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Paper 8
Entered: September 6, 2024

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

COMCAST CABLE COMMUNICATIONS, LLC,
Petitioner,

v.

ENTROPIC COMMUNICATIONS, LLC,
Patent Owner.

IPR2024-00431
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

Comcast Cable Communications, LLC ("Petitioner") filed a Petition requesting inter partes review ("IPR") of claims 1–4 of U.S. Patent No. 7,295,518 B1 (Ex. 1001, "the '518 patent"). Paper 2 ("Petition" or "Pet."). Entropic Communications, LLC ("Patent Owner") 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 Comcast Corporation, Comcast Cable Communications, LLC, and Comcast Cable Communications Management, LLC as real parties-in-interest. Pet. v (Petitioner's Mandatory Notices).

Patent Owner identifies itself as the real party-in-interest. Paper 3, 1 (Patent Owner's Mandatory Notices).

C. Related Matters

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

Entropic Communications, LLC v. DirecTV, LLC, Case No. 2-23-cv-05253 (C.D. Cal.);

Entropic Communications, LLC v. DISH Network Corporation, Case No. 2-23-cv-01043 (C.D. Cal.);

Entropic Communications, LLC v. Cox Communications, Inc., Case No. 2-23-cv-01047 (C.D. Cal.); and

Entropic Communications, LLC v. Comcast Corporation., Case No. 2-23-cv-01048 (C.D. Cal).

Pet. 1 (Petitioner's Mandatory Notices); Paper 3, 1 (Patent Owner's Mandatory Notices).

Patent Owner identifies the following as patents and patent applications related to this proceeding: U.S. Patent No. 7,154,957; U.S. Patent No. 7,499,397; U.S. Patent No. 7,573,822; U.S. Patent No. 7,594,249; U.S. Patent No. 7,889,759; U.S. Patent No. 8,411,565; U.S. Patent No. 8,588,250; U.S. Patent No. 9,112,803; U.S. Patent No. 9,860,144; U.S. Patent Application No. 10/230,687; U.S. Patent Application No. 10/776,796; U.S. Patent Application No. 10/778,505; U.S. Patent Application No. 12/538,339; U.S. Patent Application No. 15/860,400; U.S. Provisional Application No. 60/288,967; U.S. Provisional Application No. 60/316,820; U.S. Provisional Application No. 60/363,420; U.S. Provisional Application No. 60/385,361; and U.S. Patent Application No. 90/019,247. Paper 3, 2–3.

Patent Owner also identifies several *inter partes* reviews against Patent Owner's patents: U.S. Patent No. 7,889,759 (IPR2024-00452); U.S. Patent No. 8,223,775 (IPR2024-00446); U.S. Patent No. 10,135,682 (IPR2024-00445); U.S. Patent No. 10,135,682 (IPR2024-00444); U.S. Patent No. 9,825,826 (IPR2024-00442); U.S. Patent No. 8,284,690

(IPR2024-00430); U.S. Patent No. 8,792,008 (IPR2024-00441); U.S. Patent No. 11,399,206 (IPR2024-00440); U.S. Patent No. 11,399,206 (IPR2024-00439); U.S. Patent No. 11,399,206 (IPR2024-00438); U.S. Patent No. 11,381,866 (IPR2024-00437); U.S. Patent No. 11,381,866 (IPR2024-00436); U.S. Patent No. 11,381,866 (IPR2024-00435); U.S. Patent No. 9,210,362 (IPR2024-00434); U.S. Patent No. 9,210,362 (IPR2024-00433); and U.S. Patent No. 9,210,362 (IPR2024-00432). Paper 3, 3–4.

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.

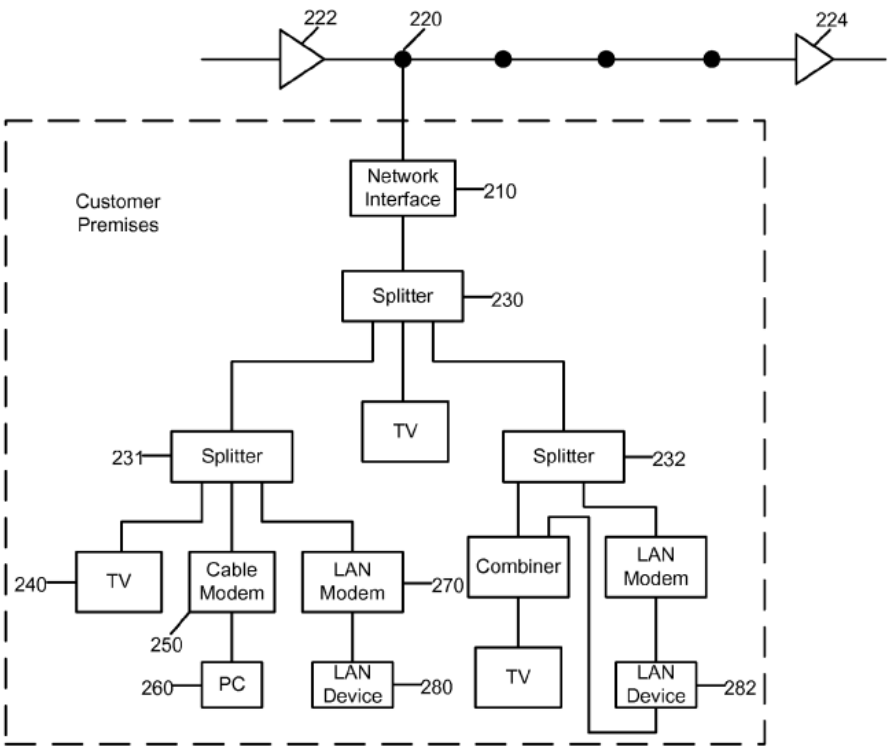


Fig. 2

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 claims 2–4 depend from claim 1. Claim 1 is set forth below with Petitioner's limitation identifiers indicated in brackets.

> **[1pre]** A data communication network comprising:
>
> **[1A]** at least two network devices, 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] wherein network devices transmit probe messages through the cable wiring and analyze received probe message signals to determine channel characteristics and bit loading is selected based on the determined channel characteristics.

Ex. 1001, 12:8–26.

F. Evidence of Record

Petitioner relies upon the following prior art references[1]:

[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. 3–4. Petitioner contends that all of these prior art references are prior art under 35 U.S.C. §§ 102(a) and (e) (pre-Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011)). *Id.* Patent Owner does not refute these assertions at this time.

