

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

COMCAST CABLE COMMUNICATIONS, LLC,
Petitioner,

v.

ENTROPIC COMMUNICATIONS, LLC,
Patent Owner.

Patent No. 9,866,438
Filing Date: February 16, 2017
Issue Date: January 9, 2018

Title: METHOD AND SYSTEM FOR SERVICE GROUP MANAGEMENT IN
A CABLE NETWORK

Inter Partes Review No.: IPR2025-00185

**PETITION FOR *INTER PARTES* REVIEW
UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. § 42.100 *et seq.***

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Ex. 1210:	U.S. Pub. No. 2013/0041990 (“Thibeault”)
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Ex. 1214:	U.S. Patent No. 8,085,802 (“Monk802”)
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- Ex. 1219: Exhibit F, U.S. Patent No. 10,135,682 Exemplary Infringement Chart, *Entropic Comms., LLC v. Charter Comms., Inc.*, Case No. 2:22-CV-00125-JRG (E.D. Tex.)
- Ex. 1220: Reserved
- Ex. 1221: Data-Over-Cable Interface Specifications, Radio Frequency Interface Specification, SP-RFII01-970326
- Ex. 1222: Data-Over-Cable Service Interface Specifications, DOCSIS 1.1, Radio Frequency Interface Specification, CM-SP-RFIv1.1-C01-050907
- Ex. 1223: Data-Over-Cable Service Interface Specifications, DOCSIS 2.0, Radio Frequency Interface Specification, CM-SP-RFIv2.0-C02-090422
- Ex. 1224: U.S. Pub. No. 2007/0171994 (“Parker”)
- Ex. 1225: U.S. Patent No. 8,503,546 (“Ashrafi”)
- Ex. 1226: Tanenbaum, “Computer Networks,” 4th ed. (2003)
- Ex. 1227: Driscoll, “Next Generation IPTV Services and Technologies” (2008)
- Ex. 1228: U.S. Pub. No. 2005/0097617 (“Currivan”)
- Ex. 1229: U.S. Patent No. 10,135,682 (“the ’682 patent”)
- Ex. 1230: U.S. Pub. No. 2008/0291840 (“Cooper840”)
- Ex. 1231: U.S. Pub. No. 2005/0122996 (“Azenkot”)
- Ex. 1232: Reserved
- Ex. 1233: ITU-T J.222.1, *Series J: Cable Networks and Transmission of Television, Sound Programme and Other Multimedia Signals* (Jul. 2007)

- Ex. 1234 “[Tentative] Claim Construction Order,” *Entropic Communications, LLC v. Comcast Corporation*, No. 2:23-cv-01050 (C.D. Cal. filed Feb. 10, 2023) and *Entropic Communications, LLC v. Cox Communications, Inc.*, No. 2-23-cv-01049 (C.D. Cal. filed Feb. 10, 2023) (collectively, “CA litigation”)
- Ex. 1235 U.S. Patent No. 6,816,463 (“Cooper463”)

MANDATORY NOTICES

Real Parties in Interest (37 C.F.R. § 42.8(b)(1))

The real parties-in-interest for this petition are (i) Comcast Corporation, (ii) Comcast Cable Communications, LLC, and (iii) Comcast Cable Communications Management, LLC. No unnamed entity is funding, controlling, or directing this Petition for *inter partes* review (IPR) of U.S. Patent No. 9,866,438 (“the ’438 patent”), or otherwise has an opportunity to control or direct this Petition or Petitioner’s participation in any resulting IPR.

Related Matters (37 C.F.R. § 42.8(b)(2))

Office Proceedings

This is the third of three petitions for *inter partes* review filed by Petitioner against the ’438 patent. Petitioner has previously filed petitions for *inter partes* review against related U.S. Patent No. 10,135,682 (“the ’682 patent”). The IPRs against the ’682 patent are assigned case numbers: IPR2024-00444 and IPR2024-00445. The Board denied institution of those IPRs for the ’682 patent, and Petitioner has filed a Request for Director Review of the decision denying institution for IPR2024-00445. This Petition relies on prior art (*e.g.*, Cooper840 and Azenkot) that was not relied on in the IPRs for the ’682 patent.

No prior Office proceedings (*e.g.*, *inter partes* review, post-grant review, or covered business method) have been filed against the ’438 patent.

This is the third of three petitions for *inter partes* review filed by Petitioner against the '438 patent.

Litigation Matters

Patent Owner has sought leave to assert the '438 patent in *Entropic Communications, LLC v. Comcast Corporation*, No. 2:23-cv-01050 (C.D. Cal. filed Feb. 10, 2023) and *Entropic Communications, LLC v. Cox Communications, Inc.*, No. 2-23-cv-01049 (C.D. Cal. filed Feb. 10, 2023) (collectively, "CA litigation"). These cases have been consolidated and remain pending. The related '682 patent has been asserted in the CA litigation.

The related '682 patent was also asserted in *Entropic Communications, LLC v. Charter Communications, Inc.*, No. 2:22-cv-00125-JRG (E.D. Tex. filed Apr. 27, 2022) ("TX litigation"), which was dismissed on December 10, 2023.

Continuity

According to the Office's records, the '438 patent is a continuation of application No.15/228,703, filed on Aug. 4, 2016, now Pat. No. 9,577,886, which is a continuation of application No. 13/948,444, filed on Jul. 23, 2013, now Pat. No. 9,419,858, which claims the benefit of Provisional application No. 61/674,742, filed on Jul. 23, 2012. The '438 patent issued from U.S. patent application Ser. No. 15/434,673 ("the '673 application") filed on February 16, 2017. The '682 patent is a continuation of the '673 application.

Lead and Back-Up Counsel (37 C.F.R. § 42.8(b)(3))

Petitioner designates counsel listed below. A power of attorney for counsel is being concurrently filed.

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I. INTRODUCTION

Comcast Cable Communications, LLC (“Petitioner”) petitions for *inter partes* review and cancellation of claims 1-18 of U.S. Patent No. 9,866,438 (“the ’438 patent”) (Ex. 1201).

II. SUMMARY OF ARGUMENT

The ’438 patent describes a well-known system for managing “service groups” of cable modems within a cable television network. The system includes a cable modem termination system (CMTS) that determines signal-to-noise ratios (SNRs) for cable modems (CMs). The CMs are assigned to service groups based on the SNRs. The system determines “a worst-case SNR profile” used to generate a “composite SNR related metric” that the CMTS uses to select physical layer communication parameters (*e.g.*, modulation order) for each service group. In other words, modems with similar SNRs are grouped, and communication parameters of all the modems in a particular group are determined based on the modem having the worst SNR in the group. The Examiner believed this feature (and only this feature) to be missing from the prior art.

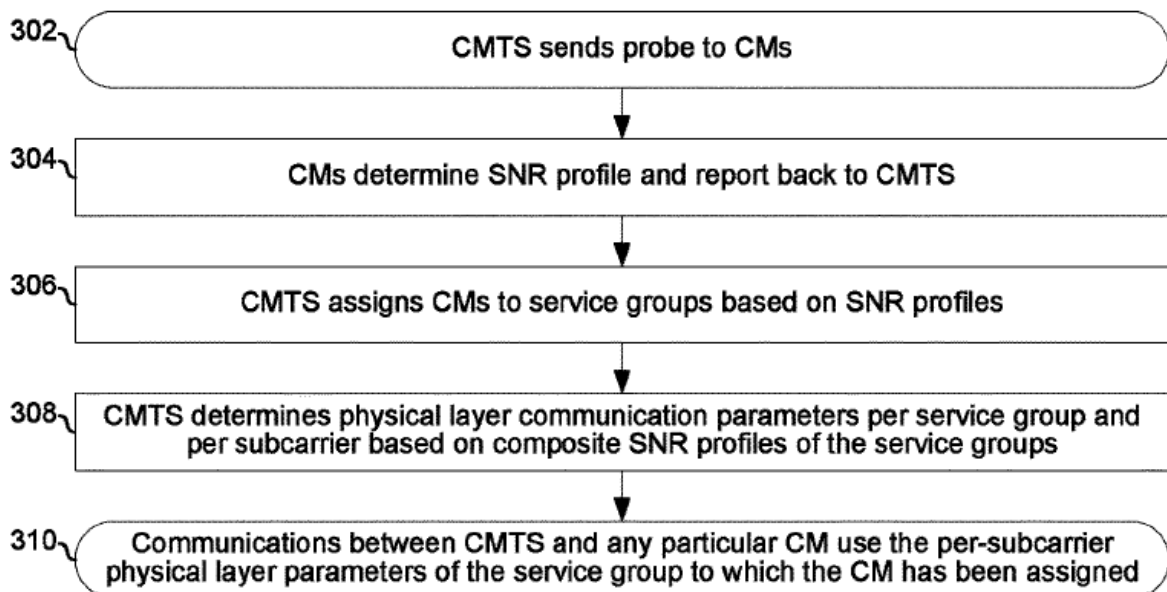
However, all of the ’438 patent claims are rendered obvious by prior art that was not considered by the Examiner, including prior art disclosing systems that determine a worst-case SNR for a group of modems and use the worst-case SNR to determine communication parameters for the modems in the group (*e.g.*, Ex. 1230).

Accordingly, claims 1-18 of the '438 patent should be cancelled.

III. OVERVIEW OF THE '438 PATENT

A. Brief Description

The '438 patent relates to service group management in a cable television network. Ex. 1201, 1:48-50. A process for grouping modems and determining communication parameters is shown in Figure 3A below.



Ex. 1201, Fig. 3A

Each of a plurality of CMs determines an SNR profile and reports to a CMTS. Ex. 1201, 4:22-27, 5:32-35. The '438 patent describes an SNR profile, consistently with its ordinary usage, as “SNR at a particular frequency or SNR over a range of frequencies.” *Id.*, 3:52-56; *see also* 3:61-63 (noting that message 202 “may”—but is not required to—span multiple frequencies), 4:40-43. The CMTS assigns the CMs to service groups based on the SNR profiles. Ex. 1201, Abstract, 4:49-53, 5:35-37,

6:44-7:4. A service group is simply a group of CMs serviced by a CMTS. *Id.*, 6:44-46, 6:60-62, Fig. 4A (Elements 402 and 404), Fig. 4B (elements 406 and 408). A composite SNR profile based on the worst-case SNR profile for each service group is used to determine physical layer communication parameters used for communications. Ex. 1201, Abstract, 4:37-53, 5:38-48. These parameters include encoding and modulation parameters, such as modulation type and modulation order. Ex. 1201, 4:53-64; *see also* Ex. 1202, ¶¶45-47.

B. Prosecution History

The application that led to the '438 patent, U.S. Application No. 15/434,673, was filed on February 16, 2017. Ex. 1204, 51.

All of the proposed claims were rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-18 of U.S. Patent No. 9,577,886, and claims 1-18 of U.S. Patent No. 9,419,858. Ex. 1204, 56-73. The claims were also rejected as obvious over combinations of prior art references that included U.S. Patent No. 8,743,933 to Prodan in view of U.S. Patent Publication No. 2009/0219856 to Richardson. Ex. 1204, 74-93.

The Applicant filed a Terminal Disclaimer and amended both independent claims to require that the composite SNR-related metric is based “at least in part on a worst-case SNR profile of said SNR-related metrics corresponding to said one of

said plurality of service groups.” Ex. 1204, 105, 107-108 (emphasis in original), 112.

The Examiner subsequently issued a Notice of Allowance on September 7, 2017. *Id.*, 152-154. The ’438 patent issued on January 9, 2018. Ex. 1201, cover; *see also* Ex. 1202, ¶¶48-51.

C. Earliest Priority Date for the Claims

The earliest possible priority date for the claims of the ’438 patent is July 23, 2012, the filing date of U.S. Provisional Application No. 61/674,742. All references relied on herein are prior art to that date as explained below. Ex. 1202, ¶52.

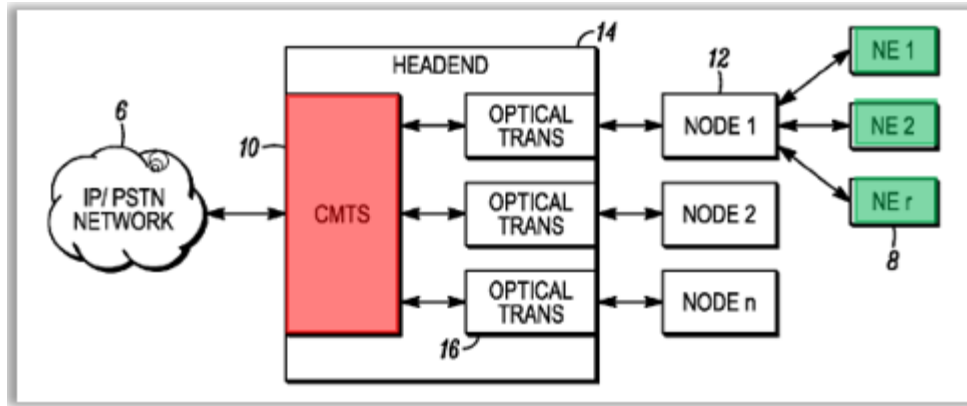
IV. OVERVIEW OF PRIOR ART

A. Thibeault

Thibeault (Ex. 1210) is a U.S. Published Application filed August 11, 2011. Thibeault is prior art under pre-AIA 35 U.S.C. § 102(e) and was not considered during prosecution. Ex. 1201, cover.

Thibeault discloses a method performed by a CMTS for automatically configuring logical channels that each have modulation profiles used to communicate with groups of cable modems (hereinafter “CMs”). Ex. 1210, Abstract, [0004], [0008]-[0015], [0021], [0024], [0029], [0032]-[0033].

The Thibeault network includes multiple network elements 8 (green) that connect to a CMTS 10 (red) via nodes 12. Ex. 1210, [0025], Fig. 1. Thibeault’s network elements 8 include cable modems. Ex. 1210, [0025], [0037].



Ex. 1210, Fig. 1 (annotated)

CMTS 10 resides at a headend 14, which includes transceivers 16 that receive upstream communications from, and send (*i.e.*, serve) downstream communications to, the CMs. Ex. 1210, [0025], [0027]. The CMTS also measures network parameters, such as SNR, for each CM. Ex. 1210, [0009], [0011], [0014]-[0015], [0023]-[0024], [0032], [0037]; *see also* Ex. 1202, ¶¶65-70. With this information, the CMTS can group CMs based on their SNRs and assign the groups to channels that use communication parameters, such as modulation order, that are appropriate to those SNRs. *Id.*

B. Cooper840

Cooper840 (Ex. 1230) is a U.S. Patent Application Publication published November 27, 2008. Cooper840 is prior art under pre-AIA 35 U.S.C. § 102(b). Cooper840 was not considered during prosecution. Ex. 1201, 1-2.

