UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DISH NETWORK LLC,
Petitioner

v.

ENTROPIC COMMUNICATIONS, LLC,
Patent Owner

Case IPR2024-00373
Patent 7,594,249 B2

PETITIONER'S REPLY TO PATENT OWNER'S RESPONSE

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LIST OF EXHIBITS

DISH-1001	U.S. Patent 7,594,249 to Gurantz *et al.* ("the '249 patent")
DISH-1002	Excerpts from the Prosecution History of the '249 Patent ("the Prosecution History")
DISH-1003	Declaration of Dr. Scott Acton
DISH-1004	Curriculum Vitae of Dr. Scott Acton
DISH-1005	U.S. Patent 7,127,734 to Amit et al. ("Amit")
DISH-1006	Excerpts from Dennis J. Rauchmayer, *ADSL/VDSL Principles*, 1999 ("ADSL/VDSL")
DISH-1007	Jacobsen et al., *An Efficient Digital Modulation Scheme for Multimedia Transmission on the Cable Television Network*, 43rd Annual National Cable Television Association Convention and Exposition, New Orleans, LA. 1994 ("Jacobsen")
DISH-1008	Excerpts from Walter Y. Chen, *DSL: Simulation Techniques and Standards Development for Digital Subscriber Lines*, 1998 ("DSL Simulation Techniques")
DISH-1009	Proof of Service of Summons and Complaint on DISH Network Corporation in *Entropic Communications, LLC v. DISH Network Corporation et al.*, Case 2:23-cv-01043, ECF No. 14 (C.D. Cal. Feb. 23, 2023)
DISH-1010	Weinberg, G. (1972). Cost Analysis of CATV Components. Final Report. ("Weinberg")
DISH-1011	Dodds, D. E., & Swanson, L. (1999, August). Simultaneous voice and Internet data on rural subscriber lines. In 1999 IEEE Pacific Rim Conference on Communications, Computers and Signal Processing (PACRIM 1999). Conference Proceedings (Cat. No. 99CH36368) (pp. 18-21). IEEE. ("Dodds")

DISH-1012	Maxemchuk, N., & Netravali, A. (1985). Voice and Data on a CATV Network. IEEE Journal on Selected Areas in Communications, 3(2), 300-311 ("Maxemchuk")
DISH-1013	Jacobsen, K. S. (1997, November). Synchronized Discrete Multi-Tone (SDMT) Modulation for Cable Modems: Making the Most of the Scarce Reverse Channel Bandwidth. In WESCON/97 Conference Proceedings (pp. 374-380). IEEE. ("Jacobsen-2")
DISH-1014	Fryxell, D., Lanning, S., & Sirbu, M. (1999). Broadband Access Networks and the Emergence of Voice over IP (VoIP): an Economic Analysis for Cable and ADSL. In 27th Annual Telecommunications Policy Research Conference, Alexandria, VA ("Fryxell")
DISH-1015	Lipoff, S. J. (1994). Personal communications networks bridging the gap between cellular and cordless phones. Proceedings of the IEEE, 82(4), 564-571 ("Lipoff")
DISH-1016	S. Ovadia, "Advanced upstream CATV access technologies and standards," 1999 Digest of the LEOS Summer Topical Meetings: Nanostructures and Quantum Dots/WDM Components/VCSELs and Microcavaties/RF Photonics for CATV and HFC Systems (Cat. No.99TH8455), San Diego, CA, USA, 1999, pp. IV35-IV36 ("Ovadia")
DISH-1017	Roden, M. S. (1985). Analog and digital communication systems. Prentice-Hall, Inc. ("Roden")
DISH-1018	Jorasch, R., & Price, K. (1988, March). Advanced satellite system architecture for VSATs with ISDN compatibility. In 12th International Communication Satellite Systems Conference ("Jorasch")
DISH-1019	Smalley, D. (1994). Equalization concepts: a tutorial. Atlanta Regional Technology Center, Texas Instruments ("Smalley")

DISH-1020	Santella, G., & Mazzenga, F. (1998). A hybrid analytical-simulation procedure for performance evaluation in M-QAM-OFDM schemes in presence of nonlinear distortions. IEEE Transactions on Vehicular Technology, 47(1). ("Santella")
DISH-1021	Corvaja, R., Costa, E., & Pupolin, S. (1998, October). Analysis of M-QAM-OFDM transmission system performance in the presence of phase noise and nonlinear amplifiers. In 1998 28th European Microwave Conference (Vol. 1, pp. 481-486). IEEE.
DISH-1022	Declaration of June Munford
DISH-1023	Excerpts from the Prosecution History of U.S. Patent 7,127,734 to Amit ("the Amit Prosecution History")
DISH-1024	Federal Court Management Statistics for September 2023 published by the Administrative Office of the U.S. Courts, retrieved from https://www.uscourts.gov/sites/default/files/data_tables/fcms_na_distcomparison0930.2023.pdf
DISH-1025	Order Granting Stipulation Setting Claim Construction Schedule, *Entropic Communications, LLC v. DISH Network Corporation et al*., Case 2:23-cv-01043-JWH-KES (CDCA)
DISH-1026	LegalMetric Time to Trial Report, Central District of California, Patent Cases (Jan. 2023 – Nov. 2023)
DISH-1027	Declaration of Michael J. Ballanco in Support of Motion for *Pro Hac Vice* Admission
DISH-1028	Declaration of Aaron P. Pirouznia in Support of Notice of Intent to Designate a Provisionally Recognized PTAB Attorney
DISH-1029	Deposition Testimony of Mr. Regis J. Bates, Jr. (January 7, 2025)
DISH-1030	Second Declaration of Dr. Scott Acton