Name	Reference	Date	Exhibit No.
Ashfary	US 2006/0218593 A1	Filed Sep. 30, 1998; Published Sep. 28, 2006	1006
Mirfakhraei	EP 1 087 586 A2	Filed Sep. 22, 2000; Published Mar. 28, 2001	1008
Welles	US 6,737,984 B1	Filed Mar. 10, 2000; Issued May 18, 2004	1022

Petitioner also supports its challenges with a declaration from James Bertonis. Ex. 1002. 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. §[2]	Reference(s)
A	1–4	103(a)	Ashfary, Mirfakhaei
B	2	103(a)	Ashfary, Mirfakhaei, Welles

Pet. 17.

[2] The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011), amended 35 U.S.C. §§ 102 and 103, effective March 16, 2013. Because the application from which the '518 patent issued was effectively filed before this date, the pre-AIA versions of §§ 102 and 103 apply.

II. ANALYSIS AND DISCUSSION

In this section, we discuss Petitioner's challenges to claims 1–4 of the '518 patent and Patent Owner's arguments against Petitioner's contentions. 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 as obvious under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the claimed subject matter 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. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. Level of Ordinary Skill in the Art

Petitioner contends as follows:

> In relation to the '518 patent, a person of ordinary skill in the art ("POSITA") would have had a bachelor's degree in electrical engineering, computer engineering, or a similar discipline, and three to four years of experience working in signal processing and/or communication systems/networks. Additional education may substitute for experience, and significant work experience may substitute for formal education.

Pet. 23 (citing Ex. 1002 ¶¶ 103–105).

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).

Petitioner contends that three claim terms presumptively invoke means-plus-function under pre-AIA § 112 ¶ 6 through the use of the words "means for." Pet. 23. Petitioner asserts that all other claim terms should be given their ordinary and customary meaning under § 282(b). Pet. 24 (citing 37 C.F.R. § 42.100(b)). We address Petitioner's contentions for the means-plus-function limitations below.

1. "means for determining signal activity"

Petitioner contends that the claimed function of "determining signal activity" does not require further construction. Pet. 24 (citing Ex. 1001, claim 2; Ex. 1002 ¶¶ 108–109). As to the corresponding structure, Petitioner asserts that the '518 patent describes different approaches for determining signal activity. *Id.* Petitioner states that one approach is to perform a Fast

Fourier Transform (FFT) on data samples from an analog-to-digital converter (ADC) using the same receiver signal path that is used for data communication. *Id.* at 24–25 (citing Ex. 1001, 8:51–9:27, 11:7–23; Ex. 1002 ¶¶ 109–110).

Petitioner contends that another approach is to measure received signal power with an envelope detector. *Id.* at 25 (citing Ex. 1001, 11:23–29; Ex. 1002 ¶ 110). Petitioner asserts that the envelope detector is another corresponding structure for "determining signal activity." *Id.* (citing Ex. 1002 ¶ 110).

2. "means for producing and transmitting a probe message"

Petitioner contends that the claimed function of "producing and transmitting a probe message" does not require further construction. Pet. 25 (citing Ex. 1001, claim 4; Ex. 1002 ¶¶ 111–112). As to the corresponding structure, Petitioner contends that a probe message is a signal "known by the receiving device" that is used "to estimate the channel characteristics" such as SNR.[3] *Id.* (citing Ex. 1001, 4:48–62, 7:22–42, 8:9–35, 9:36–10:20; Ex. 1002 ¶¶ 111–112). Petitioner contends that the corresponding structure for "producing and transmitting a probe message" is a processor. *Id.* at 26 (citing Ex. 1002 ¶¶ 111–112). Petitioner contends that "[t]o the extent the identified structure of a processor requires an algorithm for performing the recited function, the algorithm is: (a) generating a signal known to a receiving device; and (b) transmitting the known signal. *Id.* (citing Ex. 1001, code (57), 4:48–62, 9:35–10:38, Fig. 7; Ex. 1002 ¶¶ 111–112).

[3] Signal-to-noise ratio. Ex. 1001, 6:30.

3. "means for receiving and analyzing a probe message to determine a bit loading profile used to transmit data"

Petitioner asserts that the claimed function for this term, which is "receiving and analyzing a probe message to determine a bit loading profile used to transmit data," requires no further construction for purposes of this IPR. Pet. 27 (citing Ex. 1001, claim 4; Ex. 1002 ¶¶ 113–114). Petitioner further asserts that the corresponding structure for this function is a processor. *Id.* (citing Ex. 1001, 10:29–38; Ex. 1002 ¶¶ 113–114). Petitioner contends that, "[t]o the extent the identified structure of a processor requires an algorithm for performing the recited function, the algorithm is: (a) receiving a known signal; (b) determining a SNR for each subchannel based on the received known signal; and (c) determining a bit loading for each subchannel based on the determined SNR for the subchannel. *Id.* (citing Ex. 1001, code (57), 4:48–62, 8:9–26, 9:17–19, 9:35–10:38, 10:61–11:6, Fig. 7; Ex. 1002 ¶¶ 113–114).

4. Claim Construction Conclusion

Petitioner's constructions for the means-plus-function limitations are reasonable and Patent Owner does not dispute them. Accordingly, we agree with and will use those constructions in this Decision. For the remaining claim terms, we apply the ordinary and customary meaning. 37 C.F.R. § 42.100(b).

D. Ground A: Obviousness over Ashfary and Mirfakhraei

Petitioner contends that claims 1–4 would have been obvious over the combination of Ashfary and Mirfakhraei. Pet. 28–68. Patent Owner disputes Petitioner's contentions. Prelim. Resp. 10–45. We address below the disclosures of Ashfary and Mirfakhraei, the motivation to combine, and the parties' contentions concerning these claims.

1. Ashfary (Ex. 1006)

Ashfary is titled "Digital Coaxial Cable LAN." Ex. 1006, code (54). Ashfary relates to networking and data distribution through a coaxial cable that takes advantage of the operating frequency spectrum of the coaxial cable so as not to interfere with client data. *Id.* ¶ 2.

Ashfary's Figure 1 is shown below.

