

In re Patent of: Anton Monk et al.
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Issue Date: November 13, 2007
Appl. Serial No.: 10/322,834
Filing Date: December 18, 2002
Title: BROADBAND NETWORK FOR COAXIAL CABLE
USING MULTI-CARRIER MODULATION

SECOND DECLARATION OF TIM A. WILLIAMS

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

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

Dated: January 31, 2025

By: Tim Arthur Williams
Tim A. Williams

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I, DR. TIM A. WILLIAMS, hereby declare the following:

I. Introduction

1. I have been engaged by Fish & Richardson P.C. on behalf of DISH Network L.L.C. (“DISH” or “Petitioner”) for the above-captioned inter partes review (“IPR”) proceeding of U.S. Patent 7,295,518 (“the ’518 Patent”). I understand that the Patent Trial and Appeal Board (“PTAB” or “Board”) instituted trial.

2. I summarized my relevant knowledge and experience in my first declaration, which was attached as Exhibit DISH-1004 to the IPR petition. In writing this second declaration, I have considered the following: my own knowledge and experience, including my work experience as discussed in my first declaration. In addition, I have analyzed the following publications and materials, in addition to other materials I cite herein and in my first declaration:

- The Decision Granting Institution of Inter Partes Review;
- Patent Owner’s Response (“POR”) to the Petition including its exhibits;
- Walter Y. Chen, DSL: Simulation Techniques and Standards Development for Digital Subscriber Lines, 1998 (Exhibit DISH-1031);
- U.S. Patent No. 7,099,349 (Exhibit DISH-1032);

- U.S. Patent No. 6,970,905 (Exhibit DISH-1033);
- Shlomo Ovadia, Broadband Cable TV Access Networks, 1d ed., March 2001 (Exhibit DISH-1034)
- “New Technologies Take the Network Home” (Exhibit DISH-1037);
- “Voice & Data Communications Handbook” (Exhibit DISH-1038);
- Deposition Testimony of Mr. Albert Garrett (Exhibit DISH-1039).

II. Legal Standards

3. I am not a lawyer and do not provide any legal opinions, but I have been advised that certain legal standards are to be applied by technical experts in forming opinions regarding meaning and validity of patent claims. I have applied the legal standards described in the first declaration and below, which were provided to me by Counsel.

4. I understand that obviousness may be based upon a combination of references. I understand that to be eligible as a prior art reference, the reference must be analogous art to the challenged patent. To determine whether a reference qualifies as analogous art, a two-part test is used: (1) if the reference is within the same field of endeavor as the challenged patent, it qualifies as analogous art; or (2) if the

reference is reasonably pertinent to the problem addressed by the inventor of the challenged patent, it also qualifies as analogous art. If either criterion is met, the reference is considered analogous art.

5. I understand that references cannot be combined if at least one of the references teaches away from their combination. I understand that a reference teaches away when a POSITA, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken. I understand that teaching away requires a reference to criticize, discredit, or otherwise discourage the claimed invention. I understand that a reference's disclosure of more than one alternative does not constitute a teaching away from any of these alternatives because such disclosure does not criticize, discredit, or otherwise discourage the solution claimed.

6. I also understand that a given course of action often has simultaneous advantages and disadvantages, e.g., as a matter of design tradeoff, and this does not necessarily obviate motivation to combine. I understand that the benefits, both lost and gained, should be weighed against one another. Further, if the motivating benefit comes at the expense of another benefit, however, that alone should not nullify its use as a basis to modify the disclosure of one reference with the teachings of another.

III. Analysis of Mr. Garrett's Arguments Regarding Ordinary Skill Level

7. As I explained in my first declaration, "a person of ordinary skill in the

art (“POSITA”) relating to the subject matter of the ’518 Patent as of August 30, 2001 would have a degree in electrical engineering, computer engineering, or a related field and experience working in signal processing and/or communication systems/networks, e.g., a bachelor’s and three or more years of experience; a master’s and at least one year of experience; or a doctorate and some work experience” and that “[a]dditional education could substitute for professional experience, or *vice versa*.” DISH-1004, ¶22.

8. I understand that Mr. Garrett offers a different level of skill: “a person of ordinary skill in the art (“POSITA”) with respect to the ’518 Patent would have had at least a bachelor’s degree in electrical engineering, computer engineering, or an equivalent field with at least two years of experience with coaxial cables.” Garrett Decl., ¶37.

9. I disagree with Mr. Garrett’s additional requirement of “at least two years of experience with coaxial cables.” *Id.* The concepts described in the ’518 Patent, like channel characterization using known sequences, multi-carrier modulation, and bit loading, do not require “at least two years of experience with coaxial cables” to understand or implement. By the alleged priority date of the ’518 Patent, these concepts were commonly used in wired and wireless communication networks. As I explained in my first declaration, the ’518 Patent cites to and incorporates by reference non-coaxial references that used these concepts. DISH-

1004, ¶¶40-44.

10. A POSITA would not have needed “at least two years of experience with coaxial cables” to understand how to implement these known concepts into an existing coaxial network (as the ’518 Patent does). Instead, a communications engineer with a bachelor’s degree and at least three years of experience with communication systems/networks would have learned the relevant technologies at a level consistent with the ’518 Patent. Such a communications engineer would have been able to implement the known concepts into an existing coaxial network.

IV. The Claims Are Not Limited to an In-Home Network

11. In his declaration, Mr. Garrett focuses on the in-home disclosures of the ’518 Patent. Ex. 2002, 18 (describing that the ’518 Patent transmits digital data signals through the *coaxial cable wiring installed in homes*)¹, 20-21 (describing signal splitters that are used to distribute downstream signals to *terminals in a home*), 29 (discussing that the ’518 Patent’s background distinguishes between *on-premises networks* and out-of-home systems), 35 (discussing supposed technical differences between *in-home cables* and out-of-home cables).

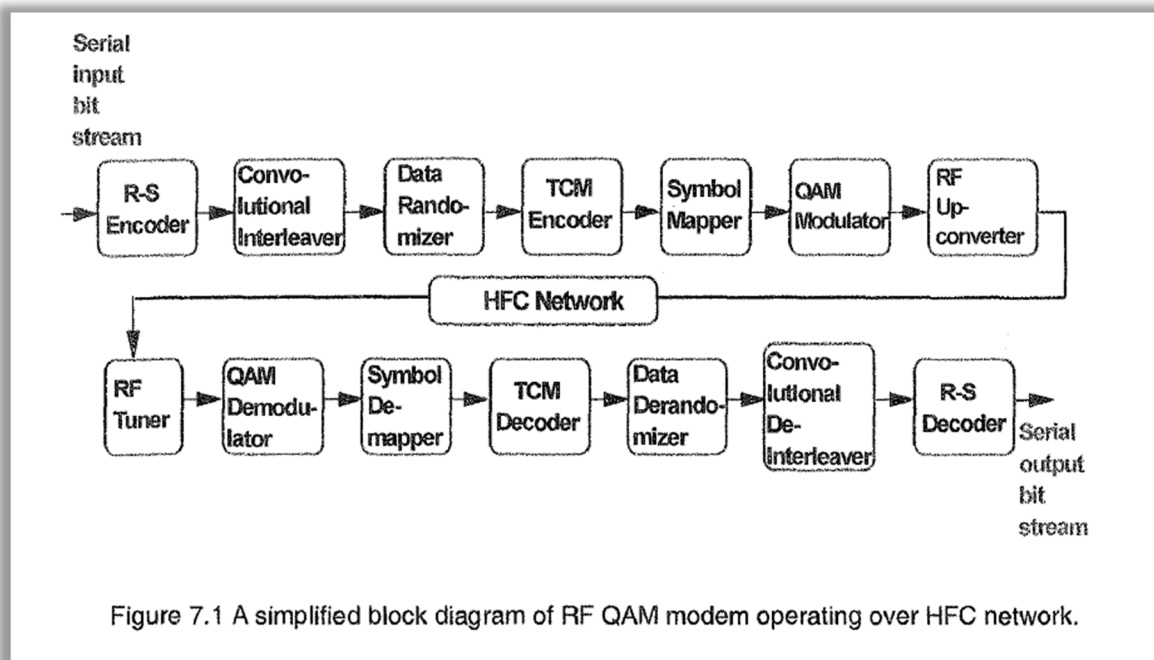
12. In my opinion, the claimed “data communication network” in claims 1 and 3 of the ’518 Patent is not limited to an “in-home,” “on-premises,” or “local” implementation. Specifically, the claims do not include any limitation that would

¹ Emphasis added unless I state otherwise.

Ovadia illustrates in Figure 7.1 (reproduced below), a Quadrature Amplitude



Modulation (QAM) modem operating over an HFC network. As shown in the figure, the QAM modem includes the claimed modulation and frequency conversion circuitry.



Id., 184.

13. As for the claimed cable wiring, it includes a splitter and coaxial cable segments. These components can also be used in or outside of the home. The '518 Patent itself admits as much, stating “[s]everal buildings may be connected to one splitter at the street” (i.e., outside of the home). DISH-1001, 2:49-53.

