr. Samuel H. Russ

Personal

Mailing Address: 150 Student Services Dr., SH 4119, Mobile, AL 36688
Phone: (251) 461-1378
e-mail: sruss@southalabama.edu
Citizenship: U.S.

Education

Ph.D. in Electrical Engineering, Georgia Institute of Technology, 1991.
Thesis Title: *An Information-Theoretic Approach to Analysis of Computer Architectures and Compression of Instruction Memory Usage*
Thesis Advisor: Dr. Cecil O. Alford
Bachelor's of Electrical Engineering (with Highest Honor), Georgia Institute of Technology, 1986.

Employment

University of South Alabama

2007 – Present

Interim Chair, Department of Electrical and Computer Engineering (2015-2016)

Associate Professor, Department of Electrical and Computer Engineering (2011-present)

Assistant Professor, Department of Electrical and Computer Engineering

Developing new class in signal integrity, developing cross-disciplinary collaborative research efforts, updating labs and class materials, teaching both undergraduate and graduate classes.

Scientific-Atlanta (Later Cisco, Now Technicolor)

2000 - 2007

Manager, Advanced Technologies R&D, Explored major new technologies including home networking and multi-room video distribution; oversaw construction of prototypes and demonstrations; demonstrated technologies at trade shows and to stock analysts; managed group of approximately 10 designing set-top boxes for the cable television industry including all phases of high-volume electronic design including layout, high-speed digital design, emissions considerations, gate array conversion, and designing with custom ASICs; supervised cross-functional team to increase hard drive reliability; wrote numerous patent applications. Products deployed widely, including Time Warner Cable and Cablevision.

IVI Checkmate (Now Ingenico)

1999 – 2000

Matrix Manager, Electrical Engineering, Supervised staff of approximately 6 electrical engineers, oversaw assignments, allocated time across multiple projects, worked to coordinate project schedules with priorities, assisted in sales and other customer communications.

Staff Electrical Engineer, Oversaw major design overhaul of touch-pad payment system including embedded-systems design, power-system design, and system layout and schematic capture. System deployed widely at Wal-Mart, Home Depot, and others.

Mississippi State University

1994 - 1999

Thrust Leader, Computing Systems Research Thrust and Systems Integration Group, NSF Engineering Research Center -- Coordinate research plans and NSF reporting for 6 faculty and 3 full-time staff, assist in development of strategic plans and pursuit of funding opportunities, oversight of development of the ERC-wide integrated testbed. Managed multi-year research project in distributed computing that included 11 students and 5 faculty.

Assistant Professor, Department of Electrical & Computer Engineering -- Developed all-new graduate class in circuit board design, authored textbook chapter, developing new undergraduate lab, pioneered teaching classes over 2-way interactive video.

Dickerson Vision Technologies (Now Cognex)

1992 - 1994

Director of Manufacturing--Oversaw the development and implementation of a manufacturing plan for the company.

Senior Applications Engineer--Developed firmware and user-interface software for the company's proprietary hardware, Assisted in development of machine vision system hardware, Assisted in sales duties.

Georgia Institute of Technology

1987 - 1991

Graduate Research Assistant--Helped design five VLSI chips while developing two custom CPU's, Silicon-compiler-based computer chip design, including initial design, full functional simulation, size and timing optimization, and manufacturing test development.

Publications

Books

1. Samuel H. Russ, *Signal Integrity: Applied Electromagnetics and Professional Practice*, Springer, 2016. (Textbook)
2. Samuel H. Russ, *Signal Integrity: Applied Electromagnetics and Professional Practice*, Second Edition, Springer, 2022. (Textbook)

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1. Samuel H. Russ, "High-Speed Digital Effects", Chapter 10 of John Kraus and Daniel Fleisch, *Electromagnetics with Applications, Fifth Edition*, McGraw-Hill, 1998. (Textbook)
2. Samuel Russ, Bret Webb, Jonathan Holifield and Justin Walker (2011). "PILS: Low-Cost Water-Level Monitoring, Environmental Monitoring", Dr. E.O. Ekundayo, Ph.D., (Ed.), pp. 137-156, ISBN: 978-953-307-724-6, InTech, (Peer-reviewed)