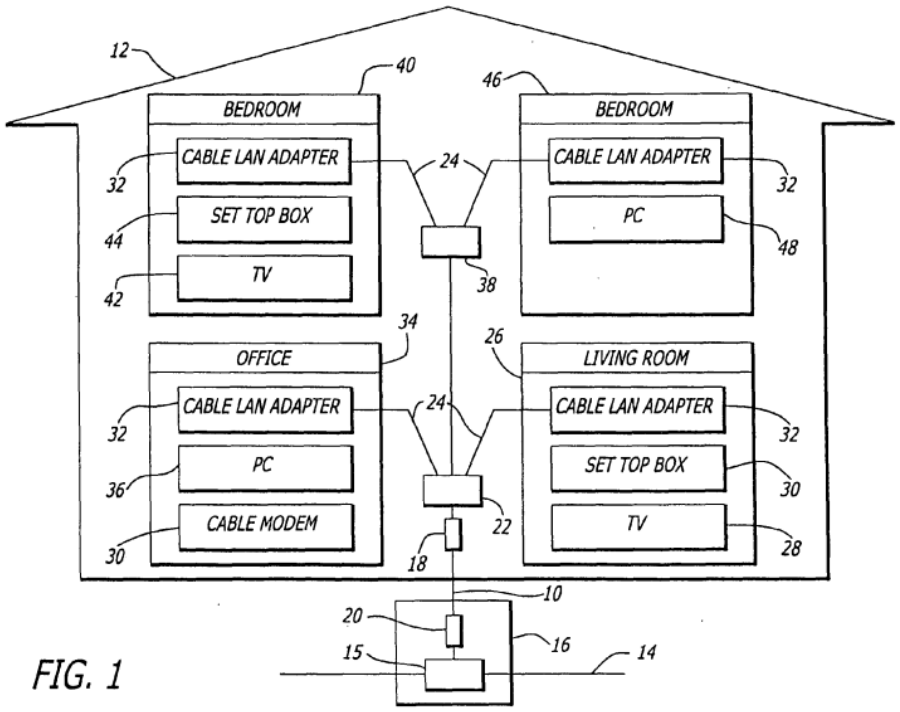


FIG. 1

Figure 1 shows an in-home coaxial cable LAN. *Id.* ¶ 8. Drop cable 10 enters home 12 after tapping main trunk 14 through splitter 15 within distribution box 16. *Id.* ¶ 14. Low pass filter (LPF) 18 is installed upstream of the in-home cable LAN network and downstream of low pass filter 20 supplied by a cable service company. *Id.* LPF 18 maintains security for the cable LAN by preventing signals generated within the cable LAN from getting back to the public cable network where they may also interfere operations of the cable service company. *Id.* ¶¶ 15–16.

Splitter 22 divides the signal on cable 10 into different cable wires 24 which are routed to different rooms in home 12 where they connect with devices such as television (TV) 28, set top box (STB) (or cable modem) 30, and personal computer (PC) 36. *Id.* ¶ 18. These client devices are connected to cable wires 24 with cable LAN adapters 32. *Id.* ¶ 19.

Ashfary's Figure 3 is shown below.

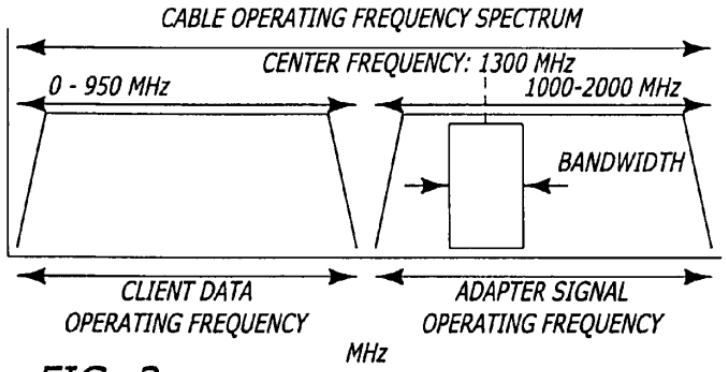


FIG. 3

Figure 3 shows an operating frequency of the client data and adapter signal. *Id.* ¶ 10. The lower region from 0–950 MHz is where conventional cable TV, digital cable TV, and cable modem services are offered. *Id.* ¶ 25. The cable LAN signal is located within the higher range of 1000–2000 MHz at a center frequency of 1300 MHz, and thus does not interfere with conventional services. *Id.* ¶¶ 25, 28.

Ashfary's Figure 4 is shown below.

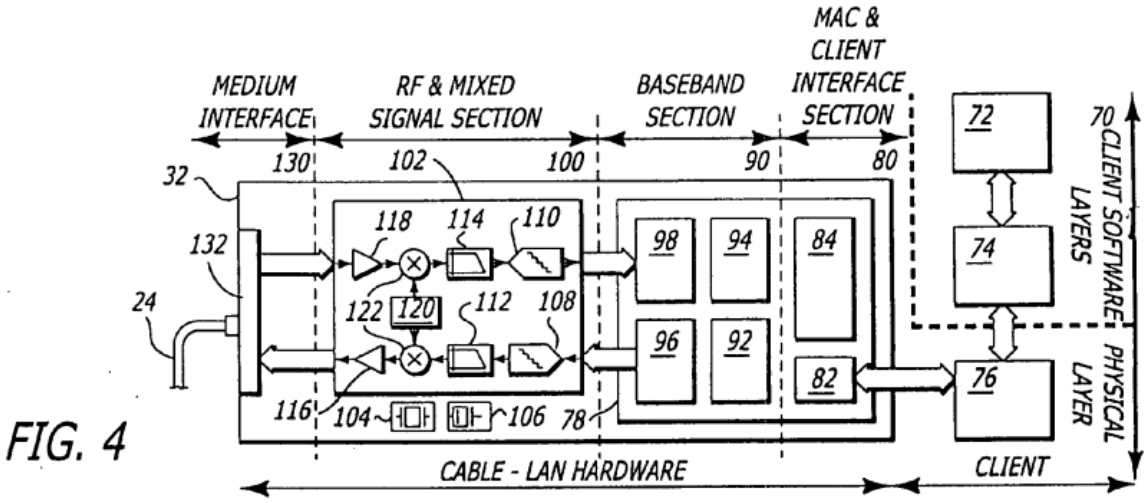


FIG. 4

Figure 4 shows an architecture of a cable LAN adapter. *Id.* ¶ 11. Modulator 96 modulates data from a client device using a modulation scheme such as Quadrature Phase Shift Keying (QPSK) digital modulation. *Id.* ¶¶ 26, 35–41. Radio Frequency (RF) and Mixed Signal section 100 up-converts the modulated data to an RF frequency. *Id.* ¶¶ 38–39. RF data signals received by the cable LAN adapter are down-converted by RF and Mixed Signal section 100 and demodulated by demodulator 98 for transmission to a client device. *Id.* ¶¶ 38–42.

2. Mirfakhraei (Ex. 1007)

Mirfakhraei is titled "Bitloading Process for Multicarrier Communications." Ex. 1007, code (54). Mirfakhraei relates to modems and transceivers that use multiple carrier frequencies for information transmissions. *Id.* ¶ 1. Mirfakhraei's modems use discrete multi-tone (DMT) modulation and bit-loading to increase transmission rates. *Id.* ¶¶ 3, 5.

