

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. 10,135,682
Filing Date: January 9, 2018
Issue Date: November 20, 2018

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

Inter Partes Review No.: IPR2024-00445

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

Petition 2 of 2

TABLE OF CONTENTS

MANDATORY NOTICES.....	1
I. INTRODUCTION	4
II. SUMMARY OF ARGUMENT	4
III. OVERVIEW OF THE '682 PATENT.....	5
A. Brief Description	5
B. Prosecution History	6
C. Earliest Priority Date for the Claims	7
IV. OVERVIEW OF PRIOR ART	7
A. Thibeault.....	7
B. Cooper	8
C. Saey	10
D. Gross.....	11
E. Cioffi.....	12
F. Cooper437	12
G. Monk.....	13
H. Monk802.....	14
V. IDENTIFICATION OF CHALLENGE PURSUANT TO 37 C.F.R.	
§ 42.104(B)	14
A. Claims for Which Review is Requested and Grounds on Which Challenge is Based	14
B. 314(a) Discretion Does Not Apply.....	15
C. 325(d) Discretion Does Not Apply	16
D. Level of Ordinary Skill.....	17
E. Claim Construction.....	17
VI. SPECIFIC GROUNDS FOR UNPATENTABILITY	18
A. Ground A: Claims 1-2 and 10-11 are Rendered Obvious by Thibeault in View of Saey	18
1. Independent Claim 1 and Independent Claim 10	18
2. Dependent Claim 2 and Dependent Claim 11	31
B. Ground B: Claims 1-2 and 10-11 are Rendered Obvious by Thibeault- Gross.....	32
1. Independent Claim 1 and Independent Claim 10	32
2. Dependent Claim 2 and Dependent Claim 11	37
C. Ground C: Claims 1-2 and 10-11 are Rendered Obvious by Thibeault- Cioffi.....	38
1. Independent Claim 1 and Independent Claim 10	38
2. Dependent Claim 2 and Dependent Claim 11	43

D. Grounds D-F: Claims 7-8 and 16-17 are Rendered Obvious by Thibeault-Saey, Thibeault-Gross, and Thibeault-Cioffi, each in view of Cooper....	43
1. Dependent Claim 7 and Dependent Claim 8	43
2. Dependent Claim 16 and Dependent Claim 17	48
E. Grounds G-I: Claims 3-6 and 12-15 are Rendered Obvious by Thibeault-Saey or Thibeault-Gross or Thibeault-Cioffi, each in view of Monk80249	
1. Dependent Claim 3 and Dependent Claim 12	49
2. Dependent Claim 4 and Dependent Claim 13	52
3. Dependent Claim 5 and Dependent Claim 14	53
4. Dependent Claim 6 and Dependent Claim 15	56
F. Grounds J-L: Claims 9 and 18 are Rendered Obvious by Thibeault-Saey, Thibeault-Gross, and Thibeault-Cioffi, each in view of Monk and Cooper437	62
1. Dependent Claim 9.....	62
2. Dependent Claim 18.....	67
VII. GROUNDS FOR STANDING & FEE PAYMENT	67
VIII. CONCLUSION.....	68
CERTIFICATION UNDER 37 CFR § 42.24(D)	69
CERTIFICATE OF SERVICE	70
CLAIM LISTING APPENDIX	71

EXHIBITS

Ex. 1101:	U.S. Patent No. 10,135,682 (“the ’682 patent”)
Ex. 1102:	Expert Declaration of Sayfe Kiaei
Ex. 1103:	Curriculum Vitae of Sayfe Kiaei
Ex. 1104:	Certified Prosecution History of the ’682 patent
Ex. 1105:	U.S. Pub. No. 2007/0223512 (“Cooper”)
Ex. 1106:	Reserved
Ex. 1107:	U.S. Pub. No. 2005/0111535 (“Saey”)
Ex. 1108:	U.S. Pub. No. 2004/0085987 (“Gross”)
Ex. 1109:	U.S. Pub. No. 2006/0274825 (“Cioffi”)
Ex. 1110:	U.S. Pub. No. 2013/0041990 (“Thibeault”)
Ex. 1111:	Reserved
Ex. 1112:	U.S. Patent No. 10,084,538 (“Nielsen-538”)
Ex. 1113:	Reserved
Ex. 1114:	U.S. Patent No. 8,085,802 (“Monk802”)
Ex. 1115:	U.S. Patent No. 7,573,822 (“Monk”)
Ex. 1116:	U.S. Patent No. 6,772,437 (“Cooper437”)
Ex. 1117:	Claim Construction Memorandum Opinion and Order, <i>Entropic Comms., LLC v. Charter Comms., Inc.</i> , Case No. 2:22-CV-00125-JRG (E.D. Tex.)
Ex. 1118:	Rebuttal Expert Report of John Holobinko Regarding Validity of U.S. Patent Nos. 8,284,690 and 10,135,682, <i>Entropic Comms., LLC v. Charter Comms., Inc.</i> , Case No. 2:22-CV-00125-JRG (E.D. Tex.)

- Ex. 1119: 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. 1120: Reserved
- Ex. 1121: Data-Over-Cable Interface Specifications, Radio Frequency Interface Specification, SP-RFII01-970326
- Ex. 1122: Data-Over-Cable Service Interface Specifications, DOCSIS 1.1, Radio Frequency Interface Specification, CM-SP-RFIV1.1-C01-050907
- Ex. 1123: Data-Over-Cable Service Interface Specifications, DOCSIS 2.0, Radio Frequency Interface Specification, CM-SP-RFIV2.0-C02-090422
- Ex. 1124: U.S. Pub. No. 2007/0171994 (“Parker”)
- Ex. 1125: U.S. Patent No. 8,503,546 (“Ashrafi”)
- Ex. 1126: Tanenbaum, “Computer Networks,” 4th ed. (2003)
- Ex. 1127: Driscoll, “Next Generation IPTV Services and Technologies” (2008)

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. These entities are referenced below as “Comcast entity _” or as “Comcast entities __,” where “__” is one of or more of (i)-(iii).

No unnamed entity is funding, controlling, or directing this Petition for *inter partes* review (IPR) of U.S. Patent No. 10,135,682 (“the ’682 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))

The ’682 patent is asserted against Comcast Corp., Comcast Cable Communications, LLC, and Comcast Cable Communications Management, LLC in the Central District of California in *Entropic Communications, LLC v. Comcast Corp. et al.*, 2:23-cv-01050-JWH-KES (C.D. Cal.) (“CDCA Litigation”). The earliest date of service on any Comcast entity named in the CDCA Litigation was February 16, 2023.

The ’682 patent is also being asserted against Cox Communications, Inc., CoxCom LLC, and Cox Communications California, LLC in the Central District of

California in *Entropic Communications, LLC v. Cox Communications, Inc. et al.*, 2:23-cv-01049-JWH-KES (C.D. Cal.).

The '682 patent was previously asserted against Charter Communications, Inc., Spectrum Advanced Services, LLC, and Spectrum Management Holding Company, LLC in *Entropic Communications, LLC v. Charter Communications, Inc.*, No. 2:22-cv-00125 (E.D. Tex.) which was terminated on December 10, 2023 pursuant to a settlement.

According to the Office's records, the '682 patent is a continuation of U.S. patent application Ser. No. 15/434,673 filed on Feb. 16, 2017 (issued as U.S. Pat. No. 9,866,438), which is a continuation of U.S. patent application Ser. No. 15/228,703 filed on Aug. 4, 2016 (issued as U.S. Pat. No. 9,577,886), which is a continuation of U.S. patent application Ser. No. 13/948,444 filed on Jul. 23, 2013 (issued as U.S. Pat. No. 9,419,858), which claims priority to U.S. Provisional Patent Application Ser. No. 61/674,742, filed on Jul. 23, 2012.

No prior petitions for *inter partes* review, post-grant review, or covered business method review have been filed against the '682 patent.

This is the second of two petitions for *inter partes* review filed by Petitioner against the '682 patent.

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. 10,135,682 (“the ’682 patent”) (Ex. 1101).

II. SUMMARY OF ARGUMENT

The ’682 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 then 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. The Examiner believed this feature (and only this feature) to be missing from the prior art.

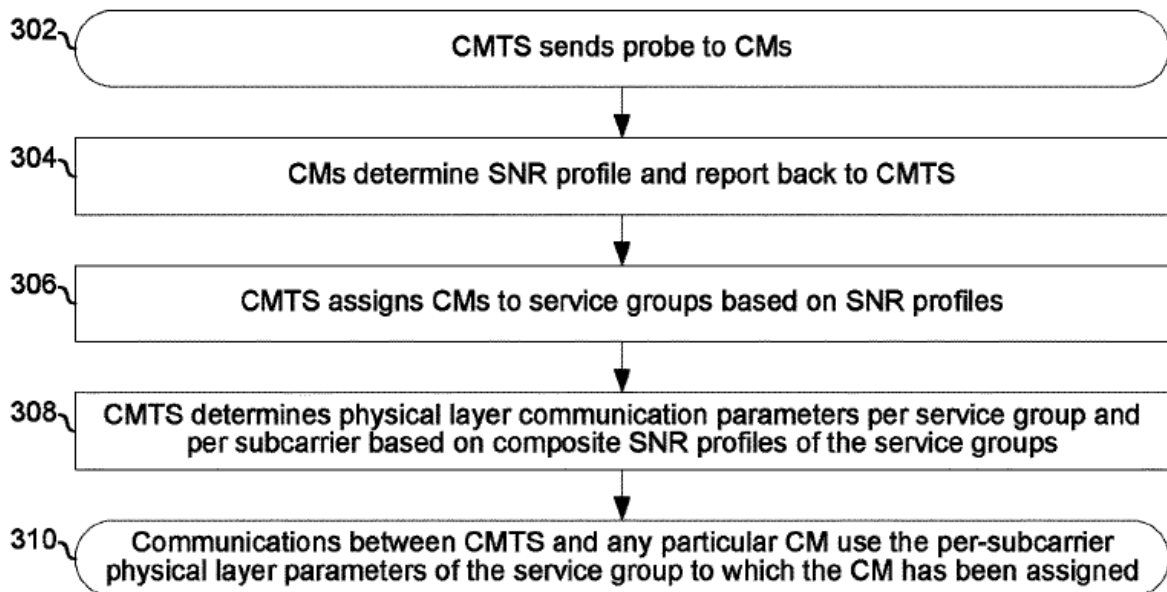
However, the Examiner was mistaken, and all of the ’682 patent claims are rendered obvious by prior art that was not considered by the Examiner, including references disclosing determining a worst-case SNR for a group of modems and using the worst-case SNR to determine a communication parameter (*e.g.*, Exs. 1107-1108).

Accordingly, claims 1-18 of the ’682 patent should be cancelled.

III. OVERVIEW OF THE '682 PATENT

A. Brief Description

The '682 patent relates to service group management in a cable television network. Ex. 1101, 1:50-52. A process for grouping modems and determining communication parameters is shown in Figure 3A below.



Ex. 1101, FIG. 3A

A plurality of cable modems each determine a signal-to-noise ratio (SNR) and report to a cable modem termination system (CMTS). Ex. 1101, 4:25-30, 5:34-37. The CMTS then assigns the cable modems to groups based on the SNR profiles. Ex. 1101, 4:52-56, 5:37-39, 6:46-7:6, Abstract. A composite SNR profile for each service group is used to determine a physical layer communication parameter used for communications. Ex. 1101, 4:40-56, 5:40-50, Abstract. Physical layer communication parameters include encoding and modulation parameters, such as

modulation type and modulation order. Ex. 1101, 4:56-67; *see also* Ex. 1102, ¶¶45-47.

B. Prosecution History

The application that led to the '682 patent, U.S. Application No. 15/866,106, was filed on January 9, 2018. Ex. 1104, 8-37, 52-54.

All claims were rejected in an Office Action dated April 3, 2018 on the ground of nonstatutory double patenting as being unpatentable over claims 1-18 of U.S. Patent No. 9,577,886 to Ling *et al.*, claims 1-18 of U.S. Patent No. 9,419,858 to Ling *et al.* and claims 1-18 of U.S. Patent No. 9,866,438 to Ling *et al.* The Examiner also indicated claims 1 and 10 were allowable, allegedly because the prior art “does not teach 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**’.” *Id.*, 87 (emphasis original). As set forth herein, the Examiner was mistaken.