Journal and Magazine Articles

1. Samuel Russ, "The Threat of Malicious Circuit-Board Alteration: Attack Taxonomy and Examples," *Electronic Device Failure Analysis*, Vol. 23, Issue 3, August 2021, pp. 13-22.
2. Mink DM, McDonald J, Bagui S, Glisson WB, Shropshire J, Benton R, Russ S. Near-Real-Time IDS for the U.S. FAA's NextGen ADS-B. Big Data and Cognitive Computing. 2021; 5(2):27. <https://doi.org/10.3390/bdcc5020027>
3. S. H. Russ and J. Gatlin, "Ways to hack a printed circuit board: PCB production is an underappreciated vulnerability in the global supply chain," *IEEE Spectrum*, vol. 57, no. 9, pp. 38-43, Sept. 2020.
4. Samuel H. Russ, Cade C. Cashen, Thomas Thomas, and Roma Hanks, "Smart Grid Architecture for Unobtrusive Home Health Monitoring," *National Social Science Journal*, Vol. 44, No. 1, 2015, pp. 62-68.
5. Samuel H. Russ, Tho D. Ha, and Jonathan H. Shapiro, "Simulation-based Optimization of Wear Leveling for Solid-State Disk Digital Video Recording," *IEEE Transactions on Consumer Electronics*, Vol. 60, No. 3, Nov. 2014, pp. 363-367.
6. Samuel H. Russ and Salim Alsharif, "Packet Loss Behavior of HomePlug AV Traffic at Video Bit Rates", *IEEE Transactions on Consumer Electronics*, Vol. 57, No. 2, May 2011, pp. 823-826.
7. Samuel H. Russ and Ramesh Nallur, "Digital Video Recording onto Solid-State Disks: Feasibility and Lifetime Estimation", *IEEE Transactions on Consumer Electronics*, Vol. 57, No. 2, May 2011, pp. 558-563.
8. Samuel H. Russ and Sasan Haghani, "802.11g Packet-Loss Behavior at High Sustained Bit Rates

- in the Home”, *IEEE Transactions on Consumer Electronics*, Vol. 55, No. 2, May 2009, pp. 788-791.
9. Samuel H. Russ, and Ramesh Nallur, “A Framework for Calculating Fundamental DVR Performance Limits”, *IEEE Transactions on Consumer Electronics*, Vol. 55, No. 1, Feb. 2009, pp. 132-138.
 10. Ioana Banicescu, Sheikh Ghafoor, Vijay Velusamy, Samuel H. Russ, Mark Bilderback, “Experiences from integrating algorithmic and systemic load balancing strategies”, *Concurrency and Computation: Practice and Experience*, Volume 13, Number 2, pp. 121-139 (2001).
 11. Roger L. King, Samuel H. Russ, Aric B. Lambert, Donna S. Reese, “An artificial immune system model for intelligent agents”, *Future Generation Computer Systems*, Volume 17, Issue 4, pp. 335 - 343 (January 2001).
 12. Dr. Samuel H. Russ, Jonathan Robinson, Matt Gleeson, Brad Meyers, and Chun-Heong Tan, “Using Hector to Run MPI Programs over Networked Workstations”, *Concurrency - Practice and Experience*, Vol. 11, No. 4, pp. 189-204 (1999).
 13. Russ, S.H. Reece, K. Robinson, J. Meyers, B. Rajan, D. Rajagopalan, L. Chun-Heong Tan, “Hector: an agent based architecture for dynamic resource management”, *IEEE Concurrency*, Vol. 7, No. 2, pp. 47-55, Apr-Jun 1999.
 14. Dr. Samuel H. Russ, Jonathan Robinson, Dr. Brian K. Flachs, and Bjorn Heckel, “The Hector Distributed Run-Time Environment”, *IEEE Transactions on Parallel and Distributed Systems*, Vol. 9, No. 11, pp. 1102-1114 (1998).
 15. S.H. Russ and C.O. Alford, “Coupled Noise and Its Effects on Modern Packaging Technology”, *IEEE Transactions on Components, Hybrids, and Manufacturing Technology*, Volume 13, Number 4, December 1990, pp. 1074-1082.

U.S. Patents

1. U.S. Patent Number 6,748,080, “Apparatus for entitling remote client devices”, Samuel Russ, Michael Gaul, Anthony Wasilewski, and Howard Pinder, June 8, 2004.
2. U.S. Patent Number 7,181,010, “Apparatus for entitling remote client devices”, Samuel Russ, Michael Gaul, Anthony Wasilewski, and Howard Pinder, February 20, 2007.
3. U.S. Patent Number 7,360,233, “Broadcast carousel system access for remote home communication terminal”, Samuel Russ, Michael Gaul, and Anthony Wasilewski, April 15, 2008.
4. U.S. Patent Number 7,360,235, “Systems and methods for operating a peripheral record/playback device in a networked multimedia system”, David Davies, Samuel Russ, and Irvan Krantzler, April 15, 2008.
5. U.S. Patent Number 7,499,822, “Analog set-top calibration patterns in manufacturing”, Leo Montreuil, Wayne B. Williams, Samuel H. Russ, and Robert Kriete, March 3, 2009
6. U.S. Patent Number 7,505,592, “Apparatus for entitling and transmitting service instances to remote client devices”, Samuel H. Russ, Michael Gaul, Anthony Wasilewski, and Howard Pinder, March 17, 2009
7. U.S. Patent Number 7,516,470, “Locally-updated interactive program guide”, Samuel H. Russ and Michael Gaul, April 7, 2009
8. U.S. Patent Number 7,826,711, “Digital Video Disc (DVD) Player or Digital Video Recorder (DVR) Playback with Memory”, Samuel H. Russ, Nov. 2, 2010.
9. U.S. Patent Number 7,849,486, “Networked subscriber television distribution”, Samuel H. Russ, David Lett, Jonathan Robinson, and Michael Gaul, Dec. 7, 2010.
10. U.S. Patent Number 7,860,250, “Apparatus for entitling and transmitting service instances to remote client devices”, Samuel H. Russ, Michael Gaul, Anthony Wasilewski, and Howard Pinder, Dec. 28, 2010.
11. U.S. Patent Number 7,861,272, “Networked subscriber television distribution”, Samuel H. Russ, David Lett, Jonathan Robinson, and Michael Gaul, Dec. 28, 2010.