Mirfakhraei discloses that "[f]or data transmission, a sending modem breaks transmitted data into packets for simultaneous transmission on separate sub-channels and independently modulates communication signals

for the sub-channels according to the data carried on each sub-channel." *Id.* ¶ 3. For data reception, the "receiving modem separates sub-channel signals according to carrier frequency, demodulates the separate sub-channel signals, and reassembles the data." *Id.*

Mirfakhraei discloses a bit-loading process that determines noise for each sub-channel of the DMT signal. *Id.* ¶ 5. The process determines target loadings to provide a desired error rate at the measured noise. *Id.* The process rounds target loadings to integers; and determines whether the proposed loadings provide a desired error rate. *Id.* If not, the process selects one or more sub-channels with a negative difference between target and proposed loadings, and for each selected sub-channel decreases the proposed loading by 1. *Id.* Gains of channels with decreased loadings are decreased for improved power efficiency. *Id.*

Mirfakhraei discloses a handshake process in which one transceiver transmits a hand-shake signal to a remote receiver when establishing a connection or retraining. *Id.* ¶ 20. The handshake signal includes a pattern that the remote transceiver requests or indicates a pattern for the remote transceiver to transmit to the one transceiver. *Id.* SNRs for the sub-channels can be determined from these handshake signals. *Id.* ¶ 22.

3. Motivation to Combine

Petitioner contends that a POSITA would have been motivated to combine Afshary and Mirfakhraei for several reasons. Pet. 40–45. Petitioner asserts that a POSITA would understand that Ashfary's network operates over a coaxial cable which is a "harsh medium for communication" that has variable frequency response caused by interference and signal reflections. *Id.* (citing Ex. 1006, code (57), ¶¶ 7, 12–20, Fig. 1; Ex. 1002

¶¶ 29–55, 128–138; Ex. 1007 ¶ 2–5, 14; Ex. 1018, 305–307). According to Petitioner, implementing Mirfakhraei's DMT bit-loading protocol would increase the data transmission rate in Ashfary's coaxial cable network, and would also improve reliability and robustness of communications therein. *Id.* at 41–42 (citing Ex. 1007 ¶ 3; Ex. 1002 ¶¶ 29–55, 139). Although Mirfakhraei describes DMT bit loading for a conventional telephone line, Petitioner contends that a POSITA would have understood that its bit-loading scheme could be implemented over coaxial cable. *Id.* at 42 (citing Ex. 1010, 374; Ex. 1013, code (54), 2:30–5:39, Figs. 1–2; Ex. 1016, code (54), 1:9–16, 3:34–59, 6:66–7:46, Fig. 1; Ex. 1017, 74; Ex. 1018, 305–307, 312; Ex. 1002 ¶ 140).

Petitioner further notes that Ashfary describes the baseband section of its cable LAN adapter as implemented on an application specific integrated circuit (ASIC), and that Mirfakhraei describes its transmitter and receiver as implemented in hardware, software, or a combination of the two. *Id.* (citing Ex. 1007 ¶ 15, Fig. 1; Ex. 1002 ¶¶ 141–144). Petitioner asserts that implementing the DMT bit-loading protocol of Mirfakhraei into Ashfary's cable LAN adapter would entail incorporating Mirfakhraei's multi-carrier modulator and demodulator into an ASIC. *Id.* at 42–43. Petitioner contends that this implementation would enable Ashfary's cable LAN adapter to communicate at higher data rates, and that it would be more robust and reliable and less affected by the harsh environment of a coaxial cable infrastructure, including interference and signal reflections. *Id.* at 43 (citing Ex. 1002 ¶¶ 141–144; Ex. 1007 ¶ 2; Ex. 1018, 205–207, 312; Ex. 1002 ¶¶ 141–144). Petitioner asserts that power efficiency would also be improved by using more available bandwidth for communicating, and using

higher order modulations schemes to transmit more bits onto frequency channels that experience less noise and interference. *Id.* (citing Ex. 1002 ¶¶ 141–144).

Petitioner further asserts that

> A POSITA would have understood that combining the teachings of Afshary and Mirfakhraei is nothing more than an obvious combination of known elements (Afshary's cable LAN adapter and Mirfakhraei's multi-carrier DMT modulator and multi-carrier DMT demodulator) according to known methods (incorporating the functionality of Mirfakhraei's multi-carrier DMT modulator and multi-carrier DMT demodulator into Afshary's cable LAN adapter – for example, by incorporating this functionality into an ASIC such as Afshary's ASIC 78) to yield predictable results (Afshary's cable LAN adapter transmits and receives data using Mirfakhraei's DMT protocol and bit loading to provide increased data rates and robust communications within Afshary's coaxial cable LAN).

Pet. 43–44 (citing Ex. 1002 ¶ 145). Petitioner argues that "a POSITA would have had a reasonable expectation of success because the proposed implementation of Afshary and Mirfakhraei would be well within the standard skill set of a POSITA and the resulting benefits of communicating over coaxial cable wiring using bit-loading and multi-carrier modulation were well known." *Id.* at 44 (citing Ex. 1002 ¶ 145).

Petitioner further contends that

> A POSITA would have also understood that combining the teachings of Afshary and Mirfakhraei is nothing more than applying a known technique (the DMT bit-loading protocol of Mirfakhraei) to a known device (Afshary's cable LAN adapter) ready for improvement to yield a predictable result (Afshary's cable LAN adapter enables communication over a coaxial cable LAN using the DMT bit-loading protocol of Mirfakhraei,

> thereby improving data rates and susceptibility to coaxial cable channel impairments).

Pet. 44 (citing Ex. 1002 ¶ 146). Petitioner asserts that combining Mirfakhraei's bit-loading and multi-carrier modulation and demodulation into Ashfary's cable LAN adapter would provide the predictable result of increased data throughput and more reliable communications in the harsh coaxial cable environment. *Id.* at 45 (citing Ex. 1002 ¶ 146).

4. Patent Owner Arguments

We now address Patent Owner's arguments against Petitioner's motivation to combine.

a) Non-Analogous Art

Patent Owner asserts that Mirfakhraei is not analogous art to the '518 patent. Prelim. Resp. 21–27 (citing *In re Klein*, 647 F.3d 1343, 1348 (Fed. Cir. 2011); *In re Clay*, 966 F.2d 656, 658–59 (Fed. Cir. 1992)). Specifically, Patent Owner asserts that Mirfakhraei does not share the same field of endeavor as the '518 patent. *Id.* at 22. Patent Owner argues that the '518 patent's field of endeavor is on-premises local area broadband coaxial cable network. Patent Owner argues that Mirfakhraei "has nothing to do with broadband networks, coaxial cables, or local area networks" because its field is multi-carrier network communications using a DSL transmission outside the home over conventional telephone lines which are "twisted pair" copper wires. *Id.* at 22–23.

