

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.: IPR2024-00444

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

Petition 1 of 2

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Ex. 1004:	Certified Prosecution History of the ’682 patent
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Ex. 1007:	U.S. Pub. No. 2005/0111535 (“Saey”)
Ex. 1008:	U.S. Pub. No. 2004/0085987 (“Gross”)
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Ex. 1011:	U.S. Pub. No. 2012/0269242 (“Prodan”)
Ex. 1012:	U.S. Patent No. 10,084,538 (“Nielsen”)
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Ex. 1014:	U.S. Patent No. 6,952,454 (“Jalali”)
Ex. 1015:	U.S. Patent No. 7,573,822 (“Monk”)
Ex. 1016:	U.S. Patent No. 6,772,437 (“Cooper437”)
Ex. 1017:	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. 1018:	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. 1019: 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. 1020: U.S. Pub. No. 2010/0061235 (“Pai”)
- Ex. 1021: Data-Over-Cable Interface Specifications, Radio Frequency Interface Specification, SP-RFII01-970326
- Ex. 1022: Data-Over-Cable Service Interface Specifications, DOCSIS 1.1, Radio Frequency Interface Specification, CM-SP-RFIV1.1-C01-050907
- Ex. 1023: Data-Over-Cable Service Interface Specifications, DOCSIS 2.0, Radio Frequency Interface Specification, CM-SP-RFIV2.0-C02-090422
- Ex. 1024: U.S. Pub. No. 2007/0171994 (“Parker”)
- Ex. 1025: U.S. Patent No. 8,503,546 (“Ashrafi”)
- Ex. 1026: Tanenbaum, “Computer Networks,” 4th ed. (2003)
- Ex. 1027: 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. 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 first 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 of claims 1-18 of U.S. Patent No. 10,135,682 (“the ’682 patent”) (Ex. 1001).

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.

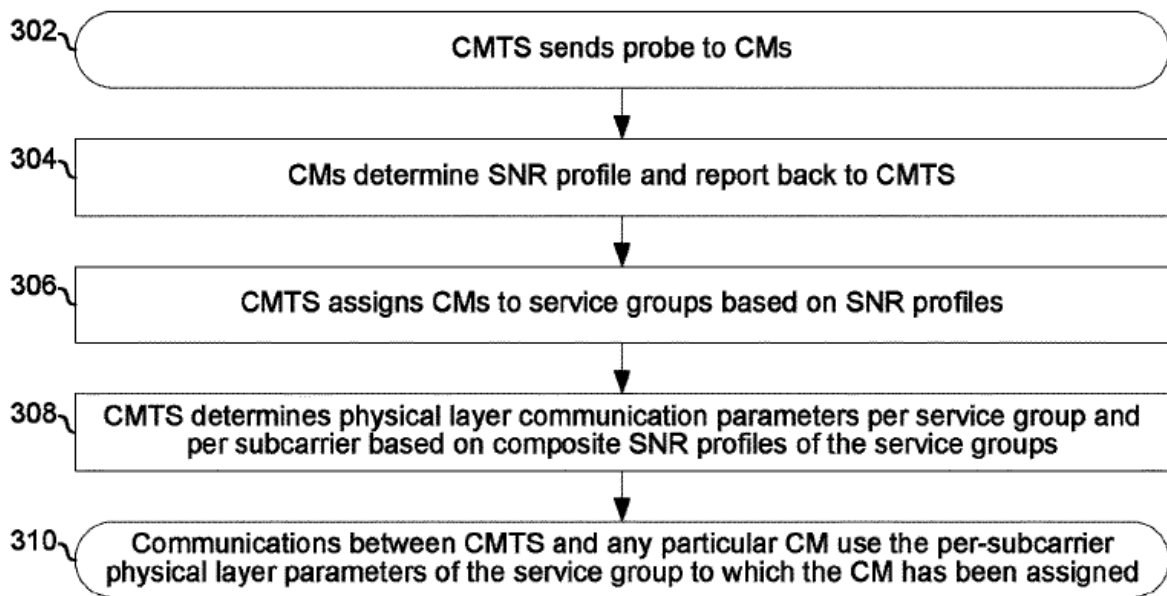
However, the Examiner was mistaken, and all of the ’682 patent claims are rendered obvious by prior art that was not considered by the Examiner, including references disclosing determining a worst-case SNR for a group of modems and using the worst-case SNR to determine a communication parameter (*e.g.*, Exs. 1007-1008).

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. 1001, 1:50-52; Ex. 1002, ¶¶45-47. An exemplary process for grouping CMs is shown in Figure 3A below.



Ex. 1001, Fig. 3A

As illustrated, a CMTS determines an SNR profile for each CM. *Id.*, 4:25-30, 5:34-37. The CMTS then assigns the CMs to groups based on the SNR profiles. *Id.*, Abstract, 4:52-56, 5:37-39, 6:46-7:6. A composite SNR profile for each service group is used to determine a physical layer communication parameter used for communication between the CMTS and CMs. *Id.*, 4:40-56, 5:40-50, Abstract. Physical layer communication parameters include modulation order. *Id.*, 4:56-67.

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. 1004, 8-37, 52-54. Along with a nonstatutory double patenting rejection (*Id.*, 61-89), the Examiner 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). Ex. 1002, ¶¶48-51. As set forth herein, the Examiner was mistaken.

C. Earliest Priority Date

The earliest possible priority date for the '682 patent claims is July 23, 2012, the filing date of U.S. Provisional Application No. 61/674,742. Ex. 1002, ¶52. Each of the references relied on herein is prior art to that date.

IV. PRIOR ART

Reference	Priority Date	Pre-AIA Basis	Discussion in Expert's Declaration
Cooper	9/27/2007 (published)	§102(b)	¶¶60-62
Saey	5/26/2005 (published)	§102(b)	¶¶63-65
Gross	5/6/2004 (published)	§102(b)	¶¶66-67
Monk	8/11/2009 (issued)	§102(b)	¶¶74-75
Prodan	12/30/2011 (filed)	§102(e)	¶¶68-69
Cooper437	8/3/2005 (issued)	§102(b)	¶¶76-78
Jalali	10/4/2005 (issued)	§102(b)	¶¶70-73
Pai	3/11/2010 (issued)	§102(b)	¶¶79-80

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

A. Grounds on Which Claims are Challenged

Petitioner requests review of claims 1-18 on the following grounds, based on §103.

Grounds	References	Claims Challenged
A	Cooper-Saey	1-2, 7-8, 10-11, 16-17
B	Cooper-Gross	1-2, 7-8, 10-11, 16-17
C-D	Cooper-Saey-Monk and Cooper-Gross-Monk	1-8, 10-17

E-F	Cooper-Saey-Monk-Cooper ⁴³⁷ and Cooper-Gross-Monk-Cooper ⁴³⁷	9, 18
G	Prodan-Saey	1-2, 6
H	Prodan-Gross	1-2, 6
I-J	Prodan-Saey-Jalali and Prodan-Gross-Jalali	3-5
K-L	Prodan-Saey-Cooper and Prodan-Gross-Cooper	7-8
M-N	Prodan-Saey-Monk-Cooper ⁴³⁷ and Prodan-Gross-Monk-Cooper ⁴³⁷	9
O-P	Prodan-Saey-Pai and Prodan-Gross-Pai	10-11, 15
Q-R	Prodan-Saey-Pai-Jalali and Prodan-Gross-Pai-Jalali	12-14
S-T	Prodan-Saey-Pai-Cooper and Prodan-Gross-Pai-Cooper	16-17
U-V	Prodan-Saey-Pai-Monk-Cooper ⁴³⁷ and Prodan-Gross-Pai-Monk-Cooper ⁴³⁷	18

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 at least Cooper, Saey, and Gross. While Prodan was considered,

the Prodan-Saey and Prodan-Gross combinations were not considered, and Saey and Gross both include the worst-case SNR profile limitation the Examiner found missing from the prior art. Ex. 1004, 85. Cooper, Saey, and Gross 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. 1002, ¶¶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 *Id.*,

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

VI. SPECIFIC GROUNDS FOR UNPATENTABILITY

A. Ground A: Claims 1-2, 7-8, 10-11, and 16-17 are Rendered Obvious by Cooper-Saey

1. Independent Claims 1 and 10

The obviousness of claim 1 is described below. Claim 10 is a counterpart system claim and is rendered obvious for the same reasons as for claim 1 and as further described below. Ex. 1002, ¶¶81-132.

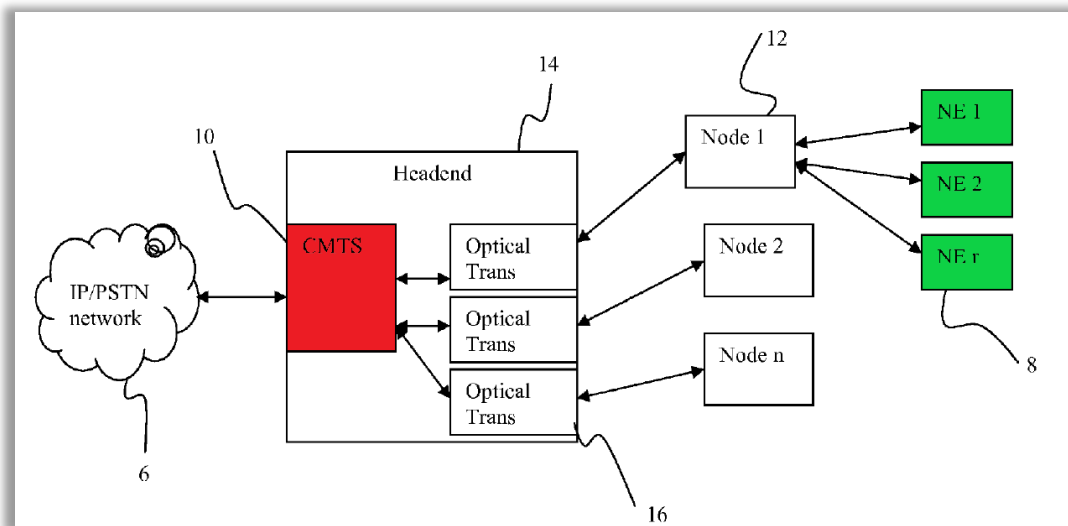
¹ With regard to the term “signal-to-noise (SNR) related metric,” the ’682 patent uses this limitation as at least including SNR (*see* Ex. 1001, 3:54-63), but Petitioner reserves the right to argue in other proceedings that the outer bounds of this term are unclear.

a. [1A]

To the extent the preamble [1A]² is limiting, Cooper discloses it. Specifically, Cooper discloses a method for configuring logical channels in a network. *Id.*, ¶81; Ex. 1005, Abstract, [0002], [0005]-[0008], [0017], [0030]-[0031].

b. [1B]

Cooper discloses [1B]. Ex. 1002, ¶¶82-86. As illustrated in Figure 1, Cooper discloses a network in which multiple network elements 8 (**green**), which include CMs connected to CMTS 10 (**red**) via nodes 12. Ex. 1005, [0022], Fig. 1.

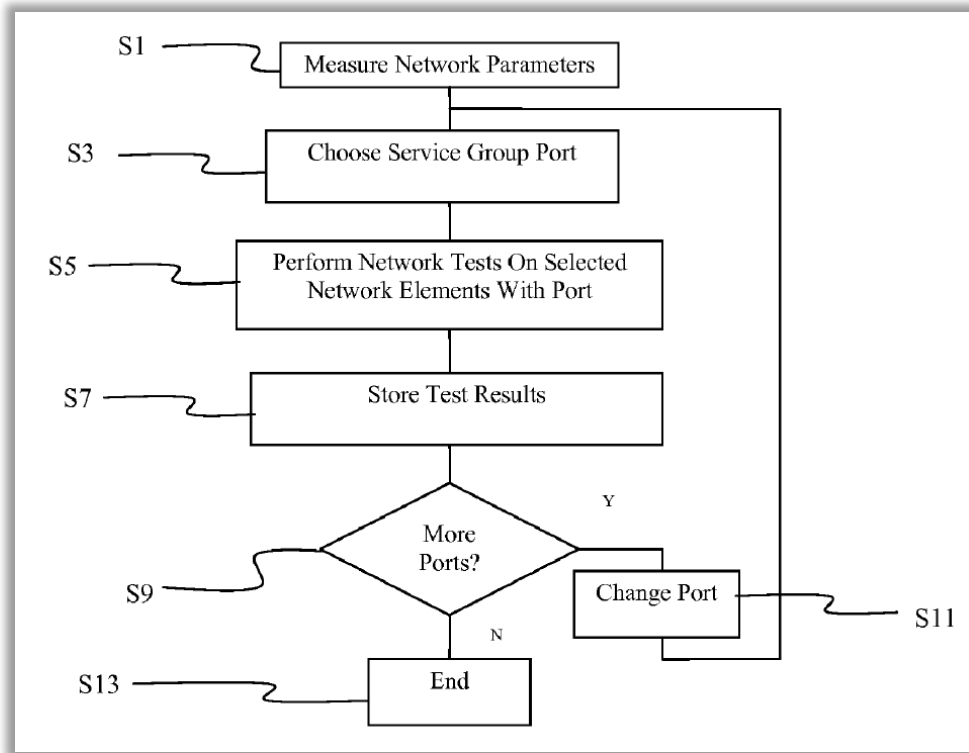


Ex. 1005, Fig. 1 (annotated)

CMTS 10 resides at headend 14, which includes transceivers that communicate with the network elements by receiving upstream communications

² Claim limitations are labelled in the Claims Listing Appendix.

from the network elements and sending (*i.e.*, serving) downstream communications to the network elements (claimed “each cable modem served by said CMTS”). *Id.*, [0003], [0022]-[0025]; Ex. 1002, ¶¶82-83. Cooper optimizes network communications based on certain network parameter measurements, which can be performed at the CMTS or each CM. Ex. 1005, [0008], [0011]; Ex. 1002, ¶84. For example, referring to Figure 4 below, Cooper discloses the CMTS initiating the measurement process (S1), which begins by choosing a “service group port” (*e.g.*, a transceiver at the headend) (S3), and performing tests on the selected port (S5). Ex. 1005, [0016], [0022]-[0023], [0026]-[0027], [0029], Fig. 4; Ex. 1002, ¶84. This testing involves the CMTS determining network parameters of the CMs connected to the selected port. Ex. 1005, [0026]-[0028].