12. U.S. Patent Number 7,870,584, "Interactive program guide with selectable updating", Samuel H. Russ and Michael Gaul, Jan. 11, 2011.
13. U.S. Patent Number 7,876,998, "DVD playback over multi-room by copying to HDD", William Wall and Samuel H. Russ, Jan. 25, 2011.
14. U.S. Patent Number 7,908,625, "Networked multimedia system", Neil C. Robertson, David B. Lett, Samuel H. Russ, Bohdan S. Prus, Michael A. Gaul, and Ajith N. Nair, March 15, 2011.
15. U.S. Patent Number 7,937,737, "Field qualification of disk drives in consumer electronics devices", Samuel H. Russ and Mark R. Murray, May 3, 2011.
16. U.S. Patent Number 7,961,780, "Generated set top calibration patterns in manufacturing", Leo Montreuil, Wayne B. Williams, Samuel H. Russ, and Robert Kriete, Jun. 14, 2011.
17. U.S. Patent Number 7,978,720, "Digital media device having media content transfer capability", Samuel H. Russ, Christopher L. Stallings, July 12, 2011.
18. U.S. Patent Number 8,046,806, "Multiroom point of deployment module", William E. Wall, Samuel H. Russ, Oct. 25, 2011.
19. U.S. Patent Number 8,127,236, "Proximity detection using wireless connectivity in a communications system", Paul J. Claussen, Ajith N. Nair, and Samuel H. Russ, Feb. 28, 2012.
20. U.S. Patent Number 8,181,205, "PVR Channel and PVR IPG Information", Samuel H. Russ, Michael A. Gaul, and Dariusz S. Kaminski, May 15, 2012.
21. U.S. Patent Number 8,208,796, "Systems and methods for prioritizing the storage location of media data", Bohdan Prus and Samuel H. Russ, June 26, 2012.
22. U.S. Patent Number 8,280,229, "DVD playback over multi-room by copying to HDD", William E. Wall and Samuel H. Russ, October 2, 2012.
23. U.S. Patent Number 8,295,338, "Generated set top calibration patterns in manufacturing", Leo Montreuil, Wayne B. Williams, Samuel H. Russ, and Robert A. Kriete, October 23, 2012.
24. U.S. Patent Number 8,364,015, "Stretch and zoom bar for displaying information", Samuel H. Russ and Gary Hibbard, January 29, 2013.
25. U.S. Patent Number 8,549,567, "Media content sharing over a home network", Samuel H. Russ, David B. Lett, Jonathan Robinson, Michael A. Gaul, October 1, 2013.
26. U.S. Patent Number 8,627,385, "Systems and methods for operating a peripheral record playback device in a networked multimedia system", David B. Davies, Samuel H. Russ, Irvan J. Krantzler, January 7, 2014.
27. U.S. Patent Number 8,966,550, "Home communication systems," David B. Davies, Samuel H. Russ, Irvan J. Krantzler, February 24, 2015.
28. U.S. Patent Number 9,762,970, "Access of stored video from peer devices in a local network," David B. Davies, Samuel H. Russ, and Irvan J. Krantzler, September 12, 2017.
29. U.S. Patent Number 10,412,439, "PVR Channel and PVR IPG Information", Samuel H. Russ, Michael A. Gaul, and Dariusz S. Kaminski, Sep. 10, 2019.

European Patents

1. European Patent Number EP1543680B1, "Locally-updated interactive program guide", Samuel Russ and Michael Gaul, Feb. 17, 2010.
2. European Patent Number EP1673937B1, "Proximity detection using wireless connectivity in a communications system", Paul Claussen, Ajith Nair, and Samuel Russ, April 21, 2010.
3. European Patent Number EP1604523B1, "Method for determining the encryption of a service content depending on the fidelity of the reformatting of said content", Samuel Russ, Michael Gaul, Anthony Wasilewski, and Howard Pinder, Nov. 21, 2012.
4. European Patent Number EP1552699B1, "Networked multimedia system", Neil Robertson, David Lett, Samuel Russ, Bohdan Prus, Michael Gaul, and Ajith Nair, Dec. 18, 2013.
5. European Patent Number EP1334617B1, "Networked Subscriber Television Distribution", Samuel Russ, David Lett, Jonathan Robinson, and Michael Gaul, April 1, 2015.

6. European Patent Number EP1920601B1, "Multiroom Point of Deployment Module," William Wall and Samuel Russ, May 4, 2016.
7. European Patent Number EP1510033B1, "Apparatus for Entitling Remote Client Devices," Samuel H. Russ, Michael Gaul, Anthony Wasilewski, and Howard Pinder, April 26, 2017.
8. European Patent Number EP1540946B1, "Broadcast Carousel System Access for Remote Home Communications Terminal via a Gateway Device," Samuel Russ, Michael Gaul, and Anthony Wasilewski, April 18, 2018.
9. European Patent Number EP2008280B1, "Method and Device for Prioritizing the Storage Location of Media Data," Bohdan Prus and Samuel Russ, September 26, 2018.

