

THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of: Itzhak Gurantz et al.
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Title: NETWORK INTERFACE DEVICE AND BROADBAND
LOCAL AREA NETWORK USING COAXIAL CABLE

SECOND DECLARATION OF SCOTT ACTON

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: 

Scott Acton

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I, DR. SCOTT ACTON, 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 7,594,249 (“the ’249 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-1003 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 Institution Decision;
- Patent Owner’s Response (“POR”) to the Petition including its exhibits;
- DISH-1029 Deposition Testimony of Mr. Regis J. Bates, Jr. (January 7, 2025);
- DISH-1032 Czulwik, A. (1998, May). Synchronization for single carrier modulation with frequency domain

equalization. In VTC'98. 48th IEEE Vehicular Technology Conference. Pathway to Global Wireless Revolution (Cat. No. 98CH36151) (Vol. 3, pp. 2277-2281). IEEE. (“Czylwik”);

- DISH-1033 Chow, J. S., Cioffi, J. M., & Bingham, J. A. (1993, May). Equalizer training algorithms for multicarrier modulation systems. In Proceedings of ICC'93-IEEE International Conference on Communications (Vol. 2, pp. 761-765). IEEE. (“Chow”);
- DISH-1034 Chow, J. S., Cioffi, J. M., & Bingham, J. A. A Computationally Efficient Adaptive Transceiver for High-Speed Digital Subscriber Lines. In Proceedings 1990 International Conference on Communications, June 1990. Boston, MA. (“Chow II”);
- DISH-1035 Chow, J.S. Finite-length Equalization for Multi-carrier Transmission Systems. PhD thesis, Stanford University, June 1992;
- DISH-1036 Busigin, A. (1986). FFT software for the IBM PC. IEEE MICRO, 6(1), 6-6;
- DISH-1037 Van der Perre, L., Thoen, S., Vandenameele,

- P., Gyselinckx, B., & Engels, M. (1998, November). Adaptive loading strategy for a high speed OFDM-based WLAN. In IEEE GLOBECOM 1998 (Cat. NO. 98CH36250) (Vol. 4, pp. 1936-1940). IEEE;
- DISH-1038 Salz, J., & Weinstein, S. B. (1969, October). Fourier transform communication system. In Proceedings of the first ACM symposium on Problems in the optimization of data communications systems (pp. 99-128);
 - DISH-1039 Press, W. H., Vetterling, W. T., Teukolsky, S. A., & Flannery, B. P. (1988). Numerical recipes (pp. 289-293). Cambridge University Press, London, England;
 - DISH-1040 Grass, E., Tittelbach-Helmrich, K., Jagdhold, U., Troya, A., Lippert, G., Kruger, O., ... & Mahonen, P. (2001). On the single-chip implementation of a Hiperlan/2 and IEEE 802.11 a capable modem. IEEE Personal Communications, 8(6), 48-57;
 - DISH-1041 DVB-T: "Press Release – April 27, 1998" (PDF). 4 June 2000. Archived (PDF) from the original on 4 June 2000. Retrieved 5 February 2020;
 - DISH-1042 Regis J. Bates, *Voice & Data Communications*

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 for the Petitioner.

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. A POSITA Would Consider The Known Communication Techniques of OFDM, Equalization, and TDD

7. Patent Owner and Mr. Bates both repeatedly argue that a POSITA would not consider implementing long-known communication techniques like OFDM, Equalization, and TDD in Amit's network. I disagree. As I explained in my first declaration, these techniques were widely used as of the purported priority date of the '249 patent, and a POSITA would learn of each of these techniques during their education. *See, e.g.,* DISH-1003, ¶184.

8. According to Patent Owner and Mr. Bates, these long-known techniques would only be used in twisted-pair, wide area networks and not a coaxial

LAN. I disagree. These techniques are not cable-specific or network-specific. To the contrary, a POSITA would be able to implement these communication techniques in both LANs and WANs, regardless of whether those networks used twisted-pair, coax, or some combination of the two. It is a long-held tradition in communications to use the existing “tricks of the trade” in combination. Consider, for example, a modem (modulator/demodulator) of the 1990s, which can be used to connect a computer to an analog telephone network. Engineers discovered multiple modulation schemes that encoded digital signals as analog waveforms. These schemes included amplitude modulation, frequency modulation, and phase modulation. In the end, one modulation did not win out; the engineers utilized all three schemes simultaneously and achieved higher bit rates with the same power and processing speeds.