V. Mr. Garrett’s New Evidence is Incorrect and/or Irrelevant

14. Throughout his declaration, Mr. Garrett discusses new evidence claiming that: (a) Isaksson is limited to twisted pair and is non-analogous art, and (b) a POSITA would not have been motivated to combine Isaksson with (coaxial)

references Amit, Jacobsen, and Kliger. As I demonstrate below, this evidence is incorrect and/or irrelevant to the analogous art and motivation to combine analyses. Among other issues, the alleged evidence does not properly contextualize the state of the art at the relevant timeframe.

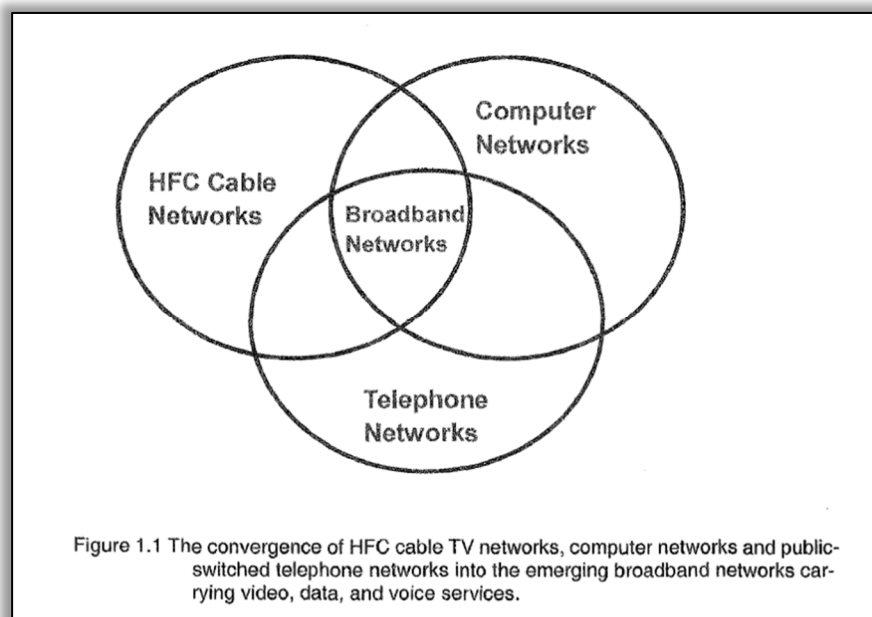
15. While I disagree with the claim that Isaksson is limited to twisted pair, I begin by discussing the state of the art by August 30, 2001 concerning twisted pair and coaxial cables. Next, I discuss the commonalities between coaxial cables and twisted pair that facilitate the cross-application of solutions between the two mediums. Finally, I address and rebut the misconceptions presented by Mr. Garrett regarding twisted pair and Isaksson.

A. Both Twisted Pair and Coaxial Cables Were Considered for Home Networking Solutions in 2001

16. By the late 1990s and early 2000s, home networking emerged as “one of the computer industry’s hottest markets.” DISH-1037, 1; *see also* DISH-1014, 1:15-30. With the increasing number of devices in households, the telecommunications industry recognized the benefits of connecting multiple devices and services within the home to manage voice, data, and video. DISH-1037, 11; DISH-1007, ¶[0003]. While early predictions suggested that home networking technologies would primarily operate over phone lines, engineers in academia and the industry also advanced wireless, coaxial cable, and power-line solutions for in-

home connectivity. DISH-1037, 11-12; DISH-1014, 1:30-37.

17. Rather than developing these technologies in isolation, engineers often worked across multiple mediums. The existing infrastructure at the time (which typically included more than one wiring type), different emerging technologies, and the need for interoperability drove efforts to consider solutions across different mediums. DISH-1037, 13. The figure below illustrates the convergence of different types of wired networks, including coaxial networks (HFC cable) and twisted pair networks (telephone and computer), into emerging broadband networks.

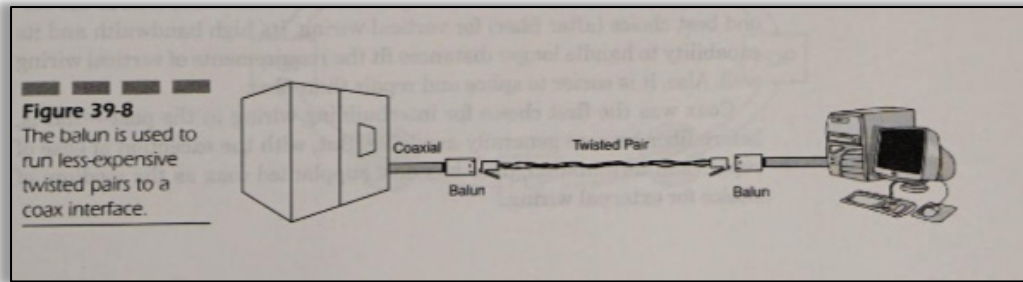


DISH-1034, 2.

18. Traditionally, twisted pair was used solely for telephone services, while coaxial cables delivered broadcast television. DISH-1037, 11-12; DISH-1014, 1:30-37, 2:4-30. However, with the growing demand for high-speed data and

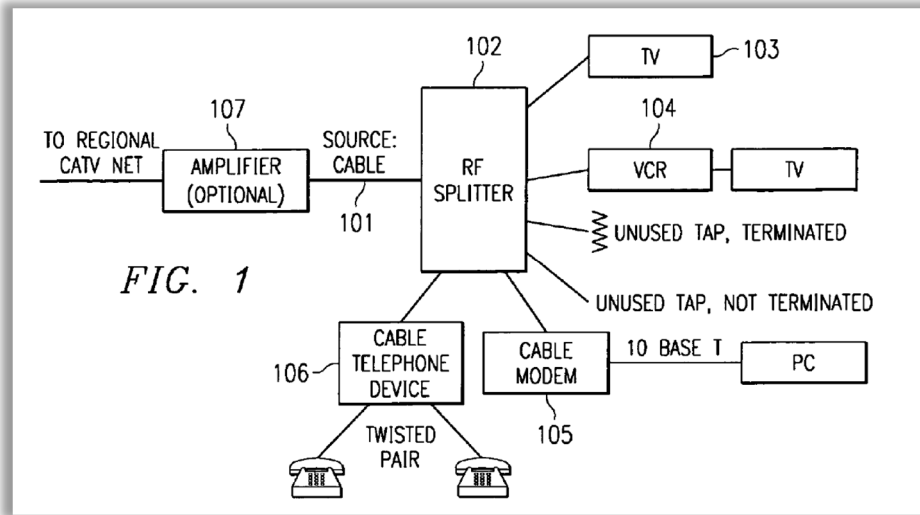
interconnected devices, these mediums were repurposed to serve as the foundation for in-home local area networks (LANs). DISH-1037, 11-12. Technologies like DSL and in-home phone line networking (e.g., HomePNA) allowed existing twisted pair wiring to carry both voice and high-speed data. DISH-1037, 12; DISH-1014, 1:30-37. Coaxial cables, which were originally installed for one-way television broadcasts, were upgraded to also support two-way communication for high-speed data. DISH-1034, 3. Within the home, coaxial set-top boxes served as gateways for connecting devices to the Internet and/or to each other. DISH-1037, 13.

19. A typical late-1990s or early-2000s household often featured a patchwork of coaxial cables (for broadband cable modems and TV) and twisted-pair lines (for telephone and DSL), and in some cases early fiber deployments. The patchwork of wiring often interconnected the different wiring types. As I testified in my deposition, I built an in-home network that used both twisted pair and coaxial cables. Williams Transc., 46:9-47:2. As shown by the figure below, some networks used a balun in some sections to run twisted pair in place of the more expensive coaxial cable. In the figure below, the balun is used to run the less-expensive twisted pair to a coaxial interface.



DISH-1038, 1025.

20. The cited references reflect this overlapping development of different communication mediums. Amit also depicts an existing in-home network during that time. DISH-1014, 5:46-67, FIG. 1. As shown in FIG. 1, the in-home network includes various wired and wireless links. The network begins with a cable input (101) from a regional cable television (CATV) network, which provides access to TV, Internet, and telephone services. A cable modem (105) is also connected to the splitter to provide Internet access, with its output using 10BaseT Ethernet to connect to a PC. A cable-based telephone device (106) is connected via twisted-pair to offer telephone service.



DISH-1014, FIG. 1.

21. Klinger also discusses several communication mediums. In addition to discussing coaxial cables, Klinger mentions the evolving standards at the time, which involved the use of existing media, such as power lines, telephone lines, and wireless links. DISH-1007, ¶[0004].

22. The '518 Patent also reflects this overlapping development. As I explained in my first declaration, the '518 Patent cites to and incorporates by reference twisted pair and coaxial references that discuss techniques claimed by the '518 Patent. DISH-1004, ¶¶40-44.