DISH-1031	Second Declaration of June Munford
DISH-1032	Czylwik, 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 Handbook*, 4th ed., July 2001

I. Introduction

Patent Owner ("PO") cannot contest that Amit teaches the patent's supposedly novel feature—a filter tuned to "**reject** network signals originating in the building, such that the network signals … are **reflected** back into the building" for device-to-device communication. Instead, PO attacks the Petition's combinations by overly limiting the relevant art, ignoring Amit's teachings, and importing limitations. Each attack fails, and Petitioner thus respectfully requests cancellation of all claims.

II. A POSITA Would Consider Known Techniques

The Patent Owner's Response ("POR") repeatedly argues that a POSITA would not consider combining long-known communication techniques like OFDM, Equalization, and TDD into Amit's network. POR, 14-16. According to PO, these techniques would only be used in twisted-pair, wide area networks—not a coaxial LAN. *Id.* PO's expert, however, disagrees:

OFDM (Orthogonal Frequency Division Multiplexing)

> Q. So you mentioned that broadband LANs used OFDM as early as the 90s; right?
> A. Could be, yeah.
> …
> Q. In your experience, are modulation schemes like OFDM cable specific or cable agnostic?
> A. I think OFDM would have been agnostic.
> …

> Q. Would you expect a POSITA at the time of '249 patent to be familiar with multicarrier modulation?
> A. A POSITA probably would because we have said that OFDM had existed before that.
> …
> Q. If I'm making an OFDM timeline, the first entry is OFDM's use in cable and then afterwards we have OFDM's use in DSL; right?
> A. I would say yeah, we were looking at OFDM in cable first and then later in DSL.

Signal Equalization

> Q. When did you first encounter equalization?
> A. Oh, Lord. … probably in the late 60s maybe.
> …
> Q. Would a system designer look to equalization in any network that is experiencing reflections?
> A. I don't see why they wouldn't.

TDD (Time Division Duplexing)

> Q. Is TDD used in LANs and WANs?
> A. It could be used depending on the LAN, depending on the WAN.
> …
> Q. Is it fair to say the use of beacon signals was common in TDD communication systems in the 1990s?
> A: I think it probably would have been, yes.

DISH-1029, 23:1-5, 32:15-17, 50:9-11, 65:6-8, 90:5-7, 92:23-93:2, 136:19-22, 156:5-9. Both experts are thus aligned with the position set forth in the Petition—a POSITA would have applied these long-known techniques in LANs **and** WANs, whether coaxial **or** twisted-pair. *Id.*; DISH-1030, ¶¶7-18 (citing DISH-1042); Pet., 27-36, 62-67, 75-81. Indeed, PO's assertion that ADSL/VDSL and DSL-Book are

non-analogous art is belied by the '249 Patent citing these references as pertinent. DISH-1001, 8:55-60.

III. Patent Owner Misreads Amit's Teachings

In attacking the motivations to combine, PO relies on three repeated misconceptions about Amit—(1) its modes are incompatible embodiments, (2) its filter disconnects the home from regional networks, and (3) it only uses single-carrier modulation.

First, Amit's Connected Home and Single Home **modes** are not incompatible **embodiments**. PO argues that Amit "discloses two different, **incompatible architectures** … differentiated by the presence or absence of a notch filter." POR, 10.[1] To the contrary, Amit teaches of an optional notch filter that can be used in multiple embodiments—"FIG. 2 shows an example of **a preferred embodiment**" where "a filter is optional," and FIG. 7 depicts the optional "Notch Filter" using a dotted line. DISH-1005, 5:22-24.

[1] All emphasis added unless otherwise stated.

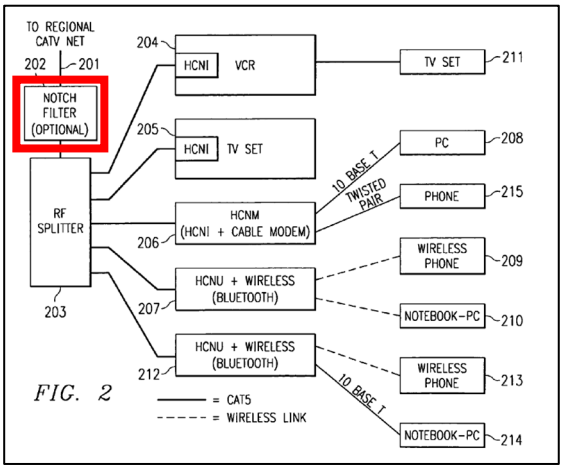


FIG. 2

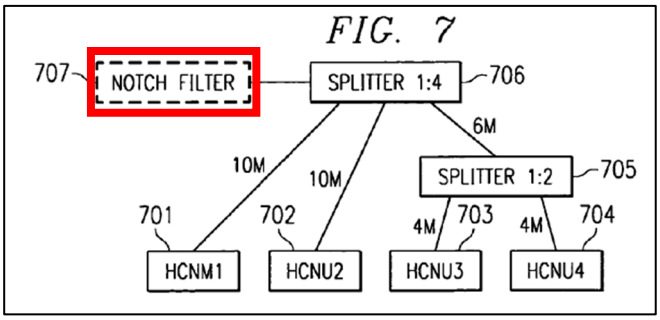


FIG. 7

The notch filter is optional because Amit's Home Cable Network ("HomeCN") "**Supports Two Operation <u>Modes</u>**: Single Home operation mode," which "require[s] a notch filter" and "Connected home operation mode," which "does not require a Notch Filter." *Id.*, 7:24-30. Amit's devices are operational in either mode, as "[t]he management system configures the components to the appropriate mode after initialization." *Id.*, 7:48-50. Thus, while a "[n]otch filter added to **the home network design** usually reduces the price and increases the performance of the home networking." it is not indicative of two incompatible embodiments. *Id.*, 7:44-46.

