

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DISH NETWORK LLC,
Petitioner,

v.

ENTROPIC COMMUNICATIONS, LLC,
Patent Owner.

IPR2024-00393
Patent 7,295,518 B1

Before LYNNE H. BROWNE, PATRICK R. SCANLON, and
JON M. JURGOVAN, *Administrative Patent Judges*.

JURGOVAN, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

A. *Background and Summary*

Dish Network, LLC (“Petitioner”) filed a Petition requesting *inter partes* review (“IPR”) of claims 1 and 3 of U.S. Patent No. 7,295,518 B1 (Ex. 1001, the “’518 patent”). Paper 2 (“Petition” or “Pet.”). Patent Owner, Entropic Communications, LLC, filed a Preliminary Response to the Petition. Paper 6 (“Prelim. Resp.”).

Under 35 U.S.C. § 314(a), an *inter partes* review may not be instituted unless the information presented in a petition and the preliminary response “shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” Upon consideration of the Petition and Preliminary Response, and accompanying exhibits and evidence, we determine Petitioner has established a reasonable likelihood that it would prevail with respect to at least one challenged claim in the *inter partes* review. Therefore, we grant institution of an *inter partes* review as to all of the challenged claims of the ’518 patent on all challenges in the Petition.

B. *Real Parties in Interest*

Petitioner identifies itself and Dish Network Service LLC, DISH Network Corporation, and Dish Network California Service Corporation as real parties-in-interest. Pet. 88 (Petitioner’s Mandatory Notices).

Patent Owner identifies itself as the real party-in-interest. Paper 5, 1 (Patent Owner’s Mandatory Notice).

C. *Related Matters*

Petitioner and Patent Owner (“the parties”) identify the following as matters related to this proceeding:

Entropic Communications, LLC v. DirecTV, LLC f/k/a DirecTV, Inc. et al., 2-23-cv-05253 (CDCA), filed July 1, 2023;

Entropic Communications, LLC v. DISH Network Corporation et al., 2-23-cv-01043 (CDCA), filed February 10, 2023;

Entropic Communications, LLC v. Cox Communications, Inc. et al., 2-23-cv-01047 (CDCA), filed February 10, 2023;

Entropic Communications, LLC v. Comcast Corporation et al., 2-23-cv-01048 (CDCA), filed February 10, 2023;

Entropic Communications, LLC v. Charter Communications, Inc., 2-23-cv-00050 (EDTX), filed February 10, 2023; and

Entropic Communications, Inc. v. ViXS Systems, Inc. et al., 3-13-cv-01102 (SDCA), filed May 8, 2023.

Pet. 89, Paper 5, 1–2.

D. The '518 Patent

The '518 patent is titled “Broadband Network for Coaxial Cable using Multi-Carrier Modulation.” Ex. 1001, code (54). The patent discloses a broadband local area network that uses coaxial cable wiring for interconnecting terminal devices. *Id.* at code (57). Orthogonal frequency division multiplexing (OFDM) with bit loading is used to overcome channel impairments to provide a path for terminal devices to transmit to and receive from other terminal devices. *Id.* Probe messages are used to characterize the channel between terminal devices to determine the optimum bit loading for the channel. *Id.*

Figure 2 of the '518 patent is shown below.

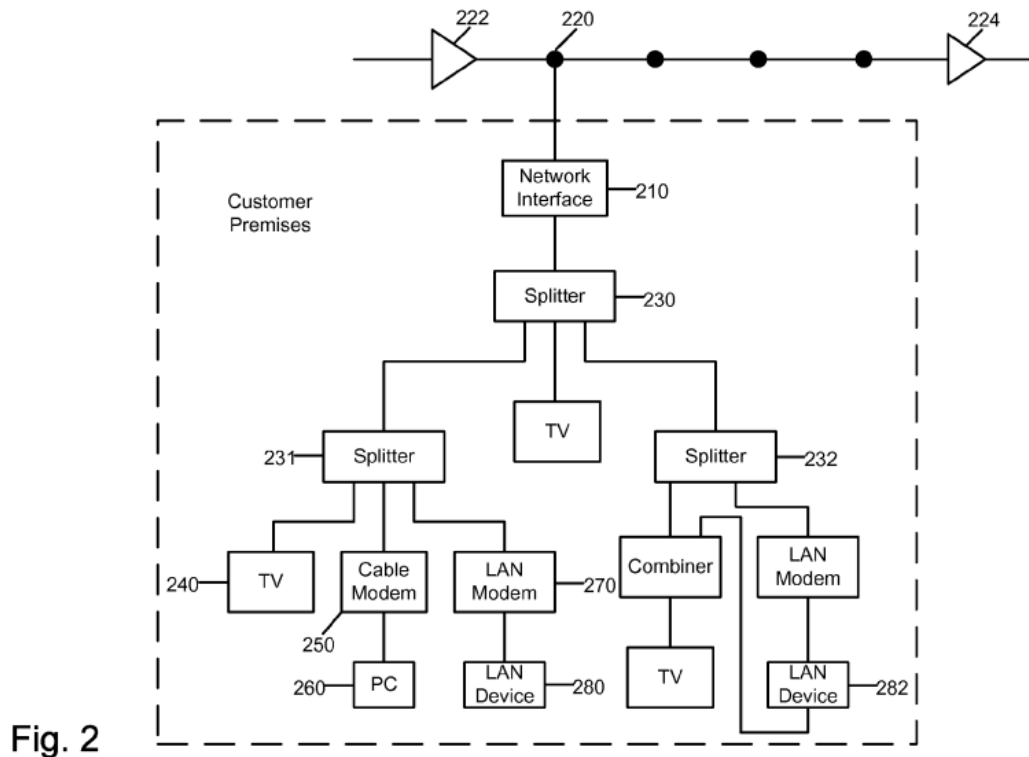


Figure 2 depicts “a signal distribution plan” of the '518 patent. *Id.* at 5:12–13. LAN modem 270 modulates and demodulates a waveform transmitted over the cable, and has an interface to communicate with LAN device 280, which is the source or destination of data transmitted over the LAN. *Id.* at 5:36–40. LAN device 280 can be a personal computer (PC) and LAN device 282 can be a modulator to produce a signal for driving a TV through a signal combiner. *Id.* at 5:40–43.

LAN devices 280 and 282 can be used for digital video or data services. *Id.* at 5:51–52. LAN device 282 can extract digital video data from a transport stream and produce a signal for a standard TV set. *Id.* at 5:52–56. Existing devices, such as TV 240, cable modem 250, and PC 260, use frequency bands distinct from the frequency band used by the LAN and

operate in the normal manner. *Id.* at 5:57–60. The frequencies used by the LAN can be located above the standard cable frequencies. *Id.* at 5:61–63.

The '518 patent describes multi-tone modulation as including discrete multi-tone (DMT) and OFDM. *Id.* at 7:20–27. The '518 patent states that OFDM uses quadrature phase shift keying (QPSK) and multi-level quadrature amplitude modulation (QAM) in which each OFDM carrier is modulated using an amplitude/phase-varying signal. The modulated carriers are then summed together for transmission over the channel. *Id.* at 7:39–40.

The '518 patent describes bit loading as a method of allocating higher order signal constellations to carriers that have higher signal to noise ratio, and lower order constellations to carriers that have lower signal to noise ratio. *Id.* at 8:9–26.