B. Similarities Between Coaxial and Twisted Pair

23. Signal impairments such as reflections, noise, signal attenuation, and inter-symbol interference (ISI) are common challenges in nearly all communication mediums due to the physical and environmental factors that influence signal

propagation. These impairments arise from the inherent characteristics of the transmission medium, the surrounding environment, and the intrinsic behavior of electromagnetic signals.

24. As I explained in my deposition, reflections occur when there are impedance mismatches within a medium or at its connection points. Williams Transc., 34:2-39:8. This phenomenon is common across wired mediums like coaxial cables, twisted pair, and optical fiber, as any discontinuity can cause part of the signal to reflect back toward the source. These reflections disrupt the integrity of the transmitted signal and lead to ISI when reflected signals overlap with new transmissions. ISI can arise from reflections, multipath propagation, or a medium's frequency-dependent characteristics, which cause portions of one signal to blur into subsequent signals. ISI is common in high data rate systems, like high-speed wired networks, in which signals are transmitted closely together in time.

25. As I also explained in my deposition, noise is another common impairment and can originate from external and internal sources. Williams Transc., 38:12-20. For example, radio frequency interference from nearby electronic devices, power lines, or other wires is common across wired systems. Noise adds unwanted signals to the transmission, which reduces the transmission's clarity and reliability.

26. Another common impairment is signal attenuation, which is the gradual weakening of signal strength as it travels through a medium. Signal attenuation is an

inevitable result of energy loss due to resistance, absorption, or scattering. This occurs in nearly all mediums, wired (e.g., twisted pair and coax) and wireless networks, and limits the distance over which signals can be transmitted without amplification.

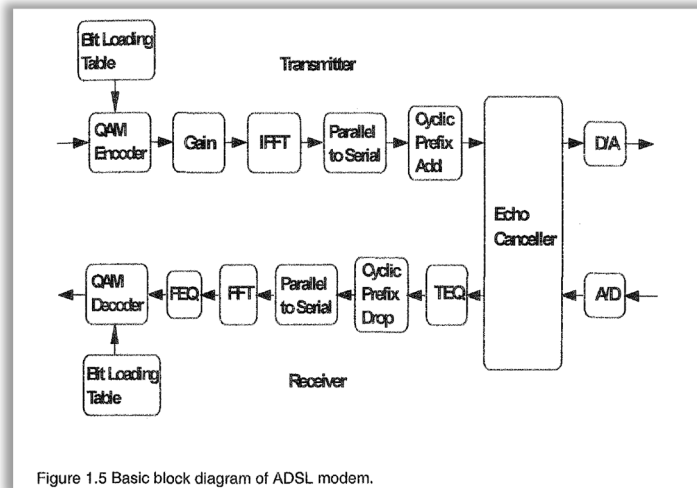
27. These impairments were known before the '518 Patent. Further, these impairments are not unique to any specific medium but are inherent to the physical nature of signal transmission. Accordingly, a POSITA can draw from the same toolbox of known solutions to address these impairments regardless of the medium. Naturally, the chosen solution must be adapted to suit the specific characteristics of the underlying medium, but making such adaptations falls well within the skillset of a POSITA.

28. As I explained in my first declaration, the fact that solutions are cross applied between different mediums is reflected in the '518 Patent itself. The '518 Patent, across the Background and Detailed Description, mentions and incorporates by reference nearly 20 prior art references that cover known solutions like RF-conversion circuitry, multi-carrier modulation, bit loading, and probe messaging in various types of networks. DISH-1004, ¶¶40-44. These include several twisted pair references (including one that shares inventorship with Isaksson) that use the claimed bit loading. *Id.*

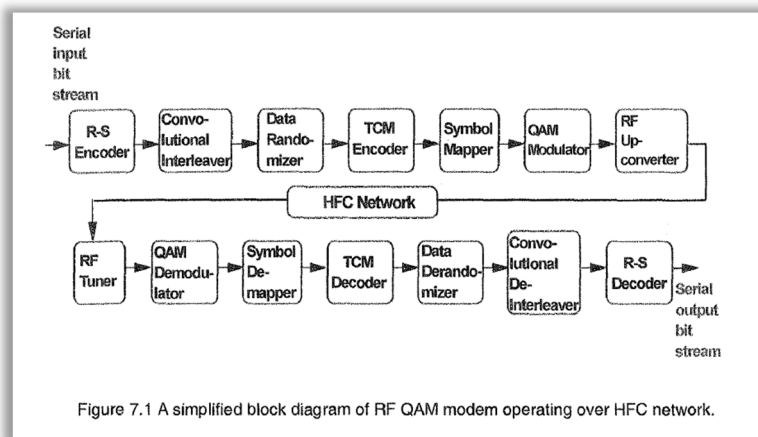
29. In the context of twisted pair and coax specifically, in view of their

overlapping development, a POSITA would have been familiar with both mediums.

While they have distinct structural components, the differences between these mediums are well understood by a POSITA. These differences would not have impeded a POSITA from cross-applying solutions between the two. As an example of cross-applying solutions, twisted pair and coaxial networks both used QAM as a modulation scheme.



DISH-1034, 13 (showing an ADSL modem using QAM on twisted pair).



Id., 184 (showing an RF modem using QAM on coax).

And as an example of the overlapping development of twisted and coax, Ethernet standards—a LAN technology—was developed both on twisted pair and coax. 10Base2, which was developed first, utilized coaxial cables to transmit data between devices in a LAN. DISH-1038, 582. Later, 10Base-T introduced Ethernet over twisted pair. DISH-1038, 587.

C. Correcting Misconceptions About Twisted Pair and Isaksson

30. Throughout his declaration, Mr. Garrett repeatedly presented incorrect and/or irrelevant claims about twisted pair and Isaksson, seemingly in an effort to create a divide between twisted pair and coaxial cables. In this section, I address many of these claims, starting with those related to twisted pair generally and then turning to the assertions concerning Isaksson specifically.

31. Mr. Garrett tries to differentiate between twisted pair and coaxial cables by stating that “[u]nlike coaxial cable, twisted pair is unshielded,” and “[a]s a result ... twisted pair suffers from a loss of signal energy over distance and also lossy signal propagation.” Garrett Decl., ¶63. Although twisted pair is commonly unshielded, it also can be shielded. DISH-1038, 1018-19. And although twisted pair suffers from signal loss over distance, this is true of coaxial cables and other mediums that experience losses as they propagate over a distance. Ex. 2006, 108.

32. Mr. Garrett also argues that the “bandwidth of twisted pair is ... much smaller than coaxial cable,” (Garrett Decl., ¶65) and “coaxial cable and twisted pair

have dramatically different frequencies and therefore wavelengths” (*id.*, ¶66). These are broad generalizations. As I explained in my deposition, the usable bandwidth in a system depends on various factors, including cable type, cable length, and operating frequency. Williams Transc., 12:15-13:19. I also noted during my deposition that twisted pair and coaxial cables have overlapping operating frequencies; while not identical, they are far from necessarily being “dramatically different.” *Id.*, 13:19-14:4.

33. Further, Mr. Garrett claims that “systems operating on twisted pair medium tend to be point-to-point systems.” Garrett Decl., ¶65. Although many twisted pair systems are point-to-point, as I explained during my deposition, twisted pair can be used in other configurations, including point-to-multipoint. Williams Transc., 60:1-11. As an example, US Patent No. 7,099,349 describes packet-based point-to-multipoint communication between an upstream xDSL modem and a plurality of downstream xDSL modems. DISH-1032, Abstract. The system includes a twisted pair connecting the upstream xDSL modem to the plurality of downstream xDSL modems. *Id.* As another example, US Patent No. 6,970,905 describes “a communications system which allows for point-to-multipoint communications using twisted pair copper telephone wire.” DISH-1033, 1:5-10.

34. Additionally, Mr. Garrett contends that “[s]ignals transmitted at high frequencies over twisted pair results in higher losses and drops in signal strength

while signals transmitted over coaxial cables at high frequencies are known to be chaotic, with sharp increases in attenuation at very specific frequencies.” Garrett Decl., ¶67. These statements provide generalizations about signaling at high frequencies. While these generalizations highlight some propagation differences between twisted pair and coaxial cables, they also overlook key similarities. Notably, the textbook relied upon by Mr. Garrett explicitly equates propagation characteristics of twisted pair and coaxial cables.

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6 Distributed Analysis: Transmission Lines and Z_0

circuit is one where the source of a changing voltage (or current) does not “know” what is happening at the destination. So now there is not only “spooky action at a distance,” but there is also the fact that the results of the action at the distance are not known until later.

Getting back to radio. . . A radio uses a transmission line. In the case of a radio, the transmission line is the air between the two antennas (transmitting and receiving). A cable or DSL modem uses a transmission line to send and receive data, with the transmission line being, respectively, the coaxial cable and twisted-pair telephone line.

What do these examples have in common? First, the signal energy is propagating in a dielectric, an electrical insulator. Second, there is a relatively low loss of signal in the dielectric. This means that the signal tends to arrive intact at the other end, which makes it much easier to receive.