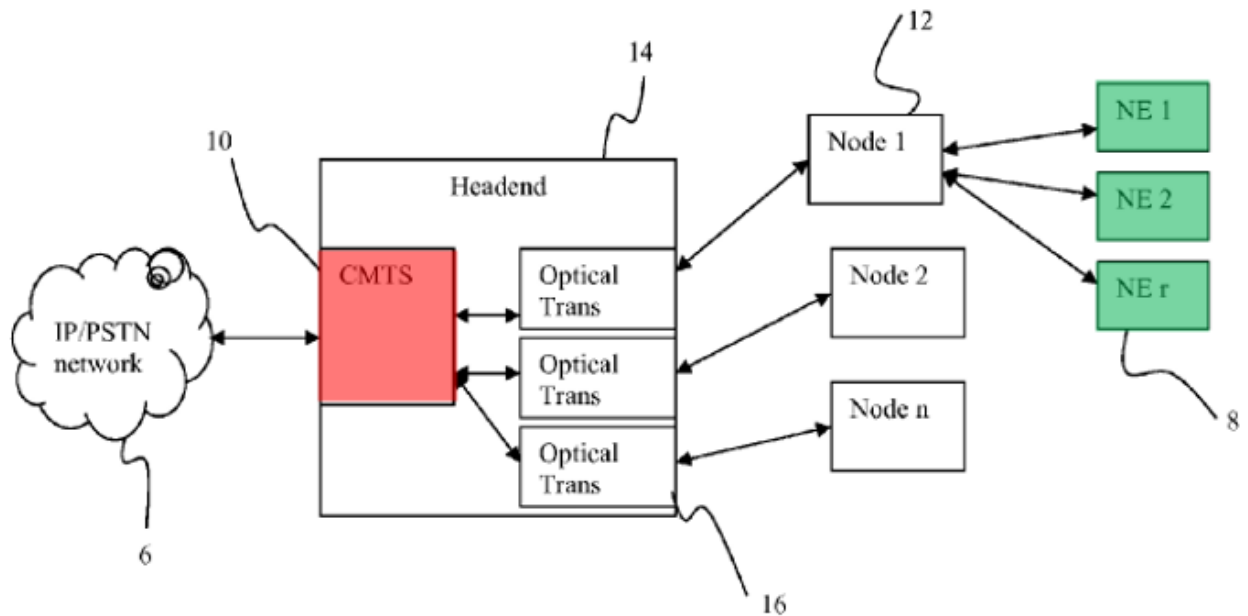


Figure 1
Ex. 1230, Fig. 1

Cooper840 discloses a network that includes a CMTS 10 (red) and multiple CMs 8 (green). Ex. 1230, [0020], Fig. 1 (reproduced above). As with Thibeault and the '438 patent, in Cooper840 the CMs are sorted based on SNR. Ex. 1230, [0009]-[0011], [0029]-[0030], Fig. 5 (element S3). And, like the '438 patent, Cooper840's CMTS uses the lowest SNR for a group of CMs when selecting common modulation parameters to be used by the CMs within the group. Ex. 1230, [0028], [0031] ("ideally, we want to set the modulation profile as a function of the lowest MER in the network element pool"), [0034], Fig. 1 (reproduced above); Ex. 1202, ¶¶71-73. The modulation parameters that are set based on the lowest SNR within a service group include modulation order, *e.g.*, QPSK, 8QAM, 16QAM, etc. Ex. 1230, [0006], [0028], [0032].

C. Azenkot

Azenkot (Ex. 1231) is a U.S. Patent Application Publication published June 9, 2005. Azenkot is prior art under pre-AIA 35 U.S.C. § 102(b). Azenkot was cited, but not applied, during prosecution. Ex. 1201, 1-2.

Azenkot, similar to Cooper840, teaches that it was known to set parameters of a common burst profile used for communications by multiple CMs based on the least capable CM (*i.e.*, the CM with the lowest SNR). Ex. 1231, [0001], [0007], [0068], [0092]-[0094]; Ex. 1202, ¶¶74-76. Specifically, Azenkot describes a process for grouping CMs by modulation profile or throughput ability into different logical groups. Ex. 1231, Abstract, [0007], [0092]-[0094]. Each logical group is commanded to transmit upstream with a burst profile set to effectively use the throughput ability of the worst-performing CM. *Id.* In one embodiment, Azenkot specifically groups CMs by SNR. Ex. 1231, [0007], [0013], [0016], [0040]-[0041], [0092]. Burst profiles used for communications are thus selected for a group based on SNR, and are selected so as to allow communication with the CM having the lowest SNR in the group. Ex. 1231, [0016], [0040]-[0041], [0092]-[0094]. Ex. 1202, ¶77.

D. Cooper

Cooper (Ex. 1205) is a U.S. Published Application published September 27, 2007. Cooper is prior art under pre-AIA 35 U.S.C. § 102(b) and was not considered during prosecution. Ex. 1201, 1-2.

Cooper shows that it was known to group CMs by location in a cable network when selecting common physical layer communication parameters for use by all CMs within the group. Ex. 1205, [0002], [0007]-[0010], [0019], [0026]-[0027], [0030]-[0033], [0039]-[0040], [0043]; Ex. 1202, ¶¶78-79. Cooper's CMTS determines the locations of CMs in a cable network and assigns the CMs to service groups based at least in part on the location of the CM (*e.g.*, its distance from the CMTS or from an upstream amplifier). Ex. 1205, Abstract, [0008], [0021], [0027]-[0028], [0037]; Ex. 1202, ¶79.

E. Cooper437

Cooper437 (Ex. 1216) is a U.S. Patent filed July 28, 1999 and granted on August 3, 2004. Cooper437 is prior art under pre-AIA U.S.C. § 102(b) and was not considered during prosecution. Ex. 1201, 1-2.

Cooper437 shows that it was known to use CM probe messages that include instructions for measuring noise and reporting the noise to a CMTS. Ex. 1216, 8:11-29, 8:60-9:5, 10:56-11:28, Table 1. In Cooper437, a CMTS initiates noise signal power measurements by transmitting a message to CMs that defines the

measurement techniques to be used and how to report the measurements. Ex. 1216, 8:11-29, 8:60-9:5, 10:53-11:28, Table 1. After a CM receives the message, it performs the noise signal power measurements specified in the message, and then sends a report of the measurements (which may be provided as raw measured data) to the CMTS. *Id.*, 10:53-11:28, Table 1; *see also* Ex. 1202, ¶¶80-83.

F. Monk

Monk (Ex. 1215) is a U.S. Patent granted on August 11, 2009. Monk is prior art under pre-AIA 35 U.S.C. § 102(b) and was not considered during prosecution. Ex. 1201, cover.

Monk shows that it was known to send a probe message to CMs when determining the SNR of a channel and the corresponding modulation schemes to be used with that channel. Ex. 1215, Abstract, 4:44-59, 9:28-41. In particular, a sending node transmits a probe message having a predetermined data sequence to a CM, which then analyzes the probe message for impairment at each frequency. Ex. 1215, 4:44-59, 9:28-41, Abstract. The CM then sends the results of the analysis back to the sending device, as either raw data or a bit loading profile for the sending device to modify the transmission parameters. Ex. 1215, 9:42-50; Ex. 1202, ¶¶84-86.

G. Monk802

Monk802 (Ex. 1214) is a U.S. Patent filed December 2, 2005, and granted on December 27, 2011. Monk802 is prior art under pre-AIA U.S.C. § 102(e) and was not considered during prosecution. Ex. 1201, cover.

Monk802 discloses a method of communication using OFDM. Ex. 1214, 8:1-39, 17:61-67, 19:27-41, 21:19-22:34, Figs. 12, 13A-13C. Monk802 describes dividing a waveform into multiple sub-carriers, each of which is independent and can be modulated on a per-subcarrier basis depending on the channel's SNR, with higher SNR channels supporting higher data capacity or modulation schemes. Ex. 1214, 8:19-39, 21:19-22:34; *see also* Ex. 1202, ¶¶87-89.

H. Currivan

Currivan (Ex. 1228) is a U.S. Patent Application Publication published May 5, 2005. Currivan is prior art under pre-AIA U.S.C. § 102(b) and was considered, but not applied, during prosecution. Ex. 1201, 1-2.

Currivan shows that it was known for a CMTS to segregate CMs into groups and select physical layer communication parameters for each group. Ex. 1228, [0017], [0026]. The physical layer communication parameters are based on an SNR metric and include: transmit power for a service group, transmit power per code word, strength of forward error correction, and length of preambles. Ex. 1228, [0017], [0026], [0065]-[0068], [0156]-[0157], Fig. 14A; Ex. 1202, ¶¶90-91.

V. IDENTIFICATION OF CHALLENGE PURSUANT TO 37 C.F.R. § 42.104(b)

A. Claims for Which Review is Requested and Grounds on Which Challenge is Based

Petitioner requests review of claims 1-18 on the following grounds.

Ground	References	Basis	Claims Challenged
A	Thibeault in view of Cooper840	§103	1-2, 10-11
B	Thibeault in view of Azenkot	§103	1-2, 10-11
C-D	Thibeault-Cooper840 and Thibeault-Azenkot, each in view of Cooper	§103	7-8 and 16-17
E-F	Thibeault-Cooper840 and Thibeault-Azenkot, each in view of Monk802	§103	1-6 and 10-15
G-H	Thibeault-Cooper840 and Thibeault-Azenkot, each in view of Monk and Cooper437	§103	9 and 18
I-J	Thibeault-Cooper840-Cooper and Thibeault-Azenkot-Cooper, each in view of Monk802	§103	7-8 and 16-17
K-L	Thibeault-Cooper840-Monk-Cooper437 and Thibeault-Azenkot-Monk-Cooper437, each in view of Monk802	§103	9 and 18
M-X	Thibeault-Cooper840, Thibeault-Azenkot, Thibeault-Cooper840-Cooper, Thibeault-Azenkot-Cooper, Thibeault-Cooper840-Monk802, Thibeault-Azenkot-Monk802, Thibeault-Cooper840-Monk-Cooper437, Thibeault-Azenkot-Monk-Cooper437, Thibeault-	§103	1-18

	Cooper840-Cooper-Monk802, Thibeault-Azenkot-Cooper-Monk802, Thibeault-Cooper840-Monk-Cooper437-Monk802, and Thibeault-Azenkot-Monk-Cooper437-Monk802, in further view of Currivan		
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None of the prior art combinations listed in the table above were before the examiner during prosecution of the '438 patent.

B. 314(a) Discretion Does Not Apply

The *Fintiv* factors as set forth in the Director's June 21, 2022 Guidance Memorandum do not warrant discretionary denial.

Factor one appears neutral. The PTAB has instituted IPR on seven of the eight patents originally asserted in the District Court in case no. 2:23-cv-01050, and Petitioner is now filing IPR petitions challenging a patent that Patent Owner seeks to add to the case. Petitioner has also requested a stay, as final written decisions on IPRs instituted in Petitioner's favor would resolve the majority of the litigation.

Factor two favors institution. Petitioner has filed a motion to dismiss the District Court case, Patent Owner has filed motions for leave to file amended complaints, and Petitioner will renew its Motion to Dismiss in order to seek dismissal of the operative complaint. In addition, no schedule beyond claim construction has been entered, and the Court has not set a trial date.

Factor three favors institution. To date, the investment by the District Court has been limited to considering motions to dismiss on the pleadings and hearing arguments on claim construction. The Court has not yet heard claim construction arguments on the '438 patent, and there is presently no schedule in place for claim construction proceedings on the '438 patent.

Factor four strongly favors institution. The petition challenges all claims in the '438 patent while Patent Owner seeks to assert only claims 1-5 and 9 in the District Court.

Factor five does not warrant denial as Petitioner is a defendant in the District Court case.

Factor six favors institution. Petitioner presents compelling unpatentability challenges that merit institution, relying on prior art that was never discussed and arguments that were never presented or were overlooked during prosecution.

C. 325(d) Discretion Does Not Apply

Considering the two-part framework discussed in *Advanced Bionics, LLC v. Med-El Elektromedizinische Geräte GMBH*, IPR2019-01469, Paper 6, *8-9 (PTAB Feb. 13, 2020), the Board should not exercise its §325(d) discretion to deny institution. First, the grounds raised herein are not the same or substantially the same as the art and arguments raised during prosecution (step one of *Advanced Bionics*). The Examiner did not consider at least Thibeault, Cooper and

Cooper⁸⁴⁰. Thibeault, Cooper and Cooper⁸⁴⁰ are also not cumulative of the references considered during prosecution.

Second, if it is asserted that the art or arguments are similar, the Examiner materially erred (i) by not applying the prior art relied on herein, and (ii) by failing to recognize that (as described below) the prior art taught the claim element added by amendment. *See* Section III.B, *supra*; *Advanced Bionics*, at 8-10, n.9.

D. Level of Ordinary Skill

A person of ordinary skill in the art (a “POSITA”) at the time of the alleged invention would have had at least a degree in computer or electrical engineering, computer science, information systems, or a similar discipline, along with at least three-to-four years of experience with the design and/or implementation of network-based content delivery systems, such as cable systems and Internet video streaming. Ex. 1202, ¶¶38-41. Additional education may substitute for professional experience, and significant work experience may substitute for formal education. Petitioner’s expert, Sayfe Kiaei, at least meets the level of skill of a POSITA. *Id.*, ¶¶42-43; *see also id.*, ¶¶1-37, 53-64.

E. Claim Construction

All claim terms herein should be given their ordinary and customary meaning to a POSITA as they would be given in a civil action under 35 U.S.C. §282(b).¹ Ex. 1202, ¶44. The District Court in the CA litigation issued a “[Tentative] Claim Construction Order” construing “CMTS” as “hardware and accompanying software, with the hardware located at the point at which the cable modem’s connection to the hybrid-fiber coaxial network terminates.” Ex. 1234, pp. 17-21, 25.

Petitioner does not contend that the claims include means-plus-function limitations.

VI. SPECIFIC GROUNDS FOR UNPATENTABILITY

A. Ground A: Claims 1-2 and 10-11 are Rendered Obvious by Thibeault in View of Cooper840

1. Independent Claim 1 and Independent Claim 10

The obviousness of independent claim 1 is described below. Independent claim 10 is a counterpart system claim and is rendered obvious for the same reasons as for claim 1 and as further described below. *See* Ex. 1202, ¶¶92-122, 125-130.

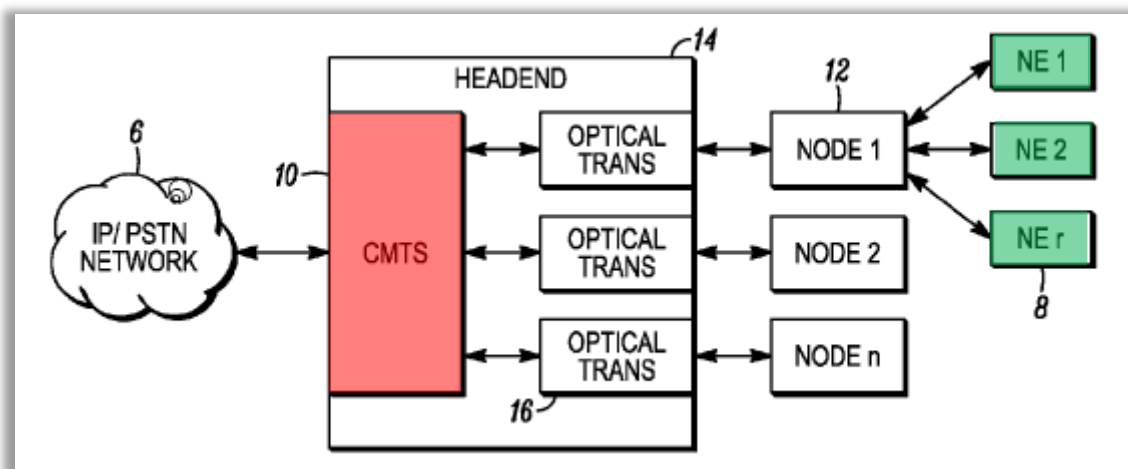
¹ The ’438 patent suggests the term “signal-to-noise (SNR) related metric” at least includes SNR (*see* Ex. 1201, 3:52-61), but Petitioner reserves the right to argue in other proceedings that the outer bounds of this term are unclear.

a. Element [1A]: “A method comprising:”

To the extent the preamble [1A]² is limiting, Thibeault-Cooper⁸⁴⁰ teaches the claimed method for the reasons set forth below. Ex. 1202, ¶93.

b. Element [1B]: “determining, by a cable modem termination system (CMTS), for a plurality of cable modems served by said CMTS, a corresponding plurality of signal-to-noise ratio (SNR) related metrics;”

Thibeault discloses [1B]. Ex. 1202, ¶¶94-98. As illustrated below in Figure 1, Thibeault discloses a network in which multiple network elements 8 (**green**) connect to a CMTS 10 (**red**) (the claimed “CMTS”) via nodes 12. Ex. 1210, [0025], Fig. 1. Thibeault’s network elements 8 include CMs. Ex. 1210, [0025], [0037]; Ex. 1202, ¶94.