Second, Amit's notch filter prevents the home network frequencies from entering the regional cable network—it does not disconnect the home altogether. As the Institution Decision ("ID") correctly recognized, Amit's "devices interface between the regional cable TV network and the in-home network." ID, 23-24. PO argues otherwise, selectively quoting Amit to argue that when "the notch filter is

present, … the **home is 'disconnected** from the regional cable network.'" POR, 11. But PO confuses the overall home with the in-home HomeCN network, as Amit actually states that "the **HomeCN is disconnected** from the regional cable network." DISH-1005, 7:16-19. In other words, the HomeCN frequencies are kept within the home by the notch filter, but terminal devices like the HomeCN Modem ("HCNM") communicate on "two data channels (that use different frequencies)" and "support the capability to bridge information between [the] cable modem channel to the home-networking channel." DISH-1005, 15:18-50. The ID thus correctly identified Amit's association with the regional network.

Third, Amit is not limited to single-carrier modulation. The POR mistakenly concludes that "*Amit* is completely silent regarding any multi-carrier technology." POR, 12. But Amit teaches of terminal devices using multicarrier transmissions, as the HCNM modem has a "single physical interface [that] contain[s] **two data channels** (that use different frequencies)": the "cable modem channel" containing "**two sub-channels**" and the "Home Networking channel." DISH-1005, 15:18-28. Amit also teaches of FDM, which both experts agree OFDM is based on. *Id.*, 26:9-67; DISH-1003, ¶106; Ex-2007, ¶89. PO thus wrongly characterizes Amit as incompatible with multicarrier modulation.

IV. Independent Claim 10

A. Ground 3

1. Jacobsen does not discourage adding equalization to Amit

Petitioner respectfully highlights Jacobsen's footnote 4, which did not appear in the ID's analysis. Pet., 70. Consequently, the ID reasoned that "Jacobsen prefers multicarrier modulation over single carrier modulation with equalization, so a POSITA considering it with Amit and DSL-Book **would not have sought to use Jacobsen's equalization in Amit's multicarrier system**." ID, 44. Jacobsen's footnote 4, however, teaches that multicarrier systems "[i]n actuality … **implement[] a time-domain equalizer** (TEQ), the purpose of which is to reduce the required length of the cyclic prefix." DISH-1007, 12, n.4 (citing DISH-1034-35). 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." *Id.*, 9. A POSITA would thus be motivated to add equalization to a multicarrier system to reduce the cyclic prefix length. DISH-1030, ¶¶16-24 (citing DISH-1033-35).

A POSITA would also be motivated to add equalization because Jacobsen consistently teaches that equalization combats interference and improves system performance, regardless of the modulation type. Jacobsen explains that "an equalizer is used to reduce the ISI, thereby improving the performance of the [single-carrier QAM] system." DISH-1007, 9. And because "a portion of every block is

wasted by the inclusion of the cyclic prefix," Jacobsen also uses equalization in multicarrier modulation "to reduce the required length of the cyclic prefix," improving performance. *Id.*, 9, 12, n.4. Moreover, both experts agree that POSITAs knew of equalization and that "a system designer [would] look to equalization in **any network that is experiencing reflections**." DISH-1029, 32:15-17; DISH-1003, ¶184.

Added complexity would not dissuade a POSITA from adding equalization. While the ID is correct "that Jacobsen teaches that multicarrier modulation performs better than single carrier modulation with equalization at least **by some measures under some circumstances**" (ID., 38), this is because Jacobsen's multicarrier system "is more computationally efficient." DISH-1007, 15. A POSITA properly weighing the benefits would not write-off all equalization as prohibitively complex, especially when Jacobsen teaches of multicarrier modulation with equalization. DISH-1007, 12, n.4; DISH-1030, ¶¶16-24 (citing DISH-1032-35); *see Winner Int'l Royalty Corp. v. Wang*, 202 F.3d 1340, 1349 n.8 (Fed. Cir. 2000) ("[t]he fact that [a] motivating benefit comes at the expense of another benefit … should not nullify its use as a basis to modify the disclosure of one reference with the teachings of another").

PO mistakenly concludes that "Jacobsen's equalization is performed external

to the terminal devices." POR, 19. PO reaches this conclusion by relying on its rejected argument that "*Jacobsen* is silent regarding the operations of devices within a LAN network and instead is directed to a regional CATV network." *Id.* In addressing this argument, the ID correctly found that "[t]he distinction Patent Owner attempts to draw between Amit's in-home network and Jacobsen's out-of-home network is unavailing" because Amit's "devices interface between the regional cable TV network and the in-home network." ID, 23-24. Indeed, Jacobsen addresses "[t]he feasibility of offering high-speed interactive data services **to customers**" and teaches of equalization in the customer's "**receiver**"—a terminal device. DISH-1007, 8, 14. PO's argument thus fails.