The Applicant filed Terminal Disclaimer on June 21, 2018 and the Examiner issued a Notice of Allowance on August 1, 2018. *Id.*, 104, 122-123, 130-136.

The '682 patent issued on November 20, 2018. Ex. 1101, cover; *see also* Ex. 1102, ¶¶48-52.

C. Earliest Priority Date for the Claims

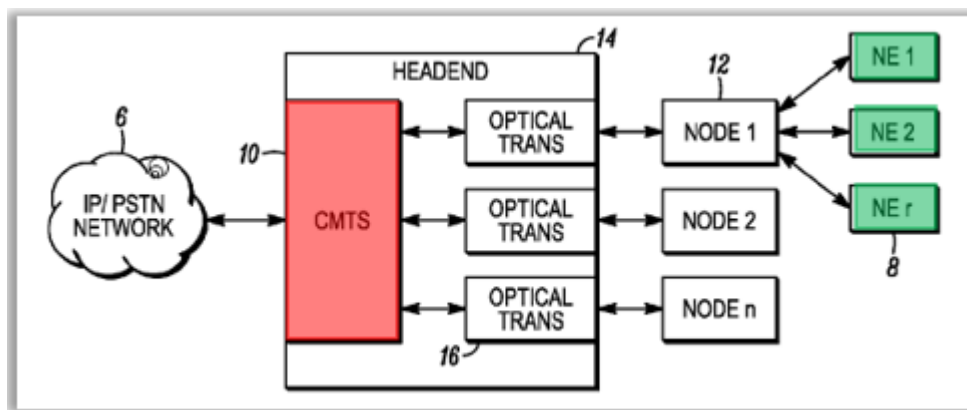
The earliest possible priority date for the claims of the '682 patent is July 23, 2012, the filing date of U.S. Provisional Application No. 61/674,742 to which the '682 patent claims priority. Each of the references relied on herein is prior art to that date as explained below. Ex. 1102, ¶52.

IV. OVERVIEW OF PRIOR ART

A. Thibeault

Thibeault (Ex. 1110) 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. 1101, cover.

Thibeault discloses a network having multiple network elements 8 (green) that connect to a CMTS 10 (red) via nodes 12. Ex. 1110, [0025], FIG. 1. Thibeault's network elements 8 include cable modems. Ex. 1110, [0025], [0037].



Ex. 1110, FIG. 1 (annotated)

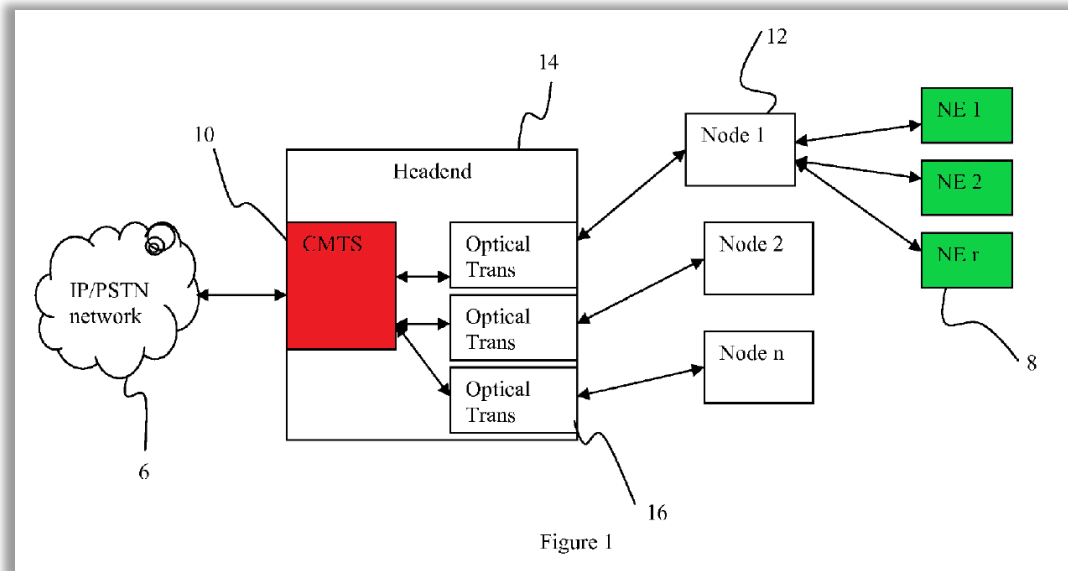
Thibeault explains that CMTS 10 resides at a headend 14, which includes transceivers 16 that communicate with the network elements by receiving upstream

communications from the network elements and sending (i.e., serving) downstream communications to network elements. Ex. 1110, [0025], [0027]. Thibeault discloses a system and process whereby its CMTS measures network parameters for the cable modems connected to the CMTS. Ex. 1110, [0024], [0032], [0037]. The network element parameters may include respective signal to noise ratios (SNRs) of each cable modem. Ex. 1110, [0009], [0011], [0015], [0023], [0032], [0037]; *see also* Ex. 1102, ¶¶60-64.

B. Cooper

Cooper (Ex. 1105) 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. 1101, cover.

Cooper describes a “process for reconfiguring logical channels” in a network. Ex. 1105, [0002], [0017], [0030]-[0031]. As illustrated below in Figure 1, Cooper discloses a network in which multiple network elements 8 such as cable modems (**green**) connect to a CMTS 10 (**red**) via nodes 12. Ex. 1105, [0022], FIG. 1.



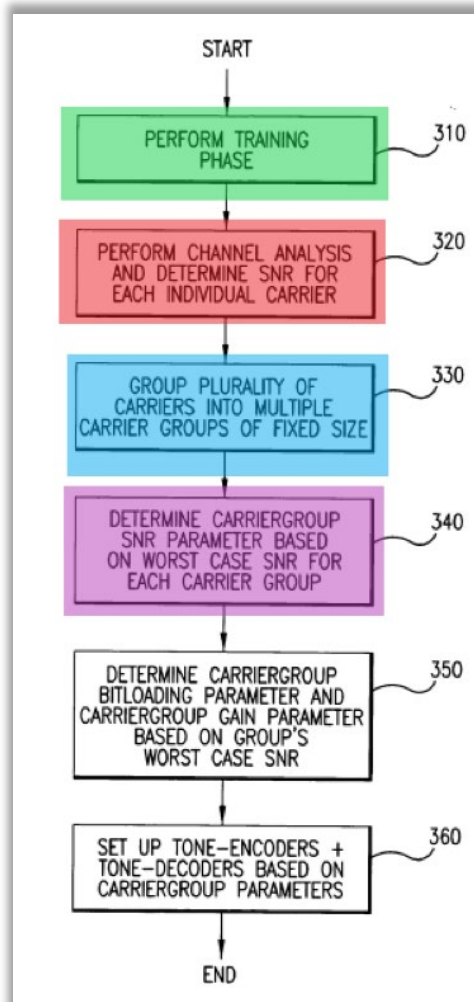
Ex. 1105, FIG. 1 (annotated)

Cooper explains that CMTS 10 resides at a headend 14, which includes transceivers that communicate with the network elements by receiving upstream communications from the network elements and sending downstream communications to the network elements. Ex. 1105, [0022]; *see id.*, [0003]. According to Cooper, its process allows a network operator to easily group cable modems based on common parametrics and performance similarities. Ex. 1105, [0019]. Cooper's groupings of cable modems may then be used to configure logical channels and subsequently the assignment of cable modems to logical channels. Ex. 1105, [0019]; *see also* Ex. 1102, ¶¶65-67.

C. Saey

Saey (Ex. 1107) is a U.S. Published Application published May 26, 2005. Saey is prior art under pre-AIA 35 U.S.C. § 102(b) and was not considered during prosecution. Ex. 1101, cover.

Saey describes a method and system of grouping one or multiple carrier groups based at least in part on a worst-case SNR. Ex. 1107, Abstract, [0010]. In one embodiment (see Figure 3 below), a training phase 310 (**green**) is performed. Modems negotiate about parameters to be used. Ex. 1107, [0029]. A channel analysis step 320 (**red**) determines an SNR for each individual carrier. Ex. 1107, [0030]. At step 330, the plurality of carriers is grouped into multiple carrier groups of fixed size (**blue**). Ex. 1107, [0031]. At step 340 (**purple**), the worst-case SNR for each fixed size carrier group is determined and used to define a “carriergroup SNR parameter” for that specific carrier group. Ex. 1107, [0032].



Ex. 1107, FIG. 3 (annotated)

See also Ex. 1102, ¶¶68-70.

D. Gross

Gross (Ex. 1108) is a U.S. Published Application published May 6, 2004. Gross is prior art under pre-AIA 35 U.S.C. § 102(b) and was not considered during prosecution. Ex. 1101, cover.

Gross describes enhancing the accuracy and reliability of communications in systems using discrete multitone technology to communicate data over digital

subscriber lines. Ex. 1108, [0024]. In the event there is a disturbance on the communication channel, the modem changes the bit allocation and the subchannel gains among the subchannels. Ex. 1108, [0025]. Channel control parameter sets are used to achieve this goal. Ex. 1108, [0030]. A key parameter used is known as the “bit allocation” for respective subchannels and is calculated based on the channel SNR. Ex. 1108, [0032]. Gross describes parameter sets representing a “worst case” condition which would be based at least in part on a worst-case SNR. Ex. 1108, [0100]; *see also* Ex. 1102, ¶¶71-72.

E. Cioffi

Cioffi (Ex. 1109) is a U.S. Published Application published December 7, 2006. Cioffi is prior art under pre-AIA 35 U.S.C. § 102(b) and was not considered during prosecution. Ex. 1101, cover.

Cioffi describes communications systems that utilize methods and systems that mitigate or remove interference signals among users with interconnected transmitters. Ex. 1109, [0012]. Cioffi uses precoding to mitigate or remove interference signals. Ex. 1109, Abstract; *see also* Ex. 1102, ¶¶73-74.

F. Cooper437

Cooper437 (Ex. 1116) 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. 1101, cover.

Cooper437 describes a CMTS initiating noise signal power measurements by transmitting to cable modems in the network a message that defines the measurement techniques to be used and how to report the measurements. Ex. 1116, 8:11-29, 8:60-9:5, 10:56-11:28, Table 1. Cooper further discloses that, after a cable modem receives the message, the cable modem 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. Ex. 1116, 10:56-11:28, Table 1; *see also* Ex. 1102, ¶¶75-77.

G. Monk

Monk (Ex. 1115) is a U.S. Patent filed November 12, 2007 and 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. 1101, cover.

Monk discloses a method of communication that relies on different modulation schemes based on a communication channel's SNR. Ex. 1115, Abstract, 4:25-38, 6:6-19, 7:14-31, 8:1-11. For example, Monk teaches that 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. Ex. 1115, 4:55-59, 8:1-11, 9:9-11, 10:58-62. To determine the SNR of a channel, Monk discloses a sending node transmitting a probe message having a predetermined data sequence to a receiving device, which then analyzes the

probe message for impairment at each frequency. Ex. 1115, 4:44-59, 9:28-41, Abstract; *see also* Ex. 1102, ¶¶78-79.

H. Monk802

Monk802 (Ex. 1114) 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. 1101, cover.

Monk802 discloses a method of communication using OFDM. Ex. 1114, 8:1-39, 17:61-67, 19:27-41, 21:19-22:34, FIGS. 12, 13A-C. 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. 1114, 8:19-39, 21:19-22:34; *see also* Ex. 1102, ¶¶80-82.

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 Saey	§103	1-2, 10-11
B	Thibeault in view of Gross	§103	1-2, 10-11
C	Thibeault in view of Cioffi	§103	1-2, 10-11

D-F	Thibeault-Saey, Thibeault-Gross, and Thibeault-Cioffi, each in view of Cooper	§103	7-8 and 16-17
G-I	Thibeault-Saey or Thibeault-Gross or Thibeault-Cioffi, each in view of Monk802	§103	3-6 and 12-15
J-L	Thibeault-Saey, Thibeault-Gross, and Thibeault-Cioffi, each in view of Monk and Cooper437	§103	9 and 18

None of the prior art listed in the table above was before the examiner during prosecution of the '682 patent.

B. 314(a) Discretion Does Not Apply

The *Fintiv* factors do not warrant discretionary denial.