Conference Papers

1. S.H. Russ, M. Khan, S. Latif, "Surreptitiously Adding a WLAN Antenna to a Printed Circuit Board" 2022 IEEE Physical Assurance and Inspection of Electronics (PAINE), Huntsville, AL, USA, 2022.
2. J. Todd McDonald, Rebecca C. Clark, Lee M. Hively, and Samuel H. Russ. 2022. "Phase space power analysis for PC-based rootkit detection." In *Proceedings of the 2022 ACM Southeast Conference (ACM SE '22)*. Association for Computing Machinery, New York, NY, USA, 82–90. <https://doi.org/10.1145/3476883.3520212>
3. S. H. Russ, "Surreptitiously Adding a Microcontroller to a Printed Circuit Board," 2021 IEEE Physical Assurance and Inspection of Electronics (PAINE), Washington, DC, USA, 2021.
4. S.H. Russ, "Circuit Board Security Vulnerabilities and Counteractions", IPC APEX EXPO 2021.
5. S. H. Russ, "Techniques to Thwart Surreptitiously Altered PCBs," 2020 IEEE Physical Assurance and Inspection of Electronics (PAINE), Washington, DC, USA, 2020, pp. 1-4.
6. S. H. Russ, E. Spencer, T. Scroggins, and S. Latif, "Power-Efficient Software Architecture for a CubeSat System", *2020 SoutheastCon*, Raleigh, NC, USA, 2020, pp. 1-6.
7. A. Russ, S. H. Russ, E. Spencer and M. Frank, "Motor Controller and Reaction Wheel for CubeSat," *2019 SoutheastCon*, Huntsville, AL, USA, 2019, pp. 1-3.
8. F. Lorenzo, J. T. McDonald, T. R. Andel, W. B. Glisson and S. Russ, "Evaluating Side Channel Resilience in iPhone 5c Unlock Scenarios," *2019 SoutheastCon*, Huntsville, AL, USA, 2019, pp. 1-7
9. E. Spencer, D. Clark, S. Russ, *et al.*, "First results from a time domain impedance probe for measuring plasma properties in the ionosphere," 2017 IEEE 60th International Midwest Symposium on Circuits and Systems (MWSCAS), Boston, MA, 2017, pp. 1284-1287.
10. E. Spencer, D. Clark, R. Gollapalli, S. Russ and B. Kerrigan, "A System On Chip design for fast time domain impedance spectroscopy," 2017 IEEE 60th International Midwest Symposium on Circuits and Systems (MWSCAS), Boston, MA, 2017, pp. 124-127.
11. Ramya Manikyam, J. Todd McDonald, William R. Mahoney, Todd R. Andel, and Samuel H. Russ, "Comparing the effectiveness of commercial obfuscators against MATE attacks," *Proceedings of the 6th Workshop on Software Security, Protection, and Reverse Engineering (SSPREW '16)*, 2016, Article 8. DOI: <https://doi.org/10.1145/3015135.3015143>
12. Samuel Russ, Tho Ha, and Jonathan Shapiro, "Simulation of Digital Video Recording to Maximize Solid-State Disk Lifetime," *Proceedings of the 2014 International Conference on Consumer Electronics*, Jan. 10-13, 2014, pp. 562-563.
13. Thomas Thomas, Cade Cashen, and Samuel Russ, "Leveraging Smart Grid Technology for Home Health Care", *Proceedings of the 2013 International Conference on Consumer Electronics*, Jan. 11-14, 2013, pp. 276-277.
14. Cade Cashen, Samuel Russ, and Thomas Thomas, "Using a Wireless LAN to Perform Motion Detection", *Proceedings of the 2013 International Conference on Consumer Electronics*, Jan. 11-14, 2013, pp. 63-64.
15. Nicklaus Thomas, David Evans, and Samuel Russ, "A Markovian Algorithm for Creating