The '518 patent further describes the use of probe messages transmitted between network devices to estimate channel characteristics. *Id.* at 9:35–41. The probe messages have a known bit sequence that can be used by the receiving device to a bit loading profile to send back to the transmitting device to use if the channel is asymmetric, or the receiving device may calculate a bit loading profile for its own use if the channel is symmetric. *Id.* at 9:42–58.

E. Challenged Claims

Claim 1 is independent and claim 3 depends from claim 1. The claims are set forth below with Petitioner's limitation identifiers indicated in brackets.

[1pre] A data communication network comprising:

[1a.i] at least two network devices,

[1a.ii] each network device comprising a multi-carrier modulator for modulating data, an up converter for translating

the modulated data to an RF carrier frequency, a down converter for translating an RF signal, and a multi-carrier demodulator for demodulating the translated RF signal to produce data; and

[1b] cable wiring comprising a splitter with a common port and a plurality of tap ports, and a plurality of segments of coaxial cable connecting between the splitter tap ports and the network devices;

[1c] whereby network devices communicate with each other through the cable wiring using multi-carrier signaling;

[1d.i] wherein network devices transmit probe messages through the cable wiring and analyze received probe message signals to determine channel characteristics and

[1d.ii] bit loading is selected based on the determined channel characteristics.

Ex. 1001, 12:8–26.

Claim 3 is set forth below with Petitioner’s limitation identifiers.

[3a] The data communication network of claim 1 wherein the network shares the cable wiring with a cable television service

[3b] and the network device up converter translates the modulated data to an RF carrier frequency above the frequency used by the cable television service.

Ex. 1001, 12:31–35.

F. Evidence of Record

Petitioner relies upon the following prior art references¹:

¹ Petitioner alleges that all of the prior art references were filed, issued or published before the ’518 patent’s earliest alleged priority date of August 30, 2001. Pet. 2. Petitioner contends that all of these prior art references are prior art under 35 U.S.C. §§ 102(b) and (e) (pre-Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”)). *Id.* Patent Owner does not refute these assertions at this time.

Name	Reference	Date	Exhibit No.
Kliger	US 2002/0069417 A1	Published Jun. 6, 2002	Ex. 1007
Isaksson	WO 98/10545	Published Mar. 12, 1998	Ex. 1013
Amit	US 7,127,734 B1	Issued Oct. 24, 2006	Ex. 1014
Jacobsen	Krista S. Jacobsen et al., <i>An Efficient Digital Modulation Scheme for Multimedia Transmission on the Cable Television Network</i> , 1994 NCTA Technical Papers, 305–312	Published Sep. 19, 1995	Ex. 1016

Petitioner also supports its challenges with a declaration from Dr. Tim Williams. Ex. 1004. Patent Owner does not rely on any declarant to support its contentions at this time.

G. The Asserted Challenges to Patentability

Petitioner asserts the following challenges to patentability:

Ground	Challenged Claims	35 U.S.C. §	Reference(s)
1	1, 3	103(a)	Kliger, Isaksson
2	1, 3	103(a)	Amit, Jacobsen, Isaksson

Pet. 3.

II. ANALYSIS AND DISCUSSION

In this section, we discuss Petitioner’s challenges to claims 1 and 3 of the ’518 patent and Patent Owner’s arguments for patentability. For the

reasons that follow, we determine that Petitioner has presented a reasonable likelihood that at least one claim of the '518 patent is unpatentable.

A. Legal Standards for Obviousness

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the claimed invention pertains. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) where present, objective evidence of nonobviousness.² *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. Level of Ordinary Skill in the Art

Petitioner contends as follows:

A POSITA [(person of ordinary skill in the art)] would have a degree in electrical engineering, computer engineering, or a related field and experience working in signal processing and/or communication systems/networks, *e.g.*, a bachelor's and three or more years of experience; a master's and at least one year of experience; or a doctorate and some work experience. Additional education could substitute for professional experience, or *vice versa*.

Pet. 13 (citing Ex. 1004 ¶¶ 22–23).

² The parties do not present any objective evidence of nonobviousness or obviousness at this time.

At this stage of the proceeding, Patent Owner does not dispute Petitioner’s proposed level of skill in the art, which is consistent with the prior art references asserted by Petitioner. *Okajima v. Bourdeau*, 261 F.3d 1350, 1354–55 (Fed. Cir. 2001) (the applied prior art may reflect an appropriate level of skill). Accordingly, we agree with and will use Petitioner’s proposed level for this Decision.

C. Claim Construction

We construe the challenged claims under the same standard used by a federal court in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b). This standard is articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc) and its progeny, and includes “construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b).

Only claim terms in controversy need to be construed, and only to the extent necessary to resolve the controversy. *See Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

Petitioner contends that the challenged claims are “obvious under any reasonable interpretation,” so “no express constructions are required.” Pet. 3. Patent Owner does not offer construction of any claim term, so there is no dispute over claim construction that we need to resolve. We apply the ordinary and customary meanings consistent with 37 C.F.R. § 42.100(b).

D. Ground 1: Obviousness over Kliger and Isaksson

Petitioner contends that claims 1 and 3 would have been obvious over the combination of Kliger and Isaksson, and Patent Owner’s presents arguments for patentability. Pet. 13–41; Prelim. Resp. 13–32.

We determine that a reasonable likelihood of prevailing to show unpatentability of these claims has been shown for ground 2 discussed below. Consequently, we do not reach this ground.

E. Ground 2: Obviousness over Amit, Jacobsen, and Isaksson

Petitioner contends that claims 1 and 3 would have been obvious over the combination of Amit, Jacobsen, and Isaksson, and Patent Owner presents arguments for patentability for this ground. Pet. 42–81; Prelim. Resp. 32–45.

1. Amit (Ex. 1014)

Amit is titled “System and Methods for Home Network Communications.” Ex. 1014, code (54). Amit purports to provide “a method and system which allows home networking over these coax cables.” *Id.* at 2:53–55.

Amit’s Figure 2 is shown below.

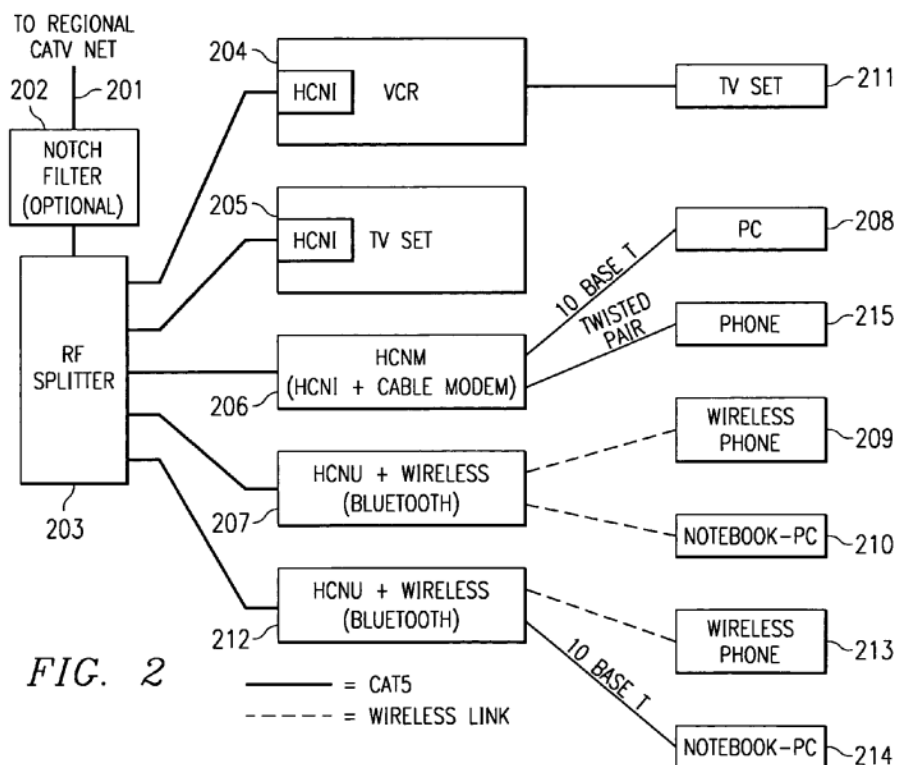


Figure 2 shows “a Home Cable networking (HomeCN/HCN)” that has nodes 204–207 and 212 connected to a regional CATV plant via cable 201. *Id.* at 2:13–17, 4:23–24, 6:24–26. Amit’s network devices include a Home Cable Networking Modem (HCNM) 206 and Home Cable Networking Units (HCNUs) 207, 212. *Id.* at 6:3–23.