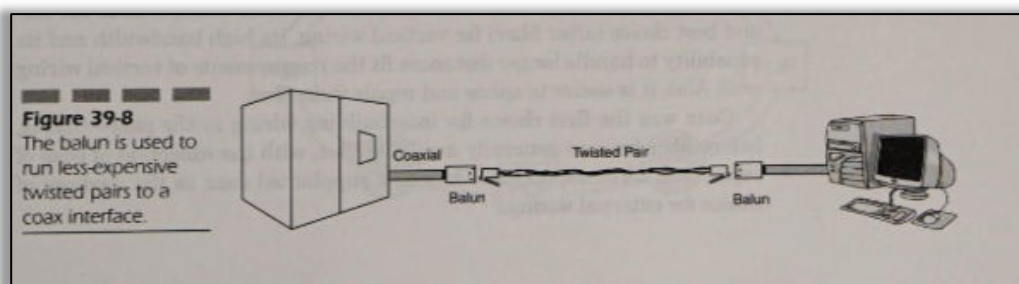
9. As I explained in my first declaration, “a person of ordinary skill in the art” (“POSITA”) relating to the subject matter of the ’249 Patent as of May 4, 2001 would have held a Bachelor’s Degree in Electrical Engineering or Computer Engineering or a related field (or equivalent understanding through actual work experience), and had at least two to three years of experience related to the design or development of signal processing and communication systems or networks. Additional graduate education could substitute for professional experience, or significant experience in the field could substitute for formal education.” DISH-

1003, ¶17.

10. I understand that Mr. Bates offers a different level of skill. According to Mr. Bates, a POSITA would have “had at least two or three years of experience relating to the design and development of broadband networks over coaxial cables.” Ex. 2007, ¶58.

11. I disagree with Mr. Bates’s requirement of “at least two or three years of experience relating to the design and development of broadband networks over coaxial cables.” As a practical matter, engineers do not exclusively work on “broadband networks” as opposed to baseband, narrowband, or non-broadband networks. Likewise, engineers do not exclusively work on coaxial cable networks as opposed to networks implemented using other cables. In fact, many networks include a combination of cable types and other media such as air.

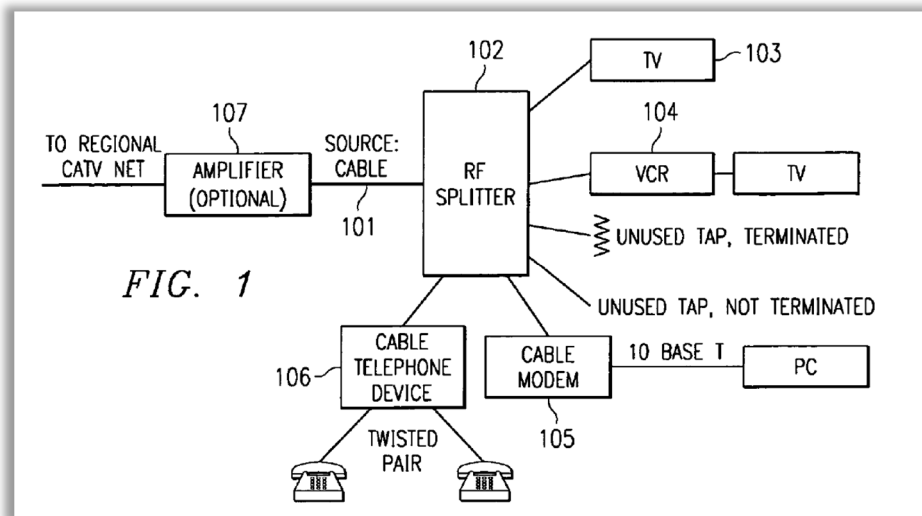
12. Mr. Bates’s own textbook shows that network can use a balun to convert between twisted pair and coaxial cable.



DISH-1042, 1025.

13. Amit similarly describes existing networks that include multiple cable

types. DISH-1005, 5:46-67. In FIG. 1, the in-home network includes wired and wireless links, including 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 10BASE-T Ethernet to connect to a PC. A cable-based telephone device (106) is connected via twisted-pair to offer telephone service.



DISH-1005, FIG. 1.

14. In my opinion, it therefore makes little sense to limit the requirement of a POSITA in the way that Mr. Bates has. As I explained in my first declaration, the '249 Patent refers to non-coaxial concepts and references, and the relevant subject matter would be understood by a POSITA meeting my proposed requirements, regardless of whether or not that POSITA had prior experience in “broadband networks over coaxial cables.”