There are some differences. For example, the radio signal gets weaker farther from the antenna, but only because the energy is spreading out in space (i.e., the dielectric is getting larger as the signal moves away from the antenna). In the case of twisted-pair or coaxial cable, the signal energy is confined to the structure and so gets weaker at a much slower rate.

So how do transmission lines work? To understand that, consider a small piece of coaxial cable. . .

Ex. 2006, 82.

35. Mr. Garrett also claims that in an in-home network, propagation over telephone lines is lumped, not distributed, and transmission-line effects such as reflections disappear. Garrett Decl., ¶67. I disagree. First, as I previously explained,

the claims of the '518 Patent are not limited to an in-home network, so the in-home propagation over telephone lines is irrelevant. Second, Mr. Garrett's statement reflects a specific modeling choice rather than an inherent physical property of the medium. The distinction between lumped and distributed models depends on the frequency of operation and the level of abstraction chosen for the analysis—not on an intrinsic characteristic of the medium itself. In other words, the modeling decision is based on the characteristics of the system, like signal frequency and line length, rather than a fundamental change in the physical nature of the propagation. Further, transmission-line effects, including reflections, occur in both twisted pair and coaxial cables. These effects do not “disappear,” but certain modeling scenarios may neglect them depending on the assumptions made.

36. None of the differences raised by Mr. Garrett change the fact that twisted pair and coaxial cables experience similar signal impairments that can be addressed using similar solutions. Thus, as I opine below, the differences are immaterial to the analogous art and motivation to combine analyses.

37. Turning to Isaksson, Mr. Garrett opines that Isaksson is limited to twisted pair. Garrett Decl., ¶59. I disagree and support my opinion with the following reasons.

38. First, Isaksson describes a multi-carrier transmission system that is agnostic to wiring type. This system can be employed in multi-carrier systems

regardless of medium. Example citations from Isaksson's Abstract, Title, Field of Invention, Detailed Description, and Claims that support this conclusion include:

- “Improvements in, or relating to, multi-carrier transmission systems.” DISH-1013, code (54).
- “In a multi-carrier system there is always a need to exchange control information between a transmitter and a receiver. This information is generated in the receiver and terminated in the transmitter. This information contains data on the instantaneous characteristics of the channel and information about system change decisions needed to handle the changes in channel characteristics. In systems that use bit-loading techniques the number of transmitted bits per symbol is adapted, or regulated, to the signal-to-noise ratio (SNR) of the current carrier wave. This regulation dynamically affects, in time, the total bandwidth [sic] of the system. This variation in bandwidth leads to an absolute system requirement for synchronous configuration of the transmitter and the receiver, in terms of the number of coded/decoded bits per symbol and carrier wave. If this requirement is not met the system will be unable to maintain a connection.” *Id.*, Abstract.
- “The present invention relates to multi-carrier transmission systems, particularly to multi-carrier transmission systems having the facility to dynamically change carrier bit-loading and a method of synchronising the updating of parameters relating to bit-loading.” *Id.*, 1:3-7.
- “The present invention relates to the synchronous updating of bit-loading factors in multi-carrier transmission systems. The precise manner in which this is achieved will, therefore, now be considered in greater detail. It should be emphasised that the present invention can be used not only with the MUSIC system as herein described, but with other multi-carrier systems employing dynamic bit-loading.” *Id.*, 72:1-9.
- “It is a further object of the present invention to provide a multi-carrier transmission system, in which synchronism

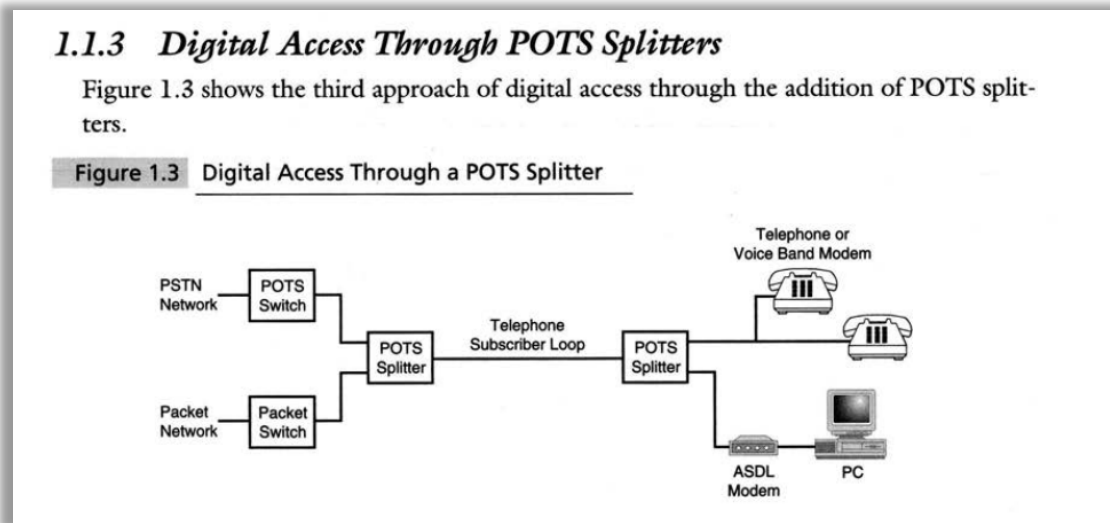
between two transceivers is maintained during dynamic system reconfiguration of bit-loading factors.” *Id.*, 4:26-30.

- “1. A multi-carrier transmission system having a first and a second transceiver, each of said transceivers having a receiver and a transmitter, wherein data is transmitted between said transceivers by modulating said data onto a multiplicity of carrier waves in the form of multi-bit symbols, wherein each carrier wave constitutes a channel, and wherein the number of bits per symbol, (the bit loading), varies between channels and, within a channel, with time, so that each channel has associated therewith a bit loading parameter.” *Id.*, 89:2-24.

39. Second, Isaksson explicitly mentions a coaxial cable network as a network on which its solutions can be implemented. Isaksson explains that the “multi-carrier system may be a DMT based VDSL system” (*id.*, 8) and that “the DAVIC specification ... enable[s] distribution of VDSL signals over coaxial cable systems” (*id.*, 5). From this, a POSITA would understand that Isaksson’s solutions can be deployed on a coaxial multi-carrier system.

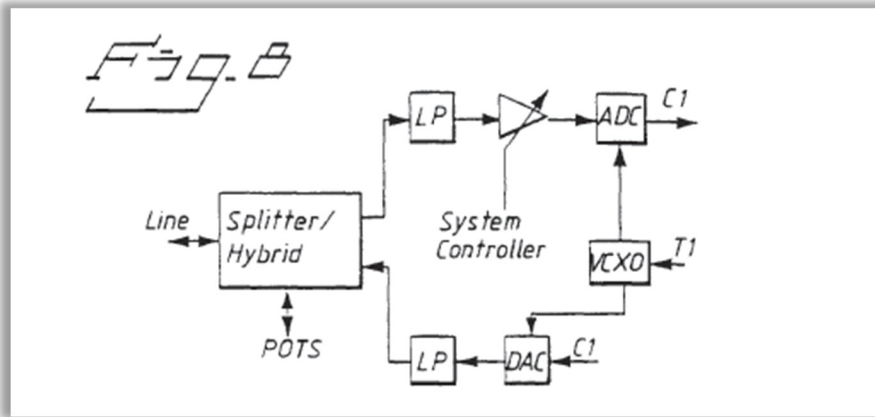
40. Mr. Garrett asserts that Isaksson’s twisted pair does not communicate over splitters. Garrett Decl., ¶¶74-75. Contrary to this assertion, twisted pair networks generally, and Isaksson’s twisted pair implementation specifically, include splitters. As an example, a DSL network includes plain old telephone service (POTS) splitters that enable DSL signals to share the twisted pair with telephone signals. A POTS splitter is used both at the transmitting end and the receiving end of the DSL network. DISH-1031, 6. Like splitters used in coaxial networks, the splitter uses its three ports to combine signals in one direction and separate them in the other. *Id.*

The figure below illustrates a twisted pair network that uses splitters for digital access.



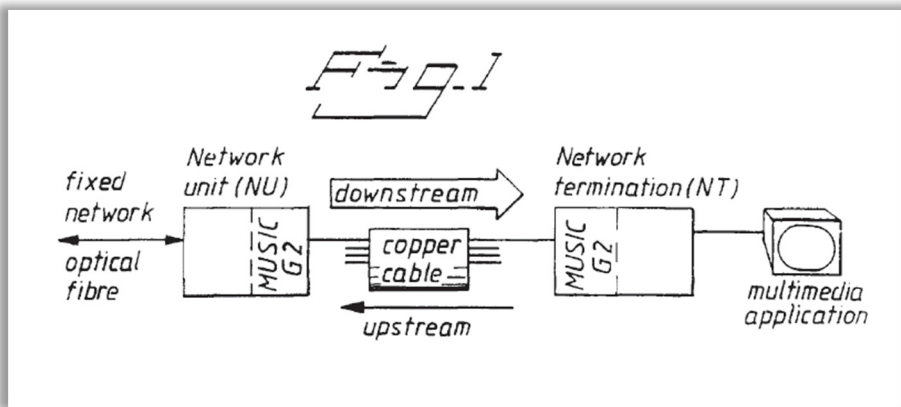
Id., 6.