Factor one appears neutral. Petitioner has filed IPR petitions challenging all eight patents asserted in the District Court in case no. 2:23-cv-01050. If trial is instituted, and the case is not dismissed based on Petitioner's motion to dismiss the Second Amended Complaint, then Petitioner expects to request a stay, as decisions in Petitioner's favor would resolve the dispute in its entirety.

Factor two favors institution. Petitioner has filed a motion to dismiss, Patent Owner has filed an Amended Complaint, and Petitioner will renew its Motion to Dismiss in order to seek dismissal of the operative complaint. In addition, no schedule has been entered beyond claim construction, 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.

Factor four strongly favors institution. The petition challenges all claims in the '682 patent while only claims 1-5 and 9 are asserted 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.

C. 325(d) Discretion Does Not Apply

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 Thibeault, Saey, Gross, Cioffi, Cooper, Cooper437, Monk or Monk802. Saey, Gross, and Cioffi each includes the worst-case SNR profile limitation the Examiner found missing from the prior art. Ex. 1104, 85-88. Thibeault, Saey, Gross, Cioffi, Cooper, Cooper437, Monk, and Monk802 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 by not applying the prior art.

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 video-on-demand cable systems and Internet video streaming. Ex. 1102, ¶¶38-43. 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; *see also id.*, ¶¶1-37, 53-59.

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 Petitioner does not contend that the claims include means-plus-function limitations. Ex. 1102, ¶44.

¹ With regard to the term “signal-to-noise (SNR) related metric,” the ’682 patent defines this limitation as at least including SNR (*see* Ex. 1101, 3:54-63), but Petitioner reserves the right to argue in other proceedings that the outer bounds of this term are unclear.

VI. SPECIFIC GROUNDS FOR UNPATENTABILITY

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

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. 1102, ¶¶83-116.

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

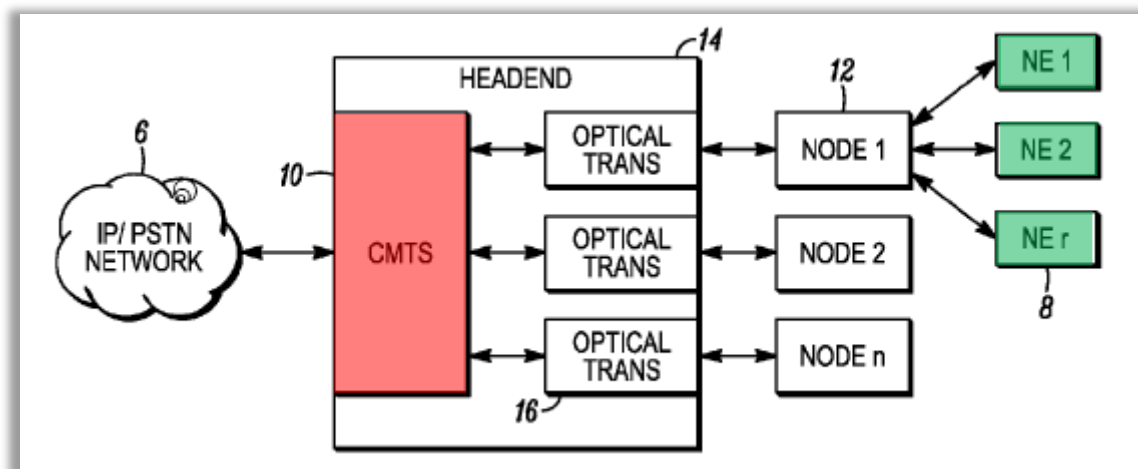
To the extent the preamble [1A]² is limiting, Thibeault discloses it. Specifically, Thibeault discloses a method performed by a CMTS for automatically configuring logical channels to communicate with cable modems (hereinafter “CMs”) in a network. Ex. 1110, Abstract, [0004], [0009]-[0015], [0021], [0032]-[0033]; Ex. 1102, ¶83.

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

Thibeault discloses Element [1B]. Ex. 1102, ¶¶85-88. 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. 1110,

² Claim limitations are labelled in the Claims Listing Appendix.

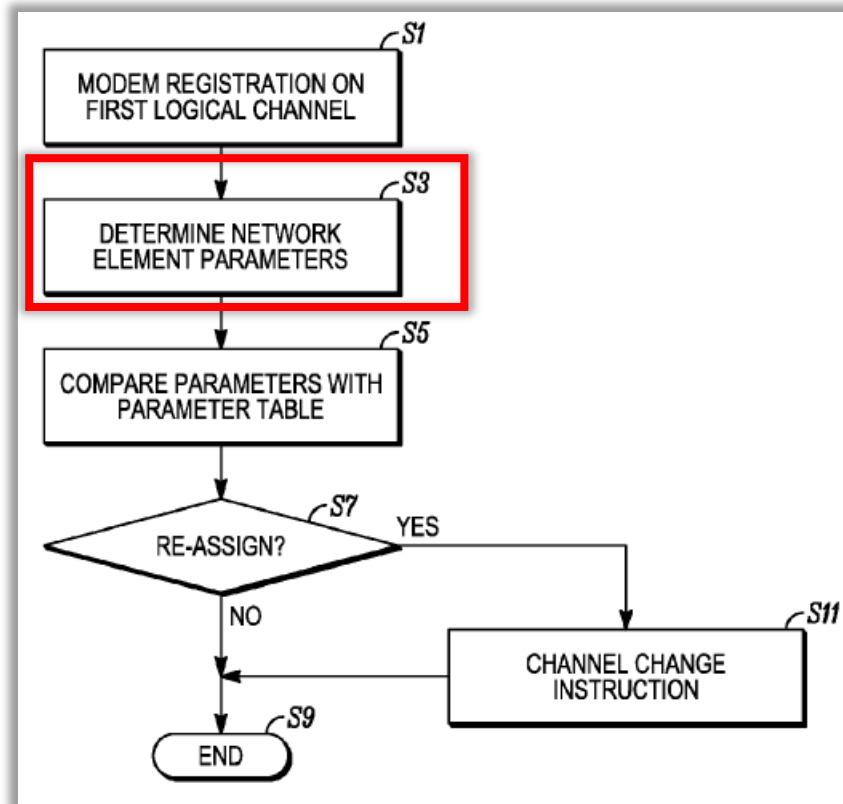
[0025], FIG. 1. Thibeault's network elements 8 include CMs. Ex. 1110, [0025], [0037]; Ex. 1102, ¶85.



Ex. 1110, FIG. 1 (annotated)

Thibeault explains that CMTS 10 resides at a headend 14, which includes transceivers 16 that communicate with the network elements by receiving upstream communications from the network elements and sending (i.e., serving) downstream communications to network elements (the claimed “each cable modem served by said CMTS”). Ex. 1110, [0025]. Thibeault discloses the optimization of network communications based on certain network parameter measurements—measurements that can be performed at the CMTS or each CM. Ex. 1110, [0013], [0031], [0039]; Ex. 1102, ¶86. For example, referring to Figure 4 below, Thibeault discloses a process whereby its CMTS determines network parameters for the CMs connected to the CMTS. Ex. 1110, [0024], [0032], [0037]. The network element parameters determined by Thibeault's CMTS may include respective signal to noise

ratios (SNRs) of each CM (the claimed “determining, by a ... CMTS ... a corresponding [SNR] related metric.”). Ex. 1110, [0009], [0011], [0015], [0023], [0032], [0037]; Ex. 1102, ¶¶86-87.



Ex. 1110, FIG. 4 (annotated)

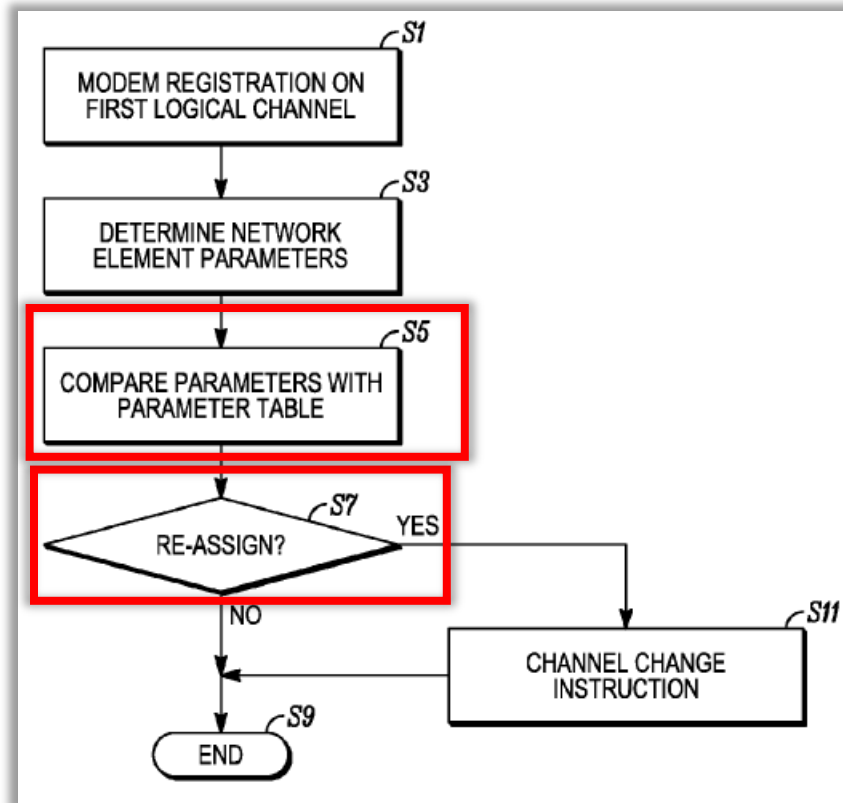
Thibeault thus discloses Element [1B]. Ex. 1102, ¶88.

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

Thibeault discloses Element [1C]. Ex. 1102, ¶¶89-94. Thibeault describes that its method is directed toward “assign[ing] [a] network element to a logical channel based on the network element parameters.” Ex. 1110, [0008]; Ex. 1102,

¶89. Specifically, Thibeault teaches that its method includes “differentiat[ing] cable modems by [SNR], ... set[ting] up multiple logical channels, each one with a different modulation rate, and then assign[ing] the appropriate network elements to each logical channel based upon which modulation could be supported” based on the respective SNR of each CM. Ex. 1110, [0024]; *see also id.*, [0008], [0011], [0023]; Ex. 1102, ¶89.

For example, Figure 4 in Thibeault illustrates this process of grouping its CMs by assigning them to respective logical channels. Ex. 1110, [0032]-[0033], FIG. 4. As shown below, after determining the network parameters (*e.g.*, SNR), 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. 1110, [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. 1102, ¶90; *see* §VI.A.1.b.

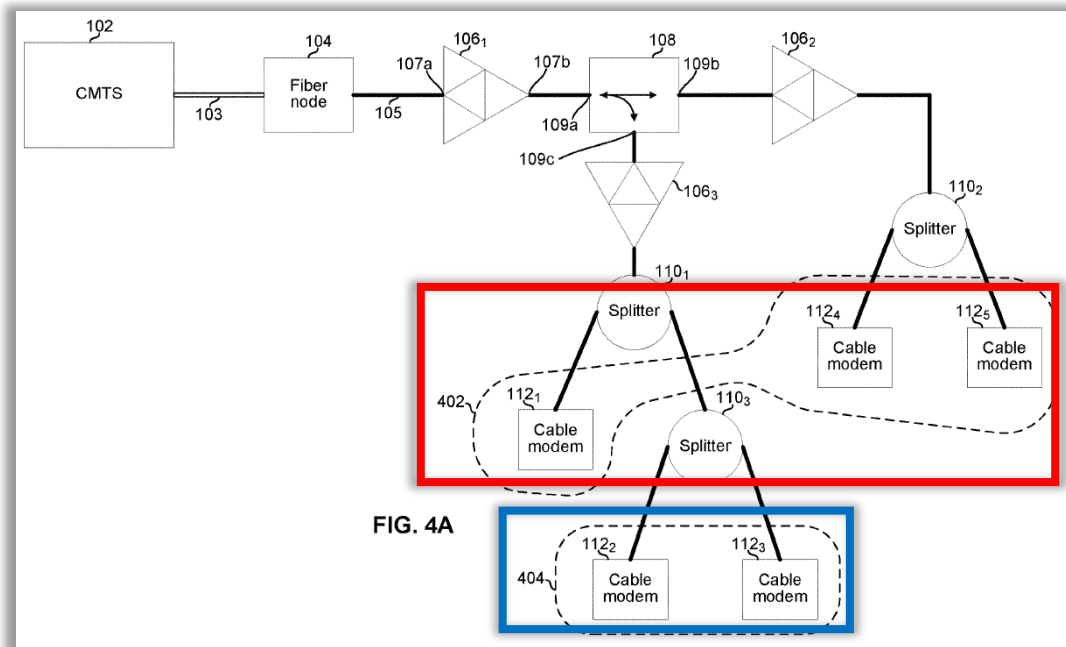


Ex. 1110, FIG. 4 (annotated)

In a specific example, Thibeault's CMTS assigns the connected CMs to one of four logical channels based on comparing the respective SNR measurements of each CM to SNR thresholds, *i.e.*, (1) a group with measured SNRs between 16 and 22 is assigned to logical channel "0"; (2) a group with measured SNRs between 22 and 25 is assigned to logical channel "1"; (3) a group with measured SNRs between 25 and 28 is assigned to logical channel "2"; and (4) a group with measured SNRs above 28 is assigned to logical channel "3." Ex. 1110, [0033]; Ex. 1102, ¶91.