Amit’s HCNUs are connected to home network equipment via various connections (e.g., 10BaseT, USB, wireless). Ex. 1014, 6:7–13. The HCNU bridges or routes communications between the home cable network (HCN) and other networks such as via other HCNUs. *Id.* at 6:11–13. The HCNM provides connections between the HCN and the cable headend. *Id.* at 6:14–18. The HCNUs and HCNM can communicate with each other by RF signaling over cable using reflection from RF splitter 203 to transmit signals back to the home network. *Id.* at 3:19–21; 6:29–41.

2. *Jacobsen (Ex. 1016)*

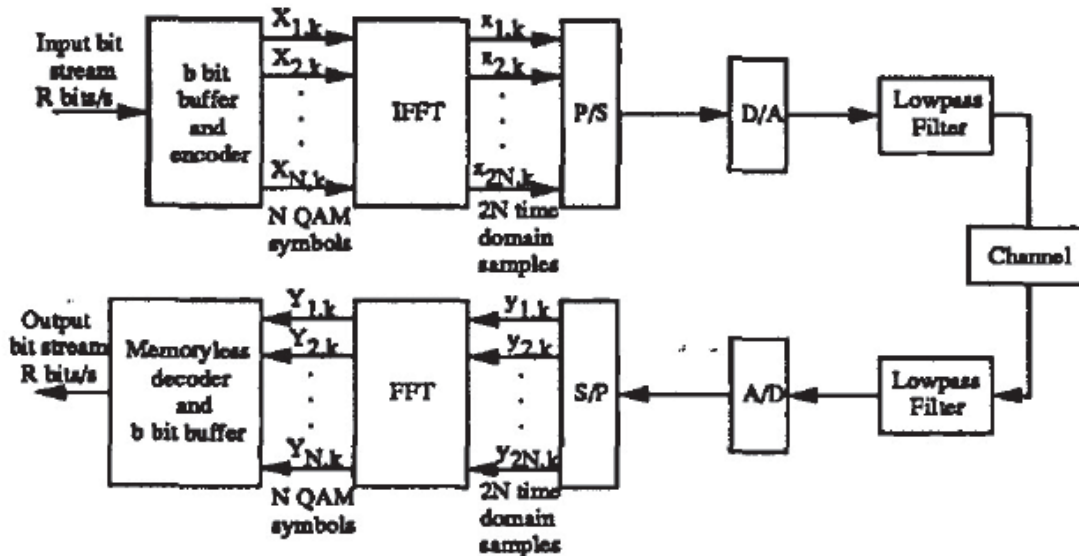
Jacobsen is an IEEE³ article titled “An Efficient Digital Modulation Scheme for Multimedia Transmission on the Cable Television Network.” Ex. 1016, 305. Jacobsen “present[s] a comparison between the performances of single-carrier modulation with equalization and multicarrier modulation on simulated cable television (CATV) channels.” *Id.* Jacobsen states that service providers at the time were investigating “[t]he feasibility of offering high-speed interactive data services to customers on CATV networks or similar broadband coaxial networks.” *Id.* Jacobsen states that “there are several electrical transmission problems that must be overcome before these services can be supplied reliably over CATV networks.” *Id.*

³ Institute of Electrical and Electronics Engineers.

Jacobsen recognizes that “[t]aps, amplifiers, and splitters can all cause signals to be reflected at their insertion points.” *Id.* Jacobsen states that these reflections can produce “[v]ariations in a channel’s frequency response caus[ing] successively transmitted symbols to interfere with one another, an effect known as intersymbol interference (ISI).” *Id.*

Jacobsen teaches that multicarrier modulation, such as DMT, may be used to combat ISI. *Id.* at 306, 308. Jacobsen states that “bits are originally assigned to subchannels just after training during system initialization in direct proportion to the subchannel signal-to-noise ratios.” *Id.* at 307. “As a result, subchannels that suffer from little attenuation and/or little noise carry the most bits, while subchannels that are severely attenuated and/or very noisy might not carry any bits.” *Id.*

Jacobsen’s Figure 1 is shown below.



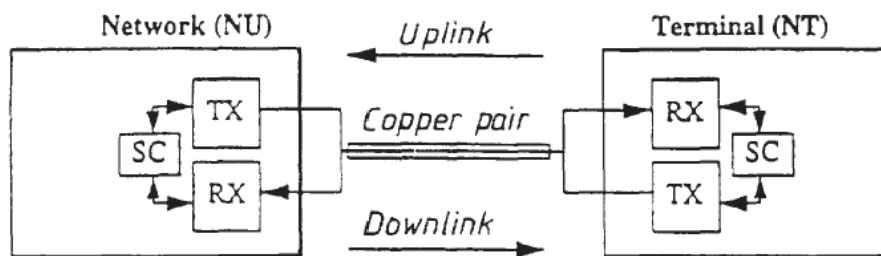
The components in the upper part of Jacobsen’s Figure 1 constitute a DMT transmitter, and components in the lower part constitute a DMT receiver. *Id.* at 307.

3. *Isaksson (Ex. 1013)*

Isaksson is titled “Improvements in, or Relating to, Multi-Carrier Transmission Systems.” Ex. 1013, code (54). Isaksson describes “multi-carrier transmission systems having the facility to dynamically change carrier bit-loading.” *Id.* at 1:3–7.⁴ Isaksson mentions demand for multi-media and other services create a need for high bit-rate traffic over copper pairs. *Id.* at 1:8–11. Isaksson further mentions transmission schemes such as ADSL and VDSL, and that modulation systems for these transmission schemes may be DMT or OFDM. *Id.* at 1:11–18.

Isaksson further describes bit-loading techniques where the number of transmitted bits per symbol is adapted or regulated to the signal-to-noise ratio (SNR) of the current carrier wave. *Id.* at 3:24–27. Isaksson states that adapting the number of bits dynamically affects the total bandwidth of the system and requires synchronous configuration of the transmitter and receiver in terms of coded/decoded bits per symbol in order to maintain the connection. *Id.* at 3:29–34.

Isaksson’s Figure 22 is reproduced below.



Isaksson states that Figure 22 is a schematic of two modems interconnected to create a multi-tone carrier transmission system. *Id.* at 19:20–24. Isaksson

⁴ Citations are to Isaksson’s page numbering, not Petitioner’s bates numbering.

discloses that channel estimation may be carried out, by periodic transmission of one the transceivers, using a base sync frame with predetermined content and comparing in the other transceiver the received sync frame with a reference frame. *Id.* at 16:8–12. The receivers in both transceivers then transmit the measurements to the transmitter in the uplink transceiver. *Id.* at 77:21–79:4.