2. Jacobsen would motivate changes to Amit's LAN

PO doubles-down on its rejected LAN versus WAN argument, devoting an entire subsection to arguing that "[a] POSITA would not have attempted to modify or improve *Amit's* Single Home LAN based on Jacobsen's teachings about regional networks." POR, 21. As explained above, the ID rejected this argument because Amit's "devices interface between the regional cable TV network and the in-home network." ID, 23-24. Indeed, PO mistakenly concludes that the notch filter "ensures the **home** is 'disconnected from the regional cable network,'" when Amit actually states that "the **HomeCN** is disconnected from the regional cable network."

Compare POR, 11 with DISH-1005, 7:16-19; *see* DISH-1030, ¶¶25-28.

Amit makes clear that even when the notch filter is present, the HCNM modem communicates with the regional network and the HomeCN using "two data channels (that use different frequencies)" and "support[s] the capability to bridge information between [the] cable modem channel to the home-networking channel and vice versa." DISH-1005, 15:18-50. Indeed, Amit's figures showing the notch filter also show a HCNM, so 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:

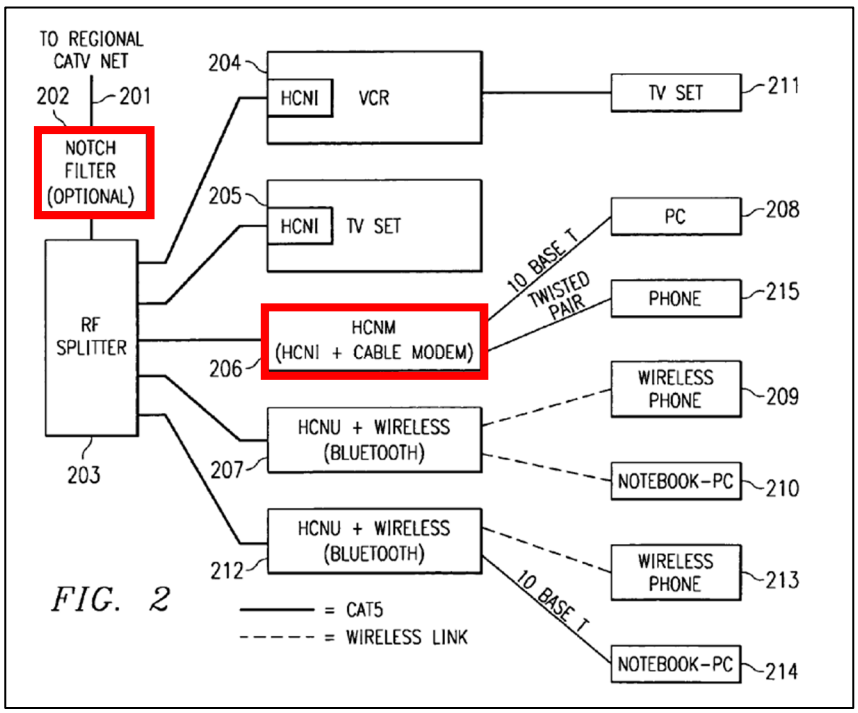
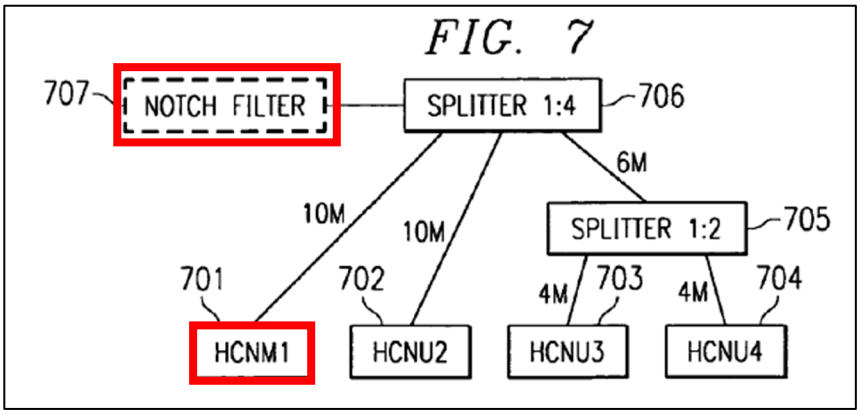


FIG. 2



Id., 6:29-33; FIGs. 2, 7. The ID is thus correct that a POSITA would combine Amit's notch filter teachings with references like Jacobsen that concern regional networks.

3. Signal Interference is relevant to Amit and Jacobsen

PO's "first" and "second" arguments regarding signal interference and the Amit-Jacobsen combination fail. POR, 22-24; DISH-1030, ¶¶29-33.