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. 1102, ¶92. This is

consistent with term's plain meaning and the '682 patent's disclosure. Ex. 1102, ¶92. For example, the '682 patent illustrates service groups in Figure 4A (below) in which the groupings are based on performance characteristics measured for the CMs. Ex. 1101, 2:24-27, 5:37-39, 6:42-61, FIGS. 3A, 4A; Ex. 1102, ¶92.



Ex. 1101, 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 CM (the claimed "each cable modem") to a particular logical channel based on its SNR measurement (the claimed "based on a respective corresponding SNR-related metric") 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 '682 patent's disclosure regarding service groups. Ex. 1102, ¶93.

Therefore, Thibeault discloses Element [1C]. Ex. 1102, ¶94.

- 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 SNR-related metrics corresponding to said one of said plurality of service groups;”**

Thibeault-Saey discloses [1D]. Ex. 1102, ¶¶95-102. As shown for [1C], Thibeault discloses assigning CMs to logical channels based on a comparison between the determined SNR for each CM and SNR thresholds. §§VI.A.1.b-c; Ex. 1110, [0009], [0011], [0015], [0023], [0032], [0037], FIG. 4; Ex. 1102, ¶95. Although Thibeault does not disclose 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 Saey’s teachings. Ex. 1102, ¶95.

Saey teaches a method of grouping the various carriers that communicate with various CMs based on a network parameter (*e.g.*, SNR) in a communication system between CMs. Ex. 1107, Abstract, [0009]-[0014]. For example, Saey discloses analyzing the SNR for individual carriers and determining a carrier group based on this analysis. Ex. 1107, [0025]-[0026], [0029]-[0031], [0042]-[0043], FIGS. 3, 5-6. Once the carriers have been sorted into groups, the worst-case SNR (*e.g.*, the lowest SNR) in the group is used as the carrier group SNR parameter. Ex. 1107, [0010], [0013]-[0014], [0025]-[0027], [0032], [0042]-[0043], FIGS. 3, 5-6. Saey’s teaching of selecting the worst-case or lowest SNR of the CMs in a group to generate the

claimed “composite SNR-related metric based at least in part on a worst-case SNR profile of said SNR-related metrics” is consistent with the term’s plain meaning, a construction from a District Court litigation, and the ’682 patent’s disclosure. Ex. 1101, 4:3-67, 5:7-20; Ex. 1117, 53-55; Ex. 1118, 187; Ex. 1119, 8-10; Ex. 1102, ¶101.

This worst-case SNR is then used to determine the gain and bit loading (the quantity of bits that can be loaded onto each carrier) for communicating with the CMs associated with the carrier group. Ex. 1107, [0004], [0027], [0033], [0043], FIGS. 3, 5-6; Ex. 1102, ¶96. A POSITA would have recognized that bit loading “is applied to increase the modulation order at carriers with high signal to noise ratio and lower the modulation order at carriers with low [SNR].” Ex. 1115, 4:55-59, 8:1-19; Ex. 1102, ¶97. For example, a carrier’s SNR impacts the bit loading of the carrier, and thus the carrier’s modulation (*e.g.*, 2 bits per symbol (bps) for QPSK, 4 bps for 16QAM, 5 bps for 32QAM). Ex. 1115, 4:55-59, 8:1-19, 9:9-11, 10:55-67, FIG. 10; Ex. 1112, 14:54-16:34; Ex. 1102, ¶97. Saey’s method of grouping carriers and determining a single parameter for the group allows the system to take advantage of similarity between carriers, which conserves system resources (*e.g.*, memory, transmission costs) while ensuring communication with all CMs within a group. Ex. 1107, [0014], [0027]; Ex. 1102, ¶97.

A POSITA would have found it obvious to apply Saey's teaching of determining the worst-case SNR for each CM group to Thibeault's selection of an optimal physical layer communication parameter (*e.g.*, modulation order) in order to take advantage of similarity between different carriers communicating within a channel, which conserves system resources (*e.g.*, memory, transmission costs) and ensures communication with all cable modems in a group. Ex. 1107, [0014], [0027]; Ex. 1102, ¶98. 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. 1110, [0004]-[0005], [0015]-[0016], [0023]-[0024], [0029]-[0030], [0033], [0038]. Applying Saey's teaching of generating a worst-case SNR-profile for a carrier group would ensure communication with all CMs in the group while also furthering Thibeault's goal of ensuring that "each network element [is] running at its best possible modulation mode." Ex. 1110, [0038], [0033]; Ex. 1107, [0004]-[0005], [0027], [0033], [0043], FIGS. 3, 5-6; Ex. 1102, ¶98. Specifically, a POSITA would have appreciated that selecting a modulation order (*e.g.*, 16QAM/32QAM/64QAM) 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. 1102, ¶98.

A POSITA would have also found it obvious to apply Saey's teaching of determining the worst-case SNR for each CM group in order to implement Thibeault's dynamic SNR thresholds. Ex. 1110, [0032]; Ex. 1102, ¶99. Specifically, Thibeault discloses that its CMTS periodically reconfigures its logical channels, including measuring parameters such as SNR for its CMs, assigning (re-registering) CMs to the logical channels, and setting SNR thresholds used to delineate the logical channels. Ex. 1110, [0016], [0032]-[0033], [0038], FIGS. 4-5. Thus, a POSITA would have an additional motivation to apply Saey's teaching of generating a worst-case SNR-profile for a carrier group in order to implement Thibeault's dynamic SNR threshold to address variance in a channel's SNR. Ex. 1107, [0010], [0013]-[0014], [0025]-[0027], [0032], [0042]-[0043]; Ex. 1102, ¶99.

Such a combination also would have been obvious because it would have been no more than combining prior art elements (Thibeault's CMTS that applies modulation order parameters to CMs that are grouped based on a comparison of the CMs SNR characteristics and SNR thresholds, and Saey's method of determining a worst-case SNR for a group of CMs also grouped based on their individual SNRs 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 metric for the CM service group and uses that metric to determine the modulation order applied to the group and update the SNR

threshold for the logical channel). Ex. 1102, ¶100. Applying Saey'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. 1102, ¶100; *see also* Ex. 1110, [0008]-[0009], [0026]-[0027], [0039]; Ex. 1107, [0023].

Therefore, Thibeault-Saey teaches Element [1D]. Ex. 1102, ¶102.

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

Thibeault-Saey teaches Element [1E]. Ex. 1102, ¶¶103-105. As shown above for Element [1D], Thibeault-Saey's CMTS generates a composite SNR for each logical channel based on the worst-case SNR of a CM assigned to that logical channel. §VI.A.1.d. This composite SNR provides the benefit of allowing Thibeault-Saey'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 thresholds that define those logical channels. §VI.A.1.d; Ex. 1102, ¶¶103-105; Ex. 1110, [0004]-[0005], [0015]-[0016], [0021], [0023]-[0024], [0032]-[0033], [0038]. The modulation order (*e.g.*, 16QAM, 32QAM, 64QAM) selected by Thibeault-Saey's CMTS for the logical channels discloses the claimed “one or more physical layer communication parameter to be

used for communicating with said one of said plurality of service groups.” Ex. 1102, ¶103; *see* Ex. 1101, Abstract, 4:56-57, 5:40-46.

Thibeault-Saey’s CMTS therefore teaches “selecting ... one or more physical layer communication parameters [(i.e., the modulation order)] to be used for communicating with said one of said plurality of service groups based on said composite SNR-related metric.” Ex. 1102, ¶104.

Therefore, Thibeault-Saey teaches Element [1E]. Ex. 1102, ¶105.

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

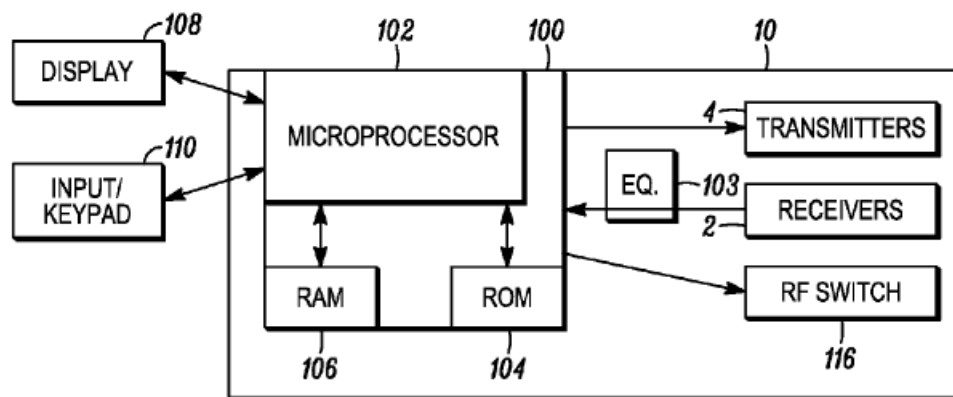
Thibeault-Saey teaches Element [1F]. Ex. 1102, ¶¶106-108. As shown above for Elements [1D]-[1E], Thibeault-Saey’s CMTS selects a modulation order for each of its logical channels based on the claimed composite SNR-related metric that is based on a worst-case SNR in each channel. Ex. 1110, [0033]; *see also* §§VI.A.1.d-e. Moreover, Thibeault-Saey’s CMTS communicates with the CMs connected to it using the selected modulation order (*e.g.*, 16QAM, 32QAM, 64QAM). Ex. 1110, [0016], [0024], [0029]-[0030], [0033]; Ex. 1102, ¶106.

Thus, Thibeault-Saey teaches “communicating, by said CMTS, with one or more cable modems corresponding to said one of said plurality of service groups using said selected one or more physical layer communication parameter.” Ex.

1102, ¶107. Thibeault-Saey therefore teaches Element [1F] and renders claim 1 obvious. Ex. 1102, ¶108.

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]. §VI.A.1.b; Ex. 1110, [0025], FIGS.1-2; Ex. 1102, ¶¶111-112. 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. 1110, [0026]-[0027], FIG. 2; Ex. 1102, ¶111.



Ex. 1110, FIG. 2

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. 1102, ¶¶113-115. Thibeault-Saey teaches that microprocessor 102 in CMTS 10 is configured to perform the limitations described above in [1B]-[1E]. §VI.A.1.b.e; Ex. 1110, [0026], FIGS. 1-2; Ex. 1102, ¶113. Accordingly, for the reasons set forth above with respect to [1B]-[1E], Thibeault-Saey’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. 1102, ¶114. Thibeault-Saey teaches that transmitters 4 and receivers 2 (the claimed “network interface”) provide communication with network elements 8. Ex. 1110, [0027], FIG. 2. Accordingly, for the reasons set forth above, Thibeault-Saey comprises a network interface that teaches and is configured to perform the limitations recited in [10F]. *Id.*; §VI.A.1.f.

Thibeault-Saey therefore renders claim 10 obvious. Ex. 1102, ¶115.