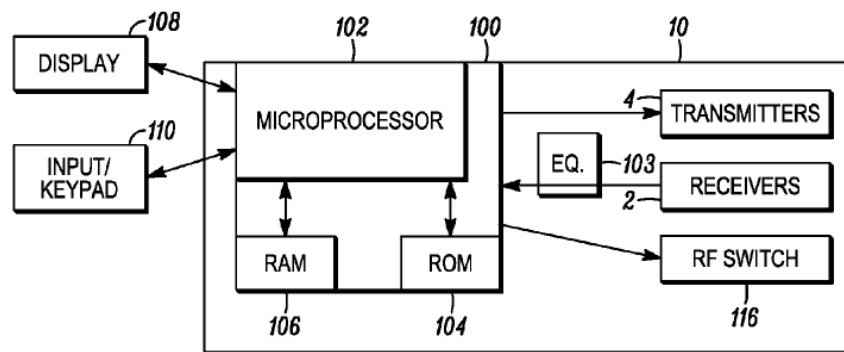


Ex. 1210, Fig. 1 (annotated)

² Claim limitations are labelled in the Claims Listing Appendix.

CMTS 10 resides at a headend 14, which includes transceivers 16 that communicate with the CMs (the claimed “a plurality of cable modems served by said CMTS”) by receiving upstream communications from them and sending (*i.e.*, serving) downstream communications to them. Ex. 1210, [0025]. Thibeault’s CMTS also meets the tentative construction of “CMTS” in the CA litigation (Ex. 1234, 17-21) because it comprises hardware and accompanying software, with the hardware located at the point at which the CMs’ connection to a hybrid-fiber coaxial network terminates (as opposed to being decentralized). Ex. 1210, [0002], [0025]-[0028], [0039]. Figs. 1-2; Ex. 1202, ¶94.

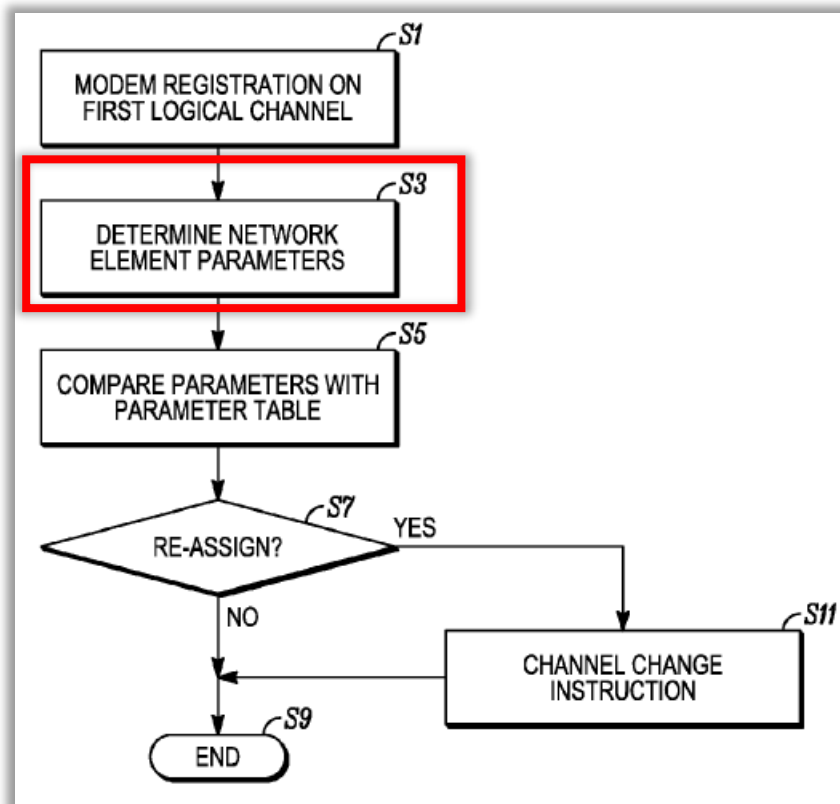
As illustrated below in Figure 2, CMTS 10 includes a microprocessor 102 that receives instructions and data from ROM 104/RAM 106 and controls the operation of the CMTS. Ex. 1210, [0025]-[0026], Fig. 2.



Ex. 1210, Fig. 2

According to Thibeault, the system optimizes network communications based on certain network parameter measurements—measurements that can be performed

at the CMTS or each CM. Ex. 1210, [0013], [0031]-[0032], [0038]-[0039]; Ex. 1202, ¶95. For example, referring to Figure 4 below, Thibeault discloses a process whereby its CMTS determines network element parameters, such as the modulation error ratio (MER) or SNR, of each CM (the claimed “determining, by a ... CMTS ... a corresponding plurality of [SNR] related metrics.”). Ex. 1210, [0009], [0011], [0014]-[0015], [0023]-[0024], [0031]-[0033], [0037]; Ex. 1202, ¶¶96-97. Modulation error ratio and SNR are both ratios that consider noise and indicate signal quality and are each independently an “SNR-related metric”. Ex. 1230, [0004]; Ex. 1234, 23-24; Ex. 1202, ¶96.

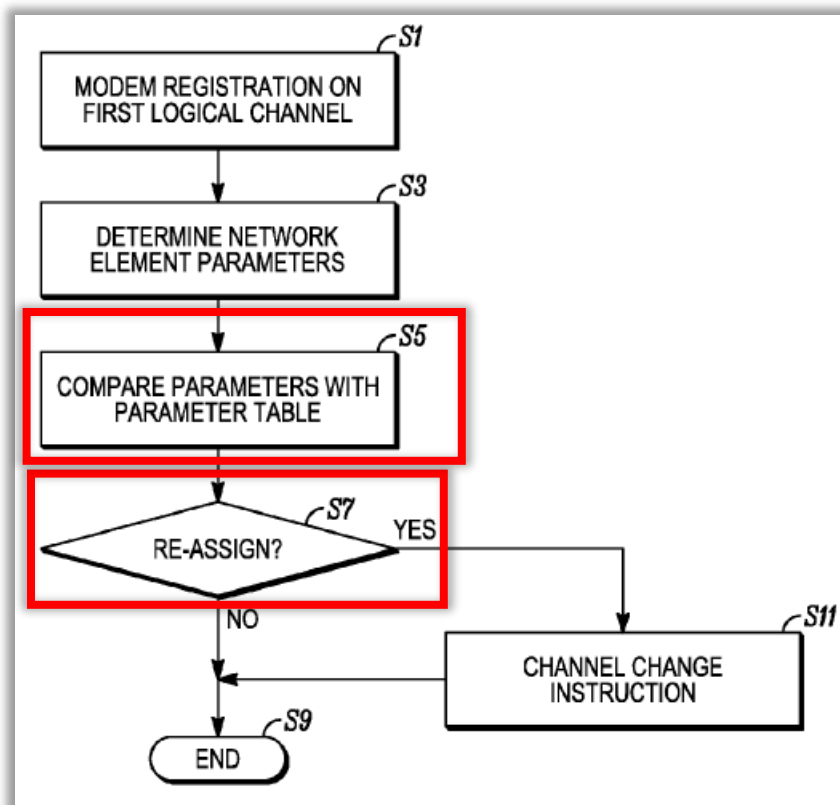


Ex. 1210, Fig. 4 (annotated)

Thibeault thus discloses [1B]. Ex. 1202, ¶¶94-98.

c. Element [1C]: “assigning, by said CMTS, said plurality of cable modems among a plurality of service groups based on said plurality of SNR-related metrics;”

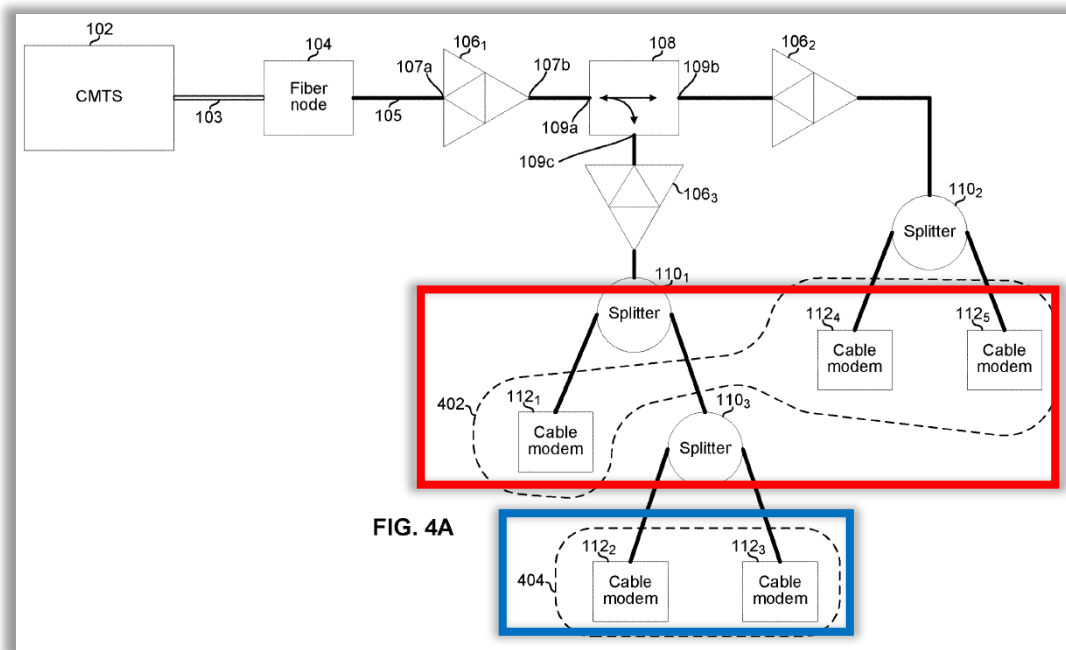
Thibeault discloses [1C]. Ex. 1202, ¶¶99-104. Thibeault describes that its method is directed toward “assign[ing] [a] network element to a logical channel based on the network element parameters.” Ex. 1210, [0008]; Ex. 1202, ¶99. For example, Figure 4 in Thibeault illustrates this process of a CMTS grouping its CMs by assigning them to respective logical channels. Ex. 1210, [0031]-[0033], Fig. 4. As shown below, after determining the network parameters (*e.g.*, SNR or MER), Thibeault’s CMTS assigns the CMs to logical channels based on a comparison between their measured network parameters and parameter thresholds (*e.g.*, SNR thresholds). Ex. 1210, [0032] (“As shown in step S5, the network element parameters are compared against a parameter table containing a table of one or more parameter thresholds associated with a logical channel available on the network to determine if the CMTS needs to reassign that modem to a different logical channel on the currently used physical upstream port”), [0033]; Ex. 1202, ¶100; *see* Section VI.A.1.b.



Ex. 1210, Fig. 4 (annotated)

In a specific example, Thibeault's CMTS assigns the connected CMs to one of four logical channels based on comparing the respective SNR-related metric measurements of each CM to SNR thresholds, *i.e.*, (1) a group with measured MERs or SNRs between 16 and 22 is assigned to logical channel "0"; (2) a group with measured MERs or SNRs between 22 and 25 is assigned to logical channel "1"; (3) a group with measured MERs or SNRs between 25 and 28 is assigned to logical channel "2"; and (4) a group with measured MERs or SNRs above 28 is assigned to logical channel "3." Ex. 1210, [0029], [0033]; Ex. 1202, ¶100. In this fashion, CMs having similar MERs or SNRs are grouped together.

Each group of CMs assigned to a logical channel is a claimed “service group,” and there are a plurality of such groups in Thibeault. Ex. 1202, ¶101. This is consistent with the claim term’s plain meaning and the ’438 patent’s disclosure. Ex. 1202, ¶¶101-102. For example, the ’438 patent illustrates service groups in Figure 4A (below) in which the groupings are based on performance characteristics measured for the CMs. Ex. 1201, 2:22-25, 5:35-37, 6:40-59, Figs. 3A, 4A; Ex. 1202, ¶101.



Ex. 1201, Fig. 4A (service group 402 includes **CMs 112₁, 112₄, 112₅**; service group 404 includes **CMs 112₂, 112₃**) (annotated)

In sum, the assignment by Thibeault’s CMTS (the claimed “assigning, by said CMTS,”) of each of the CMs (the claimed “plurality of cable modems”) to particular logical channels based on their SNR or MER measurements (the claimed “based on said plurality of SNR-related metrics”) results in groups of assigned CMs that are

grouped by logical channel (the claimed “assigning ... among a plurality of service groups”), which is consistent with the ’438 patent’s disclosure and the plain and ordinary meaning of “service groups” as recited in [1C]. Ex. 1202, ¶103; Ex. 1201, 2:22-25, 5:35-37, 6:19-21, 6:40-7:21, Figs. 3A-3B, 4A-4B; *see also* Ex. 1217, 55-57 (construing the term “service group[s]” in related U.S. Patent No. 10,135,682—“the ’682 patent”— as having its plain meaning based on disclosure in the ’682 patent that corresponds to identical disclosure in the ’438 patent at Ex. 1201, 2:22-25, 6:37-39); Ex. 1218, ¶¶145 (Patent Owner’s expert explaining that the ’682 patent defines “service group” to include “groupings of cable modems”), 146 (Patent Owner’s expert explaining that “a ‘service group’ is a group or cluster of cable modems” with reference to Patent Owner’s infringement contentions), 148 (Patent Owner’s expert describing a “service group” as a “conceptual” grouping of cable modems); Ex. 1219, 6-7 (Patent Owner’s infringement contentions alleging infringement based on organizing cable modems into groups).

Therefore, Thibeault discloses [1C]. Ex. 1202, ¶¶99-104.

d. Element [1D]: “generating, by said CMTS for each one of said plurality of service groups, a composite SNR-related metric based at least in part on a worst-case SNR profile of said plurality of SNR-related metrics corresponding to said one of said plurality of service groups;”

Thibeault-Cooper⁸⁴⁰ teaches [1D]. Ex. 1202, ¶¶105-115. As shown for [1C], Thibeault discloses a CMTS assigning CMs to logical channels based on a

comparison between the determined MER or SNR for each CM and MER or SNR thresholds. Sections VI.A.1.b-c; Ex. 1210, [0009], [0011], [0014]-[0015], [0023], [0032], [0037], Fig. 4. Although Thibeault does not disclose its CMTS determining a “worst-case” SNR for each group of CMs in each logical channel, a POSITA would have found it obvious to do so in view of Cooper840’s teachings. Ex. 1202, ¶106.

Cooper840 discloses a network that includes a CMTS and a multiple CMs. Ex. 1230, [0020], Fig. 1. The Cooper840 network and components are substantially similar to the Thibeault network and components. Ex. 1202, ¶107. Indeed, illustrations and disclosure in Thibeault that describe its network and logical architecture are identical or substantially similar to illustrations and disclosure in Cooper840. *E.g., compare* Ex. 1210, [0025]-[0028], Figs. 1-3 *to* Ex. 1230, [0020]-[0023], [0027], Figs. 1-2, 4; Ex. 1202, ¶107.

In Cooper840, the modulation parameters for communication with each group of CMs, such as modulation order, are controlled, and Cooper840 teaches that “[i]deally, we want to set the modulation profile as a function of the lowest MER in the network element pool”. Ex. 1230, [0031], [0006], [0028], [0032]; Ex. 1202, ¶107. Cooper840 discloses that CMs can be grouped by either MER or SNR. Ex. 1230, [0009]-[0011], [0020], [0028]-[0030], Fig. 5 (step S3). Modulation error ratio and SNR are both ratios that consider noise and indicate signal quality and are each independently an SNR-related metric. Ex. 1230, [0004]; Ex. 1202, ¶107. A

POSITA would have understood from Cooper840 that setting the modulation profile as a function of the lowest MER or SNR is ideal because such a setting ensures that all of the network elements can pass data on the channel (*i.e.*, no CM in a group has an SNR too low for the modulation order selected for that group). Ex. 1230, [0005]-[0006], [0032]; Ex. 1202, ¶107.