PO's "first" argument conflates **bandwidth** with **frequency range**. Specifically, PO argues that "a POSITA would not look to reduce signal interference in *Amit* with *Jacobsen* … because the **ham-radio signals** that *Jacobsen* addressed 'vary from fewer than 100 Hz to several megahertz[,]' [so] they **do not overlap** with, **or interfere** with, the band used on *Amit's* LAN." POR, 22 (quoting DISH-1007, 9). But Jacobsen actually states that "the **bandwidth of ham signals** can vary from fewer than 100 Hz to several megahertz"—not the **frequency range**. DISH-1007, 9. In other words, PO relies on a quote addressing the measurement of the ham band's width to mistakenly conclude the signals "**do not overlap** [] **or interfere**"

even though Jacobsen states "the frequency spectrum allocations for CATV and ham **overlap**, [meaning] receivers on leaky CATV networks can tune **interfering ham signals** along with the desired signals." *Id.* Indeed, Jacobsen concludes that "an effective digital transmission scheme must be able to maintain a desired performance level in the presence of **interfering signals**," so a POSITA would look to Jacobsen to mitigate signal interference. *Id.*

PO also incorrectly concludes that communications "entirely within a building" necessarily "face significantly less interference from external signals." POR, 23. Jacobsen again states the opposite, as "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. Jacobsen thus teaches of combating external interference that enters the network within a building.

PO's "second" argument cherry-picks statements from an embodiment that the Petition's combination does not rely on. Specifically, PO argues that "[a] POSITA would have no reason to look for other solutions for ISI other than" Amit's "two-frequency mode." POR, 23-24. This incorrectly reads Amit.

Amit discusses multiple types of interference that may arise in LAN configurations. PO focuses solely on Amit's "two-frequency mode exist[ing] to **eliminate the echo**" by adding a "Transponder" "in the entrance of the home," which

"changes the signal frequency from the US/[upstream] frequency to the DS/[downstream] frequency and transmits it to the home." DISH-1005, 20:15-31. This is illustrated in the Fig. 20 embodiment, which contains **no notch filter** and is therefore not cited by the Petition:

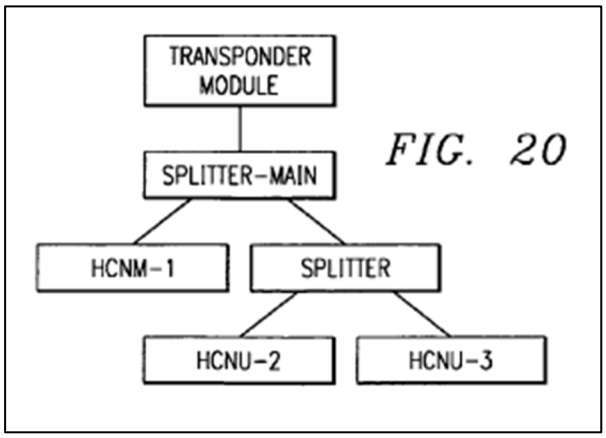


FIG. 20

Instead, the Petition relies on Amit's other configurations that take advantage 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**." Pet., 13 (quoting DISH-1005, 13:45-14:5). This matches the purportedly "novel" feature of the '249 Patent.

A POSITA implementing Amit's notch-filter-reflection would not look to Amit's "two-frequency mode," as each takes a different approach to reflections. Indeed, as the ID recognized, a POSITA "would have understood that **reflections can be beneficial** in facilitating communications between in-home network devices, **but can also be detrimental** in some cases, and would have understood that

reflections must be managed appropriately on the networks." ID, 24. PO argument does not undercut this understanding.

4. Jacobsen is prior art

PO incorrectly asserts that "[t]here is no evidence that a POSITA would have been able to identify *Jacobsen*." POR, 24-26. Yet, PO's own expert knew of Jacobsen from his work in the industry. DISH-1029, 52:10-55:1. Nevertheless, Petitioner submits a second Declaration of Ms. Munford, which confirms Jacobsen was publicly accessible before the critical date. DISH-1031, ¶¶3-18 *VidStream LLC v. Twitter, Inc.*, 981 F.3d 1060, 1065-67 (Fed. Cir. 2020) (affirming PTO's finding of public accessibility based on new evidence in reply).

B. Ground 4

1. DSL-Book is analogous

a) DSL-Book is in the '249 Patent's field of endeavor

PO ignores DSL-Book's teachings to mistakenly conclude 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. But DSL-Book recognizes 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** can be used as a reference guide" to "research studies in **digital communication systems**." *Id.* PO's

expert agrees, explaining that, "[a]t the time of the patent, the DSL books were published, so that would be extrinsic evidence that we could look to." DISH-1029, 120:17-121:2. DSL-Book is thus in the '249 Patent's field of endeavor. DISH-1030, ¶¶34-39.

PO also overly limits the relevant field of endeavor to "local area broadband coaxial cable networks." The "Technical Field" section 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. Indeed, claim 1 does not reference coaxial cable, and instead claims "A **signal distribution network**." *Id.*, Cl. 1. The Petition thus correctly identified the field of endeavor as communication techniques for broadband networks. Pet., 76.

The prior art addressed in the Background section of the '249 Patent further evinces this. For example, "Ethernet Transport Facility Over **Digital Subscriber Lines** … discloses a method of transporting Ethernet over **twisted pair lines**." DISH-1001, 2:50-67. Similarly, 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. These references address communication techniques for broadband networks—not just local area coaxial cable networks. And if these references were from a different field of endeavor than the '249 Patent, they would

not have been "incorporated herein by reference." *Id.*, 2:55-56.