Ex. 1005, Fig. 4

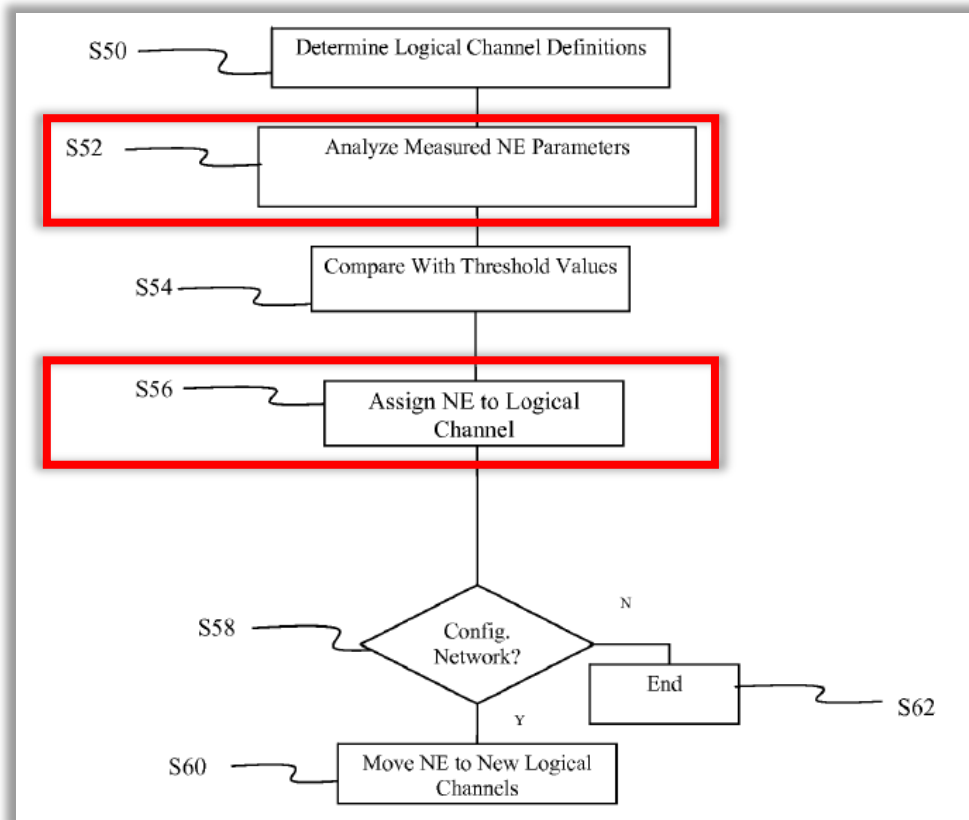
Specifically, such testing includes determining “upstream or downstream signal to noise ratio (SNR).” *Id.*, [0007], [0027]; Ex. 1002, ¶85. Cooper thus discloses a CMTS determining the SNR for each CM served by the CMTS. Ex. 1002, ¶¶85-86.

c. [1C]

Cooper discloses [1C]. *Id.*, ¶¶87-96. After determining the SNR of the CMs, Cooper’s CMTS assigns them to logical channels based on based on a comparison with SNR thresholds, with the goal of leveraging grouping benefits in order to, in part, increase overall network through-put by optimizing physical layer

configuration parameters to each CM grouping. *Id.*, ¶¶87-89; Ex. 1005, [0002], [0007]-[0010], [0019], [0026]-[0027], [0030]-[0033], [0039]-[0040], [0043].

Specifically, as shown below in Figure 5, Cooper analyzes the parameters measured for each CM and then assigns them to logical channels based on a comparison between their measured parameters and respective thresholds, which are predetermined or dynamically determined. Ex. 1005, [0008], [0030], Fig. 5; Ex. 1002, ¶90.



Ex. 1005, Fig. 5 (annotated)

For example, Figure 6 (which corresponds to Figure 3³ below) includes a list of **modems** identified by MAC address, a list of corresponding **SNR measurements**, and a list of three **SNR thresholds** used to delineate four **logical channels** numbered 0-3. Ex. 1006, 11 (Figure 3); Ex. 1005, [0032]-[0033], [0041], Fig. 6.

³ Figure 3 in U.S. Provisional Patent Application No. 60/785,647, which Cooper incorporates by reference, is a higher-quality version of Cooper's Figure 6.

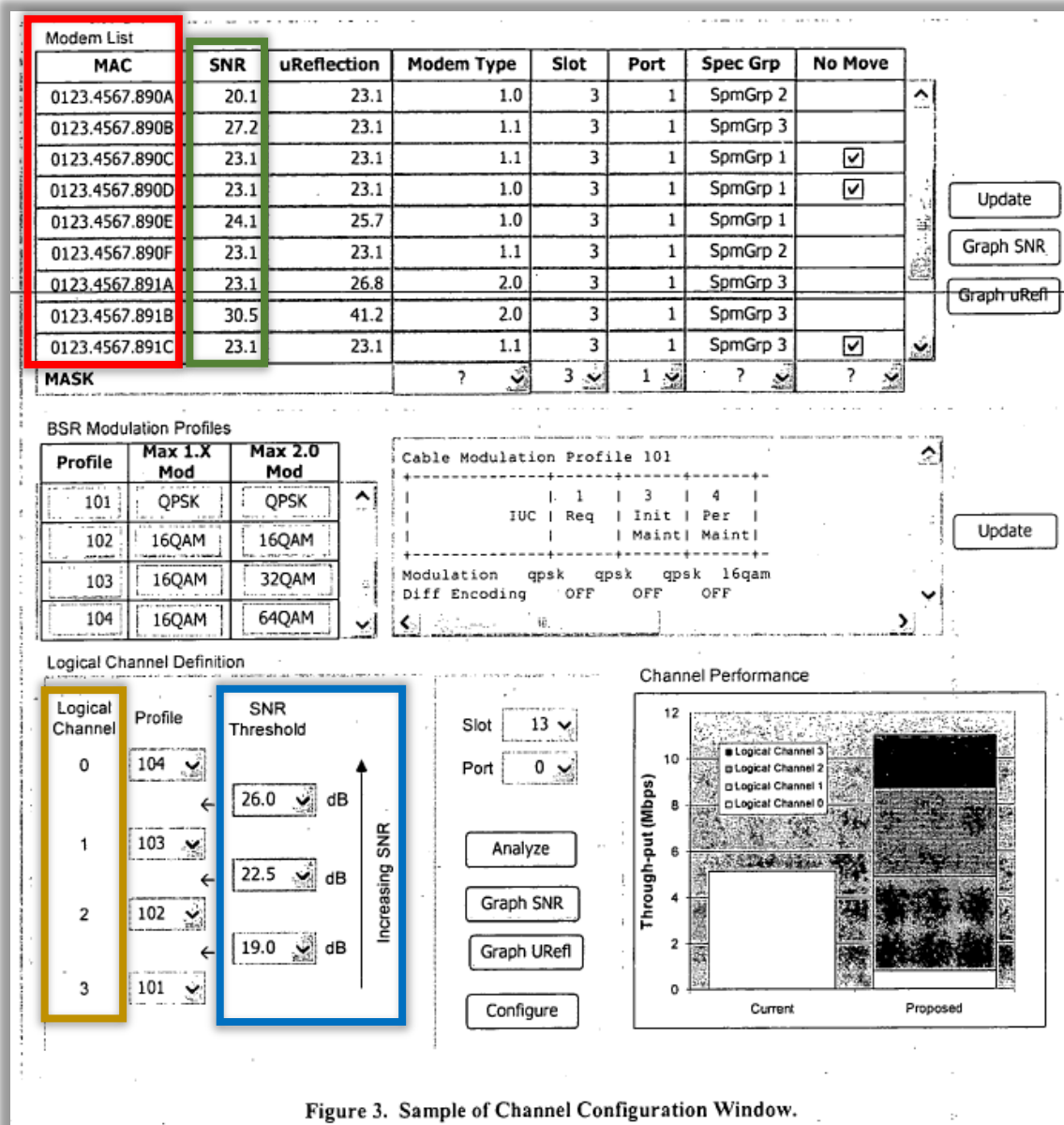
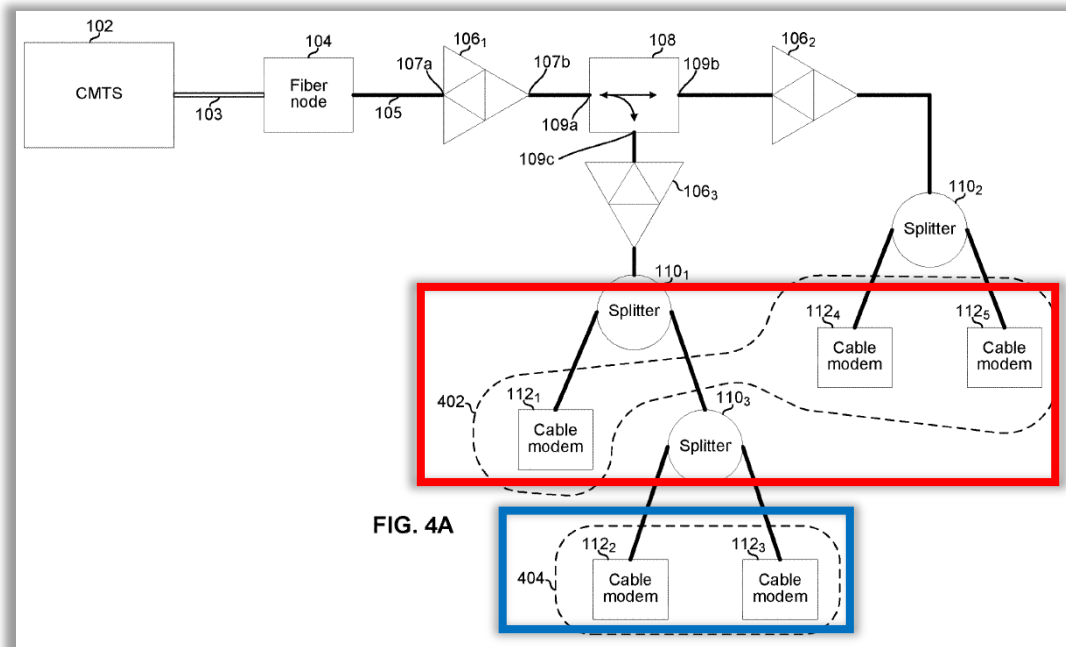


Figure 3. Sample of Channel Configuration Window.

Ex. 1006, 11 (annotated); *see also* Ex. 1005, Fig. 6

As illustrated, Cooper's process of assigning each CM to a logical channel (*i.e.*, one of channels "0", "1", "2" and "3") is based on comparing its respective SNR measurement to SNR thresholds. Ex. 1006, 11; Ex. 1005, [0030]-[0033], Fig. 6; Ex. 1002, ¶¶91-92. Each group of CMs in a logical channel is a claimed "service group", and there are a plurality of such groups in Cooper. Ex. 1002, ¶93. This is

consistent with term's plain meaning and the '682 patent's disclosure. *Id.*, ¶¶94. 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. *Id.*, ¶¶93-94; Ex. 1001, 2:24-27, 5:37-39, 6:42-61, Figs. 3A, 4A.



Ex. 1001, Fig. 4A (service group 402 includes **CMs 112₁, 112₄, 112₅**; service group 404 includes **CMs 112₂, 112₃**) (annotated)

In sum, the assignment by Cooper's CMTS (claimed "assigning, by said CMTS,") of each CM (claimed "each cable modem") to a particular logical channel based on its SNR measurement (claimed "based on a respective corresponding SNR-related metric") results in CMs that are grouped by logical channel (claimed "assigning ... among a plurality of service groups"). Ex. 1002, ¶¶95-96.

d. [1D]

Cooper-Saey discloses [1D]. *Id.*, ¶¶97-110. As shown for [1C], Cooper 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. Although Cooper 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. 1002, ¶97.

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. 1007, Abstract, [0009]-[0014]. For example, Saey discloses analyzing the SNR for individual carriers and determining a carrier group based on this analysis. *Id.*, [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. *Id.*, [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. 1002, ¶¶109-110; Ex. 1001, 4:3-67, 5:7-20; Ex. 1017, 53-55; Ex. 1018, 187; Ex. 1019, 8-10.

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 modems associated with the carrier group. *Id.*, [0004], [0027], [0033], [0043], Figs. 3, 5-6; Ex. 1002, ¶98. A POSITA would have recognized that bit loading “is applied to increase the modulation order at carriers with high [SNR] and lower the modulation order at carriers with low [SNR].” Ex. 1015, 4:55-59, 8:1-19; Ex. 1002, ¶99. For example, a carrier’s SNR impacts the bit loading of the carrier, and thus the carrier’s modulation order (*e.g.*, 4 bits-per-symbol (bps) for 16QAM, 5 bps for 32QAM). Ex. 1015, 4:55-59, 8:1-19, 9:9-11, 10:55-67, Fig. 10; Ex. 1012, 14:54-16:34; Ex. 1002, ¶99; §VI.A.1.e. Saey’s method of grouping carriers and determining a single parameter for the group allows the system to take advantage of similarity between different carriers communicating with CMs, which conserves system resources (*e.g.*, memory, transmission costs) while ensuring communication with all CMs within a group. Ex. 1007, [0014], [0027]; Ex. 1002, ¶99.

A POSITA would have found it obvious to apply Saey’s teaching of determining the worst-case SNR of the carriers for each CM group to Cooper’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. 1007, [0014], [0027]; Ex. 1002, ¶100. As shown below, Cooper's channel configuration screen includes a **Modulation Profile** display panel that allows the configuration of profile templates that may be assigned to an individual logical channel, thereby optimizing the specific needs of a subset of the CMs. Ex. 1005, [0036], Fig. 6; Ex. 1002, ¶101.