Isaksson further discloses that bit-loading factors are calculated for each carrier based on signal-to-noise ratios. *Id.* at 5:14–6:1, 54:16–21. The “multi-carrier system is adapted to synchronously update, at said first and second transceivers, the bit loading parameters associated with each channel.” *Id.* at 5:27–30, 54:13–21.

4. *Motivation to Combine Amit, Jacobsen, and Isaksson*

Petitioner contends that a POSITA seeking to implement Amit’s coaxial network would have understood that coaxial cable is an “excellent communication medium” but that there can be problems with reflections and “hidden nodes” in houses. Pet. 47 (citing Ex. 1014, 2:51–53, 13:54–14:1, 20:42–43). According to Petitioner, Amit further suggests varying “channel conditions” may necessitate different communication techniques. *Id.* at 47–48 (citing Ex. 1014, 8:30–32; Ex. 1004 ¶ 165).

Petitioner asserts that Jacobsen similarly observes that taps, amplifiers, and splitter can cause signal reflections and that resulting variations in frequency response cause successively transmitted symbols to interfere with one another, an effect known as intersymbol interference (ISI). *Id.* at 48 (citing Ex. 1016, 305; Ex. 1004 ¶ 166). Petitioner argues that Jacobsen teaches that multicarrier modulation reduces effects of distortion on a cable television (CATV) network, easily adapts to a variety of channel

degradations, and is more computationally efficient than single-carrier modulation. *Id.* (citing Ex. 1016, 305–306; Ex. 1004 ¶ 167).

Petitioner contends that a POSITA implementing Amit’s coaxial network would have been motivated to address Amit’s challenges using techniques from analogous publications that discuss broadband coaxial networks and overcoming signal impairments in coaxial networks, including Jacobsen. *Id.* at 48–50 (citing § IV.B.1 and § IV.B.2; Ex. 1016, 312; Ex. 1004 ¶¶ 168–173). Petitioner further notes that both references “recognize that providing high-speed data services on existing wiring infrastructure is a motivator for implementing broadband coaxial networks.” *Id.* at 49.

Petitioner asserts that “Jacobsen’s findings that multi-carrier modulation provides advantages over single-carrier for digital communications over coaxial networks” would have motivated a POSITA “to replace [Amit’s] single-carrier modulation in Amit’s HomeCN with Jacobsen’s multi-carrier signaling to overcome potential signal impairments in the HomeCN.” *Id.* at 49–50 (citing Ex. 1016, 312; Ex. 1004 ¶ 173).

Petitioner further contends that “Jacobsen describes how to implement multi-carrier modulation.” *Id.* at 50. Specifically, Petitioner contends that Jacobsen explains how to divide a channel into subchannels supporting its own QAM constellation, and assigning bits to the subchannels in direct proportion to the subchannel signal-to-noise (SNR) ratios, a technique known as “bit loading.” Petitioner thus asserts that the combination results in Amit’s HCN devices implementing multicarrier modulation with bit loading. *Id.* at 50 (citing Ex. 1016, 306–307; Ex. 1004 ¶ 175).

Petitioner contends that, like Jacobsen, Isaksson teaches multicarrier modulation with bit loading based on channel characteristics. *Id.* at 51 (citing Ex. 1013, 1:19–26, 3:24–34; Ex. 1004 ¶ 177). Petitioner further states that Isaksson’s bit-loading causes time variation of system bandwidth, which imposes a “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.* at 51 (citing Ex. 1013, 3:24–34). Petitioner asserts that “Isaksson’s solution involves transceivers sending and measuring base sync frames (i.e., “channel probes”) to determine channel characteristics for configuring bit-loading.” *Id.* (citing § IV.A.2; Ex. 1004 ¶ 178).

Petitioner contends that a “POSITA would have been motivated to improve the Amit-Jacobsen HomeCN with Isaksson’s synchronized bit-loading” in order “to maintain connections between Amit’s HCN devices.” *Id.* at 52 (citing Ex. 1004 ¶¶ 179–181). Petitioner further asserts that a “POSITA reading Amit’s and Jacobsen’s teachings about coaxial networks would have been motivated to improve such networks with methods used in related wired networks, such as Isaksson’s.” *Id.* at 53 (citing Ex. 1014, 28:67, 2:24–30). Petitioner alleges that Isaksson recognizes that its features can extend to coaxial networks. *Id.* (citing Ex. 1013, 1:8–18, 3:4–15).

In summarizing its motivation contentions, Petitioner states the following:

A POSITA would have considered the Amit-Jacobsen-Isaksson combination to be an example of: (1) use of known techniques (Isaksson’s synchronized bit-loading) to improve similar devices (Amit-Jacobsen’s HCN devices) in the same

way (overcoming interference and maintaining connections with other HCN devices); (2) a teaching, suggestion, or motivation in Isaksson that would have led a POSITA to implement the Amit-Jacobsen combination with Isaksson's synchronized bit-loading; and (3) combining prior art elements (Isaksson's synchronized bit-loading) according to known methods to yield predictable results (Amit-Jacobsen's HCN devices using multi-carrier signaling with synchronized bit-loading). [Ex. 1004, ¶ 182]; *see KSR*, 550 U.S. at 415-21.

Like Isaksson, Amit and Jacobsen are analogous art to the '518 patent because they are from the same field of endeavor as the patent—wired networking systems—and are reasonably pertinent to the particular problem at issue in the patent—overcoming wired network signal impairment issues. [Ex. 1004, ¶¶ 183–184].

Pet. 53–54.

Patent Owner argues that a POSITA would not have combined Amit and Jacobsen. Prelim. Rep. 36–41. Specifically, Patent Owner argues that Amit already identified and solved the reflection problem so there would be no need to make an additional modification to Amit. *Id.* at 36–37 (citing Ex. 1014, 19:65–20:43). This argument does not negate, however, Petitioner's contention that a POSITA would have recognized that Jacobsen's multicarrier modulation would improve upon Amit's single-carrier modulation by mitigating distortion on the cable network, adapting to channel degradation, and providing increased computational efficiency. Pet. 49–50 (citing Ex. 1016, 312; Ex. 1004 ¶ 173); *see KSR*, 550 U.S. at 422 (motivation to combine established when POSITA would have appreciated the benefits achieved by the combination).

Patent Owner takes issue with Petitioner's characterization of Amit as teaching single-carrier modulation because it teaches the modulator of the home networking device must provide QPSK and QAM 16. Prelim. Resp.

40 (citing Ex. 1014, 8:30–37); Pet. 49 (citing Ex. 1004 ¶¶ 171–172). We do not understand Amit’s disclosure of QPSK and QAM 16 to teach multicarrier modulation, however, because either modulation technique can be used on a single carrier. Prelim. Resp. 40–41 (citing Ex. 1014, 8:30–37; Pet. 49–50 (citing Ex. 1021; Ex. 1023)).

Patent Owner then acknowledges that Amit uses single-carrier modulation but asserts that this teaches away from Jacobsen’s multicarrier modulation. Prelim. Resp. 40–41. This does not address Petitioner’s contention that a POSITA would have recognized from Jacobsen that there are advantages to using multicarrier modulation in Amit’s home network, as discussed. *See* Pet. 49–50. Patent Owner’s argument does not undermine Petitioner’s motivation to combine.