- Immersive Public-Speaking Audiences”, *Proceedings of the 2013 International Conference on Consumer Electronics*, Jan. 11-14, 2013, pp. 384-385.
16. Samuel H. Russ, “Podcasting to Improve Software Usage”, *Proceedings of the 2012 ASEE Southeastern Section Conference*, April 1-3 2012, Starkville, MS, Paper ID 605.
 17. Samuel H. Russ, “Using Student ID Numbers to Create Customized Homework Problems”, *Proceedings of the 2012 ASEE Southeastern Section Conference*, April 1-3 2012, Starkville, MS, Paper ID 606.
 18. Samuel H. Russ and Ramesh Nallur, “Digital Video Recording Onto Solid-State Disks”, *2011 Digest of Technical Papers, 2011 International Conference on Consumer Electronics*, pp. 495-496. (2nd place in best paper contest, 2011.)
 19. Mohammad Mushtaq, Samuel H. Russ, and Mohammad S. Alam, “Variable FEC to Reduce ECC Overhead in Digital Video Transmission”, *2011 Digest of Technical Papers, 2011 International Conference on Consumer Electronics*, pp. 215-216.
 20. Samuel H. Russ and Salim Alsharif, “Behavior of HomePlug AV Traffic At High Sustained Bit Rates in the Home”, *2011 Digest of Technical Papers, 2011 International Conference on Consumer Electronics*, pp. 682-683.
 21. Samuel H. Russ, Viswakalyan Perepa, Silas Leavesly, and Bret Webb, “Novel Low-Cost Salinity Sensor for Embedded Environmental Monitoring”, *Proceedings of IEEE Southeastcon 2010*, March 18-21, 2010, pp. 53-56.
 22. Samuel H. Russ and Kung-Hsien Chen, “Thermally Conductive Circuit Boards”, *Proceedings of the 59th Electronic Components and Technology Conference (ECTC 2009)*, May 2009, pp. 465-468.
 23. Samuel H. Russ and Sasan Haghani, “Behavior of 802.11g Traffic at High Sustained Bit Rates in the Home”, *2009 Digest of Technical Papers, 2009 International Conference on Consumer Electronics, Jan. 2009*, pp. 423-424.
 24. Samuel H. Russ, and Ramesh Nallur, “A Framework for Calculating Fundamental DVR Performance Limits”, *2009 Digest of Technical Papers, 2009 International Conference on Consumer Electronics, Jan. 2009*, pp. 51-52.
 25. Samuel H. Russ, “Home Networking: Extending Cable’s Reach”, *The Complete Technical Paper Proceedings from NCTA*, 2001, pp. 160-165.
 26. Samuel H. Russ, Rashid Jean-Baptiste, Tangirala Shailendra Krishna Kumar, and Marion G. Harmon, “Transparent Real-Time Monitoring in MPI”, *IPPS/SPDP Workshops 1999*, in *Parallel and Distributed Processing*, Lecture Notes in Computer Science, vol. 1586, Springer-Verlag, 1999, pp. 1327-1334.
 27. Roger L. King, Aric B. Lambert, Samuel H. Russ, and Donna S. Reese, “The Biological Basis of the Immune System as a Model for Intelligent Agents”, *IPPS/SPDP Workshops 1999*, in *Parallel and Distributed Processing*, Lecture Notes in Computer Science, vol. 1586, Springer-Verlag, 1999, pp. 156-164.
 28. Aric Lambert, Roger King, Sam Russ, and Donna Reese, “Intelligent Control Agents for Resource Management of Heterogeneous Parallel Computing”, *Computational Intelligence for Modeling, Control, and Automation (CIMCA 98) in Concurrent Systems Series*, vol. 55, IOS Press, 1999, pp. 116-121.
 29. Samuel H. Russ and Adam Gaither, “Developing An Integrated Environment for Computational Field Simulation”, *Object-Oriented Methods for Inter-Operable Scientific and Engineering Computing: Proceedings of the 1998 SIAM Workshop*, pp. 50-57.
 30. Samuel H. Russ, Ioana Banicescu, Sheikh Ghafoor, Bharathi Janapareddi, Jonathan Robinson, and Rong Lu, “Hectiling: An Integration of Fine and Coarse-Grained Load-Balancing Strategies”, *Proceedings of the Seventh International Symposium on High Performance Distributed Computing*, August 1998, IEEE Computer Society, pp. 106-113.

31. Samuel H. Russ, "An Architecture for Rapid Distributed Fault Tolerance", 3rd International Workshop on Embedded High-Performance Computing, in J. Rolim, Editor, *Parallel and Distributed Processing*, Lecture Notes in Computer Science, vol. 1388, Springer-Verlag, 1998, pp. 925-930.
32. Dr. Samuel H. Russ, Brad Meyers, Jonathan Robinson, Matt Gleeson, Laxman Rajagopalan, Chun-Heong Tan, and Bjørn Heckel, "User-Transparent Run-Time Performance Optimization", *Proceedings of the 2nd International Workshop on Embedded HPC Systems and Applications*, Geneva, April 1997.
33. J. Robinson, S.H. Russ, B. Flachs, and B. Heckel, "A Task Migration Implementation of the Message-Passing Interface", *Proceedings of the 5th High Performance Distributed Computing Conference (HPDC-5)*, August 1996, IEEE Computer Society, pp. 61-68.
34. S.H. Russ, B. Flachs, J. Robinson, and B. Heckel, "Hector: Automated Task Allocation for MPI", *Proceedings of the 10th International Parallel Processing Symposium*, April, 1996, IEEE Computer Society, pp. 344-348.
35. W.S. Tan, C.O. Alford, and S.H. Russ, "GT-EP: A Novel High-Performance Real-Time Architecture", *Proceedings of the 18th International Symposium on Computer Architecture*, May 1991, pp. 12-21.