15. Even if Mr. Bates was correct that a POSITA needs to possess “at least two or three years of experience relating to the design and development of broadband networks over coaxial cables,” I meet this definition. Both at the University of Texas (in the late 80s) and at Oklahoma State University in the mid 1990s, my labs used broadband networks (over 10BASE5 or “thick net” coaxial cable) to transmit and receive image and video data. At Texas, I ushered in the first internet distribution system (including first email by internet) in the Laboratory for Image and Video Engineering. This experience meets Mr. Bates’s (unnecessary) criterion. In fact, I note that Mr. Bates testified in his deposition “would never challenge” my qualification as a POSITA. DISH-1029, 131:11-14.

IV. Independent Claim 10

A. Ground 3

i. Jacobsen does not discourage adding equalization to Amit

16. Jacobsen teaches of using equalization in both single-carrier and multicarrier systems. Jacobsen teaches that its multicarrier system “could use the smaller FFT sizes ... by implementing a time-domain **equalizer**.” DISH-1007, 12, n.4. My first declaration explained this disclosure (DISH-1003, ¶290), yet neither patent owner nor Mr. Bates addressed it.

17. Jacobsen explains that “one goal in the design of a multicarrier system is to minimize the percentage of each block wasted by transmitting the cyclic prefix.”

DISH-1007, 9. In my opinion, a POSITA reading Jacobsen would be motivated to reduce the cyclic prefix length by implementing a time domain equalizer. This is further supported by Jacobsen, which explains that “one goal in the design of a multicarrier system is to minimize the percentage of each block wasted by transmitting the cyclic prefix.” *Id.*, 9.

18. In my opinion, a POSITA would be motivated to add equalization to Amit’s system, irrespective of whether single-carrier or multicarrier modulation was in use. DISH-1003, ¶¶288-295. While Jacobsen does teach that multicarrier modulation performs better than single carrier modulation with equalization at least by some measures under some circumstances, a POSITA reading the entirety of Jacobsen would not come away with the conclusion that Jacobsen teaches away from adding equalization. Jacobsen teaches that “the complexity” of a single-carrier system with equalization “is at least 2.5 times the complexity” of a multicarrier system. DISH-1007, 310. This complexity had to do with the specific comparison between those two specific systems. It is not a blanket conclusion that all equalization is overly complex or that the complexity that equalization requires outweighs the added benefits of equalization.

19. This is further supported by the teachings of Czylik, A. (1998, May). Synchronization for single carrier modulation with frequency domain equalization. In VTC’98. 48th IEEE Vehicular Technology Conference. Pathway to Global

Wireless Revolution (Cat. No. 98CH36151) (Vol. 3, pp. 2277-2281). IEEE.

20. If a POSITA was implementing single carrier modulation in Amit's system, the POSITA would implement equalization. The Czylik paper proposed using frequency domain equalization with single carrier modulation, and concluded that "single carrier modulation with FDE and OFDM exhibit approximately the same complexity." DISH-1032.

21. If a POSITA was implementing multicarrier modulation in Amit's system, the POSITA would still look to equalization for the added benefits taught by Jacobsen. DISH-1007, 309, n.4. This is further supported by the teachings of Chow, J. S., Cioffi, J. M., & Bingham, J. A. (1993, May). Equalizer training algorithms for multicarrier modulation systems. In Proceedings of ICC '93-IEEE International Conference on Communications (Vol. 2, pp. 761-765). IEEE.

22. The Chow, Cioffi and Bingham paper "describes several algorithms for designing the time-domain equalizer, which use adaptation in the frequency domain and windowing in the time domain in order to minimize the mean squared error of the equalized response." DISH-1033 at 761. It elaborates that "[i]f, as is usual, the length of the impulse response of the channel is not negligible compared to the permitted symbol length, the impulse response can be shortened by passing the received signal through a time-domain equalizer before demodulation." *Id.* As a result, "[t]he best performance for a given computational complexity can then be

achieved by appending to each block of samples of the transmit signal a cyclic prefix that is the same length as the shortened impulse response.” *Id.*