Cooper840 thus teaches a POSITA to determine the lowest MER or SNR for CMs in a service group (each the claimed “composite SNR-related metric based on a worst-case SNR profile ...”) and to use that to select modulation parameters (such as modulation order) for the service group. A POSITA would have been motivated to apply this teaching to Thibeault’s algorithm (executed at the CMTS) that selects physical layer communication parameters (*e.g.*, modulation order) because it ensures that all of the CM’s can pass data on the channel. Ex. 1230, [0005]-[0006], [0032]; Ex. 1202, ¶108. Thibeault’s CMTS already assigns CMs to logical channels based on a comparison of a CM’s SNR measurement with SNR thresholds, which also determines the modulation mode (*e.g.*, modulation order) that is used for communicating within the logical channel. Ex. 1210, [0004]-[0005], [0015]-[0016], [0023]-[0024], [0029]-[0030], [0033], [0038]; Ex. 1202, ¶109.

Applying Cooper840’s teaching in this manner would also further Thibeault’s goal of ensuring that “each network element [is] running at its best possible modulation mode.” Ex. 1210, [0033], [0038]; Ex. 1202, ¶109. Specifically, a

POSITA would have appreciated that selecting a modulation order (*e.g.*, 16QAM/32QAM/64QAM) and encoding parameters for a logical channel based on the worst-case SNR of a CM group would have ensured communication with all CMs in the group while also optimizing the network as described above. Ex. 1202, ¶109.

A POSITA would have also found it obvious to apply Cooper840's teaching of determining the lowest MER or SNR of a CM in a service group to select modulation parameters for the service group to Thibeault's method (executed at the CMTS) of assigning CMs to logical channels in order to implement Thibeault's dynamic SNR thresholds. Ex. 1210, [0032]; Ex. 1202, ¶113. Specifically, Thibeault discloses that its CMTS periodically reconfigures its logical channels, including measuring parameters such as MER or SNR for its CMs, assigning (re-registering) CMs to the logical channels, and setting SNR-related metric thresholds used to delineate the logical channels. Ex. 1210, [0016], [0032]-[0033], [0038], Figs. 4-5. Thus, a POSITA would have an additional motivation to apply Cooper840's teaching of determining the lowest MER or SNR of a CM in a service group to select modulation parameters for the service group in order to implement Thibeault's dynamic SNR threshold to address variance in a channel's SNR. Ex. 1210, [0016], [0032]-[0033], [0038], Figs. 4-5; Ex. 1202, ¶¶113-114.

Such a combination simply combines prior art elements (Thibeault's CMTS that applies modulation order parameters to CMs that are grouped based on MER or SNR, and Cooper840's teaching of determining the lowest MER or SNR of a CM in a service group to select modulation parameters for the service group) according to known methods (programming of a CMTS) to yield predictable results (a CMTS that generates a worst-case SNR-related metric for the CM service group and uses that metric to determine the modulation order applied to the group). Ex. 1202, ¶110. Applying Cooper840's teachings to Thibeault's CMTS would have been well within the capabilities of a POSITA because it would have involved only straightforward modifications to the programming of Thibeault's CMTS's microprocessor. *Id.*; *see also* Ex. 1210, [0008]-[0009], [0026]-[0027], [0039]; Ex. 1230, [0021].

Cooper's CMTS (as modified by Cooper840) therefore teaches the claimed "generating ... for each one of said plurality of services groups, a composite SNR-related metric based at least in part on a worst-case SNR profile of said SNR-related metrics corresponding to said one of said plurality of service groups." The use by Thibeault-Cooper840 of the lowest MER or SNR within a cable modem group to select the physical layer parameters for that group is a "composite" SNR-related metric because it is applied to all of the cable modems within a service group. This is consistent with the '438 patent's disclosure. Ex. 1202, ¶¶111-12. For example,

the '438 patent discloses that a worst-case SNR profile simply includes multiple performance metric measurements (*e.g.*, SNR) for the cable modems of a particular service group. Ex. 1201, 4:7-17, Fig. 2B. The '438 patent also teaches that physical layer parameters are determined based on the singular worst-case SNR for a service group. Ex. 1201, 5:38-44.

Thibeault-Cooper⁸⁴⁰'s teaching of this limitation is also consistent with a District Court's construction of an identical phrase that appears in the claims of a related patent (*i.e.*, Ex. 1229, the '682 patent) that issued from a parent application to which the '438 patent claims priority. *See* Ex. 1217, 53-55 (citing disclosure in the '682 patent at 4:9-20, 5:7-12, 5:42-57, Fig. 2C, which corresponds to identical disclosure in the '438 patent at 4:7-17, 5:4-9, 5:40-55, Fig. 2C); *see also id.*, 54 (noting Patent Owner's position that "'composite' means that something is **for** more than one cable modem" and that a POSITA "would understand that the term 'composite SNR-related metric' **relates to** multiple cable modems") (emphasis added); Ex. 1218, ¶187 (Patent Owner's expert explaining that the '682 patent's "specification describes that examples of a 'worst-case SNR profile' is the SNR profile related to a cable modem or group of cable modems, indicating their worst-case performance metrics" and citing the '682 patent at 4:9-20, 5:7-12, Fig. 2C); Ex. 1219, 8-10 (Patent Owner's infringement contentions for the '682 patent alleging

infringement of the claimed “composite SNR-related metric” based on a “worst case noise that is expected on” upstream and downstream channels); Ex. 1202, ¶112.

If it is asserted that the “worst-case SNR profile” recited in [1D] must comprise the SNR-related metric of a CM over a range of frequencies, this feature is also taught by Thibeault-Cooper840. In particular, Cooper840 discloses a technique for measuring MER over a range of frequencies in order to select the best relative channel quality for routing a communications signal. Ex. 1230, ¶35 (incorporating Ex. 1235 by reference); Ex. 1235, Abstract, 1:45-48, 2:62-67, 3:55-65, 5:33-44, Figs. 1, 3. A POSITA would have been motivated to further modify Thibeault to generate a worst-case SNR profile that comprises an SNR-related metric over a range of frequencies in order to facilitate selection of the best relative channel quality for routing a communications signal, as taught by Cooper840. Ex. 1202, ¶115.

Therefore, Thibeault-Cooper840 teaches [1D]. Ex. 1202, ¶¶105-115.

- e. Element [1E]: “selecting, by said CMTS, physical layer communication parameters to be used for communicating with said one of said plurality of service groups based on said composite SNR-related metric; and”**

Thibeault-Cooper840 teaches [1E]. Ex. 1202, ¶¶116-119. As shown above for [1D], Thibeault-Cooper840’s CMTS generates a composite SNR-related metric for each logical channel based on the worst-case SNR-related metric of a CM assigned to that logical channel. Section VI.A.1.d. This composite SNR-related

metric provides the benefit of allowing Thibeault-Cooper840's CMTS to select an optimal modulation order for communicating with the CMs assigned to each logical channel (the claimed "plurality of service groups") and to dynamically adjust the SNR-related metric thresholds that define those logical channels. *Id.*; Ex. 1202, ¶116; Ex. 1210, [0004]-[0005], [0015]-[0016], [0021], [0023]-[0024], [0032]-[0033], [0038]. Thibeault further discloses that each CM includes a processor that controls the pre-equalization parameters and preamble lengths of communications sent by the CM in accordance with instructions from the CMTS based on a measured SNR. Ex. 1210, [0028], [0031], [0032], [0039], Fig. 4; Ex. 1202, ¶116.

Such parameters (*i.e.*, modulation order, pre-equalization parameters, and preamble lengths) disclose the claimed "physical layer communication parameters to be used for communicating with said one of said plurality of service groups based on said composite SNR-related metric." Ex. 1202, ¶116; *see also* Section VI.A.1.d, *supra*. Indeed, such teachings in Thibeault (as modified by Cooper840) are very similar to the '438 patent's disclosure for this limitation. For example, the '438 patent describes that "physical layer communication parameters" include, but are not limited to, "encoding parameters", "modulation type," "modulation order," and "modulation parameters." Ex. 1201, Abstract, 4:53-64, claims 2 and 5. A POSITA would have understood that Thibeault discloses "encoding parameters" (*i.e.*, preamble length, and pre-equalization parameters) as well as "modulation order"

(*e.g.*, QPSK, 16QAM, 32QAM, 64QAM). Ex. 1202, ¶117. Thus, Thibeault discloses the same types of “physical layer communication parameters” described in the ’438 patent. Ex. 1202, ¶118.

Thibeault-Cooper840’s CMTS therefore teaches the claimed “selecting ... physical layer communication parameters [*i.e.*, the modulation order, preamble length, and pre-equalization parameters)] to be used for communicating with said one of said plurality of service groups based on said composite SNR-related metric.” Ex. 1202, ¶118.

Therefore, Thibeault-Cooper840 teaches [1E]. Ex. 1202, ¶¶116-119.

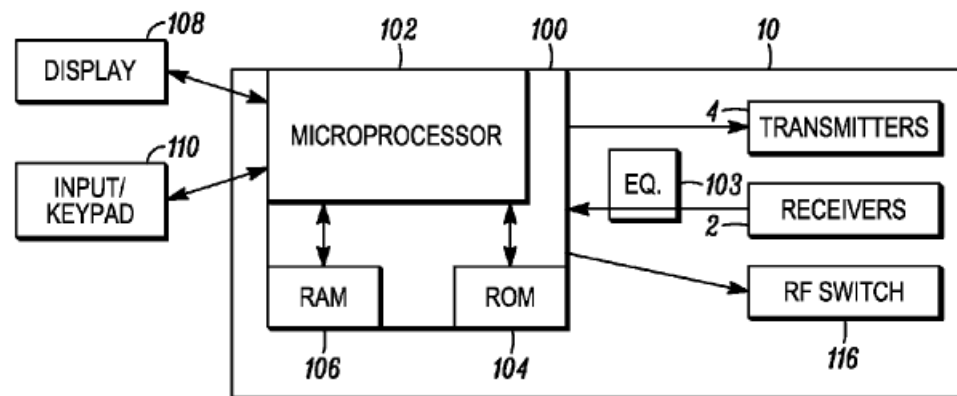
f. Element [1F]: “communicating, by said CMTS, with a portion of said plurality of cable modems corresponding to said one of said plurality of service groups using said selected physical layer communication parameters.”

Thibeault-Cooper840 teaches [1F]. Ex. 1202, ¶¶120-122. As shown above for [1D]-[1E], Thibeault-Cooper840’s CMTS selects a modulation order and encoding parameters (*i.e.*, preamble length, and pre-equalization parameters) for each of its logical channels based on the claimed composite SNR-related metric that is based on a worst-case SNR-related metric in each channel. Ex. 1210, [0033]; *see also* Sections VI.A.1.d-e. Moreover, Thibeault-Cooper840’s CMTS communicates with the CMs connected to it using the selected modulation order (*e.g.*, 16QAM, 32QAM, 64QAM) and encoding parameters. Ex. 1210, [0016], [0024], [0029]-[0030], [0033]; Ex. 1202, ¶121.

Thus, Thibeault-Cooper840 teaches the claimed “communicating, by said CMTS, with a portion of said plurality of cable modems corresponding to said one of said plurality of service groups using said selected physical layer communication parameters.” Ex. 1202, ¶121. Thibeault-Cooper840 therefore teaches [1F] and renders claim 1 obvious. *Id.*, ¶122.

g. Element [10A]: “A system comprising: circuitry for use in a cable modem termination system (CMTS), said circuitry comprising a network interface and a processor wherein:”

Thibeault’s “network” described above in Section VI.A.1.b. discloses a “system” as recited in [10A]. Section VI.A.1.b; Ex. 1210, [0025], Figs.1-2; Ex. 1202, ¶125. And as illustrated below in Figure 2, Thibeault discloses that CMTS 10 comprises circuitry that includes: (i) microprocessor 102 (the claimed “circuitry ... comprising a ... processor”) that receives instructions and data from ROM 104 or RAM 106, and (ii) transmitters 4 and receivers 2 (the claimed “circuitry ... comprising a network interface”) that provide bi-directional communication with network elements 8. Ex. 1210, [0026]-[0027], Fig. 2; Ex. 1202, ¶¶125-126.



h. Elements [10B]-[10F]

Elements [10B]-[10E] are nearly identical to [1B]-[1E], except [10B]-[10E] recite that the “processor” in the CMTS “is configured to” perform the limitations recited in [1B]-[1E]. Ex. 1202, ¶¶127-128. Thibeault-Cooper840 teaches that microprocessor 102 in CMTS 10 is configured to perform the limitations described above in [1B]-[1E]. Sections VI.A.1.b-e; Ex. 1210, [0026], Figs. 1-2; Ex. 1202, ¶128. Accordingly, for the reasons set forth above with respect to [1B]-[1E], Thibeault-Cooper840’s microprocessor 102 teaches and is configured to perform the limitations recited in [10B]-[10E]. *Id.*

Element [10F] is nearly identical to [1F], except [10F] recites that the claimed “network interface” is configured to perform the limitations recited in [1F]. Ex. 1202, ¶129. Thibeault-Cooper840 teaches that transmitters 4 and receivers 2 (the claimed “network interface”) provide communication with network elements 8. Ex. 1210, [0027], Fig. 2; Ex. 1202, ¶130. Accordingly, for the reasons set forth above, Thibeault-Cooper840 comprises a network interface that teaches and is configured to perform the limitations recited in [10F]. *Id.*; Section VI.A.1.f.

Thibeault-Cooper840 therefore renders claim 10 obvious. Ex. 1202, ¶¶127-130.

2. Dependent Claim 2 and Dependent Claim 11

a. Claim 2

Claim 2 depends from claim 1. Ex. 1201, 8:23-27.

Thibeault-Cooper840 teaches dependent claim 2. Ex. 1202, ¶¶123-124. As shown above for [1E], Thibeault-Cooper840's CMTS selects a modulation order (e.g., 16QAM, 32QAM, 64QAM) based on a composite SNR-related metric for the modulation profiles of its logical channels. Ex. 1210, [0029]-[0030], [0033]; *see also* Section VI.A.1.e.

Accordingly, Thibeault-Cooper840 teaches the additional limitations of claim 2, and Thibeault-Cooper840 therefore renders claim 2 obvious. Ex. 1202, ¶124.

b. Claim 11

Claim 11 depends from claim 10. Ex. 1201, 9:34-38. Claim 11 is substantially similar to claim 2, and is therefore rendered obvious for the same reasons. *See* Section VI.A.2.a; Ex. 1202, ¶131.

B. Ground B: Claims 1-2 and 10-11 are Rendered Obvious by Thibeault-Azenkot

1. Independent Claim 1 and Independent Claim 10

a. Elements [1A]-[1C] and [10A]-[10C]

For the reasons described above in Sections VI.A.1.a-c and VI.A.1.g-h, Thibeault discloses [1A]-[1C] and [10A]-[10C]. Sections VI.A.1.a-c, VI.A.1.g-h; Ex. 1202, ¶132.

b. Elements [1D] and [10D]

As discussed above in Section VI.A.1.c, Thibeault discloses assigning CMs to logical channels based on a comparison between the determined SNR-related metric for each CM and SNR thresholds. Although Thibeault does not explicitly disclose determining a “worst-case” SNR-related metric for each group of CMs in each logical channel, a POSITA would have found it obvious to do so in view of Azenkot’s teachings. *Id.*, ¶133.

Azenkot, like Thibeault, teaches grouping cable modems by SNR using multiple logical channels. Ex. 1231, [0007], [0013], [0016], [0040]-[0041], [0092]. Burst profiles used to communicate with each CM group are then selected such that CMs with higher SNRs receive higher-throughput communications based on SNR. Ex. 1231, [0016], [0040]-[0041], [0092]-[0094]. A POSITA would have understood that there are trade-offs between the robustness of a burst profile and throughput. Ex. 1202, ¶134. In particular, relatively higher CM SNRs are required for burst profiles that support higher throughput, while more robust burst profiles that result in lower throughput are required for lower CM SNRs. *Id.*; Ex. 1231, [0010], [0068], [0092]-[0093], [0111].