41. Consistent with this approach, Isaksson's system includes a "splitter/hybrid transceiver," which is depicted at the receiver end in Isaksson's FIG. 8 (reproduced below). Isaksson describes the splitter's functionality as "split[ting] and combin[ing] telephone signals (POTS) and VDSL signal frequency bands." DISH-1013, 37:28-29.



Id., FIG. 8.

42. Further, Mr. Garrett characterizes Isaksson as a point-to-point system. Garrett Decl., ¶67. But Isaksson is not limited to a point-to-point system. As I explained in my deposition, “[o]ne application of Isaacson [sic] is point to point” (Williams Transc., 60:3) and Isaksson “can be deployed in point-to-multipoint networks” (*id.*, 60:5-6). As an example, multiple of Isaksson’s Networking Terminations (NTs) could be associated with a single Networking Unit (NU) over different frequency spans. *Id.*, 60:9-11.



DISH-1013, FIG. 1.

43. Mr. Garrett also characterizes Isaksson as a full-duplex system. Garrett Decl., ¶60. Although Isaksson describes a full-duplex system, the system can be adapted to a half-duplex system, as I explained in my deposition: “[i]f you look at Figure 6, the spectrum available for transmission is shown. In here, he has ISDN shown in the range of 4 to 150 kilohertz. You could put another upstream or downstream communication module in either of the upstream or downstream frequency allocations.” Williams Transc., 61:11-21.

44. In view of the above, it is my opinion that Mr. Garrett’s attempts to limit Isaksson to low-bandwidth, low-frequency, and/or point-to-point applications are baseless.

VI. Isaksson is Analogous Art

A. Isaksson is From the Same Field of Endeavor as the ’518 Patent

45. As I stated in my first declaration, Isaksson is from the same field of endeavor as the ’518 Patent. *See* DISH-1004, ¶77. The field of endeavor is wired communication networks, which includes wired networking systems using coaxial cables. *Id.*, (“Kliger and Isaksson are analogous art because both Kliger and Isaksson are in the same field of endeavor as the ’518 patent (i.e., wired communication networks).”), *id.*, ¶184 (“[E]ach of Amit, Isaksson, and Jacobsen are in the same field of endeavor as the ’518 patent (i.e., wired networking systems using coaxial cables).”). To be clear, I do not limit “wired networking systems” in the ’518 Patent

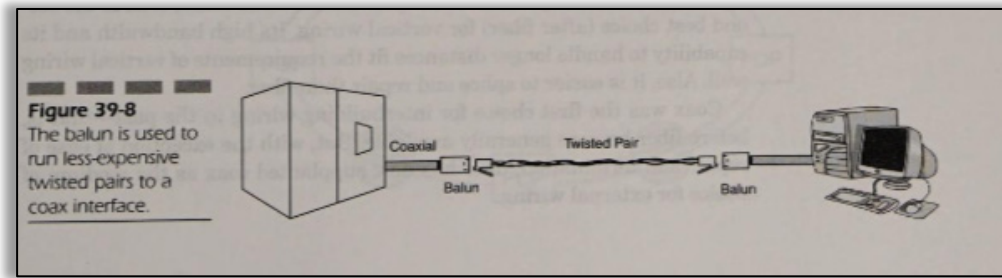
exclusively to local coaxial networks. That is, it is my opinion that the '518 Patent encompasses wired networks that may use coaxial cables, but not that the '518 Patent is limited only to local coaxial networks.

46. I disagree that Isaksson is from a different field of endeavor.

47. One of Isaksson's embodiments is a multi-carrier transmission system that is agnostic to the underlying medium. DISH-1013, 72:1-9. A POSITA would understand that this medium-agnostic system can be implemented on various communication mediums, like coaxial cables. Additionally, Isaksson specifically calls out coaxial cable systems as an implementation of the multi-carrier transmission system. Isaksson explains that the "multi-carrier system may be a DMT based VDSL system" (DISH-1013, 6:13-15) and that "distribution of VDSL signals over coaxial cable systems" is possible (*id.*, 3:14-15). Even though these statements appear only once in Isaksson, a POSITA would understand from them that Isaksson's multicarrier system can be implemented on coaxial cables.

48. Even if Isaksson did not explicitly mention coaxial cables, a POSITA would understand that Isaksson's solutions can be implemented on coaxial cables. As I explained, twisted pair and coaxial cables are both wired networking mediums that were considered for in-home networks, and in some scenarios were used in the same network (see below). Due to the similar impairments that occur across these mediums, a POSITA can adapt solutions to either medium, irrespective of the

differences between the two.



DISH-1038, 1025.

49. Mr. Garrett argues “Isaksson repeatedly asserts that its system is specific to twisted pair,” and therefore, is limited to that implementation only. Garrett Decl., ¶60. But Mr. Garrett’s assertion contradicts Isaksson’s explicit statement that the system is **not** limited to just twisted pair. Isaksson says, “It should be emphasised that the present invention can be used not only with the MUSIC system as herein described, but with other multi-carrier systems employing dynamic bit-loading.” DISH-1013, 72:1-9.

50. Mr. Garrett also argues that my analysis does not appreciate the differences between twisted pair and coaxial cables. Garrett Decl., ¶61. As I explained, the differences that Mr. Garrett lists are incorrect, overstated, and/or inconsequential to extending Isaksson’s solutions to coax. As an example, Mr. Garrett argues that, unlike coaxial cables, the propagation modeling of in-home telephone lines is lumped and not distributed. Garrett Decl., ¶67. As I explained, this is merely a propagation modeling choice and not an actual difference between the

two mediums. Irrespective of the propagation model that is picked, reflections still exist within in-home telephone lines. The other differences that Mr. Garrett provides fair no better, as I explained above. Importantly, missing from Mr. Garrett's analysis is why any of the purported differences that he listed would prevent Isaksson's solutions from being used in coaxial cables. Simply, they do not.

B. Isaksson is Reasonably Pertinent to the Problems of the '518 Patent

51. As I also stated in my first declaration, Isaksson is reasonably pertinent to the problems of the '518 Patent. DISH-1004, ¶¶76-80, 183-184.

52. Mr. Garrett characterizes the problems addressed by the '518 Patent as “impairments that restricted high-bandwidth communication between devices over existing on-premises coaxial cabling.” Garrett Decl., ¶71. This is an overly narrow interpretation of the '518 Patent's problems. While the impairments mentioned in the '518 Patent do occur in on-premises coaxial cable networks, they are not confined to this specific context. As I explained, these impairments—such as signal reflections, inter-symbol interference, and signal attenuation—are common across various communication mediums, including twisted pair. While the sources of these impairments may vary between networks, the impairments themselves remain fundamentally the same.

53. For instance, the '518 Patent identifies reflections in coaxial cables caused by imperfect connection points at the splitters as a problem. In a twisted pair

network, reflections might arise from the same cause or from a different cause (e.g., impedance mismatches). In either case, the phenomenon of reflections remains the same. Moreover, the solutions designed to address these impairments are often applicable across different mediums.

54. Ovadia (DISH-1034) explains that the electronic impairments in cable TV networks include: Additive white Gaussian noise (AWGN), Multipath electrical echoes (reflections) and group delay, In-band QAM amplitude variations, Phase noise, Burst and impulse noise, AM hum modulation, and Nonlinear distortions. DISH-1034, 262. Most of these impairments also occur in twisted pair networks. Twisted pair suffers from voice channel attenuation and phase delay, impulse noise, magnitude (amplitude) distortions, phase distortions, and inter-symbol interference. DISH-1031, 30 (discussing voice channel attenuation and phase delay), 59 (discussing impulse noise), 149 (discussing amplitude and phase distortions), 439-40 (discussing inter-symbol interference). Jacobsen's discussion of the same impairments also confirms that these impairments are not limited to in-home networks. DISH-1016, 305-06.

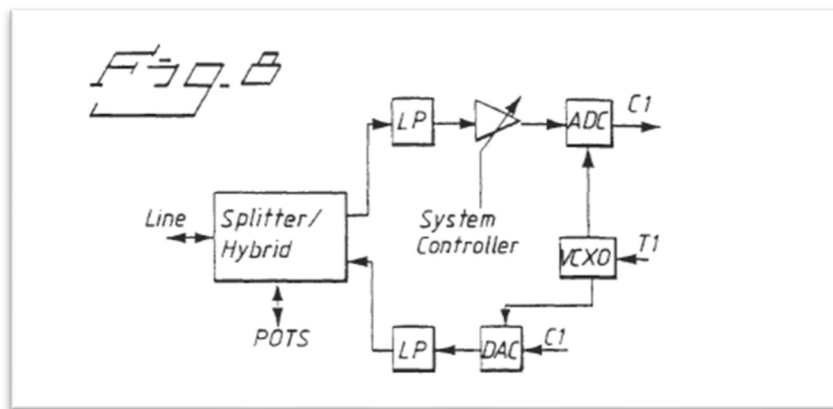
55. Mr. Garrett states that "[a] POSITA would have understood that Isaksson is directed to bitloading techniques for any given hop in a twisted pair network." Garrett Decl., ¶76. Isaksson's solutions address more than that. As I stated in my first declaration, Isaksson addresses signal impairments on wired networks.