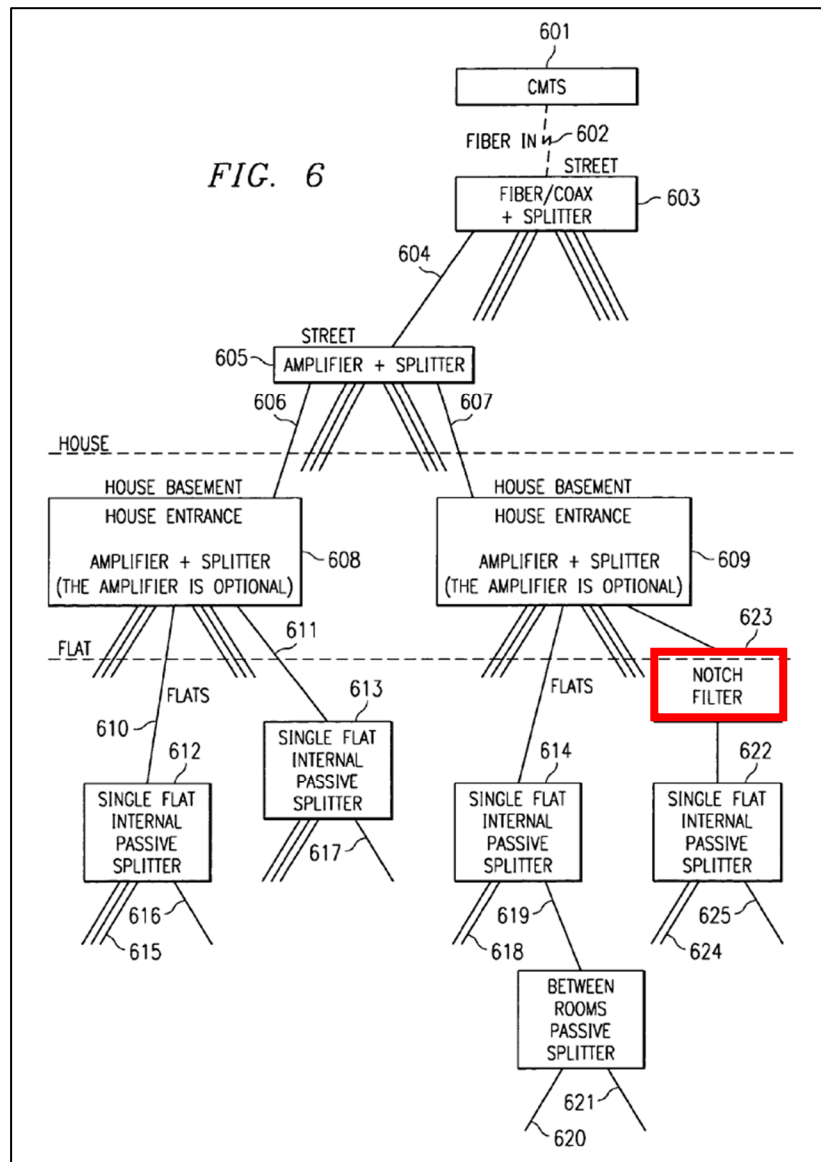
23. This is further supported by the articles cited by Jacobsen’s footnote 4. A Computationally Efficient Adaptive Transceiver for High-Speed Digital Subscriber Lines “presented the basic structure and the complexity of implementing the IDFT/DFT multichannel transceiver” and “describe[s] an efficient adaptive equalizer which serves to convert the channel response to an FIR one.” DISH-1034, 1753. The cited Chow dissertation also explains that “The key feature of our DMT system is the inclusion of a finite-length equalizer at the front-end of the receiver, in addition to the cyclic prefix that effectively ensures independence between successive blocks of data.” DISH-1035, iv.

24. Jacobsen teaches of equalization performed in a terminal device. Specifically, Jacobsen teaches of equalization in the “receiver,” which is a receiver within a home (*i.e.*, a terminal device). We know this because Jacobsen addresses “[t]he feasibility of offering high-speed interactive data services **to customers**” and teaches of equalization in the customer’s “**receiver**.” DISH-1007, 8, 14. A POSITA would thus understand that the equalization occurs in a terminal device. In fact, equalization was commonly employed within terminal devices well before the purported priority date of the ’249 Patent.

ii. Jacobsen would motivate changes to Amit’s LAN

25. I do not agree that Amit's notch filter disconnects the **home** from the regional cable network. Amit actually states that "the **HomeCN** is disconnected from the regional cable network." DISH-1005, 7:16-19. In my opinion, stopping the HomeCN frequencies from entering the regional network is not the same as disconnecting the entire home from the regional network.

26. Amit's notch filter teachings further explain this. For example, Amit repeatedly mentions the regional network, and Amit's HCNM communicates on "two data channels (that use different frequencies)" and can "support the capability to bridge information between [the] cable modem channel to the home-networking channel and vice versa." DISH-1005, 15:18-50. Amit's figures showing the notch filter also show a HCNM. A POSITA would thus understand that even though the "filter improves the isolation between the home network and other homes as well as the regional network," it does not prevent the HCNM from communicating with the regional network:



DISH-1005, 8:50-9:8.