Azenkot additionally sets a burst profile that all CMs within a group must use that (i) is tailored to the throughput abilities of the modems in a group, and (ii) is based on the “least capable cable modem” in the group (thereby allowing for

communications with the least capable CM). Ex. 1231, [0001], [0007], [0013], [0089]. A POSITA would have understood that the least capable CM described in Azenkot corresponds to the CM with the lowest SNR. Ex. 1202, ¶135. Indeed, if, as a result of dynamic conditions, a CM in a group has an SNR that becomes too low for the burst profile being used with that group, the CM is moved to a different group, thus maintaining groupings so that the worst SNR in any group is still high enough to accommodate the burst profile being applied to that group. *Id.* A POSITA would also have understood that Azenkot’s disclosure of setting a burst profile based on the least capable CM is also a disclosure of generating a value for lowest SNR for a group of CMs (which is required to set the burst profile). *Id.* According to Azenkot, the burst profile includes modulation order (QPSK, 64 QAM, 128 QAM, etc.). Ex. 1231, [0013], [0068], [0074].

Azenkot thus teaches that the CMTS should determine the lowest CM SNR for a group of CMs (the claimed “composite SNR-related metric based at least in part on a worst-case SNR profile”) and to use that to select modulation parameters, such as modulation order, for the service group. A POSITA would have found it obvious to apply this teaching to Thibeault’s selection of the modulation order and encoding parameters of a logical channel to optimize these physical layer communication parameters and ensure communications with all CMs in the group. *Id.*, [0001], [0007], [0013], [0089]; Ex. 1202, ¶136. Thibeault’s CMTS already

executes an algorithm that assigns CMs to logical channels based on a comparison of a CM's SNR-related metric with SNR-related metric thresholds, which also determines the modulation mode (*e.g.*, modulation order) and encoding parameters that are used for communicating within the logical channel. Ex. 1210, [0015]-[0016], [0023]-[0024], [0028]-[0030], [0033], [0038]; Ex. 1202, ¶137.

Applying Azenkot's teaching in this manner would also further Thibeault's goal of ensuring that "each network element [is] running at its best possible modulation mode." Ex. 1210, [0038], [0033]; Ex. 1202, ¶137. Specifically, a POSITA would have appreciated that selecting a modulation order (*e.g.*, 16QAM/32QAM/64QAM) and encoding parameters for a logical channel based on the worst-case SNR of a CM group would have ensured communication with all CMs in the group while also optimizing the network as described above. Ex. 1202, ¶137.

A POSITA would have also found it obvious to apply Azenkot's teaching of determining the lowest CM SNR for a group of CMs to Thibeault's selection of the optimal modulation order and encoding in order to implement Thibeault's dynamic SNR thresholds. Ex. 1210, [0032]; Ex. 1202, ¶138. As discussed above, Thibeault describes that its CMTS periodically reconfigures its logical channels, including measuring parameters such as SNR and MER for its CMs, assigning CMs to the logical channels, and dynamically setting SNR thresholds used to delineate the

logical channels. Ex. 1210, [0032]-[0033], [0038]; Section VI.A.1.d. Thus, a POSITA would have an additional motivation to apply Azenkot's teaching of determining the lowest CM SNR for a group of CMs in order to implement Thibeault's dynamic SNR threshold to address variance in a channel's SNR. Ex. 1202, ¶138.

Such a combination also combines prior art elements (Thibeault's CMTS that applies modulation order and encoding parameters to CMs that are grouped based on SNR or MER, and Azenkot's teaching of determining the lowest CM SNR for a group of CMs to determine which physical layer parameters to apply to the group) according to known methods (programming of a CMTS) to yield predictable results (a CMTS that generates a worst-case SNR-related metric for the CM service group and uses that metric to determine the modulation order and encoding parameters applied to the service group). Ex. 1202, ¶139.

Applying Azenkot's teachings to Thibeault's CMTS would have been well within the capabilities of a POSITA because it would have involved only minor modifications to the programming of Thibeault's CMTS's microprocessor. Ex. 1202, ¶140; *see also* Ex. 1210, [0008]-[0009], [0026]-[0027], [0039]. Accordingly, Thibeault-Azenkot teaches "generating ... a composite SNR-related metric based at least in part on a worst-case SNR profile of said SNR-related metrics" as required by [1D]. Ex. 1201, 4:4-64; Ex. 1217, 53-55; Ex. 1218, ¶187; Ex. 1219, 8-10; Ex.

1202, ¶¶141-142. And for reasons similar to those described above for Thibeault-Cooper840, Thibeault-Azenkot also teaches that its microprocessor is configured to perform the limitations described in [1D]. Ex. 1202, ¶142; Sections VI.A.1.g-h. Thus, Thibeault-Azenkot also teaches [10D]. *Id.*

c. Elements [1E]-[1F] and [10E]-[10F]

For reasons similar to those described above for Thibeault-Cooper840, Thibeault-Azenkot teaches [1E]-[1F]/[10E]-[10F]. Sections VI.A.1.e-f, VI.A.1.h. In particular and as discussed above, Thibeault-Azenkot's CMTS would have similarly selected and used the modulation orders and encoding parameters for its logical channels based on the worst-case SNR-related metrics determined for the groups of CMs assigned to the logical channels to ensure communication with all modems in the group while also optimizing the network. Ex. 1202, ¶¶143-144; *see also* Sections VI.A.1.e-f.

Thibeault-Azenkot's CMTS also would have communicated with the CMs connected to it using the selected modulation orders and encoding parameters. Ex. 1210, [0019], [0029]-[0030]; Ex. 1202, ¶144; *see also* Sections VI.A.1.f, VI.A.1.h. In addition, for reasons similar to those described above for Thibeault-Cooper840, Thibeault-Azenkot teaches that its microprocessor is configured to perform the limitations described in [10E], and that it comprises a network interface to perform the limitations recited in [10F]. Ex. 1202, ¶145.

Thibeault-Azenkot therefore teaches [1E]-[1F]/[10E]-[10F] and renders claims 1 and 10 obvious. *Id.*, ¶146.

2. Dependent Claim 2 and Dependent Claim 11

For reasons similar to those described above for Thibeault-Cooper840, Thibeault-Azenkot teaches dependent claims 2 and 11. Section VI.A.2. In particular, Thibeault-Azenkot's CMTS selects a modulation order (*e.g.*, 16QAM/32QAM/64QAM) based on a composite SNR for the modulation profiles of its logical channels. Section VI.A.2; Ex. 1210, [0029]-[0030], [0033]; Ex. 1201, 4:53-64; Ex. 1202, ¶¶147-148.

Accordingly, Thibeault-Azenkot teaches the additional limitations of claims 2 and 11, and Thibeault-Azenkot therefore renders claims 2 and 11 obvious. Ex. 1202, ¶¶147-148.

C. Grounds C-D: Claims 7-8 and 16-17 are Rendered Obvious by Thibeault-Cooper840 and Thibeault-Azenkot each in view of Cooper

1. Dependent Claim 7 and Dependent Claim 8

a. Claim 7

Claim 7 depends from claim 1.

As described above in Sections VI.A.1.c and VI.B.1.a, Thibeault-Cooper840's/Thibeault-Azenkot's CMTS assigns CMs to logical channels (*i.e.*, a plurality of service groups) based on SNR-related metrics. Sections VI.A.1.c, VI.B.1.a. While Thibeault-Cooper840 and Thibeault-Azenkot do not teach

assigning each CM to a group based on distances between a CMTS and a plurality of cable modems, Cooper does. Ex. 1202, ¶¶149-150.

Cooper discloses assigning CMs among a plurality of service groups based on different network parameters. Ex. 1205, Abstract, [0008], [0021], [0027]-[0028], [0037]; Ex. 1202, ¶151. For example, in addition to assigning CMs to service groups based on SNR measurements, Cooper also discloses a CMTS assigning CMs to service groups based on their location in a cable network. Ex. 1205, Abstract, [0021], [0027]-[0028], [0035], [0037]; Ex. 1202, ¶152. Grouping CMs based on the additional factor of the location of network elements in a cable network would allow the identification and isolation of geographic areas in the network that are problematic and/or the identification and isolation of problematic network elements, supporting proactive maintenance activities. Ex. 1205, [0019]; Ex. 1202, ¶152.

It would therefore have been obvious to modify Thibeault-Cooper840's/Thibeault-Azenkot's CMTS to assign CMs to service groups based on parameters associated with the location of CMs in a cable network to allow for more proactive maintenance of the network. Ex. 1205, [0019]; Ex. 1202, ¶153. More specifically, it would have been obvious to configure Thibeault-Cooper840's/Thibeault-Azenkot's CMTS to determine the location of CMs in a cable network, and then assign the CMs among a plurality of service groups based at least in part on such a location (satisfying claim 7's requirement of "assigning said

plurality of cable modems among said plurality of service groups based on distances between said CMTS and said plurality of cable modems”), in order to quickly identify and isolate problematic geographic regions in the network or network elements for maintenance. Ex. 1205, [0019], Ex. 1202, ¶153.

Such modifications also would have been obvious because they would have merely involved the combination of prior art elements (Thibeault-Cooper840’s/Thibeault-Azenkot’s CMTS and Cooper’s methods of assigning CMs to service groups based on parameters associated with each CM’s location in a cable network) according to known methods (programming of a CMTS) to yield predictable results (a CMTS that is better able to identify and isolate problematic areas in the network or network elements). Ex. 1202, ¶154. Applying Cooper’s teachings to Thibeault-Cooper840’s/Thibeault-Azenkot’s CMTS would have been well within the capabilities of a POSITA because it would have involved straightforward modifications to the programming of Thibeault-Cooper840’s/Thibeault-Azenkot’s CMTS’s microprocessor. Ex. 1202, ¶155; *see also* Ex. 1210, [0008]-[0009], [0026]-[0027], [0039]; Ex. 1205, [0008], [0023]-[0024], [0030].

Therefore, claim 7 is rendered obvious by Thibeault-Cooper840-Cooper and Thibeault-Azenkot-Cooper. Ex. 1202, ¶156.

b. Claim 8

Claim 8 depends from claim 1.

As described above in Sections VI.A.1.c and VI.B.1.a, Thibeault's CMTS assigns CMs to logical channels (*i.e.*, a plurality of service groups) based on a comparison between the determined SNR-related metrics for each CM and SNR-related metric thresholds. Sections VI.A.1.c, VI.B.1.a. While Thibeault-Cooper840 and Thibeault-Azenkot do not teach assigning each CM to a group based on which one or more of a plurality of branch amplifiers are upstream of said one of said plurality of CMs, Cooper does. Ex. 1202, ¶¶157-158.

Cooper discloses assigning CMs among a plurality of service groups based on different network parameters. Ex. 1205, Abstract, [0008], [0021], [0027]-[0028], [0037]; Ex. 1202, ¶159. For example, in addition to assigning network elements to service groups based on SNR measurements, Cooper also discloses a CMTS assigning network elements to service groups based on determined amplifier cascade depths. Ex. 1205, Abstract, [0021], [0027]-[0028], [0035], [0037]; Ex. 1202, ¶159. Grouping CMs based on the additional factor of amplifier cascade depth would allow the identification and isolation of problematic network elements, supporting proactive maintenance activities. Ex. 1205, [0019]; Ex. 1202, ¶159.

It would therefore have been obvious to modify Thibeault-Cooper840's/Thibeault-Azenkot's CMTS to assign CMs to service groups based on

amplifier cascade depth to allow for more proactive maintenance of the network. Ex. 1205, [0019]; Ex. 1202, ¶160. More specifically, it would have been obvious to configure Thibeault-Cooper840's/Thibeault-Azenkot's CMTS to assign a CM to one of a plurality of service groups based at least in part on amplifier cascade depth (satisfying claim 8's requirement of "assigning any particular one of said plurality of cable modems to one of said plurality of service groups based on which one or more of a plurality of branch amplifiers are upstream of said one of said plurality of cable modems") in order to quickly identify and isolate problematic geographic regions in the network or network elements for maintenance. Ex. 1202, ¶160.

Such modifications also would have been obvious because they would have merely involved the combination of prior art elements (Thibeault-Cooper840's/Thibeault-Azenkot's CMTS and Cooper's methods of assigning CMs to service groups based on amplifier cascade depth) according to known methods (programming of a CMTS) to yield predictable results (a CMTS that is better able to identify and isolate problematic areas in the network or network elements). Ex. 1202, ¶161. Applying Cooper's teachings to Thibeault-Cooper840's/Thibeault-Azenkot's CMTS would have been well within the capabilities of a POSITA because it would have involved straightforward modifications to the programming of Thibeault-Cooper840's/Thibeault-Azenkot's CMTS's microprocessor. Ex. 1202,

¶162; *see also* Ex. 1210, [0008]-[0009], [0026]-[0027], [0039]; Ex. 1205, [0008], [0023]-[0024], [0030].

Therefore, claim 8 is rendered obvious by Thibeault-Cooper⁸⁴⁰-Cooper, and Thibeault-Azenkot-Cooper. Ex. 1202, ¶163.

2. Dependent Claim 16 and Dependent Claim 17

a. Claim 16

Claim 16 is substantially similar to claim 7 except that it identifies “said processor” to make the assignments. Ex. 1201, 10:26-29. As discussed in Section VI.A.1.g, Thibeault-Cooper⁸⁴⁰-Cooper’s/Thibeault-Azenkot-Cooper’s CMTS comprises the claimed processor, and the processor is configured to perform the limitations recited in claim 16 (as discussed in claim 7). Ex. 1202, ¶164; Section VI.C.1.a. Therefore, claim 16 is rendered obvious for the same reasons discussed in Section VI.C.1.a. Ex. 1202, ¶164.

b. Claim 17

Claim 17 is substantially similar to claim 8 except that it identifies “said processor” to make the assignments. Ex. 1201, 10:30-34. As discussed in Section VI.A.1.g, Thibeault-Cooper⁸⁴⁰-Cooper’s/Thibeault-Azenkot-Cooper’s CMTS comprises the claimed processor, and the processor is configured to perform the limitations recited in claim 17 as discussed in claim 8. Ex. 1202, ¶¶165-166; Section VI.C.1.b. Therefore, claim 17 is rendered obvious for the same reasons discussed in Section VI.C.1.b. Ex. 1202, ¶¶165-167.

D. Grounds E-F: Claims 1-6 and 10-15 are Rendered Obvious by Thibeault-Cooper840 and Thibeault-Azenkot, each in view of Monk802

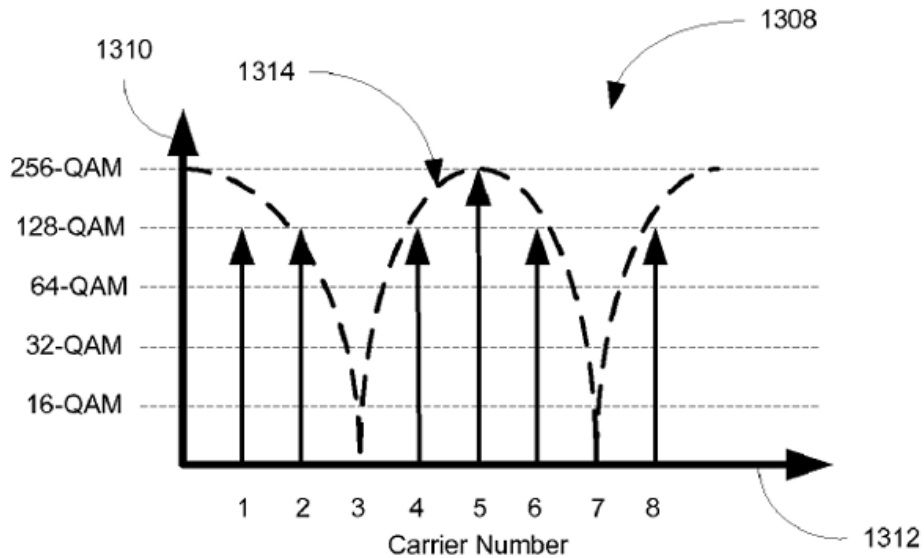
1. Dependent Claim 3 and Dependent Claim 12

a. Claim 3

Claim 3 depends from claim 1 and requires orthogonal frequency division multiplexing (OFDM) communication. Ex. 1201, 8:28-30. As discussed above in Sections VI.A.1.d-f and VI.B.1.b-c, Thibeault-Cooper840/Thibeault-Azenkot teach that the CMTS selects physical layer communication parameters (*i.e.*, a modulation order and encoding parameters) that are then used to communicate with one or more CMs in a particular service group. Use of OFDM for such communication was ubiquitously known and is taught in Monk802. A POSITA would have found it obvious to use OFDM in these combinations, as taught by Monk802. Ex. 1202, ¶168.