Patent Owner next argues that Amit and Jacobsen are incompatible because Amit uses reflection to achieve on-premises communication, whereas Jacobsen attempts to eliminate signal reflections because Jacobsen concerns head end communications. Prelim. Resp. 38–39. This assertion amounts to attorney argument that is not sufficiently substantiated in the record. *Icon Health & Fitness, Inc. v. Strava, Inc.*, 849 F.3d 1034, 1043 (Fed. Cir. 2017) (“[a]ttorney argument is not evidence”). Petitioner has shown sufficiently that a POSITA considering Amit’s and Jacobsen’s reflection teachings would have understood that they can be beneficial in facilitating communications between in-home network devices, but that reflections can also be detrimental in some cases, and thus would have understood that reflections must be managed appropriately on the networks. *See* Pet. 47; Ex. 1005, 13:54–14:5, 20:42–43. Thus, on this record, we do not see Amit’s and Jacobsen’s teachings as necessarily contradictory.

To the extent that Patent Owner argues that Amit teaches “there *can* be ‘houses where there is a problem with reflection’” but that this does not establish that “such problems even existed,” our understanding is that Amit would not have mentioned this if the problem did not exist. Prelim. Resp. 37. This argument does not undermine Petitioner’s showing.

Patent Owner also takes issue with Petitioner’s contention that the “hidden node” problem would have provided a POSITA with a motivation to combine Amit and Jacobsen, and asserts that this motivation was not explained sufficiently in the Petition. Prelim. Resp. 39–40. Assuming Patent Owner is correct in its assertions, this does not overcome Petitioner’s other stated motivations to combine.

Patent Owner does not refute Petitioner’s statement that Petitioner’s combination of prior art references recognizes that demand for high-speed data services on existing wiring infrastructure would have motivated a POSITA to implement broadband coaxial networks. Pet. 44–45 (citing Ex. 1016, 305), 49 (citing § IV.B.1–2; Ex. 1004 ¶¶ 168–170); *KSR*, 550 U.S. at 418 (“effects of demands known to the design community or present in the marketplace” may provide a reason to combine known elements).

Patent Owner asserts that Petitioner failed to show motivation to combine Amit and Jacobsen with Isaksson. Prelim. Resp. 42–45. Specifically, Patent Owner contends that a POSITA would not have been motivated to combine Isaksson’s teachings relating to communication infrastructure outside of a home on twisted pair cabling, with Amit’s communication infrastructure inside of a home network. *Id.* at 42 (citing Pet. 53). Patent Owner argues that Petitioner is incorrect in stating that “Isaksson recognizes that its features can extend to coaxial networks.” *Id.*

(citing Pet. 53; Ex. 1013, 1:8–18, 3:4–15). Patent Owner asserts that Isaksson explains that DMT can be used for high-rate traffic over copper pairs, but does not recognize that this transmission scheme can extend to coaxial networks, which, according to Patent Owner, highlights the technical differences between Isaksson and Amit. *Id.* at 43.

However, Petitioner’s declarant, Dr. Williams, states that a “POSITA would have been motivated to combine the teachings of Amit, Isaksson, and Jacobsen because they each deal with developing coaxial networks for digital communications and overcoming potential signal impairments that could impede that goal.” *See* Pet. 49 (citing Ex. 1004 ¶ 170). Patent Owner’s attorney argument does not overcome Petitioner’s evidence. *See Icon Health*, 849 F.3d at 1043.

While Patent Owner acknowledges that Isaksson states that “the DAVIC specification reverses this order to enable premises distribution of VDSL signals over coaxial cable systems,” Patent Owner argues that this single sentence does not disturb that Isaksson is entirely directed towards the distribution of signals to the home, not within the home, and relates to twisted pair cabling, not coaxial cables. Prelim. Resp. 42–44 (citing Ex. 1013, 3:13–15, 24:8–10). However, Dr. Williams states that “[a] POSITA reading Amit’s and Jacobsen’s teachings about coaxial networks would have been motivated to improve such networks with methods used in related wired networks, such as Isaksson’s network.” Pet. 53 (citing Ex. 1004 ¶ 181). “[I]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious” unless beyond the POSITA’s skill. *KSR*, 550 U.S. at 417. Patent Owner’s attorney

argument does not undermine Petitioner's showing of motivation to combine. *See Icon Health*, 849 F.3d at 1043.

Patent Owner further asserts that Isaksson contains no teachings on communications traversing tap ports of coaxial splitters, as in Amit, and does not mention important aspects including reflection, attenuation, and isolation. Prelim. Resp. 44. This argument does not address the reasons Petitioner gave for the motivation to combine Isaksson, including that Isaksson's techniques for maintaining synchronism using base sync frames would have improved multicarrier communication in the combination of Amit and Jacobsen. Pet. 47, 51–52 (citing Ex. 1013, 3:24–34, 4:21–25; Ex. 1016, 307; Ex. 1004 ¶¶ 178–179).

Patent Owner argues that Amit does not suffer from lack of synchronism because it uses single carrier modulation, and that Isaksson was added to solve a problem that was created by Petitioner's combination of Amit and Jacobsen. Prelim. Resp. 44–45. Although it may be true that the problem arises from using Jacobsen's multicarrier modulation in Amit, Petitioner shows that there are advantages to using multicarrier modulation with bit loading in Amit. Isaksson teaches that in order to use multicarrier modulation with bit loading, synchronism must be maintained, and Isaksson teaches a way to achieve synchronism using base sync messages.

Thus, on the current record, Petitioner has shown sufficiently that a POSITA would have combined Amit, Jacobsen, and Isaksson for the reasons that Petitioner identifies notwithstanding Patent Owner's arguments.

5. *Reasonable Expectation of Success*

Petitioner contends that a POSITA would have a reasonable expectation in making the combination of Amit, Jacobsen, and Isaksson.

Pet. 54–56. Specifically, Petitioner contends that a POSITA would have had a reasonable expectation of success because Amit and Jacobsen similarly describe coaxial networks, and because single carrier and multicarrier modulation were known techniques that would have been straightforward for a POSITA to implement. *Id.* at 54–55 (citing Ex. 1004 ¶¶ 185–187, 192–197; Ex. 1017; Ex. 1018; Ex. 1022; Ex. 1014, 8:30–33, 25:1–10). Petitioner further contends that Jacobsen describes how to implement multicarrier modulation. *Id.* at 50.

Petitioner asserts that the Amit-Jacobsen combination teaches multicarrier modulation, and applying Isaksson’s multicarrier teachings would have been using known techniques to improve similar devices in the same way. Pet. 55 (citing *KSR*, 550 U.S. at 415–421; Ex. 1013, 72:5–8; Ex. 1004 ¶ 188). Petitioner notes that Isaksson states that its disclosure can be used with other multicarrier systems than described. *Id.* (citing Ex. 1013, 72:5–8; Ex. 1004 ¶ 188).

Petitioner alleges that a POSITA would have expected Isaksson’s multicarrier improvements to work in the Amit-Jacobsen network because Jacobsen already employed bit loading calculated in initial training, and adapted the number of transmitted bits according to the subchannel signal-to-noise (SNR) ratio. *Id.* at 55–56 (citing Ex. 1013, code (57), 54; Ex. 1016, 305, 307; Ex. 1004 ¶¶ 189–190).