28. In my opinion, a POSITA would combine Amit's notch filter teachings with references like Jacobsen that concern regional networks.

iii. Signal Interference is relevant to Amit and Jacobsen

29. A POSITA would thus look to Jacobsen to reduce signal interference.

Jacobsen states that "the bandwidth of ham signals can vary from fewer than 100

Hz to several megahertz.” DISH-1007, 9. Jacobsen explains that “[b]ecause **the frequency spectrum allocations for CATV and ham overlap**, receivers on leaky CATV networks can tune interfering ham signals along with the desired signals.” *Id.*

30. This interference is just one example of “interference from other signals” discussed by Jacobsen, which concludes that “an effective digital transmission scheme must be able to maintain a desired performance level in the presence of **interfering signals**.” *Id.*

31. Jacobsen also explains that “leaks in a CATV network caused by poorly shielded **consumer** devices or system hardware allow amateur radio (ham) signals to enter the CATV system.” DISH-1007, 9. A POSITA would thus understand that interference enters the network through devices in a building.

32. Amit’s two-frequency mode does not teach away from combining Jacobsen with Amit. In fact, Amit’s “two-frequency mode exists to **eliminate the echo**” by adding a “Transponder” “in the entrance of the home,” which “changes the signal frequency from the US frequency to the DS frequency and transmits it to the home.” DISH-1005, 20:15-31. On the other hand, Amit teaches of “notch filter reflection” where the “reflection from the notch filter is in the power of the signal or it might be higher,” such that “we can **use this reflection as our main signal**.” DISH-1005, 13:45-14:5.

33. In my opinion, a POSITA implementing Amit’s beneficial reflection would

not look to Amit's "two-frequency mode," as it addresses the reflection in a completely different way. Rather, a POSITA would have understood that reflections can be beneficial but can also be detrimental in some situations. As a result, a POSITA would have understood that reflections must be managed appropriately.

B. Ground 4

i. DSL-Book is analogous

34. In my opinion, DSL-Book is in the same field of endeavor as the '249 Patent. DSL-Book explains that "[m]any techniques developed for DSLs can be very useful **also for next-generation communication systems**, such as a **high-throughput home digital network**." DISH-1008, 12. DSL-Book also explains that it "**also** can be used as a reference guide" to "research studies in **digital communication systems**." *Id.*

35. I disagree with Mr. Bates and PO that the relevant field of endeavor should be limited to "local area broadband coaxial cable networks." To the contrary, the Technical Field of the '249 Patent states that "[t]his invention relates to **broadband communication networks** and specifically to **network interface devices and network wiring**." DISH-1001, 1:14-16.

36. In my opinion, the correct field of endeavor is communication techniques for broadband networks. The prior art in the Background section of the '249 Patent supports this understanding too. As one example, "Ethernet Transport Facility Over

Digital Subscriber Lines ... discloses a method of transporting Ethernet over **twisted pair lines.**” DISH-1001, 2:50-67. As a similar example, the “Humpleman patents disclose a home network using an active network interface unit to **couple the home network to the external network.**” *Id.*, 2:59-61. In my opinion, these references address communication techniques for broadband networks and not just local area coaxial cable networks.

37. I disagree with patent owner’s conclusion that DSL-Book’s “network structure and architecture relies on fundamentally different technologies from a local network in a single building over coaxial cable.” POR, 31. As explained above, DSL-Book teaches that it “can be very useful also for **next-generation communication systems**, such as a **high-throughput home digital network**” and “also can be used as a reference guide” to “research studies in **digital communication systems.**” DISH-1008, 12. In my opinion, a POSITA would use a textbook like DSL-Book as a general communication reference guide and wouldn’t look at the book solely for DSL networks.

38. In my opinion, DSL-Book would be one example of extrinsic evidence that a POSITA would look to in conjunction with Amit and Jacobsen at the time of the ’249 Patent.

39. Like Amit and Jacobsen, DSL-Book seeks to overcome network communication channel impairments. In my opinion, it is therefore reasonably

pertinent to the problem the '249 patent seeks to address, including the problem of providing a suitable path for terminal-to-terminal communication. In fact, DSL-Book recognizes that while “[t]he usable bandwidth of a twisted-pair telephone subscriber loop is much wider than the voice band telephony channel,” “the **channel distortion is also more severe** for using the full available bandwidth.” DISH-1008, 149. A POSITA reading DSL-Book would understand that it teaches communication techniques that provide a suitable path for communication, despite the channel impairments.

ii. DSL-Book’s twisted-pair network is not fundamentally different than a coaxial network

40. In the 1990s (the decade that preceded the '249 Patent), LANs transitioned from 10BASE5 to 10BASE-T. Note that 10BASE5 is a coaxial network, and 10BASE-T is a twisted-pair network. 10BASE-T was desirable due to low cost and the robustness to noise as well as the ubiquity of telephone wire in existing buildings. So, for Ethernet, the exact same protocols were used within the coaxial network (wired by 10BASE5) and the twisted-pair network (wired by 10BASE-T). The fact that DSL-Book highlights twisted pair is simply a reflection on the state of the art in wiring – twisted pair was cheaper and more robust.