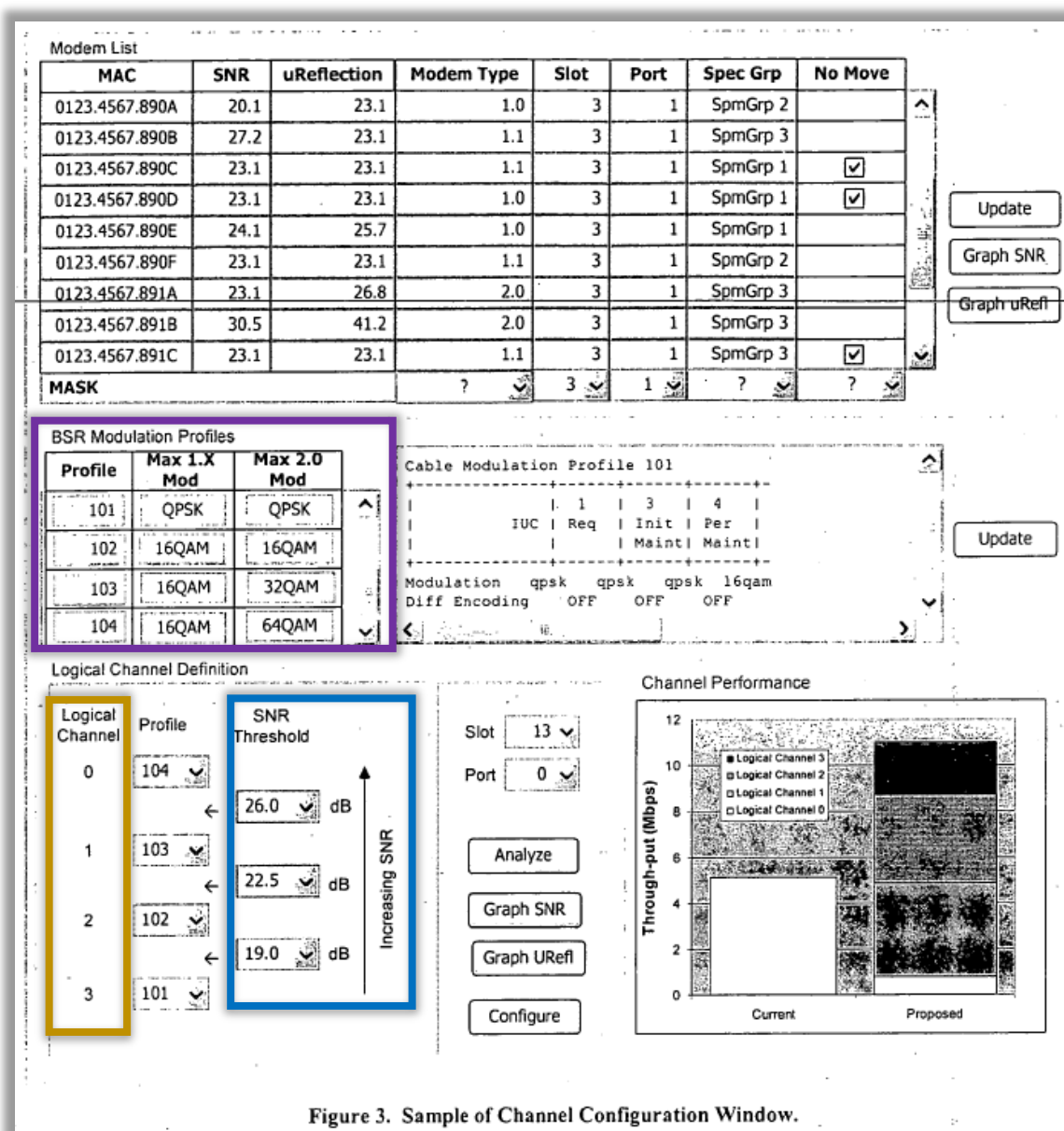


Figure 3. Sample of Channel Configuration Window.

Ex. 1006, Fig. 3 (annotated); Ex. 1005, Fig. 6

For example, Figure 6 shows that **logical channel** “1”, which is defined by **SNR thresholds**, is assigned profile “103” that specifies a maximum **modulation** of “16QAM” for 1.x CMs and a maximum modulation of “32QAM” for 2.0 CMs. Ex. 1006, 11-12; Ex. 1005, [0036], Fig. 6; Ex. 1002, ¶102. Applying Saey’s teaching of generating a worst-case SNR-profile for a carrier group to beneficially determine group physical layer communication parameters to Cooper’s method of configuring Modulation Profiles for CM groups that were grouped by SNR would further Cooper’s goals of “optimizing the performance of [Cooper’s] network” and “optimizing physical layer configuration parameters” for CM groups. Ex. 1005, [0011], [0019], [0039]; Ex. 1007, [0004], [0027], [0033], [0043], Figs. 3, 5-6; Ex. 1002, ¶103. Specifically, a POSITA would have appreciated that selecting a modulation order (*e.g.*, 16QAM/32QAM/64QAM) for a Modulation Profile 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 and conserving resources as described above. Ex. 1002, ¶¶103-104.

It also would have been obvious to apply Saey’s teaching of determining the worst-case SNR for each CM group in order to implement Cooper’s dynamic SNR thresholds for assigning CMs to a logical channel. Ex. 1002, ¶105; Ex. 1005, [0030]. Because “SNR parameters will vary over time” (Ex. 1005, [0040]), Cooper’s CMTS periodically reconfigures its logical channels, including measuring parameters such

as SNR for its CMs, assigning CMs to the logical channels, and setting SNR thresholds used to delineate the channels. *Id.*, [0026]-[0027], [0030], [0033], [0039]-[0040], [0043], Fig. 6. 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 Cooper's dynamic SNR threshold to address variance in a channel's SNR. *Id.*, [0010], [0013]-[0014], [0025]-[0027], [0032], [0042]-[0043]; Ex. 1002, ¶105.

Such a combination also would have been obvious because it would have merely been a combination of prior art elements (Cooper's CMTS that applies modulation order parameters to CMs that are grouped based on a comparison of their 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. 1002, ¶106. Applying Saey's teachings to Cooper's CMTS would have been well within the capabilities of a POSITA because it would have involved only minor modifications to the programming of Cooper's CMTS. *Id.*, ¶¶107-108; Ex. 1005, [0042]; Ex. 1007, [0023].

e. [1E]

As shown for [1D], Cooper-Saey's CMTS generates a composite SNR for each logical channel based on the worst-case SNR of a CM assigned to that channel. §VI.A.1.d; Ex. 1002, ¶113. This composite SNR is beneficially used by Cooper-Saey's CMTS to select an optimal modulation order for communicating with the modems assigned to each logical channel (claimed "plurality of service groups") and to dynamically adjust the SNR thresholds that define those channels. §VI.A.1.d, *supra*; Ex. 1002, ¶¶117-118. The modulation order (*e.g.*, 16QAM/32QAM/64QAM) selected by Cooper-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. 1002, ¶¶111-112.

Cooper-Saey therefore teaches [1E]. Ex. 1002, ¶¶111-120.

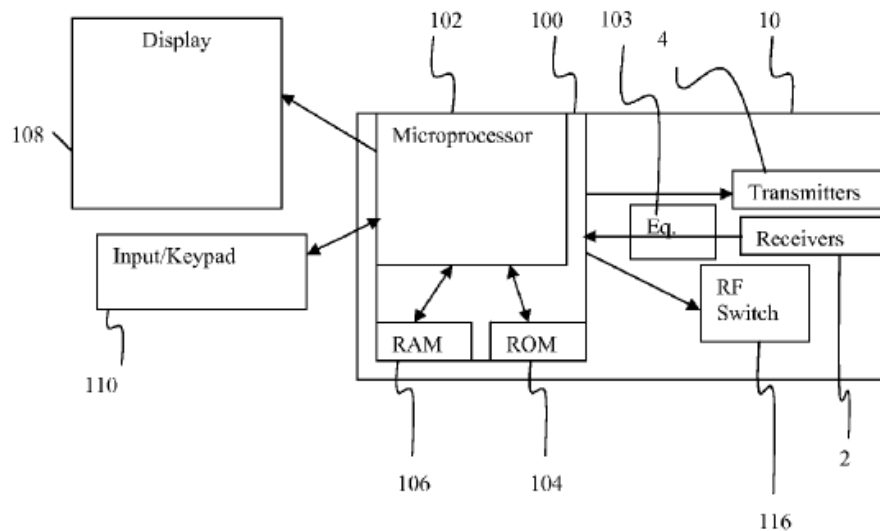
f. [1F]

Cooper-Saey teaches [1F]. *Id.*, ¶¶121-122. As shown for [1D]-[1E], Cooper-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. §§VI.A.1.d-e. Cooper-Saey's CMTS uses the selected modulation orders to communicate with the connected CMs in each respective logical channel. Ex. 1005, [0019], [0030]; Ex. 1002, ¶¶121-122.

Cooper-Saey therefore renders claim 1 obvious.

g. [10A]

Cooper's "network" described in [1B] discloses a "system" as recited in [10A]. Ex. 1005, [0022], Figs. 1-2; Ex. 1002, ¶¶130-131. Referring to Figure 2 below, CMTS 10 comprises circuitry that includes: (i) microprocessor 102 (claimed "circuitry ... comprising a ... processor") that receives instructions and data from ROM 104/RAM 106, and (ii) transmitters 4 and receivers 2 (claimed "circuitry ... comprising a network interface") that provide bi-directional communication with network elements 8. *Id.*



Ex. 1005, Fig. 2

h. [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. 1002, ¶132. Cooper-Saey teaches that microprocessor 102

in CMTS 10 is configured to perform the limitations described in [1B]-[1E]. *Id.*; §VI.A.1.b-e; Ex. 1005, [0022]-[0023], Figs. 1-2. Accordingly, for the reasons set forth in [1B]-[1E], Cooper-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 described in [1F]. Ex. 1002, ¶133. Cooper-Saey teaches that transmitters 4/receivers 2 (claimed "network interface") provide bi-directional communication with network elements 8. Ex. 1005, [0022]-[0023], Fig. 2. Accordingly, as explained in [1F], Cooper-Saey comprises a network interface configured to perform the limitations recited in [10F]. *Id.*; §VI.A.1.f.

Cooper-Saey therefore renders claim 10 obvious.

2. Dependent Claims 2 and 11

Claim 2 depends from claim 1.

As shown for [1E], Cooper-Saey's CMTS selects a modulation order (*e.g.*, 16QAM/32QAM/64QAM) based on a composite SNR for its logical channels. §VI.A.1.e.

Accordingly, Cooper-Saey teaches the additional limitations of claim 2. Ex. 1002, ¶123. Claim 11 is substantially similar to claim 2, and is therefore rendered obvious for the same reasons. *Id.*, ¶134.

3. Dependent Claims 7-8 and 16-17

Claims 7 and 8 depend from claim 1.

As described for [1C], Cooper's CMTS assigns CMs to logical channels (claimed "plurality of service groups") based on a comparison between the determined SNR for each CM and SNR thresholds. §VI.A.1.c. The CMTS also determines the location of CMs in a cable network and assigns the CMs to service groups based at least in part on the location of the CM (claimed "assigning said cable modems among said plurality of service groups based on respective distances between said CMTS and said cable modems"). Ex. 1005, Abstract, [0008], [0021], [0027]-[0028], [0037]; Ex. 1002, ¶125; §VI.A.1.c. Cooper further discloses assigning CMs based at least in part on amplifier cascade depth (claimed "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"). *Id.*

Accordingly, Cooper-Saey teaches the additional limitations of claims 7-8. Ex. 1002, ¶¶124-129. Claims 16-17 are substantially similar to claims 7-8, respectively, except that they identify "said processor" to make the assignments. Ex. 1001, 10:30-37. As discussed in Section VI.A.g, Cooper's CMTS comprises the claimed processor, and therefore, claims 16-17 are rendered obvious for the same reasons discussed in this section. *Id.*, ¶135.

B. Ground B: Claims 1-2, 7-8, 10-11, and 16-17 are Rendered Obvious by Cooper-Gross

1. Independent Claims 1 and 10

a. [1A]-[1C]/[10A]-[10C]

For the reasons described in Sections VI.A.1.a-c and VI.A.1.g-h, Cooper discloses [1A]-[1C] and [10A]-[10C]. Ex. 1002, ¶136.

b. [1D]/[10D]

As discussed in Section VI.A.1.c, Cooper discloses assigning CMs to logical channels based on a comparison between the determined SNR for each CM and SNR thresholds. Although Cooper 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. *Id.*, ¶¶137-144.

Gross teaches a method of setting communication parameters in a communication system between modems that ensures efficient transmission of data despite interruptions/disturbances in the network. Ex. 1008, Abstract, [0022], [0027]. For example, Gross teaches setting bit allocation (a communication parameter) based on a measured carrier’s SNR. *Id.*, [0014]-[0015], [0032], [0043], [0088]. Bit allocation is the number of bits that a carrier can accommodate and depends on SNR. *Id.* A POSITA would have recognized this as bit loading, which is a method of allocating a higher order modulation to carriers that have higher SNR and a lower order modulation to carriers that have lower SNR. Ex. 1015, 8:1-19,

4:55-59; Ex. 1002, ¶138. A carrier's SNR affects its bit loading, and thus, its modulation order (*e.g.*, 4 bps for 16QAM, 5 bps for 32QAM). Ex. 1015, 4:55-59, 8:1-19, 9:9-11, 10:55-67, Fig. 10; Ex. 1012, 14:54-16:34; Ex. 1002, ¶138; §VI.B.1.c.

Gross sets communication parameters for each carrier, but also teaches a simplified approach that uses single, composite parameters to represent the “worst case” condition for communicating with a group of modems. Ex. 1008, [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”/minimum bit allocation to communicate with any of the modems. *Id.*; Ex. 1002, ¶¶138-139. This simplified approach ensures transmission of data to any modem in the group regardless of which modems are activated. Ex. 1008, [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 Cooper's selection of the optimal modulation order of a logical channel to create a system wherein the worst-case SNR for a CM in a logical channel is used to determine the modulation order for that channel. Similar to the discussion in Section VI.A.1.d, Cooper optimizes Modulation Profiles, and a POSITA would have appreciated that selecting a modulation order (*e.g.*, 16QAM/32QAM/64QAM) for a Modulation Profile based on the worst-case SNR of a CM group, as taught by Gross, would have ensured

communication with all CMs in the group regardless of which modems are activated. Ex. 1002, ¶140; Ex. 1005, [0011], [0019], [0036], [0039], Fig. 6; Ex. 1008, [0044], [0100].

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 Cooper's dynamic thresholds. Ex. 1002, ¶141; Ex. 1005, [0030]. As further discussed in Section VI.A.1.d, Cooper acknowledges that SNR parameters will vary over time, requiring periodically reconfiguring its logical channels, including measuring parameters such as SNR for its CMs, assigning CMs to the logical channels, and setting SNR thresholds used to delineate the logical channels. Ex. 1005, [0026]-[0027], [0030], [0033], [0037], [0039]-[0040], [0043]. 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 Cooper's dynamic SNR threshold to address variance in a channel's SNR. Ex. 1002, ¶141.