2. Dependent Claim 2 and Dependent Claim 11

- a. Dependent Claim 2: “The method of claim 1, wherein said one or more physical layer communication parameter includes one or more of: transmit power, receive sensitivity, timeslot duration,**

modulation type, modulation order, forward error correction (FEC) type, and FEC code rate.”

Claim 2 depends from claim 1. Ex. 1101, 8:24-29.

Thibeault-Saey teaches dependent claim 2. Ex. 1102, ¶¶109-110. As shown above for Element [1E], Thibeault-Saey’s CMTS selects a modulation order (*e.g.*, 16QAM, 32QAM, 64QAM) based on a composite SNR for the modulation profiles of its logical channels. Ex. 1110, [0029]-[0030], [0033]; *see also*, §VI.A.1.e.

Accordingly, Thibeault-Saey teaches the additional limitations of claim 2, and Thibeault-Saey therefore renders claim 2 obvious. Ex. 1102, ¶110.

b. Dependent Claim 11: “The system of claim 10, wherein said one or more physical layer communication parameter includes one or more of: transmit power, receive sensitivity, timeslot duration, modulation type, modulation order, forward error correction (FEC) type, and FEC code rate.”

Claim 11 is substantially similar to claim 2, and is therefore rendered obvious for the same reasons. §VI.A.2.a; Ex. 1102, ¶116.

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

1. Independent Claim 1 and Independent Claim 10

a. Elements [1A]-[1C] and Elements [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]. §§VI.A.1.a-c, VI.A.1.g-h; Ex. 1102, ¶117.

b. Element [1D] and Element [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 for each CM and SNR thresholds. Although Thibeault does not explicitly disclose 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 Gross’s teachings. Ex. 1102, ¶118.

Gross teaches a method of setting communication parameters in a communication system between modems that ensures efficient transmission of data despite interruptions and/or disturbances in the network. Ex. 1108, Abstract, [0022], [0027]. For example, Gross teaches setting the communication parameter of bit allocation based on a measured carrier’s SNR. Ex. 1108, [0014]-[0015], [0032], [0043], [0088]. Bit allocation is the number of bits that a carrier can accommodate and depends on SNR. Ex. 1108, [0014]-[0015], [0032], [0088]. A POSITA would have recognized this as bit loading, which is a method of allocating a higher order of modulation to carriers that have higher signal to noise ratio and a lower order modulation to carriers that have lower signal to noise ratio. Ex. 1115, 8:1-19, 4:55-59; Ex. 1102, ¶119. For example, a carrier’s SNR impacts the bit loading of the carrier, and thus the carrier’s modulation (*e.g.*, 4 bits per symbol (bps) for 16QAM,

5 bps for 32QAM). Ex. 1115, 4:55-59, 8:1-19, 9:9-11, 10:55-67, FIG. 10; Ex. 1112, 14:54-16:34; Ex. 1102, ¶119; § VI.A.1.e.

While Gross teaches setting communication parameters for each carrier, Gross also teaches a simplified approach that uses single, composite parameters to represent the “worst case” condition for communicating with a group of modems. Ex. 1108, [0044], [0100]. For example, one may measure the SNR of carriers communicating with different modems and choose the “worst case” SNR to determine a “worst case” or minimum bit allocation to communicate with the relevant modems. *Id.*; Ex. 1102, ¶120. This simplified approach ensures transmission of data to the modems in the group, regardless of which modems are activated. Ex. 1108, [0044], [0100].

A POSITA would have found it obvious to apply Gross’s teaching of determining the worst-case SNR for a CM group to Thibeault’s selection of the optimal modulation order of a logical channel to ensure communication with any modem assigned to that logical channel, regardless of which modems are activated. Ex. 1108, [0044], [0100]; Ex. 1110, [0036], FIG. 6; Ex. 1102, ¶121. 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. 1110, [0015]-[0016], [0023]-[0024], [0029]-[0030], [0033], [0038].

Applying Gross’s teaching of generating a worst-case SNR-profile for a carrier group would ensure communication with all CMs in the group while also furthering Thibeault’s goal of ensuring that “each network element [is] running at its best possible modulation mode.” Ex. 1110, [0038], [0033]; Ex. 1108, [0044], [0100]; Ex. 1102, ¶121. Specifically, a POSITA would have appreciated that selecting a modulation order (*e.g.*, 16QAM/32QAM/64QAM) for a logical channel based on the worst-case SNR of a CM group would have ensured communication with all CMs in the group regardless of which modems are activated. Ex. 1102, ¶121.

A POSITA would have also found it obvious to apply Gross’s teaching of determining the worst-case SNR for each CM group in order to implement Thibeault’s dynamic SNR thresholds. Ex. 1110, [0032]; Ex. 1102, ¶122. As discussed above, Thibeault describes that its CMTS periodically reconfigures its logical channels, including measuring parameters such as SNR for its CMs, assigning CMs to the logical channels, and dynamically setting SNR thresholds used to delineate the logical channels. Ex. 1110, [0032]-[0033], [0038]; § VI.A.1.d. Thus, a POSITA would have an additional motivation to apply Gross’s teaching of generating a worst-case SNR-profile for a carrier group in order to implement Thibeault’s dynamic SNR threshold to address variance in a channel’s SNR. Ex. 1108, [0044], [0100]; Ex. 1102, ¶122.

Such a combination also would have been obvious because it would have been no more than combining prior art elements (Thibeault's CMTS that applies modulation order parameters to CMs that are grouped based on a comparison of the CMs SNR characteristics and SNR thresholds, and Gross's method of determining and applying a worst-case SNR-based parameter for a group of CMs based on the individual SNRs of the modems) according to known methods (programming of a CMTS) to yield predictable results (a CMTS that generates a worst-case SNR metric for the CM service group and uses that metric to determine the modulation order applied to the service group and update the SNR threshold for the logical channel). Ex. 1102, ¶123. Applying Gross'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. 1102, ¶¶123-124; *see also* Ex. 1110, [0008]-[0009], [0026]-[0027], [0039]. Accordingly, Thibeault-Gross 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 Element [1D]. Ex. 1101, 4:3-67, 5:7-20; Ex. 1117, 53-55; Ex. 1118, 187; Ex. 1119, 8-10; Ex. 1102, ¶¶123-125. And for reasons similar to those described above for Thibeault-Saey, Thibeault-Gross also teaches that its microprocessor is configured to perform the limitations described in Element [1D]. *Id.*; §§VI.A.1.g-h. Thus, Thibeault-Gross also teaches Element [10D]. *Id.*

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

For reasons similar to those described above for Thibeault-Saey, Thibeault-Gross teaches [1E]-[1F]/[10E]-[10F]. §§VI.A.1.e-f, VI.A.1.h. In particular and as discussed above, Thibeault-Gross' CMTS would have similarly selected the modulation orders for its logical channels based on the worst-case SNR 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. 1102, ¶126; *see also* §VI.A.1.d.

Thibeault-Gross' CMTS also would have communicated with the CMs connected to it using the selected modulation orders. Ex. 1110, [0019], [0030]; Ex. 1102, ¶126; *see also* §§VI.A.1.f, VI.A.1.h. In addition, for reasons similar to those described above for Thibeault-Saey, Thibeault-Gross teaches that its microprocessor is configured to perform the limitations described in Element [10E], and that it comprises a network interface to perform the limitations recited in [10F]. *Id.*

Thibeault-Gross therefore teaches [1E]-[1F]/[10E]-[10F] and renders claims 1 and 10 obvious. Ex. 1102, ¶127.

2. Dependent Claim 2 and Dependent Claim 11

For reasons similar to those described above for Thibeault-Saey, Thibeault-Gross teaches dependent claims 2 and 11. §VI.A.2. In particular, Thibeault-Gross'

CMTS selects a modulation order (*e.g.*, 16QAM/32QAM/64QAM) based on a composite SNR for the modulation profiles of its logical channels. §VI.B.1.c.

Accordingly, Thibeault-Gross teaches the additional limitations of claims 2 and 11, and Thibeault-Gross therefore renders claims 2 and 11 obvious. Ex. 1102, ¶128.

C. Ground C: Claims 1-2 and 10-11 are Rendered Obvious by Thibeault-Cioffi

1. Independent Claim 1 and Independent Claim 10

a. Elements [1A]-[1C] and Elements [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]. §§ VI.A.1.a-c, VI.A.1.g-h; Ex. 1102, ¶129.

b. Element [1D] and Element [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 for each CM and SNR thresholds. Although Thibeault does not explicitly disclose 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 Cioffi’s teachings. Ex. 1102, ¶130.

Cioffi teaches a method of managing a communication system between multiple modems by measuring network characteristics and adjusting

communication protocols to ensure efficient communications despite signal interference or noise within the network. Ex. 1109, Abstract, [0011]-[0012], [0014], [0019], [0073], [0075]-[0076], [0112]. For example, Cioffi teaches using measurements such as SNR to determine the modulation constellation for a channel. Ex. 1109, [0124], [0082], [0089]- [0092], [0095]- [0101], Tables 1-2; Ex. 1102, ¶131. As another example, Cioffi further teaches adaptively selecting different communication parameters to account for varying worst-case noise for each channel, leading to higher performance in the communicating in each channel. Ex. 1109, [0019], [0063], [0075]-[0076], [0112]; Ex. 1102, ¶131.

A POSITA would have found it obvious to apply Cioffi's teaching of selecting a channel's communication parameters based on varying worst-case noise conditions to Thibeault's selection of the optimal modulation order of a logical channel to ensure communication with any modem assigned to that logical channel despite any varying worst-case noise condition in the channel, leading to higher performance in the communicating in each channel. Ex. 1102, ¶132; Ex. 1109, [0019], [0048], [0063], [0075]-[0076], [0112]; Ex. 1110, [0004], [0016], [0023]-[0024], [0029]-[0030], [0033], [0036]. 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. 1110, [0015]-[0016],

[0023]-[0024], [0029]-[0030], [0033], [0038]. Applying Cioffi's teaching of generating a worst-case SNR-profile for a carrier group would ensure communication with all CMs in the group while also furthering Thibeault's goal of ensuring that "each network element [is] running at its best possible modulation mode." Ex. 1110, [0038], [0033]; Ex. 1109, [0019], [0063], [0075]-[0076], [0082], [0089]-[0092], [0095]-[0101], [0112], [0124]; Ex. 1102, ¶132. Specifically, a POSITA would have appreciated that selecting a modulation order (*e.g.*, 16QAM/32QAM/64QAM) 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. 1102, ¶132.

As discussed above, Thibeault also discloses that SNR thresholds may be dynamically determined based on measured network parameters. Ex. 1110, [0032]. Cioffi also acknowledges that SNR parameters will vary over time, requiring updating any worst-case assumptions that are relied on. Ex. 1109, [0112]; §VI.A.1.d. Thus, a POSITA would have an additional motivation to apply Cioffi's teaching of using and updating worst-case SNR profiles for a carrier group in order to implement Thibeault's dynamic SNR threshold to address variance in a channel's SNR. Ex. 1102, ¶133; Ex. 1110, [0032]; Ex. 1109, [0112].

Such a combination also would have been obvious because it would have been no more than combining prior art elements (Thibeault's CMTS that applies

modulation order parameters to CMs that are grouped based on a comparison of the CMs SNR characteristics and SNR thresholds, and Cioffi's method of relying on worst-case noise measurements to determine the modulation constellation of the channel) according to known methods (programming of a CMTS) to yield predictable results (a CMTS that generates a worst-case SNR metric for the CM service group and uses that metric to determine the modulation applied to the service group and update the SNR threshold for the logical channel). Ex. 1102, ¶134. Applying Cioffi'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. 1102, ¶135; *see also* Ex. 1110, [0008]-[0009], [0026]-[0027], [0039]. Accordingly, Thibeault-Cioffi teaches the claimed "generating ... a composite SNR-related metric based at least in part on a worst-case SNR profile of said SNR-related metrics." Ex. 1102, ¶136; Ex. 1101, 4:3-67, 5:7-20; Ex. 1117, 53-55; Ex. 1118, 187; Ex. 1119, 8-10. And for reasons similar to those described above for Thibeault-Saey, Thibeault-Cioffi also teaches that its microprocessor is configured to perform the limitations described in Element [10D]. *Id.*; Sections VI.A.1.g-h. Thus, Thibeault-Cioffi also teaches Element [10D]. *Id.*

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

For reasons similar to those described above for Thibeault-Saey and Thibeault-Gross, Thibeault-Cioffi teaches [1E]-[1F]/[10E]-[10F]. §§VI.A.1.e-f, VI.B.1.c, *supra*. In particular, and as discussed above, Thibeault-Cioffi's CMTS would have similarly selected the modulation orders for its logical channels based on the worst-case SNR metrics determined for the groups of CMs assigned to the logical channels to ensure communication with any modem assigned to that logical channel despite any varying worst-case noise condition in the channel, leading to higher performance in the communicating in each channel. Ex. 1102, ¶137; *see also* § VI.A.1.e.