Petitioner further contends that using Isaksson’s improvements is “a straightforward adaptation that permits dynamic adjustments to bit-loading to maintain synchronism between devices on the network.” *Id.* at 56 (citing Ex. 1013, 3:23–34; Ex. 1004 ¶ 191). Petitioner contends that “[i]mplementing Isaksson’s improvements would have been within the skill

level of a POSITA because . . . [multicarrier] modulation is used in many applications and taught in courses that a POSITA would have taken.” *Id.*

Patent Owner does not dispute Petitioner’s contentions concerning reasonable expectation of success.

On the current record, Petitioner has shown sufficiently that a POSITA would have had a reasonable expectation of success in combining Amit, Jacobsen, and Isaksson due to their similarities and teachings, and the skill level a POSITA would have had.

6. *Claim 1*

We now address Petitioner’s contentions that the combination of Amit, Jacobsen, and Isaksson teaches or suggests each limitation of claim 1. Pet. 56–80. Patent Owner does not dispute Petitioner’s contentions.

a) *Preamble 1pre: Data Communications Network*

The preamble of claim 1 recites a “data communication network comprising.”

Petitioner contends that “Amit’s Home Cable Network (HomeCN or HCN) ‘allow[s] very high-speed digital and analog communications within the home and from the home to external devices or networks.’” Pet. 56 (citing Ex. 1014, 1:10–12, 2:40–43). Petitioner contends that Amit’s Figures 2 and 13 (annotated by Petitioner) show examples of the HomeCN corresponding to the claimed “data communication network.” *Id.* at 56–57 (citing Ex. 1014, 3:10–13, 3:19–21, 6:58–60, Figs. 2, 9, 13 (annotated); Ex. 1004 ¶¶ 198–200).

b) *Limitation 1a.i: Network Devices*

Limitation 1a.i of claim 1 recites “at least two network devices.”

Petitioner contends that Amit's HomeCN includes at least two HCN devices to enable networking over coaxial cables. Pet. 59 (citing Ex. 1014, 3:10–12). According to Petitioner, the HCN devices include Home Cable Networking Units (HCNUs) and Home Cable Networking Modems (HCNMs) 206, 207, 212 shown in Figures 2 and 13 (annotated by Petitioner). *Id.* at 59–60 (citing Ex. 1014, 6:7–16, 6:3–23, 6:57–60; Ex. 1004 ¶¶ 204–210).

c) Limitation 1a.ii: Modulator

Limitation 1a.ii recites “each network device comprising a multi-carrier modulator for modulating data, an up converter for translating the modulated data to an RF carrier frequency, a down converter for translating an RF signal, and a multi-carrier demodulator for demodulating the translated RF signal to produce data.”

Petitioner contends that Amit's “HomeCN is a data communication network in which the HCN devices, including HCNUs and HCNMs, communicate with each other, *e.g.*, to deliver data from one device to another.” Pet. 62.

Petitioner further contends that Amit's HCN devices communicate using RF signaling over the HomeCN's coaxial cables. *Id.* (citing Ex. 1014, 3:19–21). Petitioner asserts that the frequency range of the RF signaling, or RF carrier frequency, can be 900–960 MHz. *Id.* (citing Ex. 1014, 3:24–27, 8:21–29). Petitioner contends that each HCN device includes a transmitter (TX) and receiver (RX) circuitry that enables the device to communicate using RF signaling. *Id.* at 62–63 (citing Ex. 1014, 29:10–21, Figs. 18, 19; Ex. 1004 ¶¶ 211–215, 221).

Petitioner contends that Amit's HCN device circuitry includes frequency converters, including the claimed "up converter" and "down converter." *Id.* at 62–64 (citing Ex. 1014, 3:24–30, 11:61–65, 19:32–37, Fig. 11 (annotated); Ex. 1004 ¶ 216). Petitioner states that, to transmit a signal, Amit's upstream TX block obtains data that originates from a node (e.g., a PC) connected to the HCN Device. *Id.* at 64 (citing Ex. 1004 ¶ 217). The TX signal is up-converted by multiplier/local oscillator (LO) blocks, amplified, and transmitted on the coaxial network (the claimed "translating . . . data to an RF carrier frequency"). *Id.* (citing Ex. 1004 ¶ 217).

Petitioner contends that, to receive a signal, Amit's multiplier/LO blocks down-convert an RF signal received over the coaxial network (the claimed "translating an RF signal"), which the upstream RX block routes to the node. *Id.* (citing Ex. 1014, 20:32–35; Ex. 1004 ¶ 217).

Petitioner contends that a POSITA would have understood that it is well known in the art that Amit's Figure 11 depicts frequency conversion circuitry. *Id.* at 64–66 (citing Ex. 1017, 93, 99–100, Fig. 3.6a; Ex. 1004 ¶¶ 218–220).

Petitioner contends that Amit discloses the claimed "modulator" and "demodulator." Pet. 66–68. Specifically, Petitioner asserts that each HCN device includes a modulator that employs QPSK, QAM 16, QAM 64 or QAM 256 according to channel conditions and equipment capabilities. *Id.* at 66 (citing Ex. 1014, 3:7–8, 3:19–20, 8:30–37). Petitioner states that, because Amit's HCN devices are transceivers, a POSITA would have understood that each HCN device includes a modulator providing "modulated data to the up-converter to be up-converted to the RF carrier frequency for transmission on the coaxial network," and a demodulator for

performing the “inverse of the up-converter operations.” *Id.* at 66–67 (citing Ex. 1014, Fig. 11; Ex. 1004 ¶¶ 222–227). Petitioner’s declarant, Dr. Williams, contends that transmitter and receiver architectures in cable modems that operate on coaxial networks were known to a POSITA. *Id.* at 67 (citing Ex. 1004 ¶¶ 230–231; Ex. 1019). Petitioner thus contends that Amit discloses the claimed “modulator for modulating data” and “demodulator for demodulating the translated RF signal to produce data.” *Id.* at 67–68 (citing Ex. 1004 ¶ 232).

Petitioner contends that Jacobsen discloses the multicarrier elements of limitation 1a.ii. Pet. 68–72. Specifically, Petitioner contends that Jacobsen discloses multi-carrier modulation using discrete multitone modulation (DMT). *Id.* at 68 (citing Ex. 1016, 306; Ex. 1004 ¶ 233). Petitioner asserts that Jacobsen’s Figure 1 shows a DMT transmitter that includes a multicarrier modulator for modulating signals to be transmitted on the coaxial cable, and a receiver that includes a multicarrier demodulator for demodulating the modulated signals received on the coaxial cable. *Id.* (citing Ex. 1016, 307; Ex. 1004 ¶ 237).

Petitioner asserts that the advantages afforded by multicarrier modulation (*see* § II.E.4), would have prompted a POSITA to implement Jacobsen’s multicarrier modulator and demodulator in place of Amit’s single-carrier modulator and demodulator. Pet. 69–72 (citing Ex. 1014, Fig. 11 (annotated); Ex. 1016, Fig. 1 (annotated); Ex. 1004 ¶¶ 236–238).