Such a combination also would have been obvious because it simply combines prior art elements (Cooper's CMTS that applies modulation order parameters to CMs that are grouped based on a comparison of their SNR characteristics and SNR thresholds, and Gross's method of determining and applying a worst-case SNR-based parameter for a group of modems also grouped based on their individual SNRs) 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). *Id.*, ¶142. Applying Gross’s teachings to Cooper’s CMTS would have been well within the capabilities of a POSITA because it would have involved only minor modifications to the programming of Cooper’s CMTS, leading to an expectation of success. *Id.*, ¶143; Ex. 1005, [0042]; Ex. 1007, [0023]. Accordingly, Cooper-Gross 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. 1002, ¶¶142-143; Ex. 1001, 4:3-67, 5:7-20; Ex. 1017, 53-55; Ex. 1018, 187; Ex. 1019, 8-10.

c. [1E]-[1F]/[10E]-[10F]

For reasons similar to those described for Cooper-Saey, Cooper-Gross teaches [1E]-[1F]/[10E]-[10F]. In particular, Cooper-Gross’s CMTS would have similarly selected and used 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, based on the further teachings of Cooper. Ex. 1005, [0019], [0030]; Ex. 1002, ¶145; §§VI.A.1.e-f, VI.A.1.h.

Cooper-Gross's CMTS also would have communicated with the CMs connected to it using the selected modulation orders. Ex. 1002, ¶145; §§VI.A.1.f, VI.A.1.h.

Cooper-Gross therefore teaches [1E]-[1F]/[10E]-[10F] and renders claims 1 and 10 obvious. Ex. 1002, ¶145.

2. Dependent Claims 2 and 11

For reasons similar to those described for Cooper-Saey, Cooper-Gross teaches dependent claims 2/11. §VI.A.2. In particular, Cooper-Gross's CMTS selects a modulation order (*e.g.*, 16QAM/32QAM/64QAM) based on a composite SNR for its logical channels. §VI.B.1.c.

Accordingly, Cooper-Gross teaches the additional limitations of claims 2/11 and renders them obvious. Ex. 1002, ¶146.

3. Dependent Claims 7-8 and 16-17

Cooper-Gross teaches dependent claims 7/16 and 8/17 based on the additional teachings of Cooper as set forth in Section VI.A.3. Cooper's teachings of the additional elements of these claims applies to Cooper-Gross for the same reasons they apply to Cooper-Saey. In particular, with regard to claims 7/16, Cooper-Gross teaches a CMTS comprising a processor configured to assign CMs among a plurality of service groups based at least in part on distances between the CMTS and CMs. Ex. 1005, Abstract, [0008], [0021], [0027]-[0028], [0037]; Ex. 1002, ¶147; §VI.A.3.

In addition, with regard to claims 8/17, Cooper-Gross teaches a CMTS comprising a processor configured to assign a CM to a service group based at least in part on which of a plurality of branch amplifiers is upstream of the CM. *Id.*

Accordingly, Cooper-Gross renders claims 7-8 and 16-17 obvious.

C. Grounds C-D: Claims 1-8 and 10-17 are Rendered Obvious by Cooper-Saey and Cooper-Gross, each in view of Monk

1. Claims 1-2, 6-8, 10-11, and 15-17

As described in Sections VI.A.1.e, VI.A.1.h, and VI.B.1.c, Cooper-Saey and Cooper-Gross teach [1E]/[10E] by teaching a CMTS selecting a network communication parameter (*e.g.*, modulation order) for a group of modems based on a worst-case SNR metric for a service group of modems.

If it is asserted that Cooper-Saey or Cooper-Gross do not teach [1E]/[10E] because a POSITA would not have applied Saey's teachings of using a composite bit loading parameter or Gross's teachings of using a composite bit allocation parameter in the proposed combinations to yield the use of a modulation order parameter in Cooper-Saey and Cooper-Gross, Monk further teaches that bit loading and bit allocation are used to select modulation order. Ex. 1002, ¶¶148-153; §§VI.A.1.e, VI.B.1.c.

Monk discloses different methods of multi-carrier communication that address signal impairments that restrict high bandwidth communication with CMs. Ex. 1015, Abstract, 1:29-31, 4:25-43. One such method is bit loading, which

includes allocating more bits per carrier and “is applied to increase the modulation order at carriers with high [SNR] and lower the modulation order at carriers with low [SNR].” *Id.*, 4:55-59, 8:1-19, 9:9-11, 10:55-67, Fig. 10. For example, carriers with higher SNRs can support higher order modulations, while carriers with lower SNRs use lower order modulations. *Id.*; Ex. 1002, ¶149. Monk discloses that selecting the appropriate modulation order based on the SNR helps overcome problems, e.g., of multipath and high attenuation in building cable wiring while maximizing a carrier’s data capacity. Ex. 1015, 4:38-59, 8:1-19, 10:57-64; Ex. 1002, ¶149.

A POSITA would have found it obvious to apply Monk’s teachings to Cooper-Saey’s/Cooper-Gross’s method of using a composite SNR to select a physical layer communication parameter by selecting a modulation order (as an application of bit loading/allocation), which would better maximize data capacity and ensure communication with all modems in the group while also optimizing the network, in light of common problems of multipath and high attenuation in building cable wiring. Ex. 1015, 4:38-43, 4:55-59, 8:1-19, 10:57-64; Ex. 1002, ¶150.

Such combinations also would have been obvious because they would have been nothing more than combining prior art elements (Cooper-Saey’s/Cooper-Gross’s CMTS that selects physical layer communication parameters based on a worst-case composite SNR and Monk’s method of selecting a modulation order

based on an SNR) according to known methods (programming of a CMTS) to yield predictable results (a CMTS that selects a modulation order based on a worst-case composite SNR). Ex. 1002, ¶151. Applying Monk's teachings to Cooper-Saey's/Cooper-Gross's CMTS would have been well within the capabilities of a POSITA because it would have involved only minor modifications to the programming of the CMTS. *Id.*, ¶152; Ex. 1005, [0042]; Ex. 1015, 10:22-31.

Thus, Cooper-Saey-Monk's/Cooper-Gross-Monk's CMTS teaches [1E] and these combinations therefore render claims 1-2, 6-8, 10-11, and 15-17 obvious. Ex. 1002, ¶153.

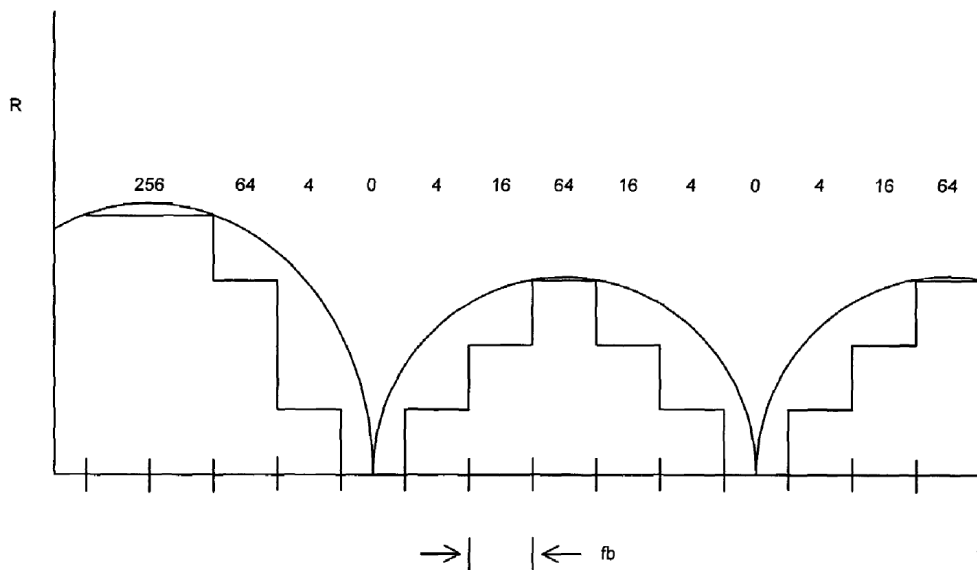
2. Dependent Claims 3 and 12

Claim 3 depends from claim 1. As discussed in Sections VI.A.1.d-f and VI.B.1.b-c, Cooper-Saey/Cooper-Gross teach that the CMTS selects a physical layer communication parameter (*i.e.*, a modulation order) that is used to communicate with one or more CMs in a particular service group. While Cooper-Saey, Cooper-Gross and the combinations described in Section VI.C.1 that include Monk do not teach communicating using OFDM over a plurality of subcarriers, Monk discloses this feature and a POSITA would have found it obvious to further modify each of these combinations based on the additional teachings in Monk. Ex. 1002, ¶154.

Monk's CMs and cable headend communicate over a broadband network using OFDM. Ex. 1015, Abstract, 4:25-38, 4:60-64, 7:13-9:19, Figs. 5-6, 10.

Specifically, Monk discloses dividing a frequency bandwidth into narrower channels or “bins” to transmit subcarriers. *Id.*, 7:14-16, 8:20-28; Ex. 1002, ¶155. Each subcarrier can be modulated independently (on a per-subcarrier basis) depending on the channel’s SNR, with higher SNR channels supporting higher data capacity or modulation schemes. Ex. 1015, 8:1-19, 10:55-67; Ex. 1002, ¶155.

For example, Monk’s Figure 10 (below) shows an OFDM waveform in which the different subcarriers that correspond to frequency bins with a bandwidth of “fb” are encoded with different QAM orders (*e.g.*, 4/16/64/256) based on the level of response at each frequency bin, which corresponds to that bin’s SNR. Ex. 1015, 10:55-67; Ex. 1002, ¶156.



Ex. 1015, Fig. 10

OFDM helps networks overcome signal impairments caused by issues such as micro-reflections and impedance mismatches. Ex. 1015, 4:16-43, 6:20-27, 7:36-50.

For example, OFDM allows data bits generated at a higher rate to be distributed over many subcarriers with lower data rates, reducing the potential of interference. *Id.*, 7:36-50; Ex. 1002, ¶157.

A POSITA would have been motivated to combine the OFDM communication techniques taught by Monk with Cooper-Saey's/Cooper-Gross's/Cooper-Saey-Monk's/Cooper-Gross-Monk's CMTS in order to provide more reliable communication and overcome signal impairments. Ex. 1015, 4:16-43, 6:20-27, 7:36-50; Ex. 1002, ¶158. As discussed in Sections VI.A.1.e, VI.B.1.c, and VI.C.1, Cooper-Saey's/Cooper-Gross's/Cooper-Saey-Monk's/Cooper-Gross-Monk's CMTS selects different modulation orders for different carriers/channels based on a composite worst-case SNR. Monk's OFDM communication technique allows for higher quality and more reliable services to the service groups by splitting up each logical channel further and allowing bits to be spread over multiple subcarriers, which would still utilize different modulation orders of QAM but on a per-subcarrier basis depending on a SNR. Ex. 1002, ¶158.

Such combinations represent an obvious combining of prior art elements (Cooper-Saey's/Cooper-Gross's/Cooper-Saey-Monk's/Cooper-Gross-Monk's CMTS and Monk's OFDM method) 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 QAM on a per-subcarrier basis). *Id.*, ¶159.

Moreover, applying OFDM would have been well within the capabilities of a POSITA, leading to an expectation of success, as it would have only required routine modifications to the programming of the microprocessor in the CMTS, and OFDM was a well-known technique. *Id.*, ¶160; Ex. 1005, [0008], [0024]-[0025], [0042]; Ex. 1015, 10:22-31.

Thus, Cooper-Saey-Monk and Cooper-Gross-Monk teach the claimed use of “(OFDM) over a plurality of subcarriers for said communicating” and these combinations render claim 3 obvious. *Id.*, ¶160-161. Claim 12 is substantially similar to claim 3 except that it identifies “said network interface and cable modems” are configured to use OFDM. Ex. 1001, 9:41-44. As discussed in Section VI.A.1.g, Cooper’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 this section. Ex. 1002, ¶182.

3. Dependent Claims 4 and 13

Claim 4 depends from claim 3. As discussed in Section VI.C.2, Cooper-Saey-Monk’s/Cooper-Gross-Monk’s CMTS uses OFDM wherein a particular modulation order is selected on a per-subcarrier basis depending on a SNR. Ex. 1015, 7:14-16, 8:1-28, 10:55-67, Fig. 10; Ex. 1002, ¶162. Thus, Cooper-Saey-Monk’s/Cooper-Gross-Monk’s CMTS teaches the CMTS “selecting ... said one or more physical

layer communication parameter on a per-OFDM-subcarrier basis.” Ex. 1002, ¶¶162-163.

Accordingly, claim 4 is invalid as obvious over Cooper-Saey-Monk and Cooper-Gross-Monk. *Id.* Claim 13 is substantially similar to claim 4 except that it identifies “said network interface” is configurable on a per-OFDM-subcarrier basis. Ex. 1001, 9:45-10:2. As discussed in Section VI.A.g, Cooper’s CMTS comprises the claimed network interface, and therefore, claim 13 is therefore rendered obvious for the same reasons discussed in this section. Ex. 1002, ¶183.

4. Dependent Claims 5 and 14

Claim 5 depends from claim 4. As discussed in Sections VI.A.1.e, VI.B.1.c, VI.C.3, Cooper-Saey-Monk’s/Cooper-Gross-Monk’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, Cooper 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. 1005, Abstract, [0005]-[0006], [0008], [0011], [0020]-[0021], [0027]; Ex. 1021, 1-3, 7-9; Ex. 1022, 1, 7-10; Ex. 1023, 1-3, 25, 27; Ex. 1002, ¶¶164-165. This is consistent with Monk’s disclosure, which also discloses different frequency bands used for upstream and downstream signals. Ex. 1015, 5:66-6:5, Fig. 4; Ex. 1002, ¶165.

And as discussed above in Sections VI.A.1.b and VI.B.1.a, Cooper 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. 1005, [0008], [0027]; Ex. 1002, ¶166. Because Cooper discloses determining separate upstream and downstream SNR metrics in different frequency bands, Cooper-Saey-Monk’s/Cooper-Gross-Monk’s CMTS teaches selecting 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. 1002, ¶166. Thus, Cooper-Saey-Monk’s/Cooper-Gross-Monk’s CMTS teaches the additional limitations in claim 5. *Id.*

Therefore, claim 5 is invalid as obvious over Cooper-Saey-Monk/Cooper-Gross-Monk. *Id.*, ¶167. Claim 14 is substantially similar to claim 5, and is therefore rendered obvious for the same reasons. *Id.*, ¶184.