Reports

1. Aric B. Lambert, Roger L. King, Samuel H. Russ, Donna S. Reese, "Adaptive Analysis for the Design of Hardware Agents Using the Artificial Immune System Model for Resource Management of Heterogeneous Systems", Miss. State Technical Report No. MSSU-COE-ERC-98-10, Aug. 1998.
2. Daniel H. Linder, Robert B. Reese, Jon Robinson, and Samuel H. Russ, "JavaCADD: A Java-based Server and GUI for Providing Distributed ECAD Services", Mississippi State University Technical Report No. MSSU-COE-ERC-98-07, May 1998.
3. Samuel H. Russ, "Using Hector in an Architecture for Rapid Distributed Fault Tolerance", Mississippi State Technical Report No. MSSU-EIRS-ERC-97-17, December 1997.
4. Samuel H. Russ, Jonathan Robinson, Matt Gleeson, and Jose Figueroa, "Dynamic Communication Mechanism Switching in Hector", Mississippi State Technical Report No. MSSU-EIRS-ERC-97-8, September 1997.
5. Samuel H. Russ, Brian Flachs, Jonathan Robinson, and Bjorn Heckel, "Hector: Automated Task Allocation for MPI", Mississippi State Technical Report No. MSSU-EIRS-ERC-95-6, September, 1995.

Funded Grants and Contracts

University of South Alabama

1. National Space Grant Foundation, Aug. 2018-May 2019, "Automation Infrastructure for Gateway Biological Laboratory," PI, \$28,062.
2. Nfina (Local Mobile Company), March 2018 – March 2019, "Redhawk", PI, \$119,881.
3. NASA, May 2016 – Present, "Spatially Resolved Measurements Of Plasma Density Irregularities In The Ionosphere F Region For Scintillation Studies", Co-I, \$100,000.
4. Marine Environmental Science Consortium (GRI), Jan. 2011-Dec. 2011, "Conductivity Based In-Situ Hydrocarbon Sensor", PI, \$9,338.
5. University of South Alabama Research Council (USARC), Feb. 2008 – Feb. 2009, "Instrumentation of Hurricane Forecast Models for Performance Optimization", \$5,000 for one year.

Mississippi State University

1. National Science Foundation, April 1998-March 1999, "An ERC-CREST Partnership in Distributed and Computational Systems", PI, \$100,000/year, renewable for 5 years.
2. Office of Naval Research, Nov. 1996-Nov. 1998, "Distributed Visualization and Virtual Environments for Oceanography and Meteorology", Co-PI, \$200,000.
3. U.S. Army Waterways Experiment Station, July 1996-July 1999, "Efficient Parallel Wave Modeling", PI, \$200,000, Funded under CHSSI (Common HPC Scalable Software Initiative) of the DoD. (\$50,000 actually funded.)
4. NSF Engineering Research Center for Computational Field Simulation, April 1995- May 1999, "Heterogeneous Computing Testbed (CA 8)", PI, By year: \$34,983/\$70,111/\$55,916. Funded through NSF Engineering Research Center.

Dickerson Vision Technology

1. Small Business Innovations Research Program of the NSF, Division of Industrial Interface, September 1993 - February 1994, Award No. III-9260914. (\$50,000 Phase I contract conducted at Dickerson Vision Technologies.)

Technology Transfer and Licensing

Hector Distributed Run-Time Environment licensed by MPI Software Technology, Inc., Starkville, MS in June 1998 (while at Mississippi State University)

Students Advised (Major Professor)

Level	At USA	At MSU
Ph.D.	--	0
Masters	3	9

Courses Created and Enhanced

University of South Alabama

EE 264 Microprocessor Systems and Interfacing – Replaced 68HC11 with Freescale 9S12 architecture and redesigned the entire course, Introduced use of 68HC11 simulator and accompanying podcast to enhance student's ability to visualize microprocessor operation

EE 268 Digital Logic Design Lab – Updated one lab experiment

EE 368 Microprocessor Systems Lab – Developed all-new sequence to tie EE 368 to senior projects with hands-on experiments like motors, photocells, and servomotors.

EE 401 Introduction to ECE Design – Completely overhauled the first-semester senior project course. Added lectures on professionalism, career development, and legal aspects of engineering. Structured the course so that reports would lead up to their senior-project reports.

EE 404 ECE Design – Completely overhauled the second-semester senior project course by requiring better projects and adding material on giving effective presentations. Obtained very enthusiastic response from the department's Industrial Advisory Board.

EE 446 – Obtained donation of boards from Freescale and redesigned all of the experiments to develop more interesting demonstrations and to switch from assembly language to C.

EE 457/557 – Developing series of podcasts to augment in-class lectures with materials related to embedded systems and professional development.

EE 469/569 Advanced Digital System Design – Developed all-new course in high-speed circuit board design from an electromagnetics perspective, and authored a textbook for the course. Added a lab experience in 2009.

EE 560 Advanced Computer Architecture – Selected new textbook for the class and developed lecture materials to match

EG 101 – Developed systematic curriculum shared by all sections including “checklists” for instructors, handouts, and lecture materials. Introduced motors project, which has become the most popular EG 101 project.

Mississippi State University

EE 8993 High Speed Digital Design -- Offered on video nationwide, it features pioneering treatment of high-speed circuit board design from an electromagnetics perspective. Material from the class has been included in one of the best-known electromagnetics textbooks, and it continues to be one of the most popular graduate classes in the department.

EE 4743 Computer Aided Digital Design -- Added breakthrough educational technology to permit remote access to logic synthesis capabilities. Offered on live two-way video starting Fall 1998.