Thibeault-Cioffi's CMTS also would have communicated with the cable modems connected to it using the selected modulation orders. Ex. 1110, [0013], [0028-0029], [0034]; Ex. 1102, ¶137; *see also* § VI.A.1.f. In addition, for reasons similar to those described above for Thibeault-Saey, Thibeault-Cioffi teaches that its microprocessor is configured to perform the limitations described in Element [10E], and that it comprises a network interface to perform the limitations recited in [10F]. *Id.*

Thibeault-Cioffi therefore teaches [1E]-[1F]/[10E]-[10F] and renders claims 1 and 10 obvious. Ex. 1102, ¶138.

2. Dependent Claim 2 and Dependent Claim 11

For reasons similar to those described above for Thibeault-Saey and Thibeault-Gross, Thibeault-Cioffi teaches dependent claims 2 and 11. §§VI.A.2, VI.B.2. In particular, Thibeault-Cioffi's CMTS selects a modulation order (*e.g.*, 16QAM/32QAM/64QAM) based on a composite SNR for the modulation profiles of its logical channels. §VI.A.1.e. Accordingly, Thibeault-Cioffi teaches the additional limitations of claims 2 and 11, and Thibeault-Cioffi therefore renders claims 2 and 11 obvious. Ex. 1102, ¶139.

D. Grounds D-F: Claims 7-8 and 16-17 are Rendered Obvious by Thibeault-Saey, Thibeault-Gross, and Thibeault-Cioffi, each in view of Cooper

1. Dependent Claim 7 and Dependent Claim 8

a. Dependent Claim 7: “The method of claim 1, comprising assigning said cable modems among said plurality of service groups based on respective distances between said CMTS and said cable modems.”

Claim 7 depends from claim 1. Ex. 1101, 8:62-65.

As described above in Sections VI.A.1.c, VI.B.1.a and VI.C.1.a Thibeault-Saey's/Thibeault-Gross's/Thibeault-Cioffi's CMTS assigns CMs to logical channels (*i.e.*, a plurality of service groups) based on a comparison between the determined SNR for each CM and SNR thresholds. §§VI.A.1.c, VI.B.1.a, VI.C.1.a. While Thibeault-Saey/Thibeault-Gross/Thibeault-Cioffi do not teach assigning each CM to a group based on its location in the network, Cooper does. Ex. 1102, ¶¶140-141.

Cooper discloses assigning CMs among a plurality of service groups based on different network parameters. Ex. 1105, Abstract, [0008], [0021], [0027]-[0028], [0037]; Ex. 1102, ¶142. 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 locations of network elements in a cable network. Ex. 1105, Abstract, [0021], [0027]-[0028], [0035], [0037]; Ex. 1102, ¶142. Grouping CMs according to, or at least in part according to, 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. 1105, [0019]; Ex. 1102, ¶142.

It would therefore have been obvious to modify Thibeault-Saey's/Thibeault-Gross's/Thibeault-Cioffi'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. 1105, [0019]; Ex. 1102, ¶143. More specifically, it would have been obvious to configure Thibeault-Saey's/Thibeault-Gross's/Thibeault-Cioffi'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 cable modems among said plurality of service groups based on respective distances

between said CMTS and said cable modems”), in order to quickly identify and isolate problematic geographic regions in the network or network elements for maintenance. Ex. 1102, ¶143.

Such modifications also would have been obvious because they would have merely involved the combination of prior art elements (Thibeault-Saey’s/Thibeault-Gross’s/Thibeault-Cioffi’s CMTS and Cooper’s methods of assigning CMs to service groups based on parameters associated with each CMs 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. 1102, ¶144. Applying Cooper’s teachings to Thibeault-Saey’s/Thibeault-Gross’s/Thibeault-Cioffi’s CMTS would have been well within the capabilities of a POSITA because it would have involved straightforward modifications to the programming of Thibeault-Saey’s/Thibeault-Gross’s/Thibeault-Cioffi’s CMTS’s microprocessor. Ex. 1102, ¶145; *see also* Ex. 1110, [0008]-[0009], [0026]-[0027], [0039]; Ex. 1105, [0008], [0023]-[0024], [0030].

Therefore, claim 7 is rendered obvious by Thibeault-Saey-Cooper, Thibeault-Gross-Cooper, and Thibeault-Cioffi-Cooper. Ex. 1102, ¶146.

- b. Dependent Claim 8: “The method of claim 1, comprising assigning any particular one of said 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 8 depends from claim 1. Ex. 1101, 8:67-9:3.

As described above in Sections VI.A.1.c, VI.B.1.a, and VI.C.1.a, Thibeault-Saey’s/Thibeault-Gross’s/Thibeault-Cioffi’s CMTS assigns CMs to logical channels (i.e., a plurality of service groups) based on a comparison between the determined SNR for each CM and SNR thresholds. §§ VI.A.1.c, VI.B.1.a, VI.C.1.a. While Thibeault-Saey/Thibeault-Gross/Thibeault-Cioffi do not teach assigning each CM to a group based on its location in the network, Cooper does. Ex. 1102, ¶¶147-148.

Cooper discloses assigning CMs among a plurality of service groups based on different network parameters. Ex. 1105, Abstract, [0008], [0021], [0027]-[0028], [0037]; Ex. 1102, ¶149. 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. 1105, Abstract, [0021], [0027]-[0028], [0035], [0037]; Ex. 1102, ¶149. Grouping CMs, at least in part, according to amplifier cascade depth would allow the identification and isolation of problematic network elements, supporting proactive maintenance activities. Ex. 1105, [0019]; Ex. 1102, ¶149.

It would therefore have been obvious to modify Thibeault-Saey’s/Thibeault-Gross’s/Thibeault-Cioffi’s CMTS to assign CMs to service groups based on amplifier cascade depth to allow for more proactive maintenance of the network.

Ex. 1105, [0019]; Ex. 1102, ¶150. More specifically, it would have been obvious to configure Thibeault-Saey's/Thibeault-Gross's/Thibeault-Cioffi'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 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. 1102, ¶150.

Such modifications also would have been obvious because they would have merely involved the combination of prior art elements (Thibeault-Saey's/Thibeault-Gross's/Thibeault-Cioffi'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. 1102, ¶151. Applying Cooper's teachings to Thibeault-Saey's/Thibeault-Gross's/Thibeault-Cioffi's CMTS would have been well within the capabilities of a POSITA because it would have involved straightforward modifications to the programming of Thibeault-Saey's/Thibeault-Gross's/Thibeault-Cioffi's CMTS's microprocessor. Ex. 1102, ¶152; *see also* Ex. 1110, [0008]-[0009], [0026]-[0027], [0039]; Ex. 1105, [0008], [0023]-[0024], [0030].

Therefore, claim 8 is rendered obvious by Thibeault-Saey-Cooper, Thibeault-Gross-Cooper, and Thibeault-Cioffi-Cooper. Ex. 1102, ¶153.

2. Dependent Claim 16 and Dependent Claim 17

- a. Dependent Claim 16: “The system of claim 10, wherein said processor is configured to assign said cable modems among said plurality of service groups based on respective distances between said CMTS and said cable modems.”**

Claim 16 is substantially similar to claim 7 except that it identifies “said processor” to make the assignments. Ex. 1101, 10:30-33. As discussed in Section VI.A.1.g, Thibeault-Saey-Cooper’s/Thibeault-Gross-Cooper’s/Thibeault-Cioffi-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. 1102, ¶154; §VI.D.1.a. Therefore, claim 16 is rendered obvious for the same reasons discussed in Section VI.D.1.a. Ex. 1102, ¶154.

- b. Dependent Claim 17: “The system of claim 10, wherein said processor is configured to assign each of said cable modems among said plurality of service groups based on one or more branch amplifier that serves said each of said cable modems.”**

Claim 17 is substantially similar to claim 8 except that it identifies “said processor” to make the assignments. Ex. 1101, 10:34-37. As discussed in Section VI.A.1.g, Thibeault-Saey-Cooper’s/Thibeault-Gross-Cooper’s/Thibeault-Cioffi-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. 1102,

¶155; §VI.D.1.b. Therefore, claim 17 is rendered obvious for the same reasons discussed in Section VI.D.1.b. Ex. 1102, ¶155.

E. Grounds G-I: Claims 3-6 and 12-15 are Rendered Obvious by Thibeault-Saey or Thibeault-Gross or Thibeault-Cioffi, each in view of Monk802

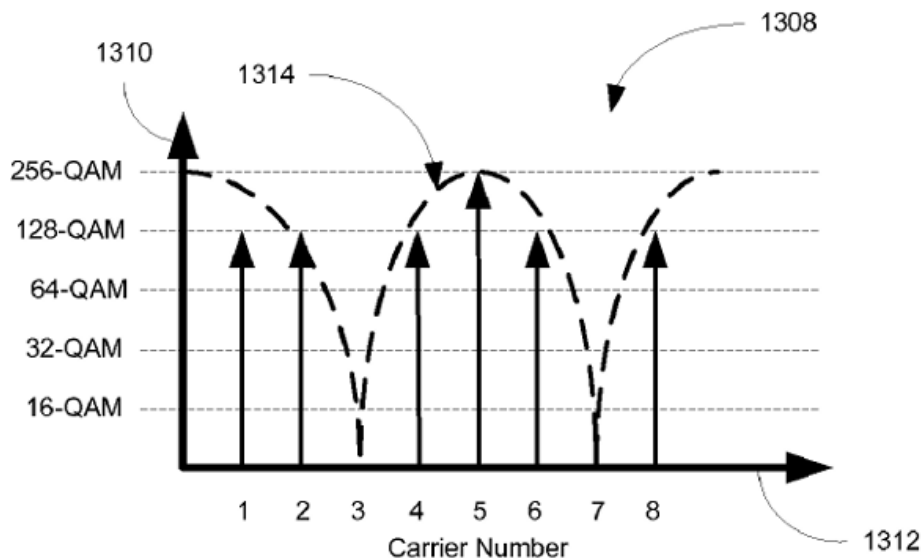
1. Dependent Claim 3 and Dependent Claim 12

a. Dependent Claim 3: “The method of claim 1, wherein said CMTS uses orthogonal frequency division multiplexing (OFDM) over a plurality of subcarriers for said communicating.”

Claim 3 depends from claim 1. Ex. 1101, 8:29-32. As discussed above in Sections VI.A.1.d-f, VI.B.1.b-c, and VI.C.1.b-c, Thibeault-Saey/Thibeault-Gross/Thibeault-Cioffi teach that the CMTS selects a physical layer communication parameter (*i.e.*, a modulation order) that is then used to communicate with one or more CMs in a particular service group. While Thibeault-Saey, Thibeault-Gross and Thibeault-Cioffi do not teach communicating using OFDM over a plurality of subcarriers, Monk802 does. Ex. 1102, ¶156.

Monk802 discloses a method of communication using OFDM. Ex. 1114, 8:1-39, 17:61-67, 19:27-41, 21:19-22:34, FIGS. 12, 13A-C. 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, with higher SNR channels supporting higher data capacity or modulation schemes. Ex. 1114, 8:19-39, 21:19-22:34; Ex. 1102, ¶157. 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. 1114, 21:53-22:16, FIGS. 13A-13C; Ex. 1102, ¶157; *see also* Ex. 1114, 8:19-25, 20:59-21:43.



Ex. 1114, FIG. 13B

OFDM helps cable broadband coaxial networks overcome signal impairments caused by issues such as multipath reflections in a highly dispersive environment (*e.g.*, an in-house coaxial network). Ex. 1114, 4:7-24, 8:8-25; Ex. 1102, ¶158.