5. Dependent Claims 6 and 15

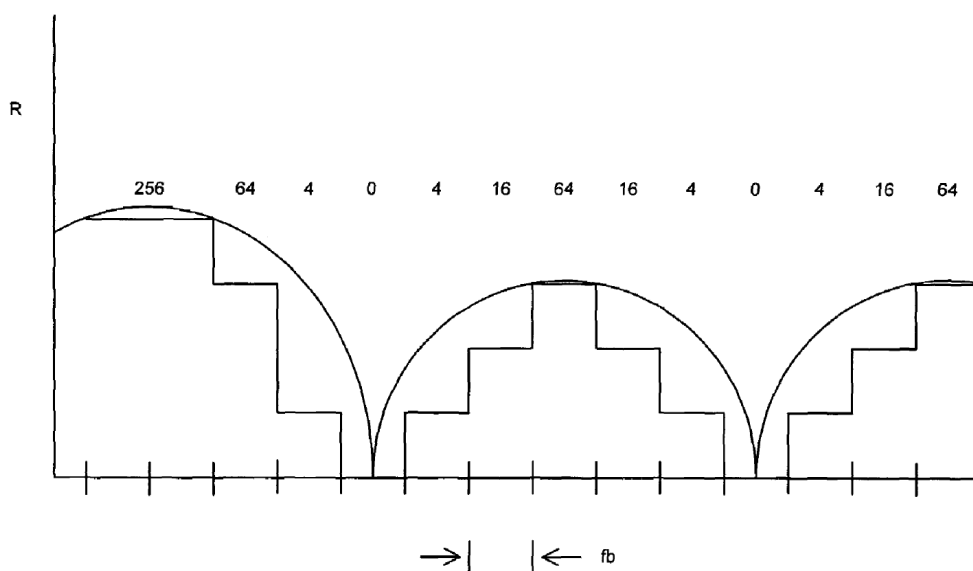
a. [6A]

Claim 6 depends from claim 1. As shown in Sections VI.A.1.c, VI.B.1.a, Cooper 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. 1005, [0031]-[0033], [0041], Fig. 6. Thus, Cooper-Saey/Cooper-Gross/Cooper-

Saey-Monk/Cooper-Gross-Monk teach at least “a first service group and a second service group.” Ex. 1002, ¶¶168-169.

And as shown in Sections VI.A.1.d and VI.B.1.b, Cooper-Saey/Cooper-Gross teach generating a composite SNR-related metric for each service group based at least in part on a worst-case SNR profile. While Cooper-Saey, Cooper-Gross and the combinations described in Section VI.C.1 that include Monk do not expressly describe these composite SNRs as SNR versus frequency profiles, Monk discloses this feature, and a POSITA would have found it obvious to further modify each of these combinations based on these additional teachings in Monk. Ex. 1002, ¶170.

Monk’s Figure 10 (below) shows a signal’s SNR profile over a channel that has been segmented into different frequency bins of bandwidth f_b with different SNRs and different applied QAM orders (*e.g.*, 4/16/64/256). *Id.*, ¶171; Ex. 1015, 10:55-67.



Ex. 1015, Fig. 10

Figure 10 shows a SNR versus frequency profile similar to line 222 in Fig. 2B of the '682 patent. *Compare* Ex. 1001, 4:6-17; Fig. 2B; *with* Ex. 1015, 10:55-67, Fig. 10; Ex. 1002, ¶172. As shown, an SNR profile over a range of frequencies indicates the maximum modulation order for each frequency band. Ex. 1002, ¶172; *see* Ex. 1015, 4:55-59, 8:1-19, 10:55-67.

A POSITA would have found it obvious to apply Monk's teachings of determining an SNR profile over a range of frequencies to Cooper-Saey's/Cooper-Gross's/Cooper-Saey-Monk's/Cooper-Gross-Monk's method of determining an SNR metric in order to optimize modulation order by both SNR and frequency. Ex. 1002, ¶173; *see* §§VI.A.1.b, VI.B.1.a, VI.C.1. While Cooper discusses modems communicating in dedicated bands of frequencies, Monk's methods would allow Cooper-Saey's/Cooper-Gross's/Cooper-Saey-Monk's/Cooper-Gross-Monk's CMTS to divide those frequency bands into multiple channels and determine which frequency band best suits each communication. Ex. 1002, ¶173; *see* Ex. 1005, [0003]. 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. 1002, ¶173.

Further, and for similar reasons explained in Sections VI.A.1.d, VI.B.1.b, once the modems have been assigned to a service group, a POSITA would have also

found it obvious to apply Monk's teaching to Cooper-Saey's/Cooper-Gross's/Cooper-Saey-Monk's/Cooper-Gross-Monk's CMTS 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. 1005, [0011], [0019], [0030], [0039]; Ex. 1002, ¶174.

Such combinations also would have been obvious because they would have been nothing more than combining prior art elements (Cooper-Saey's/Cooper-Gross's/Cooper-Saey-Monk's/Cooper-Gross-Monk's CMTS that measures and assigns modems to service groups based on their measured SNR—and determines a worst-case SNR for each group; and Monk'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. 1002, ¶175. Applying Monk's teachings to Cooper-Saey's/Cooper-Gross's/Cooper-Saey-Monk's/Cooper-Gross-Monk's CMTS would have been well within the capabilities of a POSITA and would have involved only minor modifications to the CMTS's programming. *Id.*, ¶176; *see also* Ex. 1005, [0042]; Ex. 1015, 10:22-31.

In sum, the combinations of Cooper-Saey-Monk/Cooper-Gross-Monk described in this section teach the claimed “first composite SNR versus frequency profile” and “second composite SNR versus frequency profile” associated with their respective service group. Ex. 1002, ¶¶177-178. Further, because these combinations also teach measuring a SNR versus frequency profile for each modem, they also teach “a particular cable modem has a particular SNR versus frequency profile.” *Id.*

Accordingly, Cooper-Saey-Monk/Cooper-Gross-Monk teach the additional requirements of [6A].

b. [6B]

As discussed for [6A], Cooper-Saey-Monk/Cooper-Gross-Monk teach at least a first and second service group that each have their own composite SNR versus frequency profile. §VI.C.5.a. Cooper-Saey-Monk/Cooper-Gross-Monk also teach “a particular cable modem has a particular SNR versus frequency profile.” *Id.* In addition, Cooper-Saey-Monk/Cooper-Gross-Monk teach 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]. Ex. 1002, ¶179.

Cooper discloses that modems are assigned to logical channels based on their individual measured values compared with the threshold values. Ex. 1005, [0008],

[0030]-[0031]; Ex. 1002, ¶180. Cooper also discloses that these thresholds can be dynamic and updated based on network measurements. Ex. 1005, [0030]. Cooper then teaches assigning or reassigning modems to logical channels based on these updated thresholds. Ex. 1005, [0031]; Ex. 1002, ¶180. Thus, in the combined systems, Cooper-Saey-Monk/Cooper-Gross-Monk assign 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. 1002, ¶180.

Therefore, claim 6 is invalid as obvious over Cooper-Saey-Monk/Cooper-Gross-Monk. *Id.*, ¶¶180-181. Claim 15 is substantially similar to claim 6, and claim 15 is therefore rendered obvious for the same reasons. *Id.*, ¶185.

D. Grounds E-F: Claims 9 and 18 are Rendered Obvious By Cooper-Saey-Monk-Cooper⁴³⁷ and Cooper-Gross-Monk-Cooper⁴³⁷

Claim 9 depends from claim 1. As discussed in Sections VI.A.1.b, VI.B.1.a and VI.C.1, Cooper-Saey, Cooper-Gross, Cooper-Saey-Monk, and Cooper-Gross-Monk teach determining a SNR-related metric for each CM served by the CMTS based on a measurement at either the CMTS or the CM. However, these combinations do not teach a probe message that initiates the measurement of the SNR-related metric at the CMs or that include instructions for measuring a metric and reporting the measured metric back to the CMTS (as required by claim 9). Ex. 1002, ¶¶186-187. Such a probe message is taught by Monk and Cooper⁴³⁷. *Id.*

Monk discloses a method of communication that relies on different modulation schemes based on a communication channel's SNR. Ex. 1015, 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/256-QAM), while lower SNR channels may use a different modulation scheme such as QPSK. Ex. 1015, 4:55-59, 8:1-10, 9:9-11, 10:58-62; Ex. 1002, ¶188. 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. 1015, Abstract, 4:44-59, 9:28-41. The receiving device sends the results of the analysis back to the sending device as either raw data or a bit loading profile for the sending device to determine the transmission parameters. *Id.*, 9:41-50; Ex. 1002, ¶188.

A POSITA would have found it obvious to transmit a probe message to each CM (claimed “transmitting a probe message to each cable modem”) and to receive a reporting message including SNR raw data or a bit loading profile (claimed “receiving a metric reporting message from each cable modem”) as taught by Monk in order to implement Cooper's example of measuring an SNR-related metric at each CM and reporting it back to the CMTS. Ex. 1005, [0011]; Ex. 1015, 4:44-59, 8:4-5, 9:9-11, 9:26-41, 10:60-62, Abstract; Ex. 1002, ¶189. A POSITA would have

further found it obvious to measure at the CMs to distribute processing requirements among multiple CMs. Ex. 1002, ¶189.

Incorporating the use of Monk's probe messages and reporting messages into Cooper-Saey's/Cooper-Gross's/Cooper-Saey-Monk's/Cooper-Gross-Monk's CMTS also would have been obvious because such an implementation would have merely been a combination of prior art elements (Cooper-Saey's/Cooper-Gross's/Cooper-Saey-Monk's/Cooper-Gross-Monk'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. 1002, ¶190.

Further, applying Monk's additional teachings to Cooper-Saey's/Cooper-Gross's/Cooper-Saey-Monk's/Cooper-Gross-Monk's CMTS would have been well within the capabilities of a POSITA as it would have only required minor modifications to the programming of the microprocessor in the CMTS and was a well-known technique, leading to an expectation of success. Ex. 1002, ¶191; *see also* Ex. 1005, [0008], [0024]-[0025], [0042]; Ex. 1015, 10:22-31.

Monk's probe message does not explicitly include instructions for measuring a metric and reporting said measured metric back to the CMTS, but Cooper⁴³⁷

teaches this. Ex. 1002, ¶192. Cooper437 discloses a method for a CMTS to ask for and receive specific noise signal power measurements from CMs in its network. Ex. 1016, Abstract, 1:62-65, 3:47-50, Fig. 1. The CMTS initiates these measurements by transmitting to CMs in the network a message that defines the measurement techniques to be used and how to report the measurements. *Id.*, 8:11-29, 8:60-9:5, 10:56-11:28, 11:30-60.

After receiving the probe message, a CM performs the specified measurements, and then sends back a report of the measurements (which may be raw measured data). *Id.*, 10:56-11:28, 11:30-60; Ex. 1002, ¶193. 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. 1016, 8:9-64, 10:56-11:28, 11:30-60; Ex. 1002, ¶193.

A POSITA would have found it obvious to modify Monk's probe message (which already initiates the measurement of channel characteristics) to identify a measurement mode and reporting mode, as taught by Cooper437, so that Cooper-Saey-Monk's/Cooper-Gross-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. 1002, ¶194; Ex. 1016, 8:9-64, 10:56-11:28, 11:30-60.

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. 1002, ¶194.

Moreover, modifying the probe message to identify a measurement mode (claimed “instructions for measuring a metric”) and a reporting mode (claimed “instructions for ... reporting said measured metric”) also would have been obvious because such a modification would have been nothing more than combining prior art elements (Cooper-Saey-Monk’s/Cooper-Gross-Monk’s probe message and Cooper437’s probe messages having measurement and reporting instructions) according to known methods (modifying the contents of probe messages) to yield predictable results (a CMTS that uses probe messages that include instructions for measurement and reporting of SNR-related metrics). *Id.*, ¶195.

Applying Cooper437’s teachings to Cooper-Saey-Monk’s/Cooper-Gross-Monk’s CMTS would have been well within the capabilities of a POSITA as it would have only required minor modifications to the programming of the microprocessor in the CMTS, leading to an expectation of success. *Id.*, ¶196; Ex. 1005, [0008], [0020]-[0021], [0024]-[0025], [0027], [0042]; Ex. 1016, 5:3-14, 7:6-22.

Accordingly, Cooper-Saey-Monk-Cooper437 and Cooper-Gross-Monk-Cooper437 render claim 9 obvious. Ex. 1002, ¶197. Claim 18 is substantially similar to claim 9, and is therefore rendered obvious for the same reasons. *Id.*, ¶198.

E. Ground G: Claims 1-2 and 6 Are Rendered Obvious By Prodan-Saey

As described below, Seay discloses the only feature the Examiner found missing from Prodan (Ex. 1004, 85-87), and Prodan-Saey renders claims 1-2 and 6 obvious.

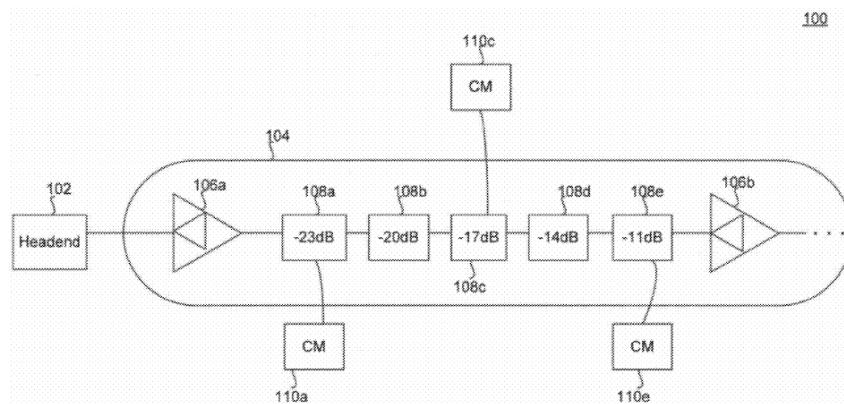
1. Independent Claim 1

a. [1A]

To the extent the preamble is limiting, Prodan discloses it. Specifically, Prodan discloses a method of assigning transmission frequency bands to cable modems in a cable network. *Id.*, ¶199; Ex. 1011, [0011]-[0012], [0030], [0042], claims 1, 16.

b. [1B]

Prodan's Figure 1 shows a network of CMs 110a/110c/110e connected to headend 102. Ex. 1011, [0016], Fig. 1.