41. In my first declaration, I covered several motivations to combine Amit with Jacobsen and DSL-Book. For example, the references disclose design and market trends toward faster broadband coaxial networks, address similar topics such as

high-speed communications, cable networks, and home networks, and address ways to overcome signal impairments on them, which would have led a POSITA to consider them together. I disagree that a POSITA would consider these motivations to simply recite a generic concern that exists across all systems, as patent owner contends. I also disagree with Patent Owner's conclusion that Amit teaches avoidance of DSL technologies and techniques to avoid interference with VDSL. POR, 39. First, Amit's system does not interfere with VDSL is because it operates on different frequencies and uses different carrier signals, so even if OFDM, equalization, TDD, and FEC were added to Amit's network, those techniques would not cause Amit's network to interfere with DSL. Second, the actual frequency overlap is irrelevant. What Amit can borrow from DSL-Book is not spectral allocation but modulation and error correction methods of the day, specifically OFDM, equalization, TDD, and FEC.

C. Ground 2

i. ADSL/VDSL is analogous

42. Like DSL-Book, ADSL/VDSL address topics such as high-speed communications and home networks, as well as ways to overcome signal impairments on them. In my opinion, ADVSL/VDSL is as analogous to the '249 Patent as DSL-Book.

43. While ADSL/VDSL focuses on twisted-pair networks, it recognizes that

“[c]able television delivered via **coaxial cable (coax)** is available throughout most of the United States” and “can handle high bandwidths, and **cable modems** take advantage of this.” DISH-1006, 15. ADSL/VDSL also provides an “overview of common protocols found in **LANs and WANs.**” Ex-2017, 267/333. ADSL/VDSL thus does purport to be directed to allowing communication between devices in a home or building.

44. In my opinion, ADSL/VDSL describes cable-agnostic techniques to provide a suitable path for terminal-to-terminal communication via, *e.g.*, OFDM, equalization, FEC, and TDD. DISH-1006, 166-203.

ii. A POSITA would combine ADSL/VDSL with Amit

45. As discussed above, a POSITA implementing Amit’s beneficial reflection would not look to Amit’s “two-frequency mode,” as it treats the reflection completely differently.

iii. Amit-ADSL/VDSL teaches of terminal device equalization

46. In my opinion, the combination of Ground 2 teaches of equalization performed by a terminal device. ADSL/VDSL explains that “[m]ost modern communications systems that operate near theoretical limits employ **equalization in the transmitter, receiver, or both** to optimize or nearly optimize transmission.” DISH-1006, 187. “Often the equalization is done digitally by adaptive digital filters,” which “provides a very flexible way to accommodate different types of

channels and different types of noise environments.” *Id.* These filters can be placed “in voice-band **modems**,” and a modem is one type of terminal device recognized by Amit. *Id.*; DISH-1005, 6:14-23. Therefore, ADSL/VDSL does teach of terminal device equalization.

V. Dependent Claim 17

A. Ground 3

47. In my experience, the use of beacon signals was common to synchronize TDD communications since well before the purported priority date of the '249 Patent. The Background section of the '249 Patent further supports this fact, as it acknowledges, via reference to Gibbs, that prior art TD-based protocols use beacon messages to synchronize nodes. DISH-1001, 2:42-59, 6:35-48. So, beacon signals are admitted prior art.

B. Ground 4

48. In my opinion, the “pilot tone” taught by ADSL/VDSL teaches the claimed “beacon message.” According to the '249 Patent, “[a]ll users are **synchronized** by a beacon message,” which “**provides a common time reference** to the users.” DISH-1001, 6:45-48. Pilot tones **synchronize the clock sources** at either ends of a transmission path. As such, it is my opinion that the pilot tone is a beacon message.

49. My first declaration further explained my analysis on this point, including why a POSITA would have understood that broadcasting a beacon message on the

network is a common way of synchronizing communications in TDM systems. DISH-1003, ¶¶95. I also explained why the pilot tone is a beacon message. *Id.*, ¶¶198, 374-75.