A POSITA would have been motivated to combine the OFDM communication techniques taught by Monk802 with the communication techniques taught by Thibeault-Saey's/Thibeault-Gross's/Thibeault-Cioffi's CMTS as an additional method to address signal impairments in a highly dispersive environment. Ex. 1114, 4:7-24, 8:8-25; Ex. 1102, ¶159. As discussed above in Sections VI.A.1.e, VI.B.1.c, and VI.C.1.c, Thibeault-Saey's/Thibeault-Gross's/Thibeault-Cioffi's

communication techniques teach selecting different modulation orders for different carriers or channels based on a composite worst-case SNR. 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 a SNR. Ex. 1102, ¶159.

Such combinations also would have been obvious because they would have been nothing more than combining prior art elements (Thibeault-Saey's/Thibeault-Gross's/Thibeault-Cioffi's CMTS and Monk802's OFDM method of communication) according to known methods (programming a CMTS) 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). Ex. 1102, ¶160.

A POSITA would have had a reasonable expectation of success applying Monk802's teachings to Thibeault-Saey's/Thibeault-Gross's/Thibeault-Cioffi's CMTS as it would have only required routine modifications to the programming of the microprocessor in the CMTS, which was well within the capabilities of a POSITA. Ex. 1102, ¶161; Ex. 1110, [0008]-[0009], [0026]-[0027]. Thus, Thibeault-Saey's/Thibeault-Gross's/Thibeault-Cioffi's CMTS as modified by Monk802

teaches the claimed use of “[OFDM] over a plurality of subcarriers for said communicating.” Ex. 1102, ¶161.

Therefore, claim 3 is invalid as obvious over Thibeault-Saey-Monk802, Thibeault-Gross-Monk802, and Thibeault-Cioffi-Monk802. Ex. 1102, ¶162.

b. Dependent Claim 12: “The system of claim 10, wherein said network interface and said cable modems are configured to communicate using orthogonal frequency division multiplexing (OFDM) over a plurality of subcarriers.”

Claim 12 is substantially similar to claim 3 except that it identifies “said network interface and cable modems” are configured to use OFDM. Ex. 1101, 9:41-44. 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.E.1.a. Ex. 1102, ¶181.

2. Dependent Claim 4 and Dependent Claim 13

a. Dependent Claim 4: “The method of claim 3, comprising selecting, by said CMTS, said one or more physical layer communication parameter on a per-OFDM-subcarrier basis.”

Claim 4 depends from claim 3. Ex. 1101, 8:33-35. As discussed above in Section VI.E.1.a, Thibeault-Saey-Monk802’s/Thibeault-Gross-Monk802’s/Thibeault-Cioffi-Monk802’s CMTS teaches the use of OFDM where a particular QAM modulation order (*e.g.*, 16/32/64/128/256) is selected on a per-subcarrier basis depending on a SNR. Section VI.E.1.a.; Ex. 1114, 8:19-39, 21:19-

22:34, FIGS. 12, 13A-C; Ex. 1102, ¶163. Thus, Thibeault-Saey's/Thibeault-Gross's/Thibeault-Cioffi's CMTS as modified by Monk802 also teaches the CMTS "selecting ... said one or more physical layer communication parameter on a per-OFDM-subcarrier basis." Ex. 1102, ¶163.

Accordingly, claim 4 is invalid as obvious over Thibeault-Saey-Monk802, Thibeault-Gross-Monk802, and Thibeault-Cioffi-Monk802. Ex. 1102, ¶164.

b. Dependent Claim 13: "The system of claim 12, wherein said network interface is configured such that at least one of said one or more physical layer communication parameters are configurable on a per-OFDM-subcarrier basis."

Claim 13 is substantially similar to claim 4 except that it identifies "said network interface and cable modems" are configured to use OFDM. Ex. 1101, 9:45-10:2. As discussed in Section VI.A.1.g, Thibeault-Saey-Cooper's/Thibeault-Gross-Cooper's/Thibeault-Cioffi-Cooper'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.E.2.a. Ex. 1102, ¶182.

3. Dependent Claim 5 and Dependent Claim 14

a. Dependent Claim 5: "The method of claim 4, wherein said one or more physical layer communication parameter includes 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 5 depends from claim 4. Ex. 1101, 8:36-40. As discussed above in Sections VI.A.1.e, VI.B.1.c, VI.C.1.c, and VI.E.2.a, Thibeault-Saey-

Monk802's/Thibeault-Gross-Monk802's/Thibeault-Cioffi-Monk802's CMTS selects "one or more physical layer communication parameter" 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. 1110, Abstract, [0001]-[0007], [0031], [0037]; Ex. 1121, 1, 3, 7-9; Ex. 1122, 1, 7-10; Ex. 1123, 1, 3, 25, 27; Ex. 1102, ¶165. This is consistent with Monk802's disclosure, which also shows different frequency bands used for upstream and downstream signals. Ex. 1114, 23:30-60, 24:4-37, FIG. 17; Ex. 1102, ¶165.

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 metrics. Ex. 1110, [0031]-[0037]; Ex. 1102, ¶166. Because Thibeault distinguishes between upstream and downstream SNR metrics in different frequency bands, Thibeault-Saey-Monk802's/Thibeault-Gross-Monk802's/Thibeault-Cioffi-Monk802's CMTS teaches selecting a separate upstream and downstream "one or more physical layer communication parameter" on a per-OFDM-subcarrier basis based on a composite upstream or downstream SNR-related metric. Ex. 1102, ¶166. Thus, Thibeault-Saey-Monk802's/Thibeault-Gross-Monk802's/Thibeault-Cioffi-Monk802's CMTS

teaches “one or more physical layer communication parameter includes 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.” Ex. 1102, ¶166.

Therefore, claim 5 is invalid as obvious over Thibeault-Saey-Monk802, Thibeault-Gross-Monk802, and Thibeault-Cioffi-Monk802. Ex. 1102, ¶167.

b. Dependent Claim 14: “The system of claim 12, wherein said one or more physical layer communication parameter includes 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 14 is substantially similar to claim 5. Ex. 1102, ¶183. Thibeault-Saey-Monk802/Thibeault-Gross-Monk802/Thibeault-Cioffi-Monk802 teach the additional limitations in claim 14 for the same reasons discussed above in Section VI.E.3.a. Accordingly, claim 14 is invalid as obvious over Thibeault-Saey-Monk802, Thibeault-Gross-Monk802, and Thibeault-Cioffi-Monk802. Ex. 1102, ¶183.

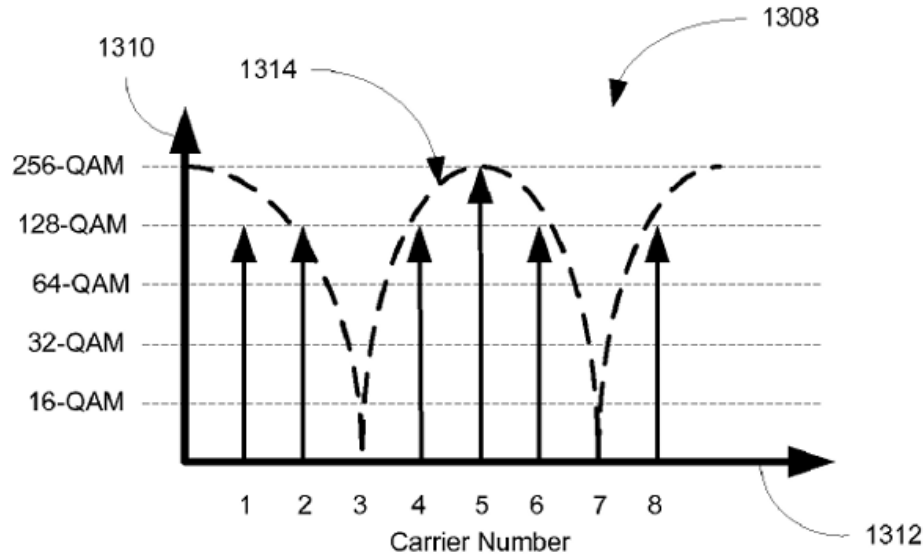
4. Dependent Claim 6 and Dependent Claim 15

- a. **Element [6A]: “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 particular cable modem has a particular SNR versus frequency profile; and”**

Claim 6 depends from claim 1. Ex. 1101, 8:41-61. As described in Section VI.1.A.c, Thibeault assigns cable modems into at least four different service groups or logical channels based on comparing a modem’s measured SNR to an SNR threshold. Ex. 1110, [0033]. Thus, Thibeault-Saey/Thibeault-Gross/Thibeault-Cioffi teach at least “a first service group and a second service group.” Ex. 1102, ¶¶168-169.

And as shown in Sections VI.A.1.d, Thibeault-Saey/Thibeault-Gross/Thibeault-Cioffi teach generating a composite SNR-related metric for each service group based at least in part on a worst-case SNR profile. §VI.A.1.d. While Thibeault-Saey/Thibeault-Gross/Thibeault-Cioffi do not expressly describe these composite SNRs as SNR versus frequency profiles, Monk802 does. Ex. 1102, ¶169.

As shown below, 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. Ex. 1114, 21:53-22:16, 8:19-25, 20:59-21:43, FIGS. 13A-13C; Ex. 1102, ¶170.



Ex. 1114, FIG. 13B

Monk802's Figure 13B shows a SNR versus frequency profile similar to line 222 in Figure 2B of the '682 patent. *Compare* Ex. 1101, 4:6-17, FIG. 2B; *with* Ex. 1114, 21:53-22:16, FIG. 13B; Ex. 1102, ¶171. As shown, an SNR profile over a range of frequencies indicates the maximum modulation order for each frequency band. Ex. 1102, ¶171; *see* Ex. 1114, 8:19-39, 21:19-22:34.

A POSITA would have found it obvious to apply Monk802's teachings of determining an SNR profile over a range of frequencies to Thibeault-Saey's/Thibeault-Gross's/Thibeault-Cioffi's method of determining an SNR metric in order to optimize modulation order by both SNR and frequency. Ex. 1102, ¶172; *see* Ex. 1114, 8:19-39, 21:19-22:34; §VI.A.1.b. While Thibeault discusses modems communicating in dedicated bands of frequencies, Monk802's methods would allow the CMTS of Thibeault-Saey/Thibeault-Gross/Thibeault-Cioffi to divide those frequency bands into multiple channels and determine which frequency band best

suites each communication. Ex. 1102, ¶172; *see* Ex. 1110, [0002]. For example, when assigning each cable modem to a plurality of service groups based on an SNR versus frequency profile, a CMTS would assign modems by their SNR versus frequency profile rather than singular SNR thresholds. Ex. 1102, ¶172.

Similarly, and for similar reason explained above in Element [1D], once the modems have been assigned to a service group, a POSITA would have also found it obvious to apply Monk802's teaching to Thibeault-Saey's/Thibeault-Gross's/Thibeault-Cioffi's CMTS in order to determine a first composite SNR versus frequency profile for each service group so as to determine an optimal modulation order and optimal frequency band for each of Cooper's logical channels as well as dynamically adjust thresholds based on the measured composite SNR versus frequency profile. Ex. 1110, [0016], [0023], [0032]-[0038]; §VI.A.1.d; Ex. 1102, ¶173.

Such combinations also would have been obvious because they would have been no more than combining prior art elements (Thibeault-Saey's/Thibeault-Gross's/Thibeault-Cioffi's CMTS that (i) measures and assigns modems to service groups based on their measured SNR, and (ii) determines a worst-case SNR for each group; and Monk802's method of measuring a modem's SNR over a range of frequencies) according to known methods (programming of a CMTS) to yield predictable results (a CMTS that measures and assigns modems to service groups

based on their measured SNR versus frequency profile, and determines a composite SNR versus frequency profile for each group). Ex. 1102, ¶174. Applying Monk802's teachings to Thibeault-Saey's/Thibeault-Gross's/Thibeault-Cioffi's CMTS would have been well within the capabilities of a POSITA and would have involved only routine modifications to the programming of the CMTS's processor. Ex. 1102, ¶175; *see also* Ex. 1110, [0008]-[0009], [0026]-[0027].

In sum, the combinations of Thibeault-Saey-Monk802, Thibeault-Gross-Monk802, and Thibeault-Cioffi-Monk802 teach the claimed “first composite SNR versus frequency profile” and “second composite SNR versus frequency profile” associated with their respective service group. Ex. 1102, ¶176. Further, because these combinations also teach measuring a SNR versus frequency profile for each modem, the combinations also teach “a particular cable modem has a particular SNR versus frequency profile.” Ex. 1102, ¶176.