Patent Owner contends that, to determine the field of endeavor, one looks to the "background of invention" and "field of the invention" sections of a patent. Pet. 23 (citing *Airbus S.A.S. v. Firepass Corp.*, 941 F.3d 1374, 1380–1381 n.8 (Fed. Cir. 2019)). Patent Owner also contends that the

patent's title, claim preamble, and function or structure of the claimed inventions are relevant. *Id.* Patent Owner asserts that these factors establish that the '518 patent's field of endeavor is "an on-premises local area broadband coaxial cable network." *Id.* at 23–24 (citing Ex. 1001, code (54), 1:27–29, 1:33–4:33, claim 1). Patent Owner asserts that Petitioner agrees that "[t]he '518 patent is directed to a coaxial cable local area network (LAN)." *Id.* at 24 (citing Pet. 1; Ex. 1:27–29; Ex. 1002 ¶ 58).

Patent Owner argues that Mirfakhraei does not mention "coaxial cables" and mentions "broadband signal" only once. *Id.* (citing Ex. 1007 ¶ 24). According to Patent Owner, Mirfakhraei's "problem and solution . . . is specific to multi-carrier communications over conventional telephone lines" and does not mention "coaxial cables" or an "on-premises" implementation. *Id.* at 24–25 (citing Ex. 1007 ¶¶ 2–5).

Patent Owner contends that Petitioner's declarant, Mr. Bertonis, stated that "Mirfakhraei is in the field of network communication and therefore in my opinion analogous to the '518 patent." *Id.* (citing Ex. 1002 ¶ 88; Ex. 1007 ¶ 1). Patent Owner alleges that Mr. Bertonis's statement was conclusory and lacked analysis. *Id.* Patent Owner also asserts that Mr. Bertonis makes no mention of "broadband," "coaxial cable," or "local area" networks which are the "overwhelming focus" of the '518 patent. *Id.* As support for its argument, Patent Owner points to a case stating that semiconductor "memory" was too broad of a field as support for its contentions. *Id.* at 25–26 (citing *Wang Labs., Inc. v. Toshiba Corp.*, 993 F.2d 858, 864-65 (Fed. Cir. 1993)).

We do not agree with Patent Owner's argument that Mirfakhraei is not in the same field of endeavor, and therefore not analogous, to

the '518 patent. Mirfakhraei's title, abstract, "Field of the Invention," and claims describe its bit loading process for multicarrier communications generally, and do not limit its modems or receivers to using telephone lines as the communication medium. Ex. 1006, codes (54, 57), ¶ 1, claims 1–18. Although telephone lines are mentioned in the "Description of the Related Art" and "Detailed Description of the Preferred Embodiments" sections, Mirfakhraei cautions that "[a]lthough the invention has been described with reference to particular embodiments, the description is only an example of the invention's application and should not be taken as a limitation." *Id.* ¶ 36. Accordingly, we do not agree with Patent Owner's argument that Mirfakhraei's field of endeavor is limited to telephone lines or DSL, as Patent Owner argues.

Patent Owner further contends that Petitioner does not demonstrate that Mirfakhraei is reasonably pertinent to the problems that the inventors of the '518 patent were trying to solve. Prelim. Resp. 26–27. Patent Owner contends that the '518 patent lays out a clear problem and solution addressing impediments that previously restricted high bandwidth communication between terminal devices over on-premises coaxial cabling. *Id.* at 26 (citing Ex. 1001, code (54), 4:19–33). Patent Owner asserts that the '518 patent addresses inter-port isolation across splitters, variable signal attenuation caused by different channel paths, and imperfect connections at splitters which cause micro reflections. *Id.* at 26–27 (citing Ex. 1001, 2:27–34, 2:41–48, 3:5–16, 4:23–25).

Patent Owner argues that Mirfakhraei is directed to an entirely different problem, which is that sub-channels in conventional telephone lines differ in the amount of data they can carry but the DMT protocols used for

multi-carrier transmission to increase data rate employ the same QAM[4] modulation scheme, leading to transmission inefficiency. Patent Owner asserts that Mirfakhraei attempts to address this issue by adjusting the modulation scheme, and hence the bit loading, used for each sub-channel. *Id.* at 27 (citing Ex. 1007 ¶¶ 3–4).

However, variable attenuation across channel paths is a problem addressed by Mirfakhraei and the '518 patent. Ex. 1001, 6:45–46; Ex. 1006 ¶ 6. And Mirfakhraei performs bit loading with multi-carrier signals for other reasons besides overcoming transmission inefficiency. For example, Mirfakhraei addresses the problem of achieving the desired noise immunity required for multicarrier transmissions. Ex. 1007 ¶ 6. Similarly, the '518 patent addresses the problem of noise on signal transmissions. Ex. 1001, 4:36–65. Thus, there is overlap in the problems addressed by Mirfakhraei and the '518 patent.

Patent Owner's arguments that the problems of Mirfakhraei are not reasonably pertinent, and therefore not analogous, to those of the '518 patent are unavailing.

b) Impermissible Hindsight

Patent Owner argues that Petitioner uses impermissible hindsight to combine Afshary and Mirkakhraei. Prelim. Resp. 27–31. Specifically, Patent Owner asserts that Afshary and Mirfakhraei "are different network types and operate over differing mediums." *Id.* at 28. Patent Owner asserts that Ashfary provides and in-home LAN whereas Mirfakhraei provides a premises-to-infrastructure link from customer to the telephone using ADSL.

[4] Quadrature Amplitude Modulation. Ex. 1007 ¶ 4.

Id. Patent Owner further asserts that Ashfary communicates over high bandwidth coaxial cables whereas Mirfakhraei uses bandwidth-constrained twisted pair telephone lines. *Id.* Patent Owner contends that Ashfary differentiates coaxial cables and telephone lines and highlights the issues presented in using telephone lines. *Id.* (citing Ex. 1006 ¶¶ 5–6).

Petitioner provided sufficient evidence that a POSITA would have understood that Mirfakhraei's DMT bit loading for a conventional telephone line can be applied to a coaxial cable. *Id.* at 42 (citing Ex. 1010, 374; Ex. 1013, code (54), 2:30–5:39, Figs. 1–2; Ex. 1016, code (54), 1:9–16, 3:34–59, 6:66–7:46, Fig. 1; Ex. 1017, 74; Ex. 1018, 305–307, 312; Ex. 1002 ¶ 140). Patent Owner also does not explain why Petitioner allegedly engaged in hindsight reconstruction when the claims do not identify where the network components are located, whether inside or outside of a home. Patent Owner's arguments do not undercut Petitioner's showing of a motivation to combine.