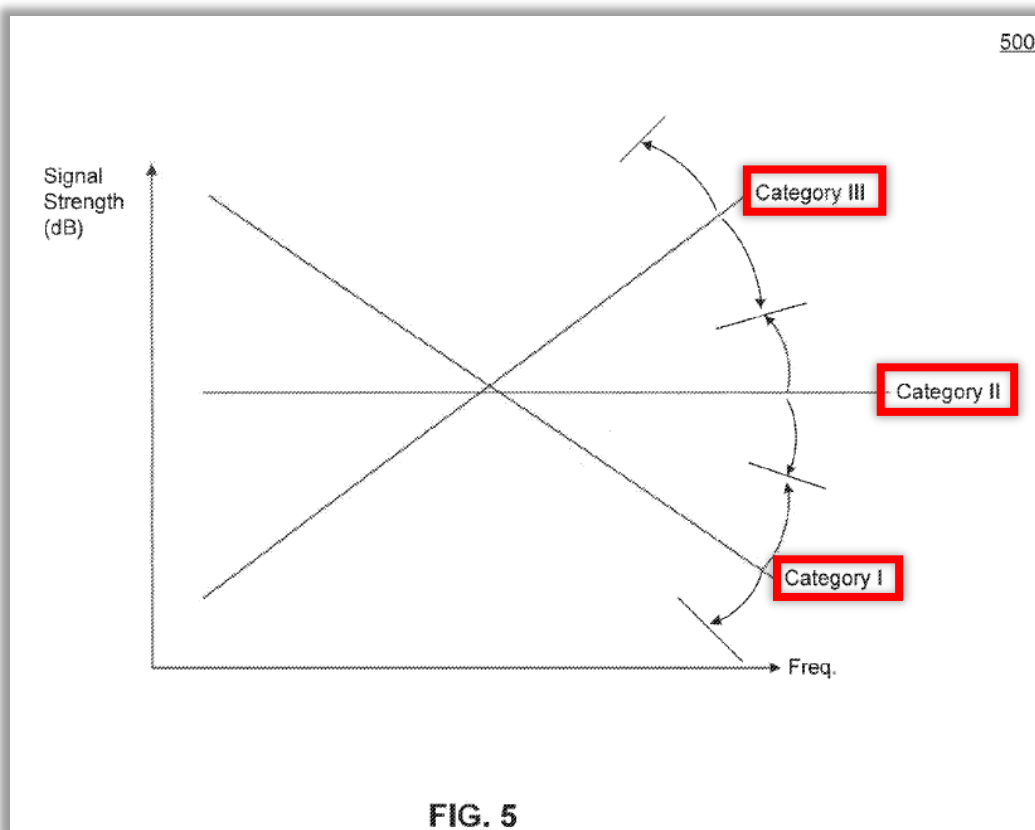
Ex. 1011, Fig. 1

A CMTS (claimed “cable modem termination system”) sits between the CMs and headend 102. *Id.*, [0032]. The CMTS measures the signal strength versus

frequency profiles, including SNR versus frequency profiles (claimed “signal-to-noise ratio (SNR) related metric”), of connected CMs. *Id.*, [0025], [0032], [0044], claim 5. Thus, Prodan discloses [1B]. Ex. 1002, ¶¶200-202.

c. [1C]

Prodan teaches that its CMTS assigns each CM into different categories based on the CM’s SNR versus frequency profile. Ex. 1011, [0034], [0044]-[0045]; Ex. 1002, ¶203. As illustrated below in Figure 5, Prodan’s CMTS analyzes the signal strength versus frequency profile measured for each of the connected CMs and then assigns them to one of three groups (*i.e.*, Category I, II, or III) based on this profile. *Id.*, [0034], Fig. 5. While Figure 5 refers to signal strength, Prodan states that SNR is associated with signal strength. For instance, Prodan expressly discloses that Figure 2 (which similar to Figure 5 refers to “Signal Strength”) “shows example [SNR] versus frequency profiles of different CMs in a cable network.” *Id.*, [0025]-[0026], [0047], Fig. 2, claim 5; Ex. 1002, ¶¶203-204.



Ex. 1011, Fig. 5 (annotated)

Thus, by assigning the CMs to the different categories based on SNR-frequency profile, Prodan discloses [1C]. See §VI.A.1.c; Ex. 1002, ¶¶204-206.

d. [1D]

As shown for [1C], Prodan discloses that its CMTS assigns each CM into a service group category based on the measured SNR versus frequency profiles of the CMs. §VI.E.1.c. While Prodan does not expressly teach “generating ... a composite SNR-related metric based at least in part on a worst-case SNR profile,” Prodan-Saey does. Ex. 1002, ¶207.

As discussed in Section VI.A.1.d, Saey teaches grouping carriers based on a measured network parameter (*e.g.*, SNR) and assigning the worst-case SNR in the group as the carrier group SNR parameter. Ex. 1007, [0009]-[0014], [0025]-[0027], [0032], [0042]-[0043], Figs. 3, 5-6; Ex. 1002, ¶208. This worst-case SNR is then used to determine the gain and bit loading (*e.g.*, modulation order) to use in communicating with the modems associated with the carrier group, allowing the system to conserve resources (*e.g.*, memory, transmission costs) while ensuring communication with all CMs within a group. Ex. 1007, [0014], [0027]; Ex. 1002, ¶208; §VI.A.1.d.

A POSITA would have found it obvious to apply Saey's teachings to Prodan in order to determine the modulation order used to communicate with Prodan's CMs assigned to each category in order to conserve system resources (*e.g.*, memory, transmission costs) while ensuring communication with all CMs within a group. Ex. 1007, [0014], [0027]; Ex. 1002, ¶¶209-211. Prodan already discloses that its CMTS may optimize modulation schemes, which would include a modulation order, according to a "minimum required SNR." Ex. 1011, [0047], [0028]-[0029], [0034], [0039], [0047], Fig. 5; Ex. 1013, [0051]; Ex. 1002, ¶¶209-211.

Such a combination also would have been obvious because it would have been no more than combining prior art elements (Prodan's CMTS that applies modulation order parameters to CMs that are grouped based on a comparison of their SNR

characteristics, and Saey’s method of determining a worst-case SNR for a group of CMs based on the individual SNRs of the CMs) according to known methods (programming of a CMTS) to yield predictable results (a CMTS that generates a worst-case SNR metric for a CM service group that is based on the measured individual SNRs of the CMs in that group). Ex. 1002, ¶¶212-213.

Applying Saey’s teachings to Prodan’s CMTS would have been well within the capabilities of a POSITA because it would have involved only minor modifications to the programming of Prodan’s CMTS. *Id.*, ¶214; Ex. 1011, [0047]. For the same reasons discussed in Section VI.A.1.d, such teachings by Prodan-Saey are very similar to the ’682 patent’s disclosure for the claimed “composite SNR-related metric based at least in part on a worst-case SNR profile ...”. §VI.A.1.d; Ex. 1002, ¶¶214-215; Ex. 1001, 4:3-67, 5:7-20; Ex. 1017, 53-55; Ex. 1018, 187; Ex. 1019, 8-10.

e. [1E]

As shown for [1D], Prodan-Saey generates a composite SNR versus frequency profile for each service group based on the worst-case SNR profile of the service group. §VI.E.1.d. As also discussed, Prodan-Saey’s CMTS would assign a “modulation scheme,” which a POSITA would recognize includes a modulation order, for each service group based on the composite SNR profile. Ex. 1011, [0034], [0044]-[0045], Fig. 4; Ex. 1007, [0026]; Ex. 1013, [0051]; §VI.E.1.d. Thus, Prodan-

Saey's "modulation scheme" is a physical layer communication parameter as taught by the '682 patent. Ex. 1001, 4:40-67; Ex. 1002, ¶¶216-217.

Accordingly, Prodan-Saey teaches [1E]. Ex. 1002, ¶¶218-220.

f. [1F]

As shown for [1E], Prodan-Saey's CMTS selects a modulation scheme to communicate with each category of CMs based on a composite SNR versus frequency profile. §VI.E.1.e. Prodan uses the selected modulation scheme for upstream communication. Ex. 1011, [0017]-[0019], [0041], [0045]. This upstream communication is consistent with the '682 patent's disclosure for the communicating step of [1F], which encompasses both upstream and downstream communications. Ex. 1001, claims 4-5; Ex. 1002, ¶¶221-223. Thus, Prodan-Saey teaches [1F]. Ex. 1002, ¶¶224-225.

2. Dependent Claim 2

As shown for [1E], Prodan-Saey's CMTS selects a modulation scheme, which would include a modulation order, for each CM service group category. §VI.E.1.e; Ex. 1002, ¶226. Therefore, claim 2 is invalid as obvious over Prodan-Saey. Ex. 1002, ¶226.

3. Dependent Claim 6

a. [6A]

As shown in Section VI.E.1.c, Prodan assigns CMs into at least three different service group categories based on comparing the CM's SNR versus frequency

profile to a threshold. Ex. 1011, [0033], [0044], Fig. 5. Thus, Prodan teaches at least “a first service group and a second service group.” Ex. 1002, ¶¶227-228. And as shown above in Section VI.E.1.d, Prodan-Saey teaches generating a composite SNR profile for each CM service group based on the worst-case SNR profile of the service group (claimed “first service group [having] a first composite SNR versus frequency profile, said second service group [having] a second composite SNR versus frequency profile.”). §VI.E.1.d.

As also shown, Prodan discloses measuring individual CM’s SNR versus frequency profiles, thus disclosing a “cable modem [with] a particular SNR versus frequency profile.” Ex. 1002, ¶¶228-229; §VI.E.1.b.

b. [6B]

As discussed for [6A], Prodan-Saey teaches at least a first and second CM service group having respective composite SNR versus frequency profiles. §VI.E.3.a. Prodan-Saey also teaches assigning a particular CM to a service group having a composite SNR versus frequency profile most similar to that of the particular CM—as required by [6B]—in order to make a modulation scheme assignment. Ex. 1002, ¶230.

Specifically, Prodan discloses that a CM is assigned to a particular service group category based on its measured SNR versus frequency profile. Ex. 1011, [0032], Figs. 2, 5. Prodan further discloses that its CMTS updates its system and

dynamically adjusts its frequency allocations and modulation schemes (*i.e.*, in real time), including when a new CM connects to the network. Ex. 1011, [0033]-[0034], [0036], [0040], [0045]-[0046]. For example, when a new CM connects to the network, the CMTS measures its SNR versus frequency profile and assigns the new CM to the service group with the closest composite SNR versus frequency profile. *Id.*, [0033]-[0034]; Ex. 1002, ¶231. Thus, Prodan-Saey teaches assigning the particular CM to the service group with a composite SNR versus frequency profile that is the most similar to the CM's particular SNR versus frequency profile. Ex. 1002, ¶¶231-232.

F. Ground H: Claims 1-2 and 6 Are Rendered Obvious By Prodan-Gross

1. Independent Claim 1

a. [1A]-[1C]

For the reasons described in Sections VI.E.1.a-c, Prodan discloses [1A]-[1C]. *Id.*, ¶233; §VI.E.1.a-c.

b. [1D]

As discussed in Section VI.E.1.d, Prodan discloses that its CMTS assigns each of the CMs into a service group category based on the respective SNR versus frequency profiles of the CMs. However, Prodan does not explicitly teach determining a “worst case” SNR for such groups of CMs. Ex. 1002, ¶234. Prodan-Gross does.

As discussed in Section VI.B.1.b, Gross teaches a method of setting the modulation order for communicating with groups of CMs where the modulation order for each group is determined by the measured “worst case” SNR in the group of modems. §VI.B.1.b. A POSITA would have found it obvious to apply Gross’s teaching of determining the worst-case SNR for a CM group to Prodan’s selection of a modulation order to ensure communication with any modem assigned to that logical channel—regardless of which modems are activated. Ex. 1008, [0043]-[0046], [0100]; Ex. 1002, ¶235.

Such a combination also would have been obvious because it would have merely been a combination of prior art elements (Prodan’s CMTS that applies modulation order parameters to CMs that are grouped based on a comparison of their SNR characteristics, and Gross’s method of determining and applying a worst-case SNR-based parameter for a group of modems also grouped based on their individual SNRs) according to known methods (programming of a CMTS) to yield predictable results (a CMTS that generates a worst-case SNR metric for a CM service group that is based on the individual SNRs of the CMs in that group and that is used to select a modulation scheme to communicate with the CM service group). Ex. 1002, ¶236. Further, Prodan already discloses that its CMTS may optimize modulation schemes, which would include a modulation order, according to a “minimum required SNR.” Ex. 1011, [0047], [0028]-[0029], [0034], [0039], [0047], Fig. 5; Ex. 1013, [0051];

§VI.E.1.d; Ex. 1002, ¶235. Thus, a POSITA would have a reasonable expectation of success applying Gross’s teachings to Prodan’s CMTS as it would have involved only straightforward modifications to the programming of Prodan’s CMTS, which would have been well within the capabilities of a POSITA. Ex. 1002, ¶237. Accordingly, Prodan-Gross 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. 1002, ¶238; Ex. 1001, 4:3-67, 5:7-20; Ex. 1017, 53-55; Ex. 1018, 187; Ex. 1019, 8-10.

c. [1E]-[1F]

For reasons similar to those described above for Prodan-Saey, Prodan-Gross teaches [1E]-[1F]. In particular and as discussed above, Prodan-Gross’s CMTS would have similarly selected the modulation schemes based on the worst-case SNR metrics determined for the groups of CMs assigned to service group categories to ensure communication with all modems in the group while also optimizing the network. *Id.*, ¶239; *see* §VI.E.1.e.

Prodan-Gross’s CMTS also would have communicated with the connected CMs using the selected modulation schemes. Ex. 1011, [0045]-[0047]; Ex. 1002, ¶240; *see* §VI.E.1.e.

Prodan-Gross therefore renders claim 1 obvious. Ex. 1002, ¶¶233-240.

2. Dependent Claim 2

For reasons similar to those described above for Prodan-Saey, Prodan-Gross teaches dependent claim 2. §VI.E.2. In particular, Prodan-Gross's CMTS selects a modulation scheme, which would include a modulation order, for each CM service group category. §§VI.E.1.e, VI.F.1.b-c. Therefore, Prodan-Gross renders claim 2 invalid. Ex. 1002, ¶241.