Courses Taught

University of South Alabama

EE 220, Circuit Analysis I, 1 course.
EE 263, Digital Logic Design, 2 courses.
EE 264, Microprocessor Sys-Interfacing, 4 courses.
EE 268, Digital Logic Design Lab, 1 course.
EE 368, Microprocessor Sys Interf Lab, 14 courses.
EE 401, Intro Elec and CpE Design - W, 7 courses.
EE 404, Elec and Comp Eng Designs-W, 7 courses.
EE 440, HDL Logic Synthesis, 1 course.
EE 446, Embedded System Design Lab, 2 courses.
EE 457, Embedded System Design, 10 courses.
EE 469, Signal Integrity, 5 courses.
EE 534, VLSI Design Systems, 1 course.
EE 540, HDL Logic Synthesis, 1 course.
EE 548, Computer-Network Security, 5 courses.
EE 557, Adv. Embedded System Design, 8 courses.
EE 560, Adv Computer Architecture, 3 courses.
EE 569, Signal Integrity, 5 courses.
EG 101, Intro to Engineering & Design, 5 courses.
EG 231, Intro to Ethics and Economics, 2 courses.

Mississippi State University

Number Description	Class Description
EE 2111 Electrical Lab I	Accompanies introductory digital class
EE 2713 Digital Devices	Introductory digital class
EE 4723 Microcomputers II	Microcontroller interfacing
EE 4743 Computer Aided Digital Design	VHDL, logic design, and synthesis
EE 8993 High-Speed Digital Design	Signal integrity and high-speed design

Honors and Awards

University of South Alabama College of Engineering “Teacher of the Year” 2015

Mobile Area Council on Engineering “Engineering Educator of the Year” 2015

Technology and Engineering Emmy® Award, 2012, for “Pioneering Development of Multi-Room DVR.” Awarded to Cisco. I managed the groups that built the first prototypes, gave public demonstrations, wrote numerous patent applications, and developed the first mass-production set-top containing Multi-Room DVR.

2nd Place in “Best Paper – Storage Category” at ICCE 2011. The paper is “Digital Video Recording Onto Solid-State Disks” as noted in Conference publications above.

Attendee, “Top Prof” Banquet – University of South Alabama chapter of Mortar Board, 2009,2010

Tau Beta Pi Engineering Professor of the Year – University of South Alabama chapter of Tau Beta Pi, 2008. One of two highest awards in the College of Engineering for teaching, and the only award voted on by honor students in the College.

Finalist, 53rd International Science and Engineering Fair, 1983, Albuquerque, NM.

Professional Activities

Expert Witness Engagements

Case	Jurisdiction and Case Number	Year(s)	Witness for	Expert Reports	Dep.	Trial	IPR* Rep.
WNE Holdings v. Rockwell Automat.	Southern District of Alabama	2011	Plaintiff	1	0	0	0
Personalized Media Corp. (PMC) v. Echostar	Eastern District of Texas	2010-2015	Plaintiff	2	3	0	0
Pegasus v. DirecTV et al.	Delaware	2011-13	Plaintiff	1	0	0	0
Apple v. Samsung	Int’l Trade Commission 337-TA-796	2012	Respondent	4	1	1	0
EON v. MobiTV et al.	Delaware	2013	Defendant	1	1	0	0
PMC v. Zynga	Eastern District of Texas	2013	Plaintiff	1	5	0	4
OpenTV v. Netflix	Delaware	2014	Defendant	0	0	0	0
Kaplan v. OnForce	N.D. California	2014	Defendant	0	0	0	1
Intellectual Ventures v. J.P. Morgan Chase	Southern District of New York	2013-2019	Defendant	2	2	0	0
PMC v. Amazon	Delaware	2014-2015	Plaintiff	1	9	0	5
Better Mouse Corp. v. Steelseries et al.	Eastern District of Texas	2015-2016	Plaintiff	2	0	1	0
SyncPoint v. Nintendo et al.	Eastern District of Texas	2015	Plaintiff	2	1	0	0
TQ Beta v. Dish	USPTO (IPR)	2016	Defendant	1	1	0	0
Script v. ADT et al.	Eastern District of Texas	2016	Plaintiff	2	2	0	0
Sony v. Pace	USPTO (IPR)	2016	Defendant	0	1	0	4
PMC v. Apple	EDTX and USPTO (IPR)	2016-Now	Patent Owner	2	1	1	2