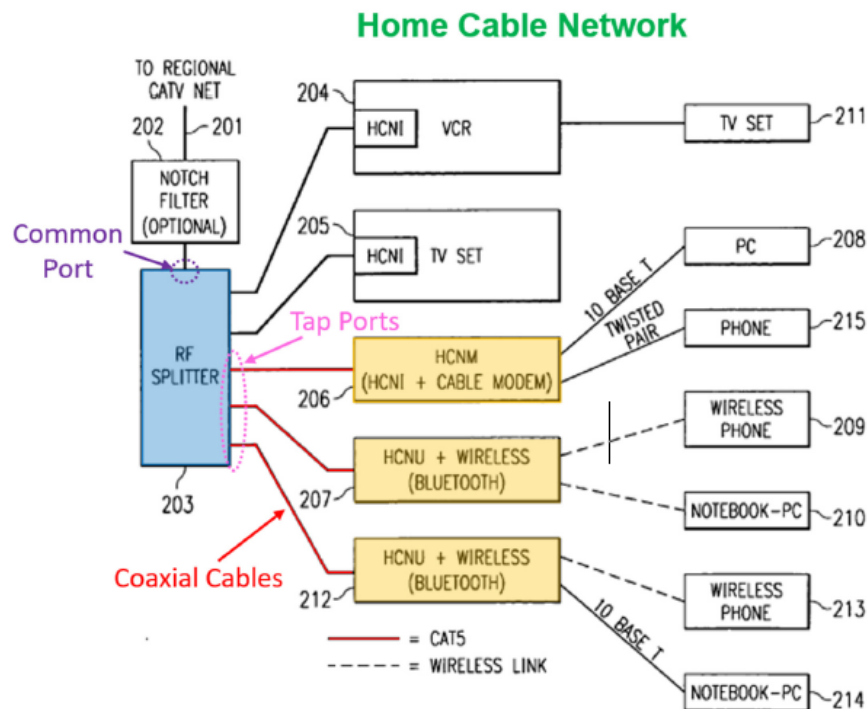
d) Limitation 1b; Cable Wiring with Splitter

Limitation 1b recites “cable wiring comprising a splitter with a common port and a plurality of tap ports, and a plurality of segments of

coaxial cable connecting between the splitter tap ports and the network devices.”

Petitioner contends that Amit discloses “home networking over coaxial TV cables.” Pet. 72 (citing Ex. 1014, 2:38–40, 3:19–23; Ex. 1004 ¶¶ 241–242). Petitioner further asserts that, in Amit’s Figure 2, RF splitter 203 splits the signal coming from and to the regional CATV plant 201, to signals coming to and from HCN devices 206, 207, 212, respectively. *Id.* at 72–73 (citing Ex. 1014, 2:36–39, Fig. 2 (annotated); Ex. 1003 ¶ 243).

Petitioner’s annotated version of Amit’s Figure 2 is reproduced below.



Referring to Amit’s Figure 2 above, Petitioner states that RF splitter 203 has a common port (purple) and a plurality of tap ports (pink) connecting to HCN devices (orange) via segments of coaxial cable (red). *Id.* at 73 (citing Ex. 1014, 8:66–67; Ex. 1004 ¶¶ 244–245).

e) Limitation 1c: Multi-Carrier Signaling

Limitation 1c recites “whereby network devices communicate with each other through the cable wiring using multi-carrier signaling.”

Petitioner contends that Amit discloses limitation 1c. Pet. 73–75. Specifically, Petitioner argues that the Amit-Jacobsen HCN devices each include a multicarrier modulator for generating multicarrier RF signals and multicarrier demodulators for processing received multicarrier RF signals. *Id.* at 73–74.

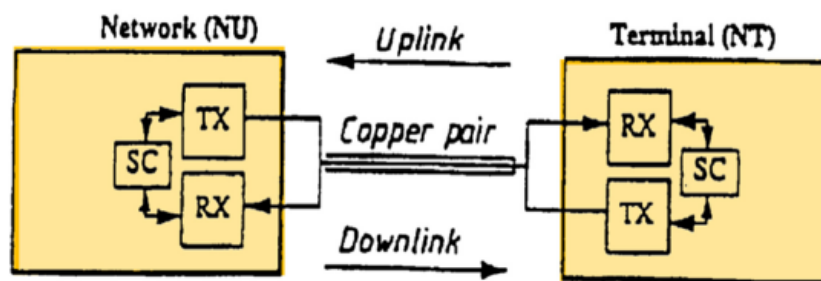
Petitioner further contends that Amit’s HCN devices communicate with each other over coaxial cables (the claimed “network devices communicate with each other through the cable wiring”). *Id.* at 74 (citing Ex. 1014, 2:34–38, 3:10–13, 3:19–21, 6:57–59; Ex. 1004 ¶¶ 246–248). Petitioner annotates Amit’s Figure 9 to show an example of how the HCN devices may communicate with one another through the splitter. *Id.* at 74–75 (citing Ex. 1014, 16:9–21, Fig. 9 (annotated); Ex. 1004 ¶ 249).

Petitioner further asserts that because the Amit-Jacobsen HCN devices are using multicarrier modulation, the communication between the devices through the cable wiring of the HomeCN is multicarrier signaling (the claimed “network devices communicate with each other through the cable wiring using multi-carrier signaling”). *Id.* at 75 (citing Ex. 1004 ¶¶ 250–251).

f) Limitation 1d.i: Probe Messages

Limitation 1d.i recites “wherein network devices transmit probe messages through the cable wiring and analyze received probe message signals to determine channel characteristics.”

Isaksson’s Figure 22, annotated by Petitioner, is reproduced below.



Petitioner contends that Isaksson’s system includes two multicarrier transceivers/modems (the claimed “network devices”) (shown in “orange”) that communicate using multicarrier signaling. Pet. 76 (citing Ex. 1013, 1:1–18, Fig. 22). Petitioner asserts that each transceiver has a receiver (RX) and transmitter (TX). *Id.* (citing Ex. 1004 ¶¶ 252–254).

Petitioner contends that, in Isaksson’s multicarrier transmission system, the receivers in both transceivers continuously measure and estimate channel characteristics and changes in the channel. *Id.* (citing Ex. 1013, 4:1–8). “Channel characteristics may be estimated by periodic transmission, by one of the transceivers, of a base sync frame having predetermined content and comparing, in the other of said transceivers, the received sync frame with a reference frame.” *Id.* at 76–77 (citing Ex. 1013, 10:10–14, 16:8–12, 16:15–20, 79:5–14; Ex. 1004 ¶¶ 255–256). Petitioner further contends that Isaksson transmits base sync frames periodically at a base sync interval, but may transmit additional sync frames between base sync frames, and thus transmit and receive multiple base sync frames to one another through the cable wiring. *Id.* at 77 (citing Ex. 1013, 16:15–20; Ex. 1004 ¶ 256). Petitioner contends that a POSITA would have understood Isaksson’s “base sync frame” “is effectively identical to the ’518 patent’s definition of “probe message.”” *Id.* (citing § IV.A.4; Ex. 1004 ¶ 257).

Petitioner contends that “a POSITA would have found it obvious to modify the combined Amit-Jacobsen HCN devices with Isaksson’s synchronized bit-loading.” *Id.* at 77–78 (citing Ex. 1013, 4:21–25; Ex. 1004 ¶ 258).

Petitioner contends that each of Amit-Jacobsen’s HCN devices—as an uplink device—would periodically transmit base sync frames (“probe messages”) to other HCN devices—as downlink HCN devices—through coaxial cables (the claimed “network devices transmit probe messages through the cable wiring”). *Id.* at 78 (citing Ex. 1013, 16:8–12). The downlink HCN devices would analyze the received frames by comparing them with reference frames to determine channel characteristics in terms of attenuation, phase shift, and variance (the claimed “analyze received probe message signals to determine channel characteristics”). *Id.* (citing Ex. 1013, 16:15–20). Petitioner contends that “[t]he receiver in the uplink HCN device also analyzes received frames from the downlink HCN devices.” *Id.* (citing Ex. 1013, 77:21–79:4; Ex. 1004 ¶¶ 259–260).

g) Limitation 1d.ii: Bit Loading Selected Based on Channel Characteristics

Limitation 1d.ii recites “bit loading is selected based on the determined channel characteristics.”