PO's reliance on the *Clay* and *Wang* decisions is misplaced. *Clay* concerns gels—not communication techniques—and held that "the **storage** of refined liquid hydrocarbons" in a tank concerned a different field of endeavor than "the **extraction** of crude petroleum" from the ground. 966 F.2d 656, 659 (Fed. Cir. 1992). PO identifies no such analogous distinction here. Regarding *Wang*, that decision actually held that substantial evidence supported a jury's presumed field of endeavor finding because the prior art "involves memory circuits … of **varying sizes**" and "in contrast, the subject patents teach **compact** modular memories." *Wang Labs., Inc. v. Toshiba Corp.*, 993 F.2d 858, 864-65 (Fed. Cir. 1993). PO again identifies no such analogous distinction or finding to defer to.

b) DSL-Book is reasonably pertinent to the '249 Patent's problem

The Petition correctly explained that DSL-Book "seek[s] to overcome network communication channel impairments" and is thus "reasonably pertinent to the problem the '249 patent purports to address—'providing a suitable path for terminal-to-terminal communication.'" Pet, 77. Indeed, 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. DSL-Book thus

teaches communication techniques that provide a suitable path for communication, despite the channel impairments. DISH-1030, ¶¶34-39.

PO mistakenly concludes that DSL-Book's teachings are "**irrelevant** to the problem of the '249 Patent" solely because they are in the context of a twisted-pair network. POR, 33-34. But DSL-Book states that it "can be used as a reference guide" for more than just twisted-pair networks, as it "can be very useful also for **next-generation communication systems**, such as a **high-throughput home digital network**." DISH-1008, 12. Indeed, PO's expert agrees that the DSL-Book techniques of OFDM, equalization, and TDD apply to a variety of communication networks—not just twisted-pair. DISH-1029, 32:15-17, 65:6-8, 90:5-7, 156:5-9.

PO's expert, Mr. Bates, contradicts PO's contention that "there would be no reason to look to the OFDM teachings" of DSL-Book "[a]bsent the '249 Patent's explicit reference." POR, 34. Mr. Bates acknowledged that OFDM was "initially developed for use in cable television systems" before being used in DSL. Ex-2007, ¶89. According to Mr. Bates, DSL adopted OFDM **because** it was being used in coaxial networks. DISH-1029, 52:10-54:2, 58:19-59:6, 156:5-9.

2. DSL-Book's twisted-pair network is not fundamentally different than a coaxial network

Mr. Bates also disagrees with PO's contention that coax networks are "fundamentally different" than twisted-pair networks. POR, 35-39. While PO

argues that "differences in **physical medium** result in **significant differences** in which communication techniques are appropriate for DSL and cable networks," Mr. Bates repeatedly testified that a single network will often use both twisted-pair and coaxial cable. DISH-1029, 44:6-12 ("Back in the '60s and '70s … the telcos were using coaxial cable"); 85:3-5 ("Q: In the 80s and 90s was it common to have LANs that used both twisted pair and coax in a single network? A: Sure."). Indeed, when asked by PO "how much time have you spent over your 50 years working on coaxial networks," Mr. Bates explained "I never really looked at it that way because I built … networks with fibers[,] … with **twisted pair**, T1s, **and coaxial cable**." *Id.*, 207:14-19.

The POR also attacks a strawman instead of the proposed combination. PO argues that "the proposed combination would actually result in a ***lower*** performance" because the "ADSL transmission throughput" was lower than "Coaxial networks at the time." POR, 37 (emphasis in original). But Petitioner does not propose replacing Amit's coaxial network with a DSL network. Instead, as the ID correctly understood, "Petitioner contends that a POSITA would have been motivated to incorporate **various features** from DSL-Book, including OFDM, equalization, TDD protocol, and FEC, into the Amit-Jacobsen combination." ID, 40.

PO also ignores Petitioner's motivations to combine. As the ID correctly

recognized, "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." ID, 41. Petitioner did not simply provide a "generic concern that exists across all systems" as PO contends. POR, 38.

Nor is PO correct that "*Amit* teaches avoidance of **DSL technologies and techniques** to avoid interference" with VDSL. POR, 39. As PO correctly recognizes, "*Amit's* system does not interfere with VDSL simply because it **operates on different frequencies** and **uses different carrier signals** on a different medium." *Id.*, 38. Therefore, even if OFDM, equalization, TDD, and FEC were properly considered "**DSL** techniques and techniques" (they're not), those techniques would not cause Amit's network to interfere with DSL.

In sum, DSL-book is analogous art, which is exactly why the '249 Patent cited it. Both experts agree that the relevant communication techniques are cable and network agnostic, and a POSITA would thus readily arrive at the combination of Ground 4. DISH-1030, ¶¶40-41.

C. Ground 2

Ground 2 teaches all claims based on the Amit-ADSL/VDSL combination—

not Jacobsen. As such, the claims should be cancelled under Ground 2, irrespective of Jacobsen's equalization. And while the ID did not reach Ground 2, its reasoning regarding DSL-Book applies to ADSL/VDSL too.

1. ADSL/VDSL is analogous

PO's ADSL/VDSL arguments rehash its DSL-Book arguments, which the ID rejected because the "references address similar topics such as high-speed communications, cable networks, and home networks, and address ways to overcome signal impairments on them." ID, 41. ADSL/VDSL also addresses these same networks and ways to overcome signal impairments on them. Pet., 28-36. Indeed, like DSL-Book, ADSL/VDSL is so analogous that the '249 Patent cites it. DISH-1001, 8:55-60.