Case	Jurisdiction and Case Number	Year(s)	Witness for	Expert Reports	Dep.	Trial	IPR* Rep.
PMC v. Samsung	Eastern District of Texas	2016	Patent Owner	2	0	0	0
Music Choice v. Stingray	Eastern District of Texas	2016-now	Plaintiff	2	2	0	4
Broadcom v. AMD	USPTO (IPR)	2016	Petitioner	0	0	0	1
Tech Pharmacy v. Alixa et al.	Eastern District of Texas	2017	Plaintiff	2	2	1	0
Rovi v. PMC	Eastern District of Texas, Arbitration	2017	Defendant	0	1	0	0
Implicit v. Trend Micro	Eastern District of Texas	2017	Defendant	2	1	0	0
Implicit v. Palo Alto	Eastern District of Texas	2018	Defendant	1	1	0	0
Invensas v. Samsung	Eastern District of Texas	2018	Plaintiff	2	1	0	0
Selective Signals v. Palo Alto	USPTO (IPR)	2018-Now	Petitioner	0	1	0	1
Rovi Tivo v. Various	Canada	2018-Now	Plaintiff	0	0	0	0
Implicit v. Netscout	Eastern District of Texas	2018-Now	Defendant	0	0	0	0
Rovi Tivo v. Comcast	USPTO (IPR)	2019-2020	Plaintiff	0	4	0	5
Rovi Tivo v. Comcast	ITC	2019-2020	Petitioner	2	1	1	0
American Patents v. Various	Eastern District of Texas	2019-Now	Plaintiff	0	0	0	0
BBiTV v. OpenTV	California	2019	Defendant	0	0	0	0
Roku v UEI	USPTO (IPR)	2019-Now	Petitioner	0	6	0	8
MV3 v Roku	Western District of Texas	2019-2020	Defendant	2	2	1	0
BBiTV v Dish	USPTO (IPR)	2019-2020	Petitioner	0	3	0	6
PMC v Google	Eastern District of Texas	2020	Plaintiff	1	1	0	0
PMC v Netflix	Southern District of New York	2020-Now	Plaintiff	2	0	0	0
UEI v Roku <i>et al.</i>	ITC	2020-2021	Respondent	1	1	1	0
BBiTV v Dish	Western District of Texas	2020-2021	Defendant	1	5	0	6
Flexiworld v Amazon <i>et al.</i>	Western District of Texas	2020-Now	Defendant	0	0	0	0
Flexiworld v Roku	Western District of Texas	2021-2022	Defendant	2	0	0	0
Roku v UEI <i>et al.</i>	ITC	2021-	Complain.	1	0	1	0

Case	Jurisdiction and Case Number	Year(s)	Witness for	Expert Reports	Dep.	Trial	IPR* Rep.
		2022					
Roku v DivX	USPTO (IPR)	2021-Now	Petitioner	0	0	0	1
Apple v Identity	USPTO (IPR), Ex Parte Re-Exam, Western District of Texas	2022-Now	Patent Owner	2	1	0	6
Audi v Aprese	USPTO (IPR)	2022-Now	Petitioner	0	0	0	2
paSafeShare	Ex Parte Re-Exam, Western District of Texas	2021-Now	Patent Owner, Plaintiff	0	0	0	3
PerfectVision v PPC Broadband	USPTO (IPR)	2022-Now	Petitioner	0	0	0	1
Google v Nobots	USPTO (IPR)	2022-Now	Patent Owner	0	2	0	4
Fall Line v Various	Eastern District of Texas	2022-Now	Plaintiff	2	1	0	0
Assa Abloy v CPC	USPTO (IPR)	2023-Now	Patent Owner	0	2	0	4
IOENGINE v Roku	Western District of Texas	2023-Now	Defendant	5	2	0	0
Gratuity v Toast	USPTO (IPR)	2023-Now	Petitioner	0	0	0	1

* Includes reports submitted for IPRs, CBMRs, and Re-Exams

Invited Lectures

“Real-time Monitoring in MPI”, Florida A&M University, Tallahassee, FL, August 1998

Consulting

Consulted with various investment firms concerning telecommunications market, 2007 – ongoing
Cox Communications – DVR Reliability – 2015

Society Memberships

Institute of Electrical and Electronic Engineers (Senior Member), IEEE Consumer Electronics Society, IEEE Computer Society, Eta Kappa Nu, Tau Beta Pi, Phi Kappa Phi, Gamma Beta Phi
Secretary, Northeast Mississippi Subsection of the IEEE, 1994-95

Article Reviewer

Computers and Electrical Engineering, Supercomputing '94, IEE Transactions, Concurrency: Practice and Experience, International Parallel Processing Symposium, IEEE Transactions on Education, IEEE Transactions on Parallel and Distributed Systems, ICT 2012, ICAEE 2012

Proposal Reviewer

Army Research Office, National Science Foundation, U.S. Department of Energy

University Service

Chair, Search Committee, ECE Department – Search for Assistant Professor positions, 2008-now (chair since 2011)

Member, ECE Department Undergraduate Affairs Committee, 2015-now
Member, College of Engineering Academic Standards Committee, 2016-now
Member, Search Committee, College of Engineering – Search for 2 Associate Dean positions, 2015
Member, Search Committee, College of Engineering – Search for Associate Dean positions, 2008-09
Member, University of South Alabama Council on International Education, 2008-15
Chairman, ECE Department “Open House” Committee, 2008-09
Conducted open house and other demonstrations for the department, 2008-now
Chairman, ECE Department Recruiting and Retention Committee, 2007-08
Updated and conducted experiment for ACE program, 2007
Member, Hearin Undergraduate Committee, 1998
Department Coordinator, United Way Campaign, 1995
Award Referee, 1995 Instructional Paper Award, MSU College of Engineering