Monk802 discloses a method of communication using OFDM. Ex. 1214, 8:1-39, 17:61-67, 19:27-41, 21:19-22:34, Figs. 12, 13A-13C. Specifically, Monk802 discloses dividing a waveform into multiple sub-carriers, each of which is independent and can be modulated on a per-subcarrier basis depending on the channel's SNR-related metric, with higher SNR-related metric channels supporting higher data capacity or modulation schemes. *Id.*, 8:19-39, 21:19-22:34; Ex. 1202, ¶169. For example, Monk802's Figure 13B (below) shows the frequency profile of a carrier frequency with eight sub-carriers, each with different QAM orders (*e.g.*,

16/32/64/128/256) based on the frequency response of each sub-carrier, which corresponds to that subcarrier's SNR. Ex. 1214, 21:53-22:16, Figs. 13A-13C; Ex. 1202, ¶170; *see also* Ex. 1214, 8:19-25, 20:59-21:43.



Ex. 1214, Fig. 13B

OFDM-based communications systems allow cable broadband coaxial networks to overcome signal impairments caused by issues such as multipath reflections in a highly dispersive environment (*e.g.*, an in-home coaxial network) and optimize communications based on the specific channel available. Ex. 1214, 4:7-24, 8:8-25, 16:64-67; Ex. 1202, ¶170.

A POSITA would have been motivated to combine the OFDM communication techniques taught by Monk802 with the communication techniques taught by Thibeault-Cooper840's/Thibeault-Azenkot's CMTS as an additional method to address signal impairments in a highly dispersive environment. Ex. 1214, 4:7-24, 8:8-25; Ex. 1202, ¶171. As discussed above in Sections VI.A.1.e and

VI.B.1.c, Thibeault-Cooper840's/Thibeault-Azenkot's communication techniques teach selecting encoding parameters and modulation orders for different carriers or channels based on a composite worst-case SNR-related metric. Monk802's OFDM communication technique would allow for higher quality and more reliable services in highly dispersive environments by splitting up each logical channel further and allowing bits to be spread over multiple subcarriers, while still utilizing different modulation orders of QAM (but on a per-subcarrier basis depending on an SNR-related metric) and while still selecting encoding parameters. Ex. 1202, ¶172.

Such combinations also would have been obvious because they would have been nothing more than combining prior art elements (Thibeault-Cooper840's/Thibeault-Azenkot's CMTS and CM system that sets communication parameters for groups of CMs and Monk802's OFDM method of communication) according to known methods (programming a CMTS and configuring the system to use OFDM) to yield predictable results (a CMTS that uses OFDM to communicate over a plurality of subcarriers that use different modulation orders of QAM on a per-subcarrier basis and while still selecting encoding parameters). *Id.*, ¶173.

A POSITA would have had a reasonable expectation of success applying Monk802's teachings to Thibeault-Cooper840's/Thibeault-Azenkot's CMTS as it would have only required straightforward modifications to the programming of the microprocessor in the CMTS, which was well within the capabilities of a POSITA.

Id., ¶174; Ex. 1210, [0008]-[0009], [0026]-[0027]. Thus, Thibeault-Cooper840's/Thibeault-Azenkot's CMTS as modified by Monk802 teaches the claimed use of "[OFDM] over a plurality of subcarriers for said communicating." Ex. 1202, ¶175.

Therefore, claim 3 is invalid as obvious over Thibeault-Cooper840-Monk802, and Thibeault-Azenkot-Monk802. *Id.*

b. Claim 12

Claim 12 is substantially similar to claim 3 except that it identifies "said network interface and said plurality of cable modems" are configured to use OFDM. Ex. 1201, 9:39-42. As discussed in Section VI.A.1.g, Thibeault's CMTS comprises the claimed network interface that it uses to communicate with CMs, and therefore, claim 12 is rendered obvious for the same reasons discussed in Section VI.D.1.a. Ex. 1202, ¶¶196-197.

2. Dependent Claim 4 and Dependent Claim 13

a. Claim 4

Claim 4 depends from claim 3 and requires the CMTS to select parameters on a per-OFDM-subcarrier basis. Ex. 1201, 8:31-33. As discussed above in Section VI.D.1.a, Thibeault-Cooper840-Monk802's/Thibeault-Azenkot-Monk802's CMTS teaches the use of OFDM where a particular QAM modulation order (*e.g.*, 16/32/64/128/256) and other encoding parameters are selected on a per-subcarrier basis depending on an SNR-related metric. Section VI.D.1.a.; Ex. 1214, 8:19-39,

21:19-22:34, Figs. 12, 13A-13C; Ex. 1202, ¶176. Thus, Thibeault-Cooper840's/Thibeault-Azenkot's CMTS as modified by Monk802 also teaches the CMTS "selecting ... said physical layer communication parameters on a per-OFDM-subcarrier basis." Ex. 1202, ¶176.

Accordingly, claim 4 is invalid as obvious over Thibeault-Cooper840-Monk802 and Thibeault-Azenkot-Monk802. *Id.*, ¶177.

b. Claim 13

Claim 13 is substantially similar to claim 4 except that it identifies "said network interface" is configured such that the physical layer communication parameters are configurable on a per-OFDM-subcarrier basis. Ex. 1201, 9:43-46. As discussed in Section VI.A.1.g, Thibeault-Cooper840's/Thibeault-Azenkot's CMTS comprises the claimed network interface that it uses to communicate with CMs, and therefore, claim 13 is rendered obvious for the same reasons discussed in Section VI.D.2.a. Ex. 1202, ¶¶198-199.

3. Dependent Claim 5 and Dependent Claim 14

a. Claim 5

Claim 5 depends from claim 4 and requires that the parameters include the selection of an OFDM subcarrier for ingoing and outgoing communications. Ex. 1201, 8:34-38. As discussed above in Section VI.D.2.a, Thibeault-Cooper840-Monk802's/Thibeault-Azenkot-Monk802's CMTS selects "physical layer communication parameters" on a per-OFDM-subcarrier basis based on a composite

SNR-related metric. In addition, Thibeault discloses the use of DOCSIS CMTSs and modems, which transmit and receive in different, designated frequency bands that would determine which frequencies of OFDM subcarriers are used for communication between equipment. Ex. 1210, Abstract, [0001]-[0007], [0031], [0037]; Ex. 1221, 17-19, 23-25; Ex. 1222, 15, 21-24; Ex. 1223, 19, 21, 43-45; Ex. 1202, ¶¶178-179. This is consistent with Monk802's disclosure, which also shows different frequency bands used for upstream and downstream signals. Ex. 1214, 23:30-60, 24:4-37, Fig. 17; Ex. 1202, ¶179.

And as discussed above in Section VI.A.1.b, Thibeault further discloses that the CMTS determines separate upstream (*i.e.*, “transmission to said CMTS”) and downstream (*i.e.*, “reception of information from said CMTS”) SNR-related metrics. Ex. 1210, [0031]-[0037]; Section VI.A.1.b; Ex. 1202, ¶¶180-181. Because Thibeault distinguishes between upstream and downstream SNR-related metrics in different frequency bands, in the proposed combinations, the CMTS selects separate upstream and downstream “physical layer communication parameters” on a per-OFDM-subcarrier basis based on a composite upstream or downstream SNR-related metric. Ex. 1202, ¶181. Thus, Thibeault-Cooper840-Monk802/Thibeault-Azenkot-Monk802 teach “physical layer communication parameters include one or both of: which of said OFDM subcarriers to use for transmission to said CMTS, and which

of said OFDM subcarriers to use for reception of information from said CMTS.” *Id.*, ¶¶181-182.

Therefore, claim 5 is invalid as obvious over Thibeault-Cooper840-Monk802, and Thibeault-Azenkot-Monk802. *Id.*

b. Claim 14

Claim 14 is substantially similar to claim 5. Ex. 1202, ¶200. Thibeault-Cooper840-Monk802 and Thibeault-Azenkot-Monk802 teach the additional limitations in claim 14 for the same reasons discussed above in Section VI.D.3.a. Accordingly, claim 14 is invalid as obvious over Thibeault-Cooper840-Monk802 and Thibeault-Azenkot-Monk802. *Id.*

4. Dependent Claim 6 and Dependent Claim 15

a. Element [6A]

Claim 6 depends from claim 1. Ex. 1201, 8:39-58. As described in Section VI.A.1.c and VI.B.1.a, Thibeault (in each proposed combination) assigns cable modems into at least four different service groups or logical channels based on comparing a modem’s measured SNR-related metric to an SNR-related metric threshold. Ex. 1210, [0033]. Thus, Thibeault-Cooper840 and Thibeault-Azenkot teach at least “a first service group and a second service group.” Ex. 1202, ¶183.

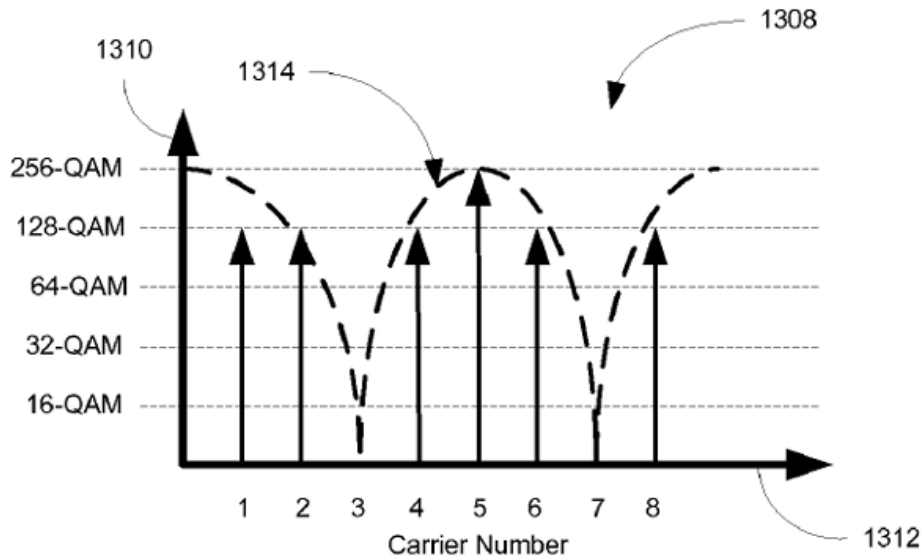
And as shown in Sections VI.A.1.d and VI.B.1.b, Thibeault-Cooper840 and Thibeault-Azenkot teach generating a composite SNR-related metric for each service group based at least in part on a worst-case SNR profile. Thibeault-

Cooper⁸⁴⁰ and Thibeault-Azenkot do not expressly teach this composite SNR-related metric as an SNR versus frequency profile, but Monk802's use of OFDM describes this feature, and a POSITA would have found it obvious to modify each combination based on the teachings of Monk802. Ex. 1202, ¶184.

As discussed in Section VI.D.1, Monk802's use of OFDM allows cable broadband coaxial networks to overcome signal impairments caused by issues such as multipath reflections in a highly dispersive environment (*e.g.*, an in-home coaxial network) and optimize communications based on the specific channel available. Ex. 1214, 4:7-24, 8:8-25, 16:64-67; Ex. 1202, ¶185. Using Monk802's OFDM splits the communication channel between network devices (*e.g.*, CMs) into sub-channels to transmit subcarriers and measure the characteristics (*e.g.*, SNR) of each sub-channel. Ex. 1214, 8:19-25, 21:19-22:34, Figs. 13A-13C; Ex. 1202, ¶185; *see also* Ex. 1202, ¶¶58-60. After determining the SNR for each sub-channel, each subcarrier can be modulated independently (on a per-subcarrier basis) depending on the sub-channel's SNR, with higher SNR channels supporting higher data capacity or modulation schemes. Ex. 1214, 8:19-25, 19:26-41, 21:19-22:34, Figs. 13A-13C; Ex. 1202, ¶185.

Monk802's Figure 13B (below) shows a profile of a carrier frequency response, which corresponds to that subcarrier's SNR, over a range of frequencies

that indicates the maximum modulation order for each frequency sub-carrier. Ex. 1214, 21:53-22:16, 8:19-25, 20:59-21:43, Figs. 13A-13C; Ex. 1202, ¶186.



Ex. 1214, Fig. 13B

A POSITA would have been motivated to combine the OFDM techniques taught by Monk802 with Thibeault-Cooper840's/Thibeault-Azenkot's CMTS to provide more reliable communication and overcome signal impairments. Ex. 1214, 8:19-25, 19:27-40, 20:23-22:34, Figs. 13A-13C; Ex. 1202, ¶187. As discussed in Sections VI.A.1.e and VI.B.1.c, Thibeault-Cooper840's/Thibeault-Azenkot's CMTS selects encoding parameters and modulation orders for different carriers/channels based on a composite worst-case SNR-related metric. Combining the OFDM techniques taught by Monk802 with Thibeault-Cooper840's/Thibeault-Azenkot's CMTS would have been obvious because the resulting system would have used a communication technique that allows for higher quality and more reliable services to the service groups by dividing each channel and allowing bits to be spread

over multiple subcarriers that each use optimal encoding parameters. Ex. 1202, ¶¶187-188. In order to utilize OFDM, a CMTS would divide each channel into sub-channels, measure and generate a composite SNR versus frequency profile for each sub-channel, as taught by Monk802. *Id.*, ¶188. And this composite SNR versus frequency profile would be based on the SNR versus frequency profile of the CM with the worst-case SNR-related metric of the service group. *Id.*

Such combinations represent an obvious application of a known technique (Monk802's OFDM method that includes generating SNR versus frequency profiles for each channel for each CM) to a known system ready for improvement (Thibeault-Cooper840's/Thibeault-Azenkot's CMTS) to yield predictable results (a CMTS that uses OFDM to overcome signal interference caused by issues such as reflections and impedance mismatches, allows for higher quality and more reliable services and generates SNR versus frequency profiles for each channel). *Id.*, ¶189. Moreover, applying OFDM would have been well within the capabilities of a POSITA, leading to an expectation of success, as it would have only required straightforward modifications to the programming of the microprocessor in the CMTS. *Id.*, ¶190; Ex. 1210, [0008]-[0009], [0026]-[0027]; Ex. 1214, 31:6-43.

In sum, the combinations of Thibeault-Cooper840-Monk802 and Thibeault-Azenkot-Monk802 teach the claimed "first composite SNR versus frequency profile" and "second composite SNR versus frequency profile" associated with their

respective service group. Ex. 1202, ¶190. Further, because these combinations also teach measuring an SNR versus frequency profile for each modem, the combinations also teach “a third cable modem has a particular SNR versus frequency profile.” *Id.*

Accordingly, Thibeault-Cooper840-Monk802 and Thibeault-Azenkot-Monk802 teach the additional requirements of [6A]. *Id.*, ¶191.

b. Element [6B]

Element [6B] requires assigning the third CM to the service group whose composite SNR profile is more similar to the SNR profile of the third CM. A POSITA would have understood from the ’438 patent that [6B] requires assigning the third cable modem to the service group that has a composite SNR versus frequency profile more similar to that of the third cable modem while still allowing that third modem to communicate with the CMTS as required by [1F]. Ex. 1202, ¶192; Ex. 1201, 5:44-55, 8:2-23, 9:9-33.

Thibeault-Cooper840-Monk802 and Thibeault-Azenkot-Monk802 teach [6B]. As discussed for [6A], Thibeault-Cooper840-Monk802 and Thibeault-Azenkot-Monk802 teach at least a first and second service group that each have their own composite SNR versus frequency profile based on the CM with the worst-case SNR versus frequency profile. Section VI.D.4.a. They also teach “a third cable modem has a particular SNR versus frequency profile.” *Id.* They assign a third cable modem to the service group that has a composite SNR versus frequency profile

more similar to that of the third cable modem—as required by [6B]—because in Thibeault, CMs are grouped so that CMs having similar SNR-related metrics are in the same group. Section VI.A.1.d; Ex. 1202, ¶193.