Accordingly, Thibeault-Saey-Monk802, Thibeault-Gross-Monk802, and Thibeault-Cioffi-Monk802 teach the additional requirements of [6A]. Ex. 1102, ¶177.

- b. Element [6B]: “said assigning said each cable modem among said plurality of service groups comprises, for the particular cable modem: assigning said particular 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 particular 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.”**

As discussed for Element [6A], Thibeault-Saey-Monk802, Thibeault-Gross-Monk802, and Thibeault-Cioffi-Monk802 teach at least a first and second service group that each have their own composite SNR versus frequency profile. §VI.E.4.a. These combinations also teach (i) “a particular cable modem has a particular SNR versus frequency profile”, and (ii) assigning the particular cable modem to the service group that has a composite SNR versus frequency profile most similar to the particular SNR versus frequency profile of the particular cable modem as required by [6B]. *Id.*; Ex. 1102, ¶178.

Thibeault discloses that modems are assigned to logical channels based on their individual measured values compared with the threshold values. Ex. 1110, [0009], [0011], [0032]; Ex. 1102, ¶179. Thibeault also discloses that these thresholds can be dynamic and updated based on network measurements. Ex. 1110, [0032]. Thibeault then teaches assigning or reassigning modems to logical channels based on these updated thresholds. Ex. 1110, [0032]; Ex. 1102, ¶179. Thus, based on such teachings, Thibeault-Saey-Monk802, Thibeault-Gross-Monk802, and

Thibeault-Cioffi-Monk802 teach assigning the particular modem to the service group with a composite SNR versus frequency profile that is the most similar to the modem's particular SNR versus frequency profile. Ex. 1102, ¶179.

Therefore, claim 6 is invalid as obvious over Thibeault-Saey-Monk802, Thibeault-Gross-Monk802, and Thibeault-Cioffi-Monk802. Ex. 1102, ¶180.

- c. Dependent Claim 15: “[15A] 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 composite SNR versus frequency profile, and a particular cable modem has a particular SNR versus frequency profile; [15B] said assignment of said each cable modem among said plurality of service groups comprises, for the particular cable modem: assignment of said particular 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 particular 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 15 is substantially similar to claim 6. Ex. 1102, ¶184. Thibeault-Saey-Monk802/Thibeault-Gross-Monk802/Thibeault-Cioffi-Monk802 teach the additional limitations in claim 15 for the same reasons discussed above in Section VI.E.4.a-b. Accordingly, claim 15 is invalid as obvious over Thibeault-Saey-Monk802, Thibeault-Gross-Monk802, and Thibeault-Cioffi-Monk802. Ex. 1102, ¶184.

F. Grounds J-L: Claims 9 and 18 are Rendered Obvious by Thibeault-Saey, Thibeault-Gross, and Thibeault-Cioffi, each in view of Monk and Cooper⁴³⁷

1. Dependent Claim 9

Claim 9 depends from claim 1. Ex. 1101, 9:4-11. As discussed in Sections VI.A.1.b, VI.B.1.a, and VI.C.1.a. above, Thibeault-Saey, Thibeault-Gross, and Thibeault-Cioffi teach determining a 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. 1110, [0039]; *see* §VI.A.1.b. Thibeault 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. Ex. 1110, [0013], [0032], [0039]. However, Thibeault-Saey, Thibeault-Gross, and Thibeault-Cioffi do not teach a probe message that initiates the measurement of the SNR-related metric at the CMs or that includes instructions for measuring a metric and reporting said measured metric back to the CMTS (as required by claim 9). Monk and Cooper⁴³⁷ teach such a probe message. Ex. 1102, ¶185.

Monk discloses a method of communication that relies on different modulation schemes based on a communication channel's SNR. Ex. 1115, Abstract, 4:25-38, 6:6-19, 7:14-31, 8:1-11. For example, Monk teaches that 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. Ex. 1115, 4:55-59, 8:1-11, 9:9-11, 10:58-62; Ex. 1102, ¶186. 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. 1115, 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. Ex. 1115, 9:41-50; Ex. 1102, ¶186.

A POSITA would have found it obvious to transmit a probe message to each CM (the claimed “transmitting a probe message to each cable modem”) and to receive a reporting message including SNR raw data or a bit loading profile (the claimed “receiving a metric reporting message from each cable modem”) as taught by Monk in order to implement Thibeault’s example of measuring an SNR-related metric at each CM and reporting it back to the CMTS. Ex. 1110, [0013]; Ex. 1115, 4:44-59, 8:4-5, 9:9-11, 9:26-41, 10:60-62, Abstract; Ex. 1102, ¶187.

Incorporating Monk’s probe messages and reporting messages into Thibeault-Saey/Thibeault-Gross/Thibeault-Cioffi also would have been obvious because such an implementation would be nothing more than combining prior art elements (Thibeault-Saey’s/Thibeault-Gross’s/Thibeault-Cioffi’s CMTS, and the probe and

reporting messages of Monk) according to known methods (programming the CMTS to send probe messages and receive reporting messages that provide an analysis of a channel's SNR) to yield predictable results (a system that uses probe messages and reporting messages to have CMs rather than a CMTS measure the SNR of a channel). Ex. 1102, ¶188. A POSITA would have further found it obvious to measure at the CMs to distribute processing requirements among multiple CMs. *Id.*

Further, applying Monk's teachings to Thibeault-Saey's/Thibeault-Gross's/Thibeault-Cioffi's CMTS would have been well within the capabilities of a POSITA as it would have only required minor modifications to the programing of the microprocessor in the CMTS. Ex. 1102, ¶189. And a POSITA would have had a reasonable expectation of success in these programming modifications as Thibeault-Saey's/Thibeault-Gross's/Thibeault-Cioffi's microprocessor would function as a programmed signal processor, which Monk discloses may be used for its teachings. Ex. 1102, ¶189; Ex. 1110, [0039]; Ex. 1115, 10:22-31.

While Thibeault-Saey-Monk/Thibeault-Gross-Monk/Thibeault-Cioffi-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. 1102, ¶190. Cooper437 discloses a method for a CMTS to ask for and receive specific noise signal power measurements from CMs in its network. Ex. 1116, Abstract, 1:62-65, 3:47-50, FIG. 1. For example,

Cooper437 describes a CMTS initiating noise signal power measurements by transmitting to CMs in the network a message that defines the measurement techniques to be used and how to report the measurements. Ex. 1116, 8:11-29, 8:60-9:5, 10:56-11:28, Table 1.

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. 1116, 10:56-11:28, Table 1; Ex. 1102, ¶191. 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. 1116, 8:9-64, 10:56-11:28, Table 1; Ex. 1102, ¶191.

A POSITA would have found it obvious to modify Thibeault-Saey-Monk's/Thibeault-Gross-Monk's/Thibeault-Cioffi-Monk's probe message (which already estimates channel characteristics) to identify a measurement mode and reporting mode, as taught by Cooper437, so that Thibeault-Saey-Monk's/Thibeault-Gross-Monk's/Thibeault-Cioffi-Monk's CMTS can send customized probe messages to specific CMs or service groups to determine the SNR of specific service groups or at specific frequencies. Ex. 1102, ¶192; Ex. 1116, 8:9-64, 10:56-11:28,

Table 1. Such a modification would allow a CMTS to more quickly identify groups of modems or frequencies that have had a change in their SNR. Ex. 1102, ¶192.

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 have been nothing more than combining prior art elements (Thibeault-Saey-Monk’s/Thibeault-Gross-Monk’s/Thibeault-Cioffi-Monk’ 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. 1102, ¶193.

Applying Cooper437’s teachings to Thibeault-Saey-Monk’s/Thibeault-Gross-Monk’s/Thibeault-Cioffi-Monk’s CMTS would have been well within the capabilities of a POSITA as it would have only required minor modifications to the programing of the microprocessor in the CMTS. Ex. 1102, ¶194. And a POSITA would have a reasonable expectation of success in these programming modifications as Thibeault-Saey-Monk/Thibeault-Gross-Monk/Thibeault-Cioffi-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. Ex. 1102, ¶194; Ex. 1110, [0013], [0037], [0039]; Ex. 1116, 5:3-14, 7:6-22.

Accordingly, Thibeault-Saey or Thibeault-Gross or Thibeault-Cioffi each in view of Monk and Cooper437 teach claim 9. Ex. 1102, ¶195.

2. Dependent Claim 18

Claim 18 is substantially similar to claim 9. Ex. 1102, ¶196. Thibeault-Saey-Monk-Cooper437, Thibeault-Gross-Monk-Cooper437, and Thibeault-Cioffi-Monk-Cooper437 teach the additional limitations in claim 18 for the same reasons discussed above in Section VI.F.1. Accordingly, claim 18 is invalid as obvious over Thibeault-Saey-Monk-Cooper437, Thibeault-Gross-Monk-Cooper437, and Thibeault-Cioffi-Monk-Cooper437. Ex. 1102, ¶196.

VII. GROUNDS FOR STANDING & FEE PAYMENT

Petitioner hereby certifies that the '682 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: February 15, 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 12,284, which is less than the 14,000 allowed under 37 CFR § 42.24(a)(1)(i). This total includes 12,284 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.

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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. 10,135,682 and supporting evidence to be served via FedEx Priority Overnight on February 15, 2024, on the following:

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CLAIM LISTING APPENDIX

U.S. Pat. No. 10,135,682

Designation	Claim Language
Claim 1	
[1A]	1. A method comprising:
[1B]	determining, by a cable modem termination system (CMTS), for each cable modem served by said CMTS, a corresponding signal-to-noise ratio (SNR) related metric;
[1C]	assigning, by said CMTS, each cable modem among a plurality of service groups based on a respective corresponding SNR-related metric;
[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 SNR-related metrics corresponding to said one of said plurality of service groups;
[1E]	selecting, by said CMTS, one or more physical layer communication parameter 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 one or more cable modems corresponding to said one of said plurality of service groups using said selected one or more physical layer communication parameter.
Claim 2	
2	2. The method of claim 1, wherein said one or more physical layer communication parameter includes 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	
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 one or more physical layer communication parameter on a per-OFDM-subcarrier basis.

Designation	Claim Language
Claim 5	
5	5. The method of claim 4, wherein said one or more physical layer communication parameter includes 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 particular cable modem has a particular SNR versus frequency profile; and
[6B]	said assigning said each cable modem among said plurality of service groups comprises, for the particular cable modem: assigning said particular 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 particular 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 cable modems among said plurality of service groups based on respective distances between said CMTS and said cable modems.
Claim 8	
8	8. The method of claim 1, comprising assigning any particular one of said 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	

Designation	Claim Language
[9A]	9. The method of claim 1, wherein said determining said plurality of SNR-related metrics comprises:
[9B]	transmitting a probe message to each cable modem, 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 cable modem.
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 each cable modem served by said CMTS, a corresponding signal-to-noise ratio (SNR) related metric;
[10C]	said processor is configured to assign each of said cable modems among a plurality of service groups based on a respective corresponding SNR-related metric;
[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 SNR-related metrics corresponding to said one of said plurality of service groups;
[10E]	said processor is configured to select one or more physical layer communication parameter 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 one or more cable modems corresponding to said one of said plurality of service groups using the one or more selected physical layer communication parameter.
Claim 11	
11	11. The system of claim 10, wherein said one or more physical layer communication parameter includes 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	

Designation	Claim Language
12	12. The system of claim 10, wherein said network interface and said 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 at least one of said one or more physical layer communication parameters are configurable on a per-OFDM-subcarrier basis.
Claim 14	
14	14. The system of claim 12, wherein said one or more physical layer communication parameter includes 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 composite SNR versus frequency profile, and a particular cable modem has a particular SNR versus frequency profile;
[15B]	said assignment of said each cable modem among said plurality of service groups comprises, for the particular cable modem: assignment of said particular 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 particular 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 cable modems among said plurality of service groups based on respective distances between said CMTS and said cable modems.

Designation	Claim Language
Claim 17	
17	17. The system of claim 10, wherein said processor is configured to assign each of said cable modems among said plurality of service groups based on one or more branch amplifier that serves said each of said 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 cable modem, 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 cable modem.