50. I also disagree with Patent Owner’s conclusion that “beacon messages on coaxial cable networks are part of ranging protocols” while pilot tones “us[e] a timing recovery circuit.” POR, 49. In this context, knowing time and knowing distance provide the same information. The distance a signal has traveled is equal to the velocity of the signal multiplied by the time it was traveling, and the velocity is constant (either the speed of light or slightly less). As such, knowing the distance the signal traveled is the same as knowing the amount of time the signal traveled, and knowing the amount of time the signal traveled is the same as knowing the distance the signal traveled. In other words, Patent Owner’s ranging protocol versus timing recovery distinction matters not.

C. Ground 2

51. In my opinion, a POSITA would consider both the ADSL teachings and the VDSL teachings when reading ADSL/VDSL. ADSL/VDSL states that SDMT “employs **many of the same fundamental blocks used in ADSL.**” DISH-1006, 296. And the SDMT transmitter and receiver “is **very similar to the DMT-based ADSL diagram** discussed in Chapter 7, ‘ADSL Modulation Specifics.’” *Id.*

52. I also disagree with Patent Owner’s ADSL/VDSL conclusion that “SDMT is

not synchronized by a pilot tone.” POR, 50. ADSL/VDSL states that, “[i]f all lines emanate from a single ONU, synchronization **might be feasible** by using a common clock.” DISH-1006, 301. Otherwise, “frame synchronization is much more difficult.” In my opinion, a POSITA reading ADSL/VDSL would understand that ADSL/VDSL is referring to other methods such as the synchronization via pilot tones taught earlier in ADSL/VDSL. *Id.*

VI. Independent Claims 1 and 5

A. Ground 3

i. Amit is not limited to single-carrier modulation

53. In my opinion, Amit is not limited to single-carrier modulation. As I explained in my first declaration, Amit can be implemented as either a single carrier or a multicarrier system. This is further supported by Amit’s teachings regarding the HCNM, which has a “single physical interface [that] contain[s] two data channels (that use different frequencies):” the “cable modem channel” contains “two sub-channels” and the “Home Networking channel” contains “a single channel.” DISH-1005, 15:18-28.

54. As I also explained in my first declaration, it is my opinion that improving bit rate would have led a POSITA to apply multicarrier modulation to the terminal devices in Amit’s home network.

55. I also disagree with Patent Owner’s conclusion that the “FFT/IFFT operations

are highly complex” and “require a significant increase in complexity for each terminal device, as taught by *Jacobsen*.” POR, 54. I further disagree with Mr. Bates’s statements regarding FFT/IFFT requiring a special chip to be added to any terminal device. DISH-1029, 96:20-97:8. In fact, I executed FFTs on PCs as early as 1988. This is further supported by Busigin, A. (1986). FFT software for the IBM PC. IEEE MICRO, 6(1), 6-6 and Press, W. H., Vetterling, W. T., Teukolsky, S. A., & Flannery, B. P. (1988). Numerical recipes (pp. 289-293). Cambridge University Press, London, England. *See* DISH-1036, DISH-1039.

56. This is further supported by the 1990 article cited in Jacobsen’s footnote 4. A Computationally Efficient Adaptive Transceiver for High-Speed Digital Subscriber Lines “presented the basic structure and the complexity of implementing the IDFT/DFT multichannel transceiver.” DISH-1034, 1753. The paper concluded that the “transmitter is very simple to implement since the modulating vectors are fixed.” *Id.* As such, FFTs were not even highly complex a decade before the ’249 Patent.

57. In fact, the FFT has been used in communications since the 1960s. *See* DISH-1038. FFTs were being implemented on general-purpose PCs using C language programs since the 1980s. *See* DISH-1039. And since the advent of IEEE 802.11a in 1999, the FFT was used to accomplish OFDM for WiFi in modems costing less than \$100. *See* DISH-1040. OFDM (by way of the FFT) has been used

to transmit and received digital video (DVB-T standard) since 1998. *See* DISH-1041.

58. I also disagree with Mr. Bates’s reading of Amit to require a typical end user to be able to implement Amit’s systems. DISH-1029, 162:6-20. In my opinion, it was not Amit’s goal to have an end user be able to modify the terminal devices. Instead, the proper inquiry is what a POSITA would be motivated and capable of doing at the time of the purported invention.

ii. Amit teaches Claim 1

59. In my opinion, a POSITA would have found it obvious for Amit’s terminal devices to provide frequency bins with more transmit bits where the SNR is high. Amit’s modem is a terminal device that communicates on “two data channels,” where the “cable modem channel” contains “two sub-channels” and the “Home Networking channel” contains “a single channel.” DISH-1005, 15:18-28. Amit selects a modulation method “**according to the channel conditions**,” so a POSITA would have understood that, where a channel’s SNR is high (*i.e.*, good channel conditions), a higher modulation method is selected (*e.g.*, QAM 64) providing more transmit bits (*i.e.*, higher bits/sec). *Id.*, 8:30-39; DISH-1003, ¶82.