As explained above, PO's proposed field of endeavor is overly narrow. Nevertheless, ADSL/VDSL is analogous under either field: "broadband networks, including the communication protocols of such networks," or "local area broadband coaxial networks." While ADSL/VDSL does refer to 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.

PO is thus incorrect that ADSL/VDSL "does not purport to be, directed to allowing communication between devices in a home or building." POR, 42; DISH-1030, ¶¶42-44.

2. A POSITA would combine ADSL/VDSL with Amit

PO once again largely rehashes the DSL-Book arguments addressed above.

PO also refers to Amit's two-frequency mode as "an **alternative solution** to resolve the issue equalization supposedly solves." POR, 42. But as discussed above, a POSITA would look to Amit's notch-filter-reflection configuration and not Amit's "two-frequency mode" configuration. Moreover, "mere disclosure of **alternative designs** does not teach away" where "such disclosure does not criticize, discredit, or otherwise discourage the solution claimed." *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004). Amit's two-frequency mode thus does not preclude the proposed combination. DISH-1030, ¶¶32-33, 45.

3. Amit-ADSL/VDSL teaches terminal device equalization

PO is wrong that the ADSL/VDSL's equalization is "not implemented in terminal devices, or any devices that Amit's in-premise coaxial network use." POR, 45. 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.* ADSL/VDSL teaches of placing these filters "in voice-band **modems**," and a modem is one type of terminal device recognized by Amit, so PO's argument fails. *Id.*; DISH-1005, 6:14-23; DISH-1030, ¶46.

V. Dependent Claims 11-16

Like PO, Petitioner incorporates its claim 10 arguments.

VI. Dependent Claim 17

Claim 17 merely adds TDD synchronized by a beacon message, which PO's expert admits was well-known in the 1980s-90s. DISH-1029, 92:23-93:2. This aligns with the Background section of the '249 Patent, which 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. Indeed, Mr. Bates could not name an alternative synchronization scheme for TDD—only T1 TDM. DISH-1029, 90:15-91:4. Claim 17 should thus be invalidated under any Ground.

A. Ground 3

PO admits Amit teaches "TDM requir[ing] synchronization" (POR, 47) and does not dispute that TDD is the application of TDM to separate outgoing and incoming signals (Pet., 26). Instead, PO contends Amit's teachings are insufficient because Amit uses TDM for "the allocation of channels across different home

networks," so "Amit does not **simultaneously** disclose a network with a filter … and utiliz[ing] TDM." POR, 47. But as explained above, Amit's filtered networks communicate with the regional network via a modem, and Mr. Bates testified that TDD could be used in WANs and LANs. DISH-1029, 89:15-90:7. Moreover, a POSITA "is also a person of ordinary creativity, not an automaton," so **simultaneous** disclosure is unnecessary. *KSR Int'l Co. v. Teleflex Inc*., 550 U.S. 398, 421 (2007); *see* DISH-1030, ¶47.

B. Ground 4

PO's distinction between a "pilot tone" and a "beacon message" fails. POR, 48-49. 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. PO concedes that "Pilot tones **synchronize the clock sources** at either ends of a transmission path." POR, 49. As such, a pilot tone is a beacon message. DISH-1030, ¶¶49-50.

PO imports limitations by arguing that "beacon messages on coaxial cable networks are part of ranging protocols" while pilot tones "us[e] a timing recovery circuit." POR, 49. Claim 17 does not require a ranging protocol, nor does the '249 Patent reference ranging protocols. As such, PO cannot properly distinguish a pilot tone from a beacon message. DISH-1030, ¶50.

C. Ground 2

PO contends a POSITA would not consider ADSL teachings with VDSL teachings when reading the ADSL/VDSL reference. Specifically, PO argues "the Petition's discussion of pilot tones cites to Chapter 7 of ADSL/VDSL on '**ADSL** modulation specifics' while SDMT is described in a different section regarding **VDSL**." POR, 50. PO then asserts SDMT is "[t]he most popular TDD approach proposed for **VDSL**," so the **ADSL** chapter's pilot tones do not apply. *Id.* But PO ignores the very next sentence of ADSL/VDSL, which states SDMT "employs **many of the same fundamental blocks used in ADSL**." DISH-1006, 296. Indeed, the SDMT transmitter and receiver "is **very similar to the** DMT-based **ADSL diagram** discussed in Chapter 7, 'ADSL Modulation Specifics.'" *Id.*

ADSL/VDSL also does not support PO's conclusion that "SDMT is not synchronized by a pilot tone." POR, 50. Instead, 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," which a POSITA would have understood necessitates other methods, like the synchronization pilot tones taught earlier in ADSL/VDSL. *Id.*; DISH-1030, ¶¶51-52.

VII. Independent Claims 1 and 5

A. Ground 3

1. Amit is not limited to single-carrier modulation

As discussed in Section III above, Amit is not limited to single-carrier modulation. Indeed, Amit's HCNM modem 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. Moreover, the ID correctly recognized "that improving bit rate would have led a POSITA to apply" multicarrier modulation to the terminal devices in Amit's home network." ID, 21.

PO thus imports numerous claim requirements in an attempt to differentiate the prior art. PO argues that Amit's "channels are only described as allocated to different home-networks, not devices on these home networks," but claims 1 and 5 do not require the allocation of channels to devices. POR, 52. PO also argues that "the Single Home embodiment does not even provide enough bandwidth to accommodate more than one channel," but claims 1 and 5 do not specify a minimum bandwidth per channel. *Id.* And in any case, a POSITA combining Jacobsen with Amit would not be limited to the channel allocation or bandwidth of Amit.