Thibeault-Cooper840 and Thibeault-Azenkot group modems with similar SNR-related metrics into service groups and select communication parameters for each service group based on the worst-case CM in each group having the worst SNR-related profile of a CM in a service group (*i.e.*, meet the requirements of the composite SNR-profile for the group, which is based on the worst-case SNR profile) so that the CMTS can communicate with each CM, as discussed for [1D] and [1E]. Sections VI.A.1.d-e, VI.B.1.b-c; Ex. 1202, ¶194. Further, as highlighted in [6A], this likewise applies when using OFDM. Section VI.D.4.a; Ex. 1202, ¶194.

Thus, a POSITA would understand that because Thibeault-Cooper840-Monk802 and Thibeault-Azenkot-Monk802 group CMs with similar SNR versus frequency profiles, these combinations also would assign a third cable modem to a service group that has the most similar SNR versus frequency profile while still allowing communication with the CMTS. Ex. 1202, ¶195.

Indeed, under any reasonable construction, the proposed combinations teach [6B]. *Id.* For example, if the first service group has a worse composite SNR versus frequency profile than that of the second service group (*e.g.*, 17-19dB vs. 22-24dB) and the third CM has an SNR versus frequency profile of 18dB-20dB, the third CM

will be assigned to the first service group. The first service group’s composite SNR is more similar to the third CM than that of the second service group. *Id.*

Therefore, claim 6 is invalid as obvious over Thibeault-Cooper840-Monk802, and Thibeault-Azenkot-Monk802. *Id.*

c. Dependent Claim 15

Claim 15 is substantially similar to claim 6. Ex. 1202, ¶201. Thibeault-Cooper840-Monk802 and Thibeault-Azenkot-Monk802 teach the additional limitations in claim 15 for the same reasons discussed above in Section VI.D.4.a-b. Accordingly, claim 15 is invalid as obvious over Thibeault-Cooper840-Monk802 and Thibeault-Azenkot-Monk802. *Id.*

5. Claims 1-6, 10-15

As shown above in Sections VI.A.1.d and VI.B.1.b, Thibeault-Cooper840/Thibeault-Azenkot teach [1D] and [10D] by teaching a CMTS generating a composite SNR-related metric for each service group based at least in part on a “worst-case SNR profile”. Sections VI.A.1.d, VI.B.1.b. If it is asserted that such a “worst-case SNR profile” (as recited in [1D] and [10D]) must comprise the SNR of a CM over a range of frequencies, and that such a feature is not taught by Thibeault-Cooper840 or Thibeault-Azenkot, Monk802 discloses this feature and a POSITA would have found it obvious to modify Thibeault-Cooper840 and

Thibeault-Azenkot to include this feature for the reasons described above for [6A].
Section VI.D.4.a; Ex. 1202, ¶¶202-203.

In particular, as described above, Thibeault-Cooper840-Monk802/Thibeault-Azenkot-Monk generate a composite SNR-related metric based at least in part on a “worst-case SNR profile” that comprises the SNR of a CM over a range of frequencies. *Id.* For the reasons described above for [6A], a POSITA would have been motivated to combine this OFDM technique taught by Monk802 with Thibeault-Cooper840’s/Thibeault-Azenkot’s CMTS to provide more reliable communication and overcome signal impairments. Ex. 1214, 8:19-25, 19:27-40, 20:23-22:34, Figs. 13A-13C; Ex. 1202, ¶203.

In addition, such combinations represent an obvious application of a known technique (Monk802’s OFDM method that includes generating an SNR versus frequency profile for a CM over a range of frequencies) to a known system ready for improvement (Thibeault-Cooper840’s/Thibeault-Azenkot’s CMTS) to yield predictable results (a CMTS that uses OFDM to overcome signal impairments caused by issues such as micro-reflections and impedance mismatches and generates SNR versus frequency profiles for each channel). Ex. 1202, ¶204. Moreover, applying OFDM would have been well within the capabilities of a POSITA for the reasons described above for [6A]. Section VI.D.4.a; Ex. 1202, ¶204; Ex. 1210, [0008]-[0009], [0026]-[0027]; Ex. 1214, 31:6-43.

Accordingly, if it is asserted that the combinations of Thibeault-Cooper840 and Thibeault-Azenkot described above in Sections VI.A.1 and VI.B.1 do not teach [1D], Thibeault-Cooper840-Monk802 and Thibeault-Azenkot-Monk802 teach [1D] for this alternative reason. And for reasons similar to those described above for Thibeault-Cooper840 and Thibeault-Azenkot, the combinations of Thibeault-Cooper840-Monk802 and Thibeault-Azenkot-Monk802 also teach [1A]-[1C] and [1E]-[1F] and render claim 1 obvious. Sections VI.A.1.a-c, VI.A.1.e-f, VI.B.1.a, VI.B.1.c; Ex. 1202, ¶205.

Further, for reasons similar to those described above for Thibeault-Cooper840 and Thibeault-Azenkot, the combinations of Thibeault-Cooper840-Monk802 and Thibeault-Azenkot-Monk802 also teach claim 2-6 and 10-15, thus rendering each of those claims obvious. Sections VI.A.2, VI.B.2, VI.D.1-4; Ex. 1202, ¶206.

E. Grounds G-H: Claims 9 and 18 are Rendered Obvious by Thibeault-Cooper840, and Thibeault-Azenkot, each in view of Monk and Cooper437

1. Claim 9

Claim 9 depends from claim 1 and requires the CMTS to (i) send a message instructing the CMs to measure a metric and report the result and (ii) receive back a message reporting the measurements. Ex. 1201, 9:1-8. As discussed in Sections VI.A.1.b and VI.B.1.a above, Thibeault-Cooper840 and Thibeault-Azenkot teach determining an SNR-related metric for each CM served by the CMTS based on a

measurement at either the CMTS or the CM. Thibeault explains that the processes illustrated in Figure 4 may be contained on a computer readable medium which may be read by microprocessor. Ex. 1210, [0039]; *see also* Section VI.A.1.b. Thibeault also discloses that any of its CMs may include a microprocessor configured to perform the processes of Figure 4 and are further configured to provide ranging messages to the CMTS indicative of the CM's SNR-related metric. Ex. 1210, [0013], [0032], [0039]. However, Thibeault-Cooper⁸⁴⁰ and Thibeault-Azenkot do not specifically teach a probe message instructing the CMs to measure the SNR-related metric and report the measured metric back to the CMTS (as required by claim 9). Monk and Cooper⁴³⁷ teach such a probe message. Ex. 1202, ¶¶207-208.

Monk applies different modulation schemes based on a communication channel's SNR. Ex. 1215, Abstract, 4:25-38, 6:6-19, 7:14-31, 8:1-11. Higher SNR channels can support higher modulation orders through bit loading (*e.g.*, 16-QAM, 64-QAM and 256-QAM), while lower SNR channels may use a different modulation scheme such as QPSK. *Id.*, 4:55-59, 8:1-11, 9:9-11, 10:58-62; Ex. 1202, ¶¶209-210. To determine the SNR of a channel, a sending node transmits a probe message having a predetermined data sequence to a receiving device, which analyzes the probe message for impairment. Ex. 1215, 4:44-59, 9:28-41, Abstract. The receiving device sends the results of the analysis back to the sending device as either raw data

or a bit loading profile for the sending device to determine the transmission parameters. *Id.*, 9:41-50; Ex. 1202, ¶210.

A POSITA would have found it obvious, in the Thibeault-Cooper840 and Thibeault-Azenkot combinations, to transmit a probe message to each of the CMs (the claimed “transmitting a probe message to each said plurality of cable modems”) and to receive a reporting message including SNR-related metric raw data or a bit loading profile (the claimed “receiving a metric reporting message from each of said plurality of cable modems”) as taught by Monk in order to implement Thibeault’s measurement of an SNR-related metric at each of the CMs and reporting it back to the CMTS. Ex. 1210, [0013]; Ex. 1215, 4:44-59, 8:4-5, 9:9-11, 9:26-41, 10:60-62, Abstract; Ex. 1202, ¶211.

Incorporating Monk’s probe messages and reporting messages into Thibeault-Cooper840 and Thibeault-Azenkot also would have been obvious because such an implementation would have been nothing more than combining prior art elements (Thibeault-Cooper840’s/Thibeault-Azenkot’s CMTS that oversees the measurement of SNR-related metrics, and the probe and reporting messages of Monk that allow for the measurement of SNR) according to known methods (programming the CMTS to send probe messages and receive reporting messages that provide an analysis of a channel’s SNR or MER) to yield predictable results (a system that uses probe messages and reporting messages to have CMs rather than a CMTS measure

the SNR or MER of a channel). Ex. 1202, ¶212. A POSITA would have further found it obvious to measure at the CMs to distribute processing requirements among multiple CMs, thus limiting processing required by the CMTS. *Id.*

Further, applying Monk's teachings to Thibeault-Cooper840's/Thibeault-Azenkot's CMTS would have been well within the capabilities of a POSITA as it would have only required straightforward modifications to the programming of the microprocessor in the CMTS. Ex. 1202, ¶213. And a POSITA would have had a reasonable expectation of success in these programming modifications as Thibeault-Cooper840's/Thibeault-Azenkot's microprocessor would function as a programmed signal processor, which Monk discloses may be used for its teachings. *Id.*; Ex. 1210, [0039]; Ex. 1215, 10:22-31.

While Thibeault-Cooper840-Monk and Thibeault-Azenkot-Monk teach a probe message, they do not teach a probe message that includes instructions for measuring a metric and reporting said measured metric back to the CMTS. However, Cooper437 does. Ex. 1202, ¶214. Cooper437 discloses a method for a CMTS to ask for and receive specific noise signal power measurements from CMs in its network. Ex. 1216, Abstract, 1:62-65, 3:47-50, Fig. 1. The CMTS initiates these measurements by transmitting to CMs a message that defines the measurement techniques to be used and how to report the measurements. *Id.*, Abstract, 1:62-65, 3:47-50, 8:11-29, 8:60-9:5, 10:56-11:60, Figs. 1, 3-4; Ex. 1202, ¶215.

After receiving the probe message, a CM performs the noise signal power measurements specified in the message, and then sends a report of the measurements (which may be provided as raw measured data). Ex. 1216, 10:56-11:28, Table 1; Ex. 1202, ¶215. By including the measurement and reporting modes (*i.e.*, instructions) in the message, Cooper437's method allows a CMTS to send customized probe messages to specific modems to conduct specific testing (*e.g.*, at specific frequencies or at specific noise thresholds), which can be adjusted as different noise sources connect or are active on the network. Ex. 1216, 8:9-64, 10:56-11:28, Table 1; Ex. 1202, ¶216.

A POSITA would have found it obvious to modify Thibeault-Cooper840-Monk's/Thibeault-Azenkot-Monk's probe message (which already estimates channel characteristics) to identify a measurement mode and reporting mode, as taught by Cooper437, so that Thibeault-Cooper840-Monk's/Thibeault-Azenkot-Monk's CMTS can send customized probe messages to specific CMs or service groups to conduct specific testing to determine the SNR-related metrics of specific service groups or at specific frequencies and report back to allow the CMTS to more quickly identify groups of modems or frequencies that have had a change in their SNR-related metrics. Ex. 1202, ¶217; Ex. 1216, 8:9-64, 10:56-11:28, Table 1.

Moreover, modifying the probe message to identify a measurement mode (the claimed "instructions for measuring a metric") and a reporting mode (the claimed

“instructions for . . . reporting said measured metric”) would also have been obvious because such a modification would have been nothing more than combining prior art elements (Thibeault-Cooper840-Monk’s/Thibeault-Azenkot-Monk’s probe message with the measurement mode and reporting mode of Cooper437) according to known methods (modifying the contents of a probe messages) to yield predictable results (a CMTS that uses probe messages that include instructions for measurement and reporting of SNR-related metrics). Ex. 1202, ¶218.

Applying Cooper437’s teachings to Thibeault-Cooper840-Monk’s/Thibeault-Azenkot-Monk’s CMTS would have been well within the capabilities of a POSITA as it would have only required straightforward modifications to the programming of the microprocessor in the CMTS. *Id.*, ¶219. And a POSITA would have a reasonable expectation of success in these programming modifications as Thibeault-Cooper840-Monk, Thibeault-Azenkot-Monk and Cooper437 each teach using the DOCSIS standard for transfer of data over a cable system and rely on generic microprocessors or microcontrollers for execution of their methods. *Id.*; Ex. 1210, [0013], [0037], [0039]; Ex. 1216, 5:3-14, 7:6-22.

Accordingly, Thibeault-Cooper840 or Thibeault-Azenkot each in view of Monk and Cooper437 teach claim 9. Ex. 1202, ¶220.

2. Claim 18

Claim 18 is substantially similar to claim 9. Ex. 1202, ¶221. Thibeault-Cooper840-Monk-Cooper437 and Thibeault-Azenkot-Monk-Cooper437 teach the additional limitations in claim 18 for the same reasons discussed above in Section VI.E.1. Accordingly, claim 18 is invalid as obvious over Thibeault-Cooper840-Monk-Cooper437 and Thibeault-Azenkot-Monk-Cooper437. *Id.*

F. Grounds I-J: Claims 7-8 and 16-17 are Rendered Obvious by Thibeault-Cooper840-Cooper and Thibeault-Azenkot-Cooper each in view of Monk802

The combinations described above in Grounds C-D teach assigning each CM to a group based on its location in the network and amplifier cascade depth. Section VI.C. Further, for the reasons described above in Section VI.D.5, if it is asserted that the “worst-case SNR profile” recited in [1D] and [10D] must comprise the SNR-related metrics of a CM over a range of frequencies, Monk802 discloses this feature and a POSITA would have found it obvious to modify Thibeault-Cooper840-Cooper and Thibeault-Azenkot-Cooper to include these features. Section VI.D.5; Ex. 1202, ¶222. For the same reasons it would have been obvious to modify Thibeault-Cooper840 and Thibeault-Azenkot to include these features, it would have been obvious to similarly modify Thibeault-Cooper840-Cooper and Thibeault-Azenkot-Cooper to include these features. Ex. 1202, ¶223. Therefore, for this alternative

reason, Thibeault-Cooper840-Cooper-Monk802 and Thibeault-Azenkot-Cooper-Monk802 render claims 7-8 and 16-17 obvious. *Id.*

G. Grounds K-L: Claims 9 and 18 are Rendered Obvious by Thibeault-Cooper840-Monk-Cooper437 and Thibeault-Azenkot-Monk-Cooper437 each in view of Monk802

The combinations described above in Grounds G-H teach using a CMTS to

- (i) send a message instructing the CMs to measure a metric and report the result and
- (ii) receive back a message reporting the measurements. Section VI.E. Further, for the reasons described above in Section VI.D.5, if it is asserted that the “worst-case SNR profile” recited in [1D] and [10D] must comprise the SNR of a CM over a range of frequencies, Monk802 discloses this feature and a POSITA would have found it obvious to modify Thibeault-Cooper840-Cooper and Thibeault-Azenkot-Cooper to include this feature. Section VI.D.5; Ex. 1202, ¶224. For the same reasons it would have been obvious to modify Thibeault-Cooper840 and Thibeault-Azenkot to include this feature, it would have been obvious to similarly modify Thibeault-Cooper840-Cooper and Thibeault-Azenkot-Cooper to include this feature. Ex. 1202, ¶225. Therefore, for this alternative reason, Thibeault-Cooper840-Cooper-Monk802 and Thibeault-Azenkot-Cooper-Monk802 render claims 9 and 18 obvious. *Id.*

H. Grounds M-X: Claims 1-18 are Rendered Obvious by: Thibeault-Cooper840 (claims 1-2, 10-11), Thibeault-Azenkot (claims 1-2, 10-11), Thibeault-Cooper840-Cooper (claims 7-8, 16-17), Thibeault-Azenkot-Cooper (claims 7-8, 16-17), Thibeault-Cooper840-Monk802 (claims 1-

6, 10-15), Thibeault-Azenkot-Monk802 (claims 1-6, 10-15), Thibeault-Cooper840-Monk-Cooper437 (claims 9, 18), Thibeault-Azenkot-Monk-Cooper437 (claims 9, 18), Thibeault-Cooper840-Cooper-Monk802 (claims 7-8, 16-17), Thibeault-Azenkot-Cooper-Monk802 (claims 7-8, 16-17), Thibeault-Cooper840-Monk-Cooper437-Monk802 (claims 9, 18), and Thibeault-Azenkot-Monk-Cooper437-Monk802 (claims 9, 18), in further view of Currivan

The combinations described above teach [1E] and [10E] by teaching a CMTS selecting network communication parameters (*i.e.*, modulation order and encoding parameters) for a group of modems based on a worst-case SNR-related metric for a service group of modems. Sections VI.A-E. If it is asserted that those combinations do not teach selecting multiple “physical layer communication parameters” as recited in [1E] and [10E], Currivan discloses this feature and a POSITA would have found it obvious to further modify the combinations based on the additional teachings in Currivan. Ex. 1202, ¶¶226-237.