60. I also disagree with Patent Owner’s conclusion that a POSITA implementing Amit’s system would be unable to make multiple modulation selections for multiple subchannels. POR, 56. In fact, Amit’s modem already communicates on multiple

sub-channels, so a POSITA would find it obvious to implement multiple sub-channels where each's modulation method is “**based on channel conditions**” (*i.e.*, the SNR). DISH-1005, 15:23-25. Moreover, FIG. 5 of Amit shows multiple “HomeCN channels,” and a POSITA would find it obvious to use these channels in a single home network. DISH-1005, 7:61-63. For example, this is further supported by the teachings in Van der Perre, L., Thoen, S., Vandenameele, P., Gyselinckx, B., & Engels, M. (1998, November). Adaptive loading strategy for a high speed OFDM-based WLAN. In IEEE GLOBECOM 1998 (Cat. NO. 98CH36250) (Vol. 4, pp. 1936-1940). IEEE. DISH-1037. Van der Perre teaches an adaptive loading strategy based on “dips in the frequency spectrum of the indoor multi-path channel.” DISH-1037, 1936. The idea is simple: based on the channel conditions, as characterized by the SNR, more bits can be transmitted in a channel of high SNR and fewer bits in a channel of low SNR. Specifically, Van der Perre states, “By measuring the channel and identifying dips and peaks in the spectrum, the transmission can be optimized. In particular, adaptive loading adjusts the number of bits assigned to a specific carrier, to the SNR of this carrier.” DISH-1037, 1938. A POSITA would know that the modulation of subchannels of Amit could be handled differently in the sense that more bits could be transmitted in a subchannel of high SNR. For example, Amit teaches quadrature amplitude modulation (QAM) 16, QAM 64, and QAM 256, which are QAM constellations of 4, 6, and 8 bits, respectively. DISH-1005, 8:30-32.

In view of Van der Perre and the knowledge/experience of the POSITA, Amit could use QAM 16 in low SNR channels and QAM 256 in high SNR, which is an example of well-known bit loading.

iii. Jacobsen's techniques are performed by a terminal device

61. As discussed above, I disagree with Patent Owner's conclusion that Jacobsen's teachings are not performed in terminal devices. POR, 57. Jacobsen explains that "the bit distribution is continuously updated during transmission as **the receiver sends the required information to the transmitter** on secure overhead channels," and "[i]f the noise on a subchannel becomes severe while the system is in use, **the transmitter simply assigns fewer or no bits** to that subchannel while the noise persists." DISH-1007, 10. Because both the receiver and transmitter participate in providing the frequency bins with more transmit bits, a POSITA would understand that the terminal devices perform this limitation.

B. Ground 2

62. Amit teaches that the modulation method will change according to the channel conditions. Moreover, a POSITA reading Amit would understand that Amit teaches of changing methods, as "the home networking device **MUST provide QPSK and QAM 16**" and "is required to supply a **scaleable bandwidth range**." DISH-1005, 8:33-34, 19:1-2.

63. I also disagree with Patent Owner's conclusion that "[n]othing in

ADSL/VDSL or the Petition would suggest implementing OFDM/DMT functionalities into a terminal device to provide frequency bins.” POR, 60. ADSL/VDSL teaches that “DMT builds on some of the ideas of QAM,” and Amit’s terminal devices use QAM. DISH-1006, 166; DISH-1005, 8:30-36. In my opinion, a POSITA building upon QAM using ADSL/VDSL would do so in Amit’s terminal devices.

C. Ground 1

64. My first declaration devoted over three pages to explaining why a POSITA would arrive at the modulation technique in Claim 1 and included citations to supporting references. DISH-1003, ¶82 (citing DISH-1013–1014).

65. I also disagree with Patent Owner’s conclusion that Ground 1 “rel[ies] on two incompatible embodiments of *Amit*” just because Patent Owner believes the “frequency allocation” teachings apply only to “the Connected Home embodiment.” POR, 62. In my understanding, Figure 5 of Amit “presents a frequency allocation that may be employed by **the present invention**” and not just the Connected Home mode. DISH-1005, 5:28-29. Moreover, Amit teaches that the same HomeCN components can work in Single Home mode or Connected Home mode, so in my opinion, Amit’s modes are not properly categorized as “embodiments” and a POSITA would consider both modes’ teachings together.