PO's complexity arguments are based on a misunderstanding of the relevant technology. Indeed, PO mistakenly argues 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. Jacobsen actually states that "[t]he penalty for the **increased FFT/IFFT size** is an increase in system complexity," but "[i]n actuality, we could use **smaller FFT sizes** … by implementing a time-domain equalizer." DISH-1007, 306, 309, n.4. Moreover, Jacobsen concludes that multicarrier modulation is "at least 2.5 times" **less complex** than single-carrier modulation with equalization, so FFT/IFFT does not "**require** a significant increase in complexity" as PO argues. *Id.*, 310.

The deposition of PO's expert revealed the source of PO's confusion. Mr. Bates mistakenly believes that FFT/IFFT requires a special chip to be added to any terminal device. DISH-1029, 96:20-97:8. Indeed, Mr. Bates believes that even modern day laptops are incapable of performing FFTs. *Id.*, 97:23-98:9. These beliefs are incorrect. DISH-1030, ¶¶53-58 (citing DISH-1034, DISH-1036, DISH-1038-41).

Mr. Bates also judges the added complexity under the wrong standard. Rather than consider whether a POSITA would be motivated and capable of implementing multicarrier modulation, Mr. Bates considers what a typical end user would be able to do. DISH-1029, 162:6-20. According to Mr. Bates, Amit's goal is to have an end user be able to modify the terminal devices, so a POSITA maters not. *Id.*, 164:8-25.

Mr. Bates is mistaken because the obviousness standard focuses on a POSITA's understanding, rendering PO's complexity arguments meritless.

2. Amit teaches Claim 1

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 kysm/sec). *Id.*, 8:30-39; DISH-1003, ¶82.

PO concedes that a "modulation scheme is selected … **based on channel conditions**" but mistakenly questions a POSITA's ability to make multiple selections for multiple subchannels. POR, 56. Amit's modem already communicates on multiple sub-channels, so it would be 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; DISH-1030, ¶59. Indeed, Amit's FIG. 5 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; DISH-1030, ¶60 (citing DISH-1037).

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

PO repeats its prior argument that Jacobsen's teachings are not performed in terminal devices. POR, 57. But 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. As both the receiver and transmitter participate in providing the frequency bins with more transmit bits, the terminal devices necessarily perform this limitation, and PO's argument fails. DISH-1030, ¶61.

B. Ground 2

PO's Ground 2 arguments rehash those addressed above. Indeed, nearly every paragraph cites to prior sections. POR, 58-60. As such, Petitioner incorporates its above responses.

PO irrelevantly argues that "*Amit* never **discloses changes** of modulation method; only that a modulation method" is selected "according to channel conditions." POR 58. But Petitioner is relying on obviousness, not anticipation, so

the proper inquiry is what Amit teaches—not what Amit "discloses." Amit does teach 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. The Petition thus correctly explained that "Amit teaches that the modulation method will change 'according to the channel conditions.'" Pet., 30.

PO also incorrectly concludes 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. But ADSL/VDSL explicitly states 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. As such, a POSITA using ADSL/VDSL to build upon QAM would do so in Amit's terminal devices, so PO's argument fails. DISH-1030, ¶¶62-63.

C. Ground 1

PO mischaracterizes the Petition as "rel[ying] on two incompatible embodiments of *Amit*" because PO considers "frequency allocation" to apply to only "the Connected Home embodiment." POR, 62. But Figure 5 "presents a frequency allocation that may be employed by **the present invention**"—not just the Connected Home mode. DISH-1005, 5:28-29. Moreover, PO's Amit citation merely states that "HomeCN **components that are working in** the single home operation mode … do

not support the frequency selection capability." POR, 62; DISH-1005, 7:64-8:3. In other words, Amit teaches that the same HomeCN components can work in Single Home mode or Connected Home mode, so the modes are not properly categorized as "embodiments" and there is nothing "incompatible" about considering teachings from each. DISH-1030, ¶¶64-65.

PO also ignores Dr. Acton's declaration in arguing that "[t]here is **no evidence** in the Petition that, prior to the '249 Patent, these modulation techniques were used in a local-area coaxial network or a POSITA would have thought they could be." POR, 61. Dr. Acton 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). Rather than confront this evidence, PO repeats the same arguments addressed above.

VIII. Dependent Claims 2 and 9

Like PO, Petitioner incorporates its arguments for claims 1 and 5.

IX. Dependent Claims 3-4 and 6-8

Like PO, Petitioner incorporates its claim 5 arguments.

X. Conclusion

Petitioner respectfully requests cancellation of all Challenged Claims.

Respectfully submitted,

Dated: January 31, 2025

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CERTIFICATION UNDER 37 CFR § 42.24(d)

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petitioner's Reply to Patent Owner's Response totals 5,592, which is less than the 5,600 allowed under 37 CFR § 42.24.

Respectfully submitted,

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§ 42.6(e)(1) and 42.6(e)(4)(iii), the undersigned certifies that on January 31, 2025, a complete and entire copy of this Petitioner's Reply to Patent Owner's Response and exhibits were provided via email to the Patent Owner by serving the email correspondence addresses of record as follows:

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