3. Dependent Claim 6

a. [6A]

As shown above, Prodan assigns CMs into at least three different service group categories based on comparing the CM's SNR versus frequency profile to a threshold. Ex. 1011, [0033], [0044], Fig. 5; §§VI.E.1.c, VI.F.1.a. Thus, Prodan teaches at least "a first service group and a second service group" and a "cable modem [with] a particular SNR versus frequency profile." Ex. 1002, ¶¶242-243. And as shown in Section VI.F.1.b, Prodan-Gross teaches generating a composite SNR profile for each CM service group based on the worst-case SNR profile of the service group (claimed "first service group [having] a first composite SNR versus frequency profile, said second service group [having] a second composite SNR versus frequency profile.")). §VI.F.1.b. Accordingly, Prodan-Gross teaches [6A]. Ex. 1002, ¶¶242-243.

b. [6B]

As discussed for [6A], Prodan-Gross teaches at least a first and second CM service group having respective composite SNR versus frequency profiles. §VI.F.3.a. Prodan-Gross also teaches assigning a particular CM to a service group having a composite SNR versus frequency profile most similar to that of the particular CM—as required by [6B]—in order to make a modulation scheme assignment. Ex. 1002, ¶244.

Prodan discloses that a CM is assigned to a particular service group category based on the individual measured SNR versus frequency profile of the CM. Ex. 1011, [0032]. Prodan further discloses that its CMTS measures and/or updates the SNR versus frequency profile of a particular CM (and subsequently performs *per CM* modulation scheme assignments) either dynamically (*i.e.*, in real time) or every time the CM connects to the network. *Id.*, [0033], [0046]. Thus, Prodan-Gross teaches assigning the particular CM to the service group with a composite SNR versus frequency profile that is the most similar to the CM's particular SNR versus frequency profile. Ex. 1002, ¶245.

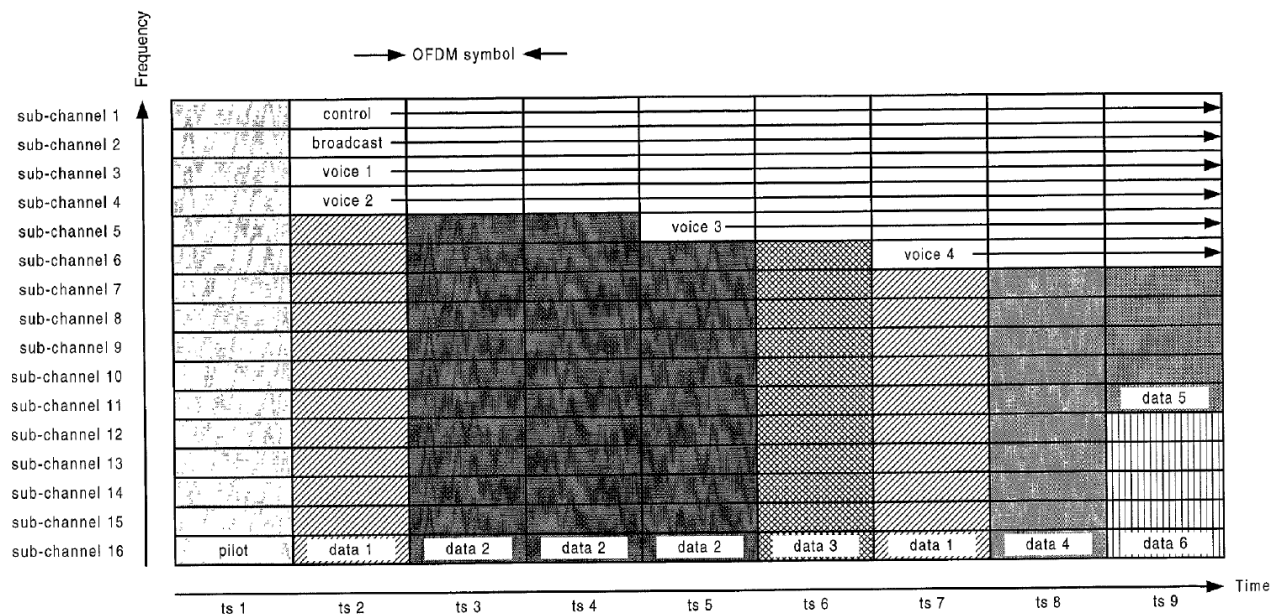
Prodan-Gross therefore renders claim 6 obvious. *Id.*, ¶¶242-245.

G. Grounds I-J: Claims 3-5 Are Rendered Obvious By Prodan-Saey-Jalali and Prodan-Gross-Jalali

1. Dependent Claim 3

As discussed in Sections VI.E.1.d-f and VI.F.1.b-c, Prodan-Saey/Prodan-Gross teach a CMTS selecting a physical layer communication parameter to communicate with one or more CMs. While Prodan-Saey/Prodan-Gross do not teach communicating using OFDM over a plurality of subcarriers, Jalali does. Ex. 1002, ¶246.

Jalali discloses a method of transmitting and receiving multiple types of services along multiple carriers using OFDM. Ex. 1014, Abstract, 3:1-4, 3:29-49, 5:41-6:13, 25:62-26:17, Fig. 1. For example, Jalali's Figure 2 (below) shows a diagram of a transmission channel where the x-axis is time and the y-axis is frequency (divided into 16 sub-channels). *Id.*, 13:49-58; Ex. 1002, ¶247.



Ex. 1014, Fig. 2

Figure 2 also shows data transmission that is partitioned into nine different timeslots, which correspond to the duration of the OFDM modulation symbol. Ex. 1014, 13:58-63. The first timeslot is used for pilot data (*e.g.*, data to help synchronize with receivers and perform channel estimation), while the other slots can be used for sub-carriers of other various types of data. *Id.*, 13:64-14:13; Ex. 1002, ¶248. As shown, Jalali's communication system provides the flexibility that data can be transmitted through multiple sub-channels, achieving both a high performance and a high efficiency. Ex. 1014, 14:20-60, 15:26-35; Ex. 1002, ¶248.

Jalali also discloses that “[f]lexibility, performance, and efficiency are further achieved by allowing for independence among the modulation symbols ... [to] be generated from a modulation scheme (*e.g.*, M-PSK, M-QAM, and others) that results in the best use of the resource at that particular time, frequency, and space.” Ex. 1014, 15:36-42, 11:51-12:9, 17:21-34, 22:19-24, 23:54-65, 32:34-46. Also, “each ... sub-channel may be restricted to a particular modulation scheme (*e.g.*, M-PSK, M-QAM) for the duration of the transmission or until such time as a new modulation scheme is assigned.” *Id.*, 15:54-61, 12:45-48. Thus, Jalali teaches communicating data over a plurality of sub-carriers using OFDM, wherein each sub-carrier has a modulation scheme that is independently chosen. Ex. 1002, ¶249.

A POSITA would have been motivated to combine the OFDM communication techniques taught by Jalali with Prodan-Saey's/Prodan-Gross's

CMTS to provide increased flexibility, performance, and efficiency in transmitting multiple types of services. *Id.*, ¶250; Ex. 1014, 15:36-42. As discussed in Sections VI.E.1.e and VI.F.1.c, Prodan-Saey's/Prodan-Gross's CMTS selects different modulation schemes for different service group categories or channels based on a composite worst-case SNR. Jalali's OFDM communication technique allows an increase in capacity by dividing the available bandwidth into subcarriers, while still relying on similar modulation schemes (*e.g.*, QAM) for the subcarriers. Ex. 1002, ¶250. Thus, utilizing OFDM would allow Prodan-Saey's/Prodan-Gross's CMTS to communicate more reliably, with more CMs, and/or more efficiently and optimally to smaller service groups of CMs based on more refined composite SNR-related metrics. *Id.*

Such combinations also would have been obvious because they would have been nothing more than combining prior art elements (Prodan-Saey's/Prodan-Gross's CMTS and Jalali's OFDM method) according to known methods (programming a CMTS) to yield predictable results (a CMTS that uses OFDM to communicate over a plurality of subcarriers that also use different modulation schemes). *Id.*, ¶251.

Moreover, applying Jalali's teachings to Prodan-Saey's/Prodan-Gross's CMTS would have been well within the capabilities of a POSITA as it would have only required minor modifications to the programming of the CMTS. *Id.*, ¶252. A

POSITA would have a reasonable expectation of success in these programming modifications as Jalali's method is implemented with basic electronic circuits, which a POSITA would recognize would be included in Prodan-Saey's/Prodan-Gross's CMTS. *Id.*; Ex. 1011, [0032], [0044], [0048]; Ex. 1014, 33:44-49. Thus, Prodan-Saey's/Prodan-Gross's CMTS as modified by Jalali teaches the claimed use of "[OFDM] over a plurality of subcarriers for said communicating." Ex. 1002, ¶252.

Therefore, claim 3 is invalid as obvious over Prodan-Saey-Jalali and Prodan-Gross-Jalali. *Id.*, ¶253.

2. Dependent Claim 4

As discussed in Sections VI.E.1.e and VI.F.1.c, Prodan-Saey's/Prodan-Gross's CMTS selects one or more physical layer communication parameter (*e.g.*, modulation schemes) for different service groups. As modified by Jalali, this selection process by the CMTS happens on a per-OFDM-subcarrier basis. Ex. 1002, ¶254.

As discussed in Section VI.G.1, Prodan-Saey-Jalali's/Prodan-Gross-Jalali's CMTS teaches the use of OFDM where each sub-carrier can have a particular modulation scheme (*e.g.*, M-PSK, M-QAM). Jalali discloses that each sub-carrier's particular modulation scheme is based on, for example, the particular sub-channel's channel state information, which includes the carrier-to-noise-plus-interference ratio. Ex. 1014, 5:30-33, 10:47-57, 11:51-12:9, 12:45-48, 15:54-61, 17:25-34.

Thus, Prodan-Saey-Jalali's/Prodan-Gross-Jalali's CMTS teaches claim 4. Ex. 1002, ¶255.

Therefore, claim 4 is invalid as obvious over Prodan-Saey-Jalali and Prodan-Gross-Jalali. *Id.*, ¶256.

3. Dependent Claim 5

As discussed in Sections VI.E.1.e, VI.F.1.c, and VI.G.2, Prodan-Saey-Jalali's/Prodan-Gross-Jalali's CMTS selects "one or more physical layer communication parameter" on a per-OFDM-subcarrier basis based on a composite SNR-related metric. Ex. 1002, ¶257.

In addition, Prodan discloses the use of DOCSIS modems (which transmit and receive in different designated frequency bands) that determine which frequencies of OFDM subcarriers are used for communication between equipment. Ex. 1011, [0019]; Ex. 1021, 1, 3, 7-9; Ex. 1022, 1, 7-10; Ex. 1023, 1, 3, 25, 27; Ex. 1002, ¶258. Prodan also acknowledges different requirements in addition to the different frequency bands used in upstream versus downstream communications. §VI.E.1.f; Ex. 1011, [0005], [0017]-[0018], [0023]; Ex. 1002, ¶258.

Because Prodan discloses using different frequency bands for upstream and downstream communication, Prodan-Saey-Jalali's/Prodan-Gross-Jalali's CMTS teaches selecting separate upstream and downstream "one or more physical layer communication parameter[s]" on a per-OFDM-subcarrier basis based on specific

frequency bands and a composite upstream or downstream SNR-related metric. Ex. 1002, ¶259. Thus, Prodan-Saey-Jalali's/Prodan-Gross-Jalali's CMTS teaches claim 5. Ex. 1002, ¶259.

Therefore, claim 5 is invalid as obvious over Prodan-Saey-Jalali/Prodan-Gross-Jalali. Ex. 1002, ¶260.

H. Grounds K-L: Claims 7-8 are Rendered Obvious by Prodan-Saey-Cooper and Prodan-Gross-Cooper

As described in Sections VI.E.1.c and VI.F.1.a, Prodan's process analyzes the SNR versus frequency profile measured for each of the CMs connected to the CMTS and then uses it to assign each CM to a service group. While Prodan acknowledges that the SNR profile of each CM is impacted by its location in a cable network (*e.g.*, distance from an amplifier), Prodan does not teach assigning each CM to a group based on its location in the network (*e.g.*, its distance from the CMTS or from an upstream amplifier). Ex. 1011, [0027]. Cooper does. Ex. 1002, ¶¶261-262

As explained in Section VI.A.3, Cooper discloses assigning CMs among a plurality of service groups based on various network parameters. Ex. 1005, Abstract, [0008], [0021], [0027]-[0028], [0037]; Ex. 1002, ¶263; §§VI.A.1.c, VI.A.3. For example, in addition to assigning network elements to service groups based on SNR measurements, Cooper discloses a CMTS assigning network elements to service groups based at least in part on determined locations of network elements in a cable network and based on determined amplifier cascade depths. Ex. 1005, Abstract,

[0021], [0027]-[0028], [0035], [0037]; Ex. 1002, ¶263; §§VI.A.1.c, VI.A.3. Grouping CMs, at least in part, according to location of network elements in a cable network or according to amplifier cascade depth 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. 1005, [0019]; Ex. 1002, ¶263.

It would therefore have been obvious to modify Prodan-Saey's/Prodan-Gross's CMTS to also assign CMs to service groups based at least in part on parameters associated with the location of CMs in a cable network or based on amplifier cascade depth to allow for more proactive maintenance of the network. Ex. 1005, [0019]; Ex. 1002, ¶264. In particular, it would have been obvious to configure Prodan-Saey's/Prodan-Gross's CMTS: (i) to determine the location of CMs in a cable network, and then also 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"), or (ii) to also assign a CM to one of a plurality of service groups based at least in part on the 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. 1002, ¶264.

Such modifications also would have been obvious because they would have merely involved the combination of prior art elements (Prodan-Saey’s/Prodan-Gross’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). *Id.*, ¶265. Applying Cooper’s teachings to Prodan-Saey’s/Prodan-Gross’s CMTS would have been well within the capabilities of a POSITA because it would have involved straightforward modifications to the programming of Prodan-Saey’s/Prodan-Gross’s CMTS. *Id.*

Therefore, claims 7-8 are rendered obvious by Prodan-Saey-Cooper and Prodan-Gross-Cooper. *Id.*, ¶266.