Petitioner contends that Isaksson discloses “that bit-loading parameters are selected based on the determined channel characteristics. Pet. 78 (citing Ex. 1004 ¶¶ 261–263). Petitioner contends that Isaksson teaches that its transceivers communicate using multiple carriers, and that they dynamically change the number of coded bits per carrier by measuring channel characteristics and, based on those measurements, reconfiguring the

number of bits per symbol for each carrier wave. Pet. 78–79 (citing Ex. 1013, 4:1–20, 25:26–26:20; Ex. 1004 ¶¶ 264).

Specifically, Petitioner asserts that Isaksson’s receivers send information about the measured channels to Isaksson’s transmitter in the uplink transceiver, which selects the bit-loading for each carrier and transmits the bit-loading constellation to the downlink transceiver while also changing the bit-loading constellation in the uplink transceiver. *Id.* at 79 (citing Ex. 1013, 77:27–79:14; Ex. 1004 ¶ 265).

Petitioner further contends that Isaksson’s system selects bit-loading based on SNR, and that attenuation, phase shift and variance measured by Isaksson’s receivers, can be used to calculate SNR. *Id.* (citing Ex. 1013, 3:24–27, 26:12–14; Ex. 1004 ¶ 266).

By way of explaining the overall operation of the Amit-Jacobsen-Isaksson combination, Petitioner contends that Amit-Jacobsen’s HCN device, operating as an uplink device, would periodically transmit base sync frames to other HCN devices operating as downlink HCN devices. *Id.* at 80 (citing Ex. 1013, 16:8–12). The downlink HCN devices would analyze the received frames to determine channel characteristics, e.g., SNR, and send that information to the uplink HCN device which selects bit-loading parameters for the channel based on the received channel characteristics (the claimed “bit loading is selected based on the determined channel characteristics”). *Id.* (citing Ex. 1013, 4:1–20, 77:27–79:14; Ex. 1004 ¶¶ 267–269).

h) Conclusion for Claim 1

Petitioner shows sufficiently, on this record, a reasonable likelihood that a POSITA would have been motivated to combine Amit, Jacobsen, and

Isaksson, notwithstanding Patent Owner’s arguments. Petitioner also demonstrates sufficiently that a POSITA would have had a reasonable expectation of success in making the combination, which Patent Owner does not dispute. Petitioner further shows sufficiently that each limitation of claim 1 is taught or suggested by the combination of Amit, Jacobsen, and Isaksson, and Patent Owner does not dispute these contentions. Accordingly, Petitioner presents a reasonable likelihood that claim 1 is obvious over the combination of Amit, Jacobsen, and Isaksson.

7. *Claim 3*

We now address Petitioner’s contentions that the combination of Amit, Jacobsen, and Isaksson teaches or suggests each limitation of claim 3, which depends from claim 1. Pet. 80–81.

a) *Limitation 3a: Shared Cable Wiring*

Limitation 3a recites “[t]he data communication network of claim 1 wherein the network shares the cable wiring with a cable television service.”

Petitioner quotes Amit as disclosing that “[t]he home networking equipment coexists with the other services on the cable network ... [such that] [i]t is spectrally aligned with any combination of television and other signals in the cables; and [i]t does not cause harmful interference to any other services that are assigned to the cable network.” Pet. 80 (citing Ex. 1014, 18:46–56; Ex. 1004 ¶¶ 270–272).

b) *Limitation 3b: RF Carrier Frequency above Cable Television Frequency*

Limitation 3b recites “the network device up converter translates the modulated data to an RF carrier frequency above the frequency used by the cable television service.”

Petitioner contends that Amit discloses an up-converter that translates the modulated data to an RF carrier frequency for the reasons explained with respect to limitation 1a.ii, *supra*.

Petitioner asserts that “Amit also discloses that the carrier frequency used by the HomeCN is above the frequency used by the cable television service.” Pet. 80–81 (Ex. 1014, 3:24–27).

Petitioner points to Amit’s Figure 5, reproduced below, as showing this feature.

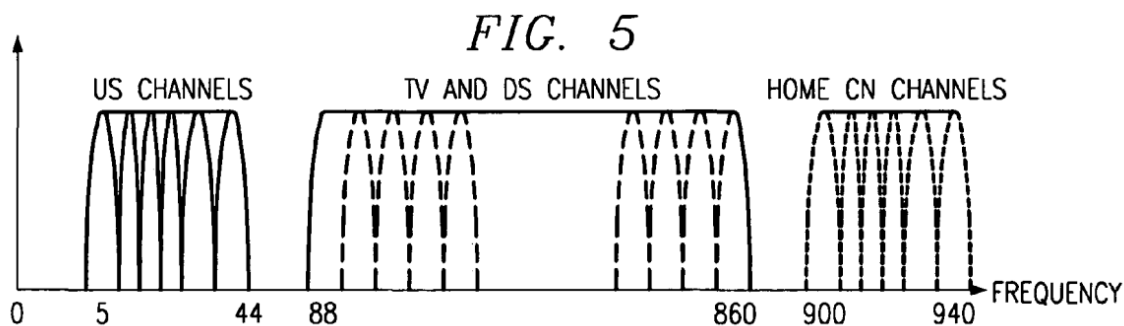


Figure 5 shows Amit’s frequency allocation. Ex. 1014, 5:28–29. Petitioner asserts that, as shown in Amit’s Figure 5, the frequency band used by cable television service is below 860 MHz whereas the frequency band dedicated to the HomeCN channels, the claimed “RF carrier frequency,” is 900–940 MHz and thus is “above the frequency used by the cable television service” as claimed. Pet. 81 (citing Ex. 1014, 7:61–8:3, 8:22–28, Fig. 5; Ex. 1004 ¶¶ 273–277).

c) Conclusion for Claim 3

Petitioner shows sufficiently, on the current record, a reasonable likelihood that a POSITA would have had reason to combine Amit, Jacobsen, and Isaksson with a reasonable expectation of success for the reasons explained for claim 1 (*see* § II.E.6). Petitioner further demonstrates sufficiently that each limitation of claim 3 is taught or suggested by the

combination, and Patent Owner does not dispute Petitioner's contentions. Petitioner thus shows a reasonable likelihood that claim 3 is obvious over the combination.

III. CONCLUSION

In light of the foregoing, based on the current record and at this stage of the proceeding, we are persuaded that Petitioner has demonstrated a reasonable likelihood of prevailing on its assertions that at least one of claims 1 and 3 of the '518 patent would have been obvious under 35 U.S.C. § 103 based on the grounds set forth in the Petition. Accordingly, we institute trial for all challenged claims on all grounds asserted by Petitioner. 37 C.F.R. § 42.108(a) ("When instituting . . . review, the Board will authorize the review to proceed on all of the challenged claims and on all grounds of unpatentability asserted for each claim").

Our factual findings, conclusions of law, and determinations at this stage of the proceeding are preliminary, and based on the evidentiary record developed thus far. At this stage of the proceeding, we have not made a final determination with respect to the patentability of the challenged claims or to the construction of any claim term.

IV. ORDER

For the foregoing reasons, it is

ORDERED that pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 1 and 3 of the '518 patent is hereby instituted on all challenges to patentability set forth in the Petition; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial and that the trial will commence on the entry date of this decision.

IPR2024-00393
Patent 7,295,518 B1

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