DISH-1004, ¶80. Isaksson is concerned with the need to transmit high bit rate traffic over a wired network. *Id.* Isaksson identifies interference, variable frequency dependent loss and noise across sub-channels, and inter-symbol interference as signal impairments affecting the ability to transmit the high bit rate traffic over a wired network. *Id.* Isaksson proposes solutions that address these impairments. In particular, Isaksson’s adaptive bit loading in a multi-carrier transmission system helps address reflections (and resulting inter-symbol interference), interference, and variable frequency dependent loss and noise across sub-channels. DISH-1013, 26:4-6 (“A multi-carrier modulation technique, such as DMT, handles frequency dependent loss and noise in twisted pair-cables in an efficient manner”), *id.*, (“Carriers affected by narrowband interferers are turned off), *id.*, 26:17-18 (“Forward error correction and data interleaving is used to mitigate the effects of occasional bursts of impulse noise”), 54:13-14 (“The number of bits each carrier carries, depends on their respective Signal-to-Noise Ratios (SNR).”), 57:24-26 (Expected error sources include random noise (inducing random bit errors), impulse noise (inducing error bursts) and clipping (inducing error bursts).”).

56. Mr. Garrett argues that Isaksson is also not reasonably pertinent to the ’518 Patent because Isaksson does not involve coaxial cables, does not communicate over splitters, and does not propose solutions to splitter-related impediments in a coaxial network. Garrett Decl., ¶¶74-75. I disagree.

57. First, as I have explained, Isaksson is not limited to a single type of wire and Isaksson encompasses coaxial cables.

58. Second, as I have also explained, Isaksson communicates over splitters. Isaksson depicts a splitter in FIG. 8 and describes the splitter's functionality as "split[ting] and combin[ing] telephone signals (POTS) and VDSL signal frequency bands." DISH-1013, 37:28-29.



Id., FIG. 8.

59. Third, Isaksson proposes solutions to the impediments that are caused by splitters in a coaxial network. The '518 Patent explains that "[i]mperfect terminations at connections create *micro reflections* ... that create[] *inter-symbol interference (ISI)*," and that [i]n the frequency domain, a reflection ... create[es] *amplitude variations* across the pass band." DISH-1001, 3:5-20. A POSITA would have understood that Isaksson's system experiences similar impairments. As DSL (DISH-1031) explains, bridged taps and terminal impedance mismatch in twisted pair networks cause magnitude/phase attenuation and reflections, which in turn,

create inter-symbol interference. DISH-1031, 7. And as I explained, Isaksson's solutions address these impairments.

60. The problems of the '518 Patent are therefore not unique to an on-premises local area broadband coaxial cable network and Isaksson's solutions are reasonably pertinent to the '518 Patent's problems.

VII. Ground 2

A. A POSITA Would Combine Amit and Jacobsen

61. As I stated in my first declaration, a POSITA would combine Amit and Jacobsen. DISH-1004, ¶¶165-176.

- i. Jacobsen's multi-carrier modulation is not redundant of Amit's frequency-shifting module

62. Mr. Garrett criticizes my analysis because "Amit's 'reflections' would not have motivated a POSITA to combine Amit and Jacobsen." Garrett Decl., ¶84. Mr. Garrett then argues that "[b]ecause Amit solves the reflections within its network, a POSITA would not have been motivated to combine Amit and Jacobsen based on these reflections." *Id.*, ¶86. I disagree with Mr. Garrett's characterization of my position and his erroneous conclusion.

63. In my first declaration, I outline the signal impairments that a POSITA would recognize as affecting Amit's system, including those (e.g., reflections) explicitly identified in Amit itself. DISH-1004, ¶165. I then highlight the advantages of Jacobsen's multi-carrier modulation, which extend beyond addressing the signal

impairments in Amit’s single-carrier network. *Id.*, ¶167. These benefits include reducing distortions, adapting to various channel degradations, and achieving more computationally efficient modulation for data transmission over coaxial cables. *Id.* Additionally, I reference Jacobsen’s conclusion that “multicarrier modulation appears to be better equipped than single-carrier modulation” for achieving a reliable digital communication system on a CATV network. *Id.* I conclude by asserting that, in view of Jacobsen’s findings, a POSITA would have been motivated to modify Amit’s network to use multi-carrier signaling. *Id.*, ¶173.

64. Mr. Garrett contends that Amit’s transponder module addresses reflections within Amit’s network. Garrett Decl., ¶¶84-86. I disagree. As I stated in my first declaration, Amit’s transponder module is, at best, an optional alternative to using multi-carrier modulation to address reflections within Amit’s network. Furthermore, Amit’s optional frequency-shifting module serves a fundamentally different purpose than Jacobsen’s multi-carrier modulation. While Amit’s frequency-shifting module may impact reflections in some scenarios, modulation and frequency shifting are distinct functions. Notably, Mr. Garrett does not assert that Amit’s frequency-shifting module performs the other functions of Jacobsen’s multi-carrier modulation, such as mitigating distortion, adapting to channel degradation, and enhancing modulation computational efficiency. Further, even if Amit’s frequency-shifting module manages reflections, it would not have prevented

a POSITA from using Jacobsen's multi-carrier modulation to also address signal impairments.

65. Therefore, it is my opinion that Jacobsen's multi-carrier modulation is not redundant of Amit's transponder.

ii. Amit and Jacobsen are compatible

66. Mr. Garrett argues that Amit's "high reflection" is not a problem that needs to be solved. Garrett Decl., ¶92.

67. As I explain in my first declaration, Amit's RF signals rely on reflections to propagate between Amit's devices. DISH-1004, ¶242. But while reflections facilitate Amit's in-home network communications, they must be carefully managed. A POSITA would understand that excessively high reflections can lead to issues, such as interference, signal degradation, and reduced network reliability. Unmanaged reflections can exacerbate other signal impairments, including inter-symbol interference and noise, which further hinders the network's performance. Therefore, a POSITA would have implemented Jacobsen's teachings to manage the reflections in Amit's in-home network.

iii. Jacobsen's multi-carrier modulation does not contradict Amit's goals

68. I disagree with Mr. Garrett's assertion that adding Jacobsen's multi-carrier modulation would (1) add unwanted complexity, (2) add hardware costs, and (3) add operational costs to Amit's network. Garrett Decl., ¶95.

69. As an initial matter, as I stated above, I understand that a given course of action often has simultaneous advantages and disadvantages, e.g., as a matter of design tradeoff, and this does not necessarily obviate motivation to combine. I also understand that the benefits, both lost and gained, should be weighed against one another. I do not believe that Mr. Garrett properly applied this balancing approach because he failed to properly weigh the benefits of the proposed modifications. Instead, Mr. Garrett focuses on describing the supposed drawbacks of implementing Jacobsen's multi-carrier modulation without weighing the benefits.

70. In my opinion, a POSITA properly weighing the benefits, both lost and gained, would implement Jacobsen's multi-carrier modulation in Amit's network. In another paper, Jacobsen2, Jacobsen's author conducted a cost-benefit analysis to evaluate implementing multi-carrier modulation in a coaxial network. That cost-benefit analysis is representative of a POSITA's analysis in this scenario. To balance the tradeoffs between performance and computational complexity, Jacobsen2 proposes dividing the channel into 1024 subchannels. DISH-1023, 378. And to ensure "the complexity of the remote terminals is not prohibitive," Jacobsen2 suggested that "the set of 1024 subchannels can be segmented into eight disjoint groups of 128 consecutive subchannels." *Id.*, 378-79. This approach enables the system to operate with an FFT size of just 256 for the full set of 1024 subchannels, which ensures practical costs even for lower-cost terminals. *Id.*, 379. For scenarios

with limited hardware resources, Jacobsen2 further proposes “reducing the active subchannels,” which lowers the FFT size to 64 and further simplifies the implementation. *Id.*

71. Mr. Garrett supports his position with an example in which the power increase from single carrier to multi-carrier is 30x. Garrett Decl., ¶101. But this example is not representative of the actual power increase. Setting aside that Mr. Garrett selectively used numbers designed to exaggerate the power increase, in practice, Mr. Garrett did not account for how Jacobsen’s multi-carrier modulation (a) “alleviate[s] the problems caused by both frequency-domain ripple and interferers” (DISH-1016, 307), (b) improves computational efficiency (*id.*, 312), (c) “improve[s] the transmission efficiency” (DISH-1031, 443), and (d) “achieves high spectral efficiencies” (DISH-1023, 374). As Jacobsen2 explains, multi-carrier modulation “achieves high spectral efficiencies, on the order of 4-5 bits/s/Hz, and offers resilience to common reverse channel impairments, including impulse noise, radio-frequency ingress, and spectral variability.” *Id.* Jacobsen2 concludes that multi-carrier modulation “is a cost-effective solution that enables efficient, robust, high-speed upstream communications on cable and HFC networks.” *Id.*

72. Additionally, the parameters of Jacobsen’s solution can be tweaked to fit power consumption requirements. For example, a POSITA can reduce power amplifier operational costs by adjusting channel usage, perhaps by allocating fewer

subchannels. Also, the increased Peak-to-Average Power Ratio observed in multi-carrier systems is offset by improvements in spectral efficiency. These benefits achieved by multi-carrier modulation reduce retransmissions, which further minimizes energy costs over time. Specifically, Jacobsen2 shows how a POSITA can address power consumption concerns by segmenting the subchannels into groups of 128 (or fewer if needed) to lower power overhead. DISH-1023, 378-79.