I. Grounds M-N: Claim 9 Is Rendered Obvious by Prodan-Saey-Monk-Cooper⁴³⁷ and Prodan-Gross-Monk-Cooper⁴³⁷

As discussed in Sections VI.E.1.b and VI.F.1.a, Prodan-Saey/Prodan-Gross teach determining a SNR-related metric for each CM served by the CMTS based on a measurement at the CMTS. However, these combinations do not teach a probe message that initiates the measurement of the SNR-related metric at the CM or that

includes instructions for measuring a metric and reporting said measured metric back to the CMTS (as required by claim 9). Such a probe message is taught by Monk and Cooper⁴³⁷. *Id.*, ¶¶267-268.

Prodan discloses a cable system that transmits data via upstream and downstream channels. Ex. 1011, [0017]-[0018], [0023], [0056]; §VI.E.1.f. In an upstream embodiment, Prodan explains that the CM transmits a test signal to the CMTS, and the CMTS measures the SNR of the CM in order to assign a modulation scheme to the CM. Ex. 1011, [0032]-[0034]. While Prodan does not explicitly mention a downstream embodiment, Prodan teaches using a variety of algorithms to make modulation scheme assignments. *Id.*, [0047]; Ex. 1002, ¶269.

Monk and its probe message are described in Section VI.D. Specifically, Monk teaches that for non-symmetrical channels (such as those in Prodan), a sending node transmits a probe message to a receiving device, which analyzes the probe message and sends the results of the analysis back to the sending device for the sending device to determine the transmission parameters. Ex. 1015, 4:44-59, 9:28-50; Ex. 1002, ¶270. Therefore, in a downstream context, a POSITA would have found it obvious to modify Prodan-Saey's/Prodan-Gross's CMTS to send a probe message to the CM (claimed "transmitting a probe message to each cable modem") to implement the measurement and reporting by the CM of the downstream channel's SNR, as taught by Monk. Ex. 1002, ¶270. A POSITA would have further

found it obvious to send probe messages to the CMs to distribute processing requirements for measuring among the CMs. *Id.*

Incorporating Monk's probe messages and reporting messages into Prodan-Saey/Prodan-Gross also would have been obvious because such an implementation would have been nothing more than combining prior art elements (Prodan-Saey's/Prodan-Gross's CMTS and Monk's probe and reporting messages) according to known methods (programming the CMTS to send probe messages and receive reporting messages that provide an analysis of a downstream channel's SNR) to yield predictable results (a system that uses probe messages and reporting messages to determine a downstream channel's SNR). *Id.*, ¶271. Further, a POSITA would have had a reasonable expectation of success applying Monk's teachings to Prodan-Saey's/Prodan-Gross's CMTS as it would have only required straightforward modifications to the programming of the CMTS, which would have been well within the capabilities of a POSITA. *Id.*, ¶272.

While Prodan-Saey-Monk/Prodan-Gross-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. Ex. 1002, ¶273. Cooper437 does. Cooper437 is described in Section VI.D, and for the same reasons described in that section, it would have been obvious to modify Prodan-Saey-Monk's/Prodan-Gross-Monk's CMTS to focus on determining the SNR of specific service groups or

frequencies. §VI.D. This would allow Prodan-Saey-Monk's/Prodan-Gross-Monk's CMTS to focus on specific service groups or frequencies that have had a change in the SNR. §VI.D; Ex. 1002, ¶273; Ex. 1016, 8:9-64, 10:56-11:28, 11:30-60. Such a modification would allow more robust communication between the CMTS and CMs on the network. Ex. 1002, ¶273.

Moreover, modifying the probe message to identify a measurement mode (claimed "instructions for measuring a metric") and a reporting mode (claimed "instructions for ... reporting said measured metric") would also have been obvious because it would have involved nothing more than combining prior art elements (Prodan-Saey-Monk's/Prodan-Gross-Monk's probe message with the measurement mode and reporting mode of Cooper437) according to known methods (modifying the contents of a probe messages) to yield predictable results (a CMTS that uses probe messages that include instructions for measurement and reporting of SNR-related metrics). *Id.*, ¶274.

Applying Cooper437's teachings to Prodan-Saey-Monk's/Prodan-Gross-Monk's CMTS would have been well within the capabilities of a POSITA as it would have only required straightforward modifications to the programming of the CMTS. *Id.*, ¶275. And a POSITA would have had a reasonable expectation of success in these programming modifications as Prodan-Saey-Monk/Prodan-Gross-Monk and Cooper437 each teach using the DOCSIS standard for transfer of data

over a cable system and rely on generic microprocessors or microcontrollers for execution of their methods. *Id.*, ¶¶275-276; Ex. 1011, [0019]; Ex. 1016, 5:3-14, 7:6-22.

Accordingly, Prodan-Saey or Prodan-Gross in view of Monk and Cooper⁴³⁷ render claim 9 obvious. Ex. 1002, ¶276.

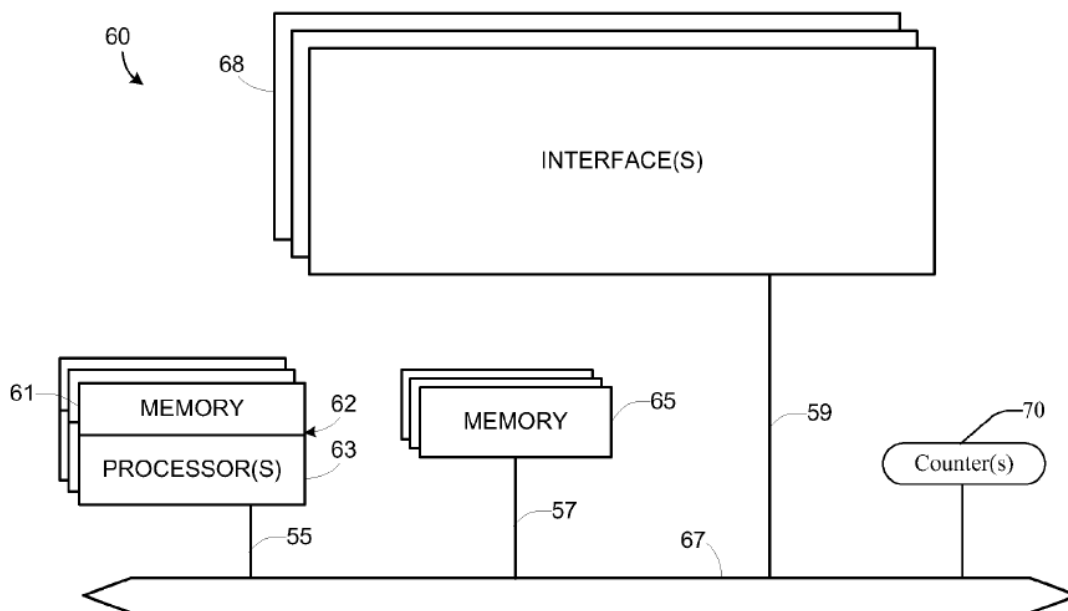
J. Grounds O-P: Claims 10-11 and 15 Are Rendered Obvious by Prodan-Saey-Pai and Prodan-Gross-Pai

a. [10A]

Prodan’s “network” described in Section VI.E.1.b discloses a system as recited in [10A]. §VI.E.1.b; Ex. 1011, [0016]-[0017], [0032], Fig. 1; Ex. 1002, ¶277. Although Prodan discloses a CMTS, it fails to expressly disclose that its CMTS includes circuitry comprising a network interface and a processor. However, Pai shows that it was known to implement a CMTS with a processor and a network interface in order to control operations of the CMTS and to communicate with other network devices. Ex. 1020, [0179]-[0181], Fig. 6; Ex. 1002, ¶277.

As illustrated below in Figure 6, Pai discloses CMTS 60 that comprises circuitry that includes: (i) processor(s) 63 (claimed “circuitry ... comprising a ... processor”) that implements programming instructions received from memory 61 for controlling operations of the CMTS, and (ii) interface 68 (claimed “circuitry ... comprising a network interface”) that communicates with network devices and

controls the sending and receiving of data packets over the network. Ex. 1020, [0179]-[0181], Fig. 6; Ex. 1002, ¶277.



Ex. 1020, Fig. 6.

It would have been obvious for a POSITA to implement Prodan-Saey's/Prodan-Gross's CMTS with the processor and network interface as disclosed by Pai in order to control the operations of Prodan-Saey's/Prodan-Gross's CMTS and to communicate with other network devices, as taught by Pai. Ex. 1020, [0179]-[0181], Fig. 6; Ex. 1002, ¶278.

Such an implementation also would have been obvious because they would have been nothing more than combining prior art elements (Prodan-Saey's/Prodan-Gross's CMTS and Pai's CMTS's circuitry) according to known methods (using Pai's components in Prodan-Saey's/Prodan-Gross's CMTS) to yield predictable

results (a CMTS that utilizes a processor and a network interface to control operations of the CMTS and to communicate with other network devices). Ex. 1002, ¶279.

Moreover, applying Pai's teachings would have been well within the capabilities of a POSITA as it would have only required basic knowledge of hardware design and/or programming, leading to an expectation of success. *Id.*, ¶280; Ex. 1011, [0032], [0044], [0048]. Thus, Prodan-Saey-Pai/Prodan-Gross-Pai teach [10A]. Ex. 1002, ¶280.

b. [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. 1002, ¶281. Prodan-Saey-Pai and Prodan-Gross-Pai teach that processor(s) 63 in CMTS 60 is configured to perform the limitations described above in [1B]-[1E]. *Id.*, ¶281; Ex. 1020, [0179]-[0181]. Accordingly, for the reasons set forth above with respect to [1B]-[1E], Prodan-Saey-Pai's/Prodan-Gross-Pai's processor(s) 63 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. 1002, ¶282. Prodan-Saey-Pai/Prodan-Gross-Pai teach that interface(s) 68

communicates with network devices and controls the sending and receiving of data packets over the network. Ex. 1002, ¶282; Ex. 1020, [0181], Fig. 6. Accordingly, for the reasons set forth above with respect to [1F], Prodan-Saey-Pai's/Prodan-Gross-Pai's interface(s) 68 comprise a network interface that teaches and is configured to perform the limitations recited in [10F]. *Id.*

c. Dependent Claim 11

Claim 11 depends from claim 10, and claim 11 is nearly identical to claim 2. Ex. 1002, ¶283. Prodan-Saey-Pai/Prodan-Gross-Pai therefore teach claim 11 for the same reasons described above for claim 2. §§VI.E.2, VI.F.2; Ex. 1002, ¶283.

d. Dependent Claim 15

Claim 15 depends from claim 10, and claim 15 is nearly identical to claim 6. Ex. 1002, ¶284. Prodan-Saey-Pai/Prodan-Gross-Pai therefore teach claim 15 for the same reasons described above for claim 6. §§VI.E.3, VI.F.3; Ex. 1002, ¶284.

K. Grounds Q-R: Claims 12-14 Are Rendered Obvious by Prodan-Saey-Pai-Jalali and Prodan-Gross-Pai-Jalali

a. Dependent Claim 12

Claim 12 depends from claim 10 and is very similar to claim 3 except claim 12 recites that the claimed “network interface” is configured to perform the limitations recited in claim 3. Ex. 1002, ¶285. As discussed in Section VI.J.a, Prodan-Saey-Pai/Prodan-Gross-Pai teach that interface(s) 68 communicates with network devices and controls the sending and receiving of data packets over the

network. Ex. 1020, [0179]-[0181], Fig. 6; Ex. 1002, ¶285. And as discussed in Section VI.G.1, applying Jalali’s teachings of OFDM to Prodan-Saey and Prodan-Gross teach the limitations of claim 3. Jalali is equally applicable to Prodan-Saey-Pai and Prodan-Gross-Pai. Ex. 1002, ¶285. For the same reasons discussed in Section VI.G.1, a POSITA would have found it obvious and been motivated to apply the OFDM communication techniques taught by Jalali to Prodan-Saey-Pai’s/Prodan-Gross-Pai’s CMTS. A POSITA would have a reasonable expectation of success applying Jalali’s teachings to Prodan-Saey-Pai’s/Prodan-Gross-Pai’s CMTS as it would have only required straightforward modifications to the programming of the CMTS’s processor—well within the capabilities of a POSITA—that would then communicate through the network interface. Ex. 1002, ¶285; Ex. 1020, [0179]-[0181], Fig. 6; Ex. 1014, 33:44-49.

Accordingly, for the reasons set forth above in Sections VI.G.1 and VI.J.a, Prodan-Saey-Pai-Jalali/Prodan-Gross-Pai-Jalali comprise a network interface that teaches and is configured to perform the limitations recited in claim 12. Ex. 1002, ¶285; §§VI.G.1, VI.J.a.

b. Dependent Claim 13

Claim 13 depends from claim 12 and is very similar to claim 4 except that claim 13 recites that the claimed “network interface” is configured to perform the limitations recited in claim 4. Ex. 1002, ¶286. As discussed in Section VI.K.a,

Prodan-Saey-Pai-Jalali/Prodan-Gross-Pai-Jalali teach a network interface that communicates using OFDM over a plurality of subcarriers, each of which is configurable on a per-OFDM subcarrier basis. Accordingly, for the reasons set forth above in Sections VI.G.2 and VI.J.a, Prodan-Saey-Pai-Jalali/Prodan-Gross-Pai-Jalali comprises a network interface that teaches and is configured to perform the limitations recited in claim 13. Ex. 1002, ¶286; §§VI.G.2, VI.J.a.

c. Dependent Claim 14

Claim 14 depends from claim 12 and is very similar to claim 5. Ex. 1002, ¶287. Prodan-Saey-Pai-Jalali/Prodan-Gross-Pai-Jalali teach claim 14 for the same reasons described above for claim 5. Ex. 1002, ¶287; §VI.G.3.

L. Grounds S-T: Claims 16-17 Are Rendered Obvious by Prodan-Saey-Pai-Cooper and Prodan-Gross-Pai-Cooper

Claims 16-17 depend from claim 10 and are nearly identical to claims 7-8, respectively, except claims 16-17 recite that the claimed “processor” is configured to perform the limitations recited in claims 7-8. Ex. 1002, ¶288-289. As discussed in Sections VI.H and VI.J.a, Prodan-Saey-Pai/Prodan-Gross-Pai teach a CMTS that includes a processor 63 configured to implement Prodan-Saey’s/Prodan-Gross’s methods. Ex. 1020, [0179]-[0181], Fig. 6; Ex. 1002, ¶¶288-289. And as further discussed in Section VI.H, applying Cooper’s teachings to Prodan-