Patent Owner next argues that Afshary and Mirfakhraei operate in incompatible environments because Ashfary operates at frequencies above those used by conventional cable services to avoid interference, whereas Mirfakhraei's ADSL transceiver communicates over the low frequency bands avoided by Ashfary. Prelim. Resp. 28–29 (citing Ex. 1006 ¶ 7; Ex. 1007 ¶¶ 2–3), 32–35. Mirfakhraei discloses that its modem or transceiver may operate on a broadband signal which presumably would include conventional low frequency bands for conventional cable services and the frequencies above them. We also note that while this argument may have relevance for dependent claim 3, on this record, it appears irrelevant to claims 1, 2, and 4.

Patent Owner then asserts that Ashfary and Mirfakhraei use differing signaling technology. Prelim. Resp. 29 (citing Ex. 1006 ¶ 37; Ex. 1007 ¶¶ 2–6), 35–38. Patent Owner argues that Ashfary uses a "clean" medium like coaxial cables where single carrier signaling is sufficient, whereas Mirfakhraei is "saddled" with telephone cables and thus uses multi-carrier signaling. *Id.* Patent Owner argues that Petitioner did not address the differing signaling architectures, and that a POSITA would not have been motivated to combine Ashfary and Mirfakhraei. *Id.*

On this record, Petitioner shows sufficiently that implementing Mirfakhraei's DMT bit-loading protocol would increase data transmission rate in Ashfary's coaxial cable network, and would also improve reliability and robustness of communications therein. *Id.* at 41–42 (citing Ex. 1007 ¶ 3; Ex. 1002 ¶¶ 29–55, 139). Hence, Patent Owner's assertion of different signaling architectures does not outweigh Petitioner's evidence that there were advantages to be obtained by the combination notwithstanding Patent Owner's noted differences in signaling architectures.

Patent Owner also argues that Petitioner made "[b]road, generic references to 'impairments' and increased data transmission rates" but that such generic concerns relate to nearly every communications system in existence, and not the motivation to combine particular bits of technology. Prelim. Resp. 38 (citing Pet. 40–41). However, under similar circumstances, our reviewing court stated that a motivation to combine "is not inherently suspect merely because it's generic in the sense of having broad applicability or appeal." *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 784, 797 (Fed. Cir. 2021).

Patent Owner asserts that Petitioner contended in its motivation section that a coaxial cable is a "harsh medium" but that Ashfary teaches that coaxial cabling is "a very clear, clean medium capable of handling operating frequencies of up to 2000 MHz." *Id.* at 38–39 (citing Ex. 1006 ¶ 24). Patent Owner further argues that Petitioner's declarant, Mr. Bertonis, stated that a coaxial cable "can be a harsh environment" because its frequency response can vary significantly. *Id.* at 39. Patent Owner also argues that Mr. Bertonis relies on Jacobsen94 (Exhibit 1018) but argues that it addressed data transmission outside of the home using frequencies different from Afshary. *Id.* at 39–40.

This evidence at best establishes that coaxial cabling may present a "harsh" or "clear" environment depending on the circumstances. We do not see this evidence as negating Petitioner's motivation to combine.

Patent Owner further argues that Afshary touts the high bandwidth of its system without the use of multi-carrier signaling, so a POSITA would not have been motivated to further increase bandwidth of Afshary's system with Mirfakhraei. *Id.* at 40 (citing Pet. 41; Ex. 1006 ¶ 27). Patent Owner also reiterates its argument that Petitioner failed to consider the differing communication mediums between Ashfary and Mirfakhraei in its motivation to combine section, and that just because a POSITA could have made the combination does not mean the POSITA would have been motivated to do so. *Id.* at 40–41.

On this record, we find these arguments do not undermine Petitioner's motivation to combine. While Afshary's inventors may have touted the high bandwidth of its single-carrier system, that does not necessarily imply that a

POSITA would not have recognized further improvement under at least some circumstances by implementing multi-carrier signaling.

We have already addressed Patent Owner's argument concerning differing mediums earlier in this section.

c) Frustration of Goals

Patent Owner asserts that inserting Mirfakhraei's multi-carrier signaling functionality into Afshary's adapters would frustrate Afshary's goal or providing a cost-effective, in-home LAN for distributing data. Prelim. Resp. 41–43 (citing Ex. 1006 ¶¶ 4–6, 29–42; Pet. 39, 42–43; § IV.A.1). Patent Owner asserts that a POSITA would not have been motivated to insert Mirfakhraei's components into Afshary's adapters because the combination would add costs and complexity contrary to Afshary's disclosure, and that Afshary teaches away from the claimed invention. *Id.* at 42. According to Patent Owner, Afshary designs its adapters to provide robust communications with cost-effective components, whereas Mirfakhraei is concerned with optimization. *Id.* at 42–45 (citing Ex. 1004 ¶¶ 29–42, Fig. 4; Ex. 1007 ¶¶ 5, 14, 17, 19; Pet. 39, 42–43).

On this record, Patent Owner's arguments at most establish that a POSITA would have considered tradeoffs between cost and complexity and performance in making the combination. On the evidence presented here, Petitioner shows sufficiently that a POSITA would have combined Afshary and Mirfakhraei at least under some circumstances.

d) Conclusion for Patent Owner Arguments

On this record, Petitioner has shown a reasonable likelihood that a POSITA would have combined Afshary and Mirfakhraei with a reasonable expectation of success.

5. Claim 1

We now address Petitioner's contentions that claim 1 is disclosed by the combination of Afshary and Mirfakhraei. Pet. 28–51. Patent Owner does not dispute Petitioner's contentions at this time. We conclude that Petitioner has shown a reasonable likelihood to prevail in showing that claim 1 would have been obvious over Afshary and Mirfakhraei for the reasons that follow.

a) Preamble 1pre: Data Communication Network

Petitioner contends that Afshary discloses a coaxial cable local area network (LAN) ("data communication network"). Pet. 28–29 (citing Ex. 1006 ¶¶ 2, 7, 12, 14, 19–23, 41, Figs. 1–2; Ex. 1002 ¶¶ 118–120).

Petitioner shows a reasonable likelihood that Afshary discloses the preamble 1pre so we do not decide whether the preamble is limiting.

b) Limitation 1A: At Least Two Network Devices

Limitations 1A recites "at least two network devices, 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 Afshary discloses each feature of limitation 1A other than a modulator and demodulator that are multi-carrier, but asserts that such devices are disclosed by Mirfakhraei. Pet. 19.

Petitioner contends that Afshary discloses cable LAN adapters 32 ("at least two network devices") within its coaxial LAN. Pet. 30 (citing *id.* at § VI.A.1.a; Ex. 1006 ¶¶ 18–19, 21–23, 41, Figs. 1–2; Ex. 1002 ¶ 121).