73. Mr. Garrett’s design challenges concerns are also overstated. Amit’s modulation is implemented in silicon. DISH-1014, 29:15-18 (“The 1st chip is designed to be designed in ‘system on a chip’ architecture.”). The costs of scaling to multi-carrier modulation using silicon would not have been significant. Jacobsen2—presented *four years* before the filing date of the ’518 Patent—confirms as much: “Each remote terminal configured according to the example parameters has a computational complexity that can be handled easily by a single DSP chip.” Similarly, Isaksson says that its solution offers a cost-effective robust customer implementation in silicon. DISH-1013, 24:14-17.

B. A POSITA Would Combine Amit and Jacobsen with Isaksson

- i. Isaksson is compatible with the Amit-Jacobsen system
 - (a) Isaksson’s base sync frames can function in Amit’s network

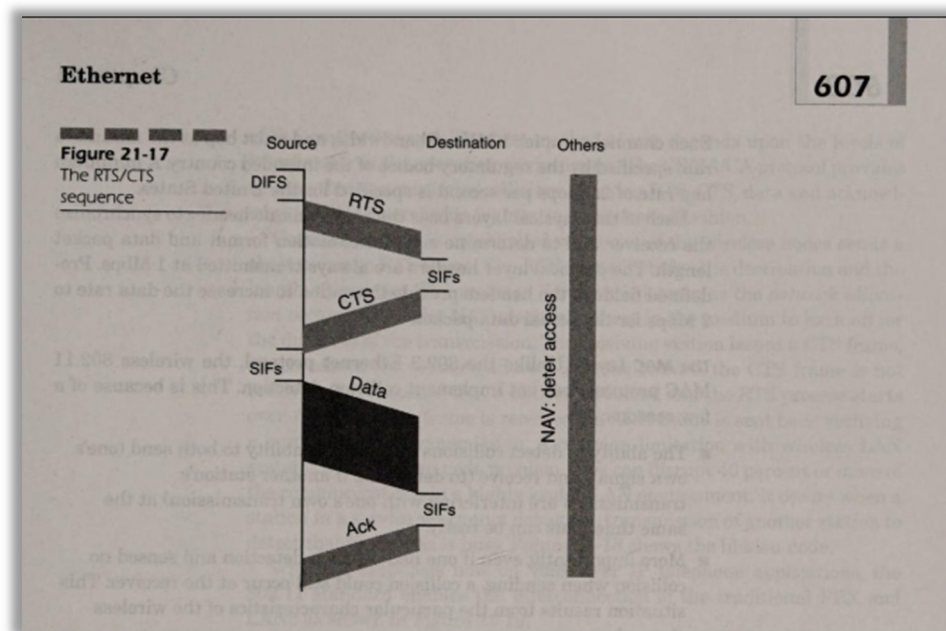
74. Mr. Garrett argues that Isaksson’s base sync frames would not function on Amit’s network. Garrett Decl., ¶105. I disagree.

75. Mr. Garrett first argues that Isaksson's base sync frames would not function on Amit's network because Isaksson provides a two node, full-duplex system that utilizes multi-carrier modulation, whereas Amit is a half-duplex system on a shared medium. Garrett Decl., ¶¶105, 107. Here, Mr. Garrett is conflating bodily incorporating Isaksson's devices into the Amit-Jacobsen network with implementing the base sync frames in the Amit-Jacobsen devices. As I explained in my first declaration, a POSITA would have found it obvious to modify the Amit-Jacobsen devices with Isaksson's *signaling method*. DISH-1004, ¶¶180-181. And as I explained in this declaration, a POSITA would understand how to modify Isaksson's full-duplex system into a half-duplex system. Similarly, a POSITA would understand how to incorporate signaling from a full-duplex system into a half-duplex system. Specifically, a POSITA would treat Isaksson's base sync frames as a message allocated to the control aspects of the Amit-Jacobsen network.

76. Relatedly, Mr. Garrett argues that Isaksson's base sync frames would not function on Amit's network because Isaksson requires a control channel. Garrett Decl., ¶¶105. I disagree. Effectively all communication systems require a mechanism for communicating control signaling. As Mr. Garrett points out, Isaksson's mechanism is a control channel. Because the base sync frames are control signals, Isaksson communicates the base sync frames on the control channel. However, a POSITA implementing Isaksson's base sync frames in the Amit-Jacobsen system

would do so using Amit-Jacobsen mechanism for control signaling—not Isaksson’s. Thus, a POSITA would not bodily incorporate Isaksson’s dedicated control channel into the Amit-Jacobsen system as Mr. Garrett suggests.

77. Amit describes using the IEEE 802.11 CSMA protocol for the data link layer. DISH-1014, 27:1-2. A POSITA would know that this protocol uses management frames for various control functions, such as network discovery (via beacon frames), Request-to-Send (RTS) and Clear-to-Send (CTS), association and disassociation, acknowledgment (ACK), and probe requests and responses. DISH-1038, 606-609.



Id., 607.

Amit, for example, describes sending ACK messages using the IEEE 802.11 CSMA protocol. DISH-1014, 27:5-7. A POSITA implementing Isaksson’s base sync frames

in the Amit-Jacobsen system could employ the IEEE 802.11 CSMA/CA protocol to transmit the base sync frames as management frames. Isaksson is compatible with this protocol. A POSITA would know that the IEEE 802.11 CSMA/CA protocol is a TDMA protocol because TDMA allocates communication resources based on time to multiple users. IEEE 802.11 CSMA/CA does the same, although the allocation is dynamic. Isaksson explicitly mentions its compatibility with TDMA: “Alternatively, other duplex methods can be used, e.g. TDMA.” DISH-1013, 26:32-34.

(b) Isaksson extends to coaxial cables

78. Mr. Garrett yet again argues that Isaksson cannot be combined with Amit-Jacobson on the basis that Isaksson allegedly does not extend to coaxial cables. Garrett Decl., ¶108. I disagree.

79. Mr. Garrett argues that Isaksson is limited to twisted pair “because Isaksson names its system Multicarrier System for the Installed Copper network (“MUSIC”).” Garrett Decl., ¶115. As I have explained, Isaksson states that “the present invention can be used not only with the [MUSIC] system ... *but with other multicarrier systems.*” DISH-1013, 72:1-9. A POSITA would understand that the Amit-Jacobsen multi-carrier system falls within the scope of Isaksson’s statement. Therefore, Isaksson is not limited to twisted pair as Mr. Garrett suggests.

80. Further, Mr. Garrett argues that a POSITA would not be motivated to combine Amit and Jacobsen with Isaksson “because Isaksson is not pertinent to any

of Amit’s potential issues caused by communicating over splitters.” Garrett Decl., ¶118. There are a few issues with this argument. First, as I explained, Isaksson involves communication over splitters, discusses reflections, and proposes solutions for addressing attenuation. *See* §§V, VI.A-B. Second, Mr. Garrett does not address the proposed combination: incorporating Isaksson’s base sync frames into the **Amit-Jacobsen system** (which already discusses Amit’s issues caused by communicating over splitters). Thus, whether or not Isaksson is pertinent to Amit’s potential splitter issues is irrelevant for the purposes of the proposed combination.

81. Finally, Mr. Garrett disagrees with my interpretation of Isaksson’s statement that the DAVIC specification enables premises distribution of VDSL signals over coaxial cables. Garrett Decl., ¶114. To be clear, I interpret the statement as follows: the statement indicates to a POSITA that Isaksson’s solution can be extended to coaxial cables, e.g., in a VDSL system implemented on coaxial cables as specified by the DAVIC specification. Mr. Garrett’s unsupported arguments about “VDSL signal distribution [being] fundamentally different than in-home signal distribution,” “the DAVIC standard itself assert[ing] that additional innovation is required on the shared medium of coaxial,” and “VDSL [being] inadmissible in its existing form on coaxial cable” are outside the scope of my interpretation. *Id.* And even if I took Mr. Garrett’s statement that additional innovation is required to implement VDSL on coax at face value, Mr. Garrett has not shown that innovation

would have been outside the skillset of a POSITA.

ii. Isaksson is not redundant of the Amit-Jacobsen system

82. Mr. Garrett incorrectly asserts that a POSITA would not have combined Isaksson with the Amit-Jacobsen system because Jacobsen teaches synchronized devices. Garrett Decl., ¶120. I disagree for several reasons.