As described above, the CMTS in Thibeault (as modified by Cooper840 or Azenkot) selects a modulation order and encoding parameters based on the composite SNR-related metric. Sections VI.A.1.d-e, VI.B.1.b-c; Ex. 1202, ¶227.

Currivan similarly discloses a CMTS that groups CMs. Ex. 1228, [0026], [00161], [00192], claim 1, claim 16. Currivan’s CMTS selects a modulation order (also referred to in Currivan as modulation density) for each group based on a measured SNR. *Id.*, [0034], [0079], [0157], [0182]; Ex. 1202, ¶227. Currivan also describes the relationship between SNR and the physical layer communication

parameters of modulation order and transmit power. Ex. 1228, [0067], [0157]-[0158]. In particular, Currivan teaches increasing SNR by increasing transmit power to support a higher modulation order. *Id.*, [0020], [0151], [0157]-[0158], [0177], [0200]. Higher modulation orders have higher throughput. *Id.*, [0018], [0065], [0158], [0170], [0182]; Ex. 1202, ¶227.

In light of such teachings, a POSITA would have found it obvious to configure Thibeault's CMTS (as modified by Cooper840 or Azenkot) to further select a higher transmit power for a service group based on the composite SNR-related metric to support a higher modulation order and increase throughput, as taught by Currivan. Ex. 1228, [0018], [0020], [0065], [0151], [0157]-[0158], [0170], [0177], [0182], [0200]; Ex. 1202, ¶228; Sections VI.A.1.d-e, VI.B.1.b-c.

Such combinations also would have been obvious because they would have merely been a combination of prior art elements (Thibeault's CMTS—as modified by Cooper840 or Azenkot—and Currivan's method of increasing CM transmit power for a service group) according to known methods (programming a CMTS to instruct a CM service group to increase transmit power level) to yield predictable results (a system that supports a higher modulation order and increased throughput). Ex. 1202, ¶229. Applying Currivan's teachings to Thibeault's CMTS (as modified by Cooper840 or Azenkot) would have been well within the capabilities of a

POSITA because it would have involved straightforward modifications to the programming of the CMTS. *Id.*, ¶230; Ex. 1210, [0028].

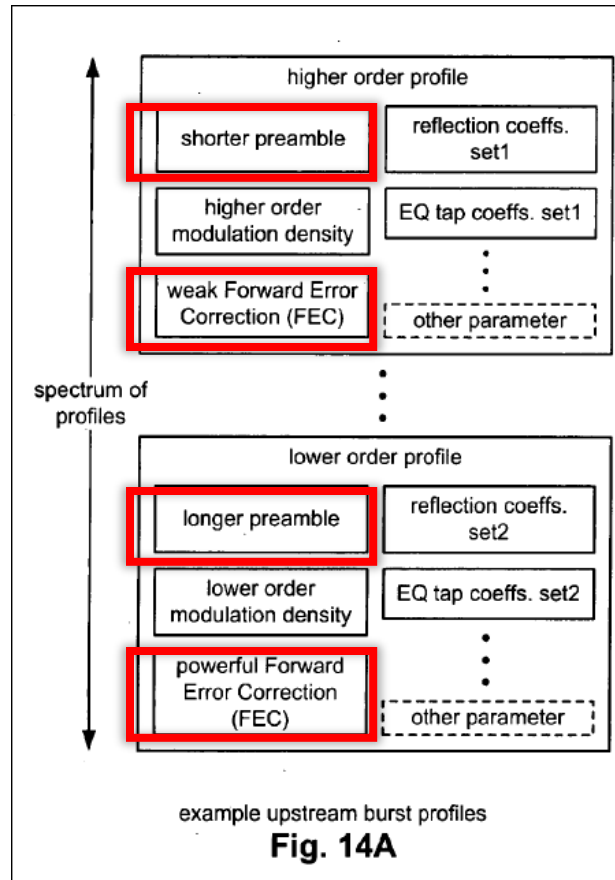
Currivan teaches another power modification procedure that includes increasing the transmit power per code word while reducing the number of codes transmitted to increase the SNR to support a higher modulation order. Ex. 1228, [0067]-[0069], [0142], [0151]-[0152], [0157], [0169], [0176]-[0177], [0182]; Ex. 1202, ¶231.

In light of such additional teachings in Currivan, a POSITA also would have found it obvious to configure Thibeault's CMTS (as modified by Cooper840 or Azenkot) to increase the transmit power per code word—while reducing the number of codes transmitted for a service group—in order to increase the SNR and allow one of the service groups to communicate at a higher modulation order. Ex. 1202, ¶231.

Such combinations also would have been obvious because they would have merely been a combination of prior art elements (Thibeault's CMTS—as modified by Cooper840 or Azenkot—and Currivan's method of increasing the transmit power per code word while reducing the number of codes transmitted) according to known methods (programming a CMTS to instruct a CM service group to increase transmit power per code word while reducing the number of codes transmitted for a service group) to yield predictable results (a system that includes a service group that

supports a higher modulation order to reduce the number of modulation orders that the CMTS is required to support). *Id.*, ¶232. Applying Currivan’s teachings to Thibeault’s CMTS (as modified by Cooper⁸⁴⁰ or Azenkot) would have been well within the capabilities of a POSITA because it would have involved straightforward modifications to the programming of the CMTS to select a modulation scheme and instruct a CM service group accordingly. *Id.*

Finally, Currivan also teaches selecting the additional physical layer communication parameters of forward error correction and preamble length. Ex. 1228, [0155]-[0156], [0161]-[0162], [0175], Fig. 14A. Figure 14A (reproduced below) shows a spectrum of burst profiles that include such physical layer communication parameters. *Id.*, [0161]-[0163]; Ex. 1202, ¶233.



Ex. 1228, Fig. 14A (annotated)

The burst profiles are selected by the CMTS and assigned to CMs based on the SNR of the communication channel from the CMs to the CMTS. Ex. 1228, [0034], [0079], [0176], [0182], [0192]. The lower order profile shown in Figure 14A is used when a channel may be corrupted to ensure that communication take place. *Id.*, [0163]. As further shown in Figure 14A, the higher order profile utilizes shorter preambles and weaker FEC. *Id.*, [0161]-[0162], Fig. 14A. A POSITA would have understood that there were trade-offs between the amount of processing required and robustness of the communications and preamble lengths and FEC

strengths that are selected to ensure communication in view of the SNR of the communication channel from the CMs to the CMTS. *Id.*, [0153]-[0157], [0162]-[0163], claim 9; Ex. 1202, ¶234.

In light of such further teachings in Currivan, a POSITA would have found it obvious to configure Thibeault's CMTS (as modified by Cooper840 or Azenkot) to further select the physical layer communication parameters of preamble length and FEC strength for a service group based on the composite SNR-related metric to optimize processing required and robustness of the communications. Ex. 1202, ¶235.

Such combinations also would have been obvious because they would have merely been a combination of prior art elements (Thibeault's CMTS—as modified by Cooper840 or Azenkot—and Currivan's method of selecting preamble length and FEC strength based on a channel's SNR) according to known methods (programming a CMTS to instruct a CM service group to use a preamble length and FEC strength based on a channel's SNR) to yield predictable results (a system that optimizes the processing required and robustness of the communications in view of various SNR levels). *Id.*, ¶236. Applying Currivan's teachings to Thibeault's CMTS (as modified by Cooper840 or Azenkot) would have been well within the capabilities of a POSITA because it would have involved straightforward

modifications to the programming of the CMTS to select preamble lengths and FEC strengths and instruct a CM service group accordingly. *Id.*, ¶237.

VII. GROUNDS FOR STANDING & FEE PAYMENT

Petitioner hereby certifies that the '438 patent is available for, and Petitioner is not barred or estopped from requesting, *inter partes* review challenging claims 1-18.

Pursuant to 37 C.F.R. § 42.103, the undersigned authorizes the charge of any required fees to Deposit Account No. 19-0733.

VIII. CONCLUSION

Inter partes review should be instituted and claims 1-18 should be canceled.

Dated: December 6, 2024

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CERTIFICATION UNDER 37 CFR § 42.24(d)

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for Inter Partes Review totals 13,958, which is less than the 14,000 allowed under 37 CFR § 42.24(a)(1)(i). This total includes 13,958 words as counted by the Word Count feature of Microsoft Word and 0 words used in annotations.

Pursuant to 37 C.F.R. § 42.24(a)(1), this count does not include the table of contents, the table of authorities, mandatory notices under § 42.8, the certificate of service, this certification of word count, the claims listing appendix, or appendix of exhibits.

BANNER & WITCOFF, LTD

Dated: December 6, 2024

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.105, I hereby certify that I caused a true and correct copy of this Petition for *Inter Partes* Review in connection with U.S. Patent No. 9,866,438 and supporting evidence to be served via FedEx Priority Overnight on December 6, 2024, on the following:

McAndrews, Held & Malloy, Ltd
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Dated: December 6, 2024

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CLAIM LISTING APPENDIX

U.S. Pat. No. 9,866,438

Designation	Claim Language
Claim 1	
[1A]	1. A method comprising:
[1B]	determining, by a cable modem termination system (CMTS), for a plurality of cable modems served by said CMTS, a corresponding plurality of signal-to-noise ratio (SNR) related metrics;
[1C]	assigning, by said CMTS, said plurality of cable modems among a plurality of service groups based on said plurality of SNR-related metrics;
[1D]	generating, by said CMTS for each one of said plurality of service groups, a composite SNR-related metric based at least in part on a worst-case SNR profile of said plurality of SNR-related metrics corresponding to said one of said plurality of service groups;
[1E]	selecting, by said CMTS, physical layer communication parameters to be used for communicating with said one of said plurality of service groups based on said composite SNR-related metric; and
[1F]	communicating, by said CMTS, with a portion of said plurality of cable modems corresponding to said one of said plurality of service groups using said selected physical layer communication parameters.
Claim 2	
2	2. The method of claim 1, wherein said physical layer communication parameters include one or more of: transmit power, receive sensitivity, timeslot duration, modulation type, modulation order, forward error correction (FEC) type, and FEC code rate.
Claim 3	

Designation	Claim Language
3	3. The method of claim 1, wherein said CMTS uses orthogonal frequency division multiplexing (OFDM) over a plurality of subcarriers for said communicating.
Claim 4	
4	4. The method of claim 3, comprising selecting, by said CMTS, said physical layer communication parameters on a per-OFDM-subcarrier basis.
Claim 5	
5	5. The method of claim 4, wherein said physical layer communication parameters include one or both of: which of said OFDM subcarriers to use for transmission to said CMTS, and which of said OFDM subcarriers to use for reception of information from said CMTS.
Claim 6	
[6A]	6. The method of claim 1, wherein: said plurality of service groups comprises a first service group and a second service group; said first service group has a first composite SNR versus frequency profile, said second service group has a second composite SNR versus frequency profile, and a third cable modem has a particular SNR versus frequency profile; and
[6B]	said assigning said plurality of cable modems among said plurality of service groups comprises: assigning said third cable modem to said first service group if said particular SNR versus frequency profile is more similar to said first composite SNR versus frequency profile than to said second composite SNR versus frequency profile; and assigning said third cable modem to said second service group if said particular SNR versus frequency profile is more similar to said second composite SNR versus frequency profile than to said first composite SNR versus frequency profile.
Claim 7	
7	7. The method of claim 1, comprising assigning said plurality of cable modems among said plurality of service groups based

Designation	Claim Language
	on distances between said CMTS and said plurality of cable modems.
Claim 8	
8	8. The method of claim 1, comprising assigning any particular one of said plurality of cable modems to one of said plurality of service groups based on which one or more of a plurality of branch amplifiers are upstream of said one of said plurality of cable modems.
Claim 9	
[9A]	9. The method of claim 1, wherein said determining said plurality of SNR-related metrics comprises:
[9B]	transmitting a probe message to each said plurality of cable modems, said probe message comprising instructions for measuring a metric and reporting said measured metric back to said CMTS; and
[9C]	receiving a metric reporting message from each of said plurality of cable modems.
Claim 10	
[10A]	10. A system comprising: circuitry for use in a cable modem termination system (CMTS), said circuitry comprising a network interface and a processor wherein:
[10B]	said processor is configured to determine, for a plurality of cable modems served by said CMTS, a corresponding plurality of signal-to-noise ratio (SNR) related metrics;
[10C]	said processor is configured to assign said plurality of cable modems among a plurality of service groups based on said plurality of SNR-related metrics;
[10D]	said processor is configured to generate, for each one of said plurality of service groups, a composite SNR-related metric based at least in part on a worst-case SNR profile of said plurality of SNR-related metrics corresponding to said one of said plurality of service groups;

Designation	Claim Language
[10E]	said processor is configured to select physical layer communication parameters to be used for communicating with said one of said plurality of service groups based on said composite SNR-related metric; and
[10F]	said network interface is configured to communicate with a portion of said plurality of cable modems corresponding to said one of said plurality of service groups using the selected physical layer communication parameters.
Claim 11	
11	11. The system of claim 10, wherein said physical layer communication parameters include one or more of: transmit power, receive sensitivity, timeslot duration, modulation type, modulation order, forward error correction (FEC) type, and FEC code rate.
Claim 12	
12	12. The system of claim 10, wherein said network interface and said plurality of cable modems are configured to communicate using orthogonal frequency division multiplexing (OFDM) over a plurality of subcarriers.
Claim 13	
13	13. The system of claim 12, wherein said network interface is configured such that said physical layer communication parameters are configurable on a per-OFDM-subcarrier basis.
Claim 14	
14	14. The system of claim 12, wherein said physical layer communication parameters include one or both of: which of said OFDM subcarriers to use for transmission to said CMTS, and which of said OFDM subcarriers to use for reception of information from said CMTS.
Claim 15	
[15A]	15. The system of claim 10, wherein: said plurality of service groups comprises a first service group and a second service group; said first service group has a first composite SNR versus frequency profile, said second service group has a second

Designation	Claim Language
	composite SNR versus frequency profile, and a third cable modem has a particular SNR versus frequency profile;
[15B]	said assignment of said plurality of cable modems among said plurality of service groups comprises: assignment of said third cable modem to said first service group if said particular SNR versus frequency profile is more similar to said first composite SNR versus frequency profile than to said second composite SNR versus frequency profile; and assignment of said third cable modem to said second service group if said particular SNR versus frequency profile is more similar to said second composite SNR versus frequency profile than to said first composite SNR versus frequency profile.
Claim 16	
16	16. The system of claim 10, wherein said processor is configured to assign said plurality of cable modems among said plurality of service groups based on distances between said CMTS and said plurality of cable modems.
Claim 17	
17	17. The system of claim 10, wherein said processor is configured to assign said plurality of cable modems among said plurality of service groups based on a branch further branch amplifier that serves each of said plurality of cable modems.
Claim 18	
[18A]	18. The system of claim 10, wherein said determination of said plurality of SNR-related metrics comprises:
[18B]	transmission, via said network interface, of a probe message to each said plurality of cable modems, said probe message comprising instructions for measuring a metric and reporting said measured metric back to said CMTS; and
[18C]	reception, via said network interface of said CMTS, of a metric reporting message from each of said plurality of cable modems.