Petitioner contends that Afshary discloses a modulator 96 and RF & Mixed Signal section 100, digital to analog converter (DAC) 108, up converter 112, local oscillator (LO) frequency synthesizer timing circuit 120, mixer 122, and power amplifier (PA) 116 (collectively, "up converter for translating the modulated data to an RF carrier frequency"). Pet. 31–32 (citing Ex. 1006 ¶¶ 38–39; Ex. 1002 ¶¶ 123–124).

Petitioner contends that Afshary discloses that these components operate to translate the modulated data from the Baseband section 90 to a 1300 MHz center frequency ("RF carrier frequency") and that the modulated data occupies a bandwidth of 5 MHz. *Id.* at 32 (citing Ex. 1006 ¶¶ 25, 38–39; Ex. 1002 ¶¶ 123–124). Petitioner asserts that the up-converted modulated data is transmitted as an RF signal to another cable LAN adapter 32 to facilitate communication between client devices. *Id.* (citing Ex. 1006 ¶¶ 23, 26, 39, 41, Fig. 3; Ex. 1002 ¶¶ 123–124).

Petitioner further contends that, for receiving RF modulated data, the RF & Mixed Signal section 100 includes low noise amplifier (LNA) 118, LO 120, mixer 122, down converter 114, and analog to digital converter (ADC) 110 (collectively, "down converter for translating an RF signal"). Pet. 33 (citing Ex. 1006 ¶¶ 38–39, 41; Ex. 1002 ¶¶ 125–126). Petitioner asserts that "Afshary teaches that these components operate to translate a received RF signal to a lower frequency signal." *Id.* (citing Ex. 1006 ¶¶ 38–39, 41; Ex. 1002 ¶¶ 125–126). According to Petitioner, "Afshary teaches that the down-converted signal from the RF & Mixed Signal section 100 is demodulated by demodulator 98." *Id.* (citing Ex. 1006 ¶¶ 41–42; Ex. 1002, ¶¶ 125–126). Petitioner states that the "demodulated data from demodulator 98 is decoded and corrected by FEC decoder 94 to recover

digital data that is provided to MAC & Client Interface section 80." *Id.* (citing Ex. 1006 ¶¶ 41–42; Ex. 1002 ¶¶ 125–126).

Petitioner asserts that "Figure 1 of Mirfakhraei . . . shows a transmitter 110 and a receiver 190 of a transceiver 100 that communicates using Mirfakhraei's DMT and a bit-loading scheme." Pet. 35 (citing Ex. 1007 ¶¶ 5–8, 14–15; Ex. 1002 ¶ 130). According to Petitioner, Mirfakhraei teaches that the transmitter 110 includes framer 113, tone ordering block 114, constellation mapper 115, Inverse Discrete Fourier Transform (IDFT) block 116, buffer 117, and TX handshake block 120 (collectively, "multi-carrier modulator for modulating data"). *Id.* at 35–36 (citing Ex. 1007 ¶¶ 15–19; Ex. 1002 ¶ 130).

Petitioner contends that "Mirfakhraei teaches that the receiver 190 includes time domain equalizer (TEQ) 180, buffer 197, Discrete Fourier Transform (DFT) block 196, frequency domain equalizer 195, slicer 194, deframer 193, and RX handshake block 170 (collectively, "multi-carrier demodulator for demodulating the translated RF signal to produce data")." Pet. 38–39 (citing Ex. 1007 ¶¶ 21–24; Ex. 1002 ¶ 135).

Petitioner shows a reasonable likelihood that limitation 1A is disclosed by the combination of Afshary and Mirfakhraei.

c) Limitation 1B: Cable Wiring

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 Afshary shows cable LAN adapters 32 within the coaxial cable LAN. Pet. 45 (citing Ex. 1006 ¶¶ 18–19, 21–23, Figs. 1–2;

Ex. 1002 ¶¶ 148–149). According to Petitioner, "Afshary explains that drop cable 10 is provided to splitter 22 within home 12." *Id.* (citing Ex. 1006 ¶¶ 16, 18–19; Ex. 1002 ¶¶ 148–149). Petitioner asserts that "Afshary teaches that 'drop cable 10 is split by splitter 22 into different cable wires 24, [with] each cable wire 24 being routed to different rooms in home 12.'" *Id.* at 45–46 (citing Ex. 1006 ¶ 18; Ex. 1002 ¶¶ 148–149).

Referring to Afshary's Figure 1, Petitioner contends that the splitter 22 ("splitter") includes an input port ("common port") and multiple output ports ("plurality of tap ports"). *Id.* at 46 (citing Ex. 1006 ¶¶ 16, 18–19; Ex. 1001, 1:53–57, Fig. 1; Ex. 1002 ¶¶ 148–149). According to Petitioner, from the output ports, multiple cable wires 24 ("cable wiring" and "plurality of segments of coaxial cable connecting between the splitter tap ports and the network devices") are connected to the cable LAN adapters 32. *Id.* at 46–47 (citing Ex. 1006 ¶¶ 16, 18–19; Ex. 1001, 1:53–57, Fig. 1; Ex. 1002 ¶¶ 148–150).

Petitioner shows a reasonable likelihood that limitation 1B is disclosed by Afshary.

d) 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 Afshary discloses cable LAN adapters 32 ("network devices") that communicate with each other via cable wire 24 ("cable wiring"). Pet. 47 (citing Ex. 1006 ¶¶ 16, 18–19, 21–23, Figs. 1–2; Ex. 1002 ¶ 151). Petitioner asserts that the cable LAN adapters 32 in the Afshary-Mirfakhraei system communicate with each other using the DMT bit-loading protocol taught by Mirfakhraei. *Id.* at 47–48 (citing Ex. 1007,

code (54), ¶¶ 2–3, 5–8, 14–15, Fig. 1; Ex. 1002 ¶ 151). Petitioner alleges that "Mirfakhraei explains that DMT is a multi-carrier communication technique (claimed "communicat[ing] … using multi-carrier signaling")." *Id.* at 48 (citing Ex. 1007, code (54), ¶¶ 2–3, 5–6, Fig. 1; Ex. 1002 ¶¶ 151–152).

Petitioner shows a reasonable likelihood that limitation 1C is disclosed by the combination of Afshary and Mirfakhraei.

e) Limitation 1D: Probe Messages

Limitation 1D recites "wherein network devices transmit probe messages through the cable wiring and analyze received probe message signals to determine channel characteristics and bit loading is selected based on the determined channel characteristics."