83. First, Mr. Garrett does not address the proposed combination of Amit-Jacobsen. Instead, Mr. Garrett addresses Jacobsen in isolation. *See* Garrett Decl., ¶122. I stated in my first declaration that “a POSITA would have been further motivated to implement Isaksson’s multi-carrier improvements to maintain connections between Amit-Jacobsen’s multi-carrier HCN devices using synchronized bit-loading in which the bit-loading parameters are based on channel.” DISH-1004, ¶179. Here, however, Mr. Garrett argues that Jacobsen’s transmitter and receiver are synchronized, but never explains how that alleged synchronism would extend to Amit-Jacobsen’s multi-carrier HCN devices. *See* Garrett Decl., ¶122.

84. Second, even if Jacobsen did teach synchronism, a POSITA would still look to Isaksson for details that explain how to synchronize devices and under what conditions. While Jacobsen supposedly discloses synchronism, it does not explain the “how”—for example, how bit loading factors are determined, or how often they are reconfigured and under what conditions. Isaksson, by contrast, discloses those details. Thus, as I explained in my first declaration, “a POSITA would have looked

to Isaksson for details on how to implement synchronized bit-loading.” DISH-1004, ¶179. I therefore maintain my opinion that a POSITA would have been motivated to apply Isaksson’s teachings to the Amit-Jacobsen system.

VIII. Ground 1

A. Mr. Garrett Does Not Address the Proposed Motivation to Combine

85. Mr. Garrett first argues that Kliger addresses reflections at the splitter because Kliger’s modems use an efficient modulation scheme that “produces less cross talk between potentially interfering signals.” Garrett Decl., ¶¶128-129. However, producing “less” cross talk does not mean that reflections are solved in Kliger’s network. And in certain scenarios, addressing a problem may require the use of multiple techniques, especially when a single technique alone is insufficient to resolve the issue. Anyway, Mr. Garrett misrepresents the proposed combination. In my first declaration, I acknowledge Kliger’s use of multi-carrier modulation and argues that a POSITA would have been motivated to use Isaksson to improve Kliger’s multi-carrier modulation. DISH-1004, ¶68. As I stated in the first declaration, “Isaksson’s multi-carrier techniques enable Kliger’s HNMs to avoid signal impairments, determine carrier availability for the inter-modem signaling, and maintain inter-modem connectivity.” *Id.*, ¶71. Additionally, Mr. Garrett has not explained how Kliger already solves these issues or why a POSITA would lack

motivation to make these improvements.

86. Further, even if Kliger's modulation scheme manages reflections, it would not have prevented a POSITA from using Isaksson's techniques to also address signal impairments.

87. Mr. Garrett argues that Kliger's registration process solves both dynamic network conditions and interference/noise. Garrett Decl., ¶¶135,139. But this too does not address the proposed combination. As I explained in my first declaration, "[t]he dynamic nature of the network conditions means that the carriers used in the multi-carrier signaling are subject to variable conditions. As a result, a carrier that was once clear of noise can later become severely affected by interference." DISH-1004, ¶67. Mr. Garrett does not explain how Kliger's registration process addresses the variable conditions that carriers experience. It is my opinion that it does not. Kliger's registration process provides "the amount of bandwidth that has been allocated to [each] HNM." DISH-1007, ¶[0110]. But the bandwidth that is allocated to an HNM can still be subject to external noise, interference from reflections, and variable conditions. Therefore contrary to Mr. Garrett's assertions, Kliger's registration process does not solve either dynamic network conditions or interference/noise.

88. Mr. Garrett also argues that Isaksson is irrelevant to addressing Kliger's problems discussed in my first declaration. But Mr. Garrett simply repeats the same

arguments that I have now refuted several times: Isaksson does not include splitters, Isaksson's twisted pair experiences different noise/interference than coax, and Isaksson's multi-carrier modulation handles noise only in twisted pair. As I explained, signal impairments such as reflections, noise, signal attenuation, and ISI are common challenges in nearly all communication mediums due to the physical and environmental factors that influence signal propagation. *See* §§V, VI.A-B. As I also explained, one of Isaksson's embodiments is a multi-carrier technique that is agnostic to the underlying medium. DISH-1013, 72:1-9.

89. Therefore, a POSITA would have been motivated to use Isaksson to improve Kliger's multi-carrier modulation.

B. A POSITA Would Combine Kliger with Isaksson

i. Isaksson's base sync frames can function in Kliger's network

90. Mr. Garrett repeats the same erroneous arguments from Ground 2 about Isaksson's solutions not functioning in a coaxial network. Again, Mr. Garrett argues that Isaksson's base sync frames are incompatible with Kliger's system because Isaksson discloses a point-to-point, full-duplex system implementation while Kliger employs half-duplex communication. I disagree with Mr. Garrett's arguments for the same reasons I did in Ground 2. *First*, a POSITA would have implemented Isaksson's base sync frames in Kliger's modules (and not bodily incorporated Isaksson's full-duplex devices into Kliger's half-duplex system). Incorporating

signaling from a full-duplex system into a half-duplex system is within the capabilities of a POSITA. **Second**, a POSITA implementing Isaksson's base sync frames in Kliger's system would implement Isaksson's base sync frames, which are a form of control signaling, using Kliger's mechanism for control signaling. Specifically, Kliger discusses supporting at least seven types of control bursts. DISH-1007, ¶[0086]. A POSITA would implement Isaksson's base sync frames using the same signaling technique that Kliger uses for those bursts. Thus, a POSITA would not bodily incorporate Isaksson's control channel into Kliger's system, as Mr. Garrett suggests.

- ii. Isaksson's base sync frames can function with Kliger's intermediary device

91. Mr. Garrett argues that Isaksson's base sync frames cannot function with Kliger's intermediary device (HRU). Garrett Decl., ¶149. Mr. Garrett claims that the HRU amplifies the signal power and shifts the frequency of an upstream signal before reflecting it downstream to a receiving device. I disagree with Mr. Garrett's conclusions for two reasons.

92. First, Mr. Garrett has failed to show that the amplification and frequency-shifting signal processing would prevent the determination of channel characteristics as required by the probing process. That is, Mr. Garrett has not shown how the listed signal processing steps would change the goal of characterizing the frequency response or the signal to noise ratio (SNR) of the channel being measured.

To the contrary, these signal processing steps would not prevent the base sync frame from characterizing the channel. First, amplifying the signal power would amplify both the transmission signal **and** the noise on the channel. The channel's SNR therefore remains the same even after signal amplification. Second, frequency shifting merely moves the information portion of the transmission signal to a different carrier frequency. Think of the same song being played on different FM radio stations. The information (song) is the same but the carrier frequency (88 MHz to 108 MHz) has changed. Frequency shifting does not change the content of the base sync frame. Even though the base sync frame is now at a different frequency, the receiver can still recognize the pattern. The impairments added to the information signal during the process of transmission and reception is indicative of the noise on the channel. The goal of the characterization process is to determine the SNR of the channel. Thus, the channel's SNR can be characterized even after the operations of gain and frequency shift.

93. Second, Mr. Garrett describes only the active embodiment of the HRU. Kliger also discloses a passive embodiment that does not amplify or shift the upstream signal's frequency. DISH-1007, ¶[0054]. Mr. Garrett has not shown that a POSITA would be unable to implement base sync frames in the passive HRU. In fact, Isaksson's base sync frames can also function with the passive embodiment of the HRU.

iii. Kliger does not teach away from bit loading

94. Mr. Garrett argues that Isaksson's base sync frames would alter the operation of Kliger because Kliger requires its HNMs to transmit over the backbone using the same constellation size. Garrett Decl., ¶155. I disagree.

95. As an initial matter, I understand that teaching away requires a reference to criticize, discredit, or otherwise discourage the claimed invention. It is my opinion that Kliger does not teach away from using bit loading with its multi-carrier modulation. Mr. Garrett has not shown where Kliger criticizes or discourages using bit loading with its multi-carrier modulation. Instead, Mr. Garrett argues that the combination of Kliger and Isaksson contradicts Kliger's transmission of bursts that use a fixed constellation size depending on the network characteristics. *Id.*, ¶157. But this disclosure would not have prevented a POSITA from improving Kliger's multi-carrier modulation using Isaksson's techniques. Therefore, it is my opinion that Kliger does not teach away from bit loading and a POSITA would have modified Kliger with Isaksson's teachings.

IX. CONCLUSION

96. After reviewing the POR and Patent Owner's expert declaration, I was not persuaded by any of the arguments therein. As such, I still conclude that the challenged claims are obvious.