Petitioner asserts that "the Afshary-Mirfakhraei system implements the DMT bit loading scheme taught by Mirfakhraei." Pet. 48 (citing Ex. 1007, code (54), ¶¶ 2–3, 5–8, 14–25, Figs. 1–3; Ex. 1002 ¶ 153). Petitioner states that, "[t]o facilitate the DMT bit loading scheme, the cable LAN adapters (claimed "network devices") of the Afshary-Mirfakhraei system include the TX handshake block 120 . . . and the RX handshake block 170 . . . to implement the 'bit-loading' process that characterizes the capabilities of sub-channels and determines the number of bits-per-symbol transmitted over the channel' as taught by Mirfakhraei." *Id.* (citing Ex. 1007 ¶ code (57), 14, ¶¶ 2–3, 5–8, 14–25, Figs. 1–3; Ex. 1002 ¶ 153).

According to Petitioner, Mirfakhraei discloses that TX handshake block 120 of a first transceiver generates and transmits handshake signals to a second transceiver ("transmit probe messages through the cable wiring"), with each handshake signal comprising a known signal (*e.g.*, a known signal

pattern or a known pseudo-random signal). Pet. 49–50 (citing Ex. 1007 ¶¶ 20–23; Ex. 1002 ¶ 154; Ex. 1007 ¶¶ 20, 22; Ex. 1002 ¶ 154). Petitioner asserts that "Mirfakhraei further teaches that RX handshake block 170 of the second transceiver estimates the SNR (claimed "channel characteristics") for each sub-channel based on received handshake signals (claimed "analyze received probe message signals"). *Id.* at 50 (citing Ex. 1007 ¶¶ 21–23; Ex. 1002 ¶ 154).

Regarding Mirfakhraei's bit-loading, Petitioner contends that Mirfakhraei discloses that "the size of a constellation map for a subchannel, and hence the number of bits represented by each transmitted signal, is based on the SNR of the subchannel." *Id.* at 50 (citing Ex. 1007 ¶¶ 4–8, 14, 17–18, Figs. 1–2; Ex. 1002 ¶¶ 29–55, 155).

According to Petitioner, Mirfakhraei discloses that "the RX handshake block 170 facilitates implementation of the bit loading process by comparing the received handshake signal to the known signal values that were transmitted." Pet. 50 (citing Ex. 1007 ¶¶ 5–8, 14, 20, 22–23, 25–32, Figs. 1–2; Ex. 1002 ¶ 155). Petitioner asserts that, "[b]ased on the comparison, SNR values for each sub-channel are determined." *Id.* (citing Ex. 1007 ¶¶ 5–8, 14, 20, 22–23, 25–32, Figs. 1–2; Ex. 1002 ¶ 155). Petitioner argues that the "appropriate bit-loadings for each sub-channel are then determined based on the SNR values determined for each sub-channel (claimed "bit loading is selected based on the determined channel characteristics")." Pet. 50–51 (citing Ex. 1007 ¶¶ 5–8, 14, 17, 20, 22–23, 25–32, Figs. 1–2; Ex. 1002 ¶ 155).

Petitioner further contends that "[s]ub-channels having higher SNRs are assigned higher order modulation constellations." Pet. 51 (citing

Ex. 1007 ¶¶ 5–8, 14, 17, 20, 22–23, 25–32, Figs. 1–2; Ex. 1002 ¶ 155). According to Petitioner, "[s]ub-channels having lower SNRs are assigned lower order modulation constellations." *Id.* Petitioner states that "[f]or example, a sub-channel with a higher SNR modulates data using a larger QAM constellation such as 256-QAM, which enables each transmitted QAM symbol to represent 8 bits, while a sub-channel with a lower SNR modulates data using a smaller QAM constellation such as 16-QAM, which enables each transmitted QAM symbol to represent 4 bits." *Id.* (citing Ex. 1007 ¶¶ 4, 17–18, 23–24; Ex. 1002 ¶¶ 29–55, 155). Petitioner contends that the "RX handshake block 170 of the second transceiver sends the determined bit-loadings for each sub-channel to the first transceiver, which then employs the bit-loadings in subsequent communications with the second transceiver." *Id.* (citing Ex. 1007 ¶¶ 5–8, 14, 20, 22–23, 25–32, Figs. 1–2; Ex. 1002 ¶¶ 29–55, 153–156).

Petitioner presents a reasonable likelihood that limitation 1D is disclosed by the combination of Afshary and Mirfakhraei.

f) Conclusion for Claim 1

On the record developed thus far, Petitioner shows that a POSITA would have combined Afshary and Mirfakhraei with a reasonable expectation of success notwithstanding Patent Owner's arguments to the contrary. Petitioner further demonstrates that each limitation is disclosed by the combination of Afshary and Mirfakhraei. Accordingly, Petitioner presents a reasonable likelihood to prevail in showing that claim 1 of the '518 patent would have been obvious over the combination of Afshary and Mirfakhraei.

6. Claims 2–4

Claim 2 depends from claim 1 and recites "wherein a network device comprises a means for determining signal activity and selects a frequency band for operation that is not used by other services."

For claim 2, Petitioner relies on Mirfakhraei's A/D converter for determining signal activity. Pet. 52–56. While an A/D converter can sample a signal to obtain spectral content, it cannot by itself determine signal activity. Consequently, Petitioner has not shown a reasonable likelihood to prevail in demonstrating obviousness of claim 2 in this ground.

Claim 3 depends from claim 1 and recites "wherein the network shares the cable wiring with a cable television service and the network device up converter translates the modulated data to an RF carrier frequency above the frequency used by the cable television service."

Reviewing Petitioner's contentions for claim 3, we determine that Petitioner has presented a reasonable likelihood that this claim would have been obvious over the combination of Afshary and Mirfakhraei. In particular, Afshary's Figure 3 and related description disclose this feature.

Claim 4 is similar to claim 1 and incorporates means-plus function limitations discussed in § II.C. Reviewing Petitioner's contentions for claim 4 (Pet. 57–68), we determine that Petitioner has shown a reasonable likelihood to prevail in showing claim 4 would have been obvious over the combination of Afshary and Mirfakhraei.

E. Ground B: Obviousness over Afshary, Mirfakhraei, and Welles

Petitioner relies on Welles to disclose an envelope detector. Pet. 68–73. Petitioner shows sufficiently that a POSITA would have been motivated to combine Welles with Afshary-Mirfakhraei. *Id.* at 69–73. In addition, Petitioner shows sufficiently that Afshary's A/D converter joined with Welles' envelope detector would have had the ability to determine signal activity, and otherwise meets the limitations of claim 2. *Id.* at 69.

Accordingly, Petitioner presents a reasonable likelihood that claim 2 would have been obvious over the combination of Afshary, Mirfakhraei, and Welles.

III. CONCLUSION

In light 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 1–4 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 1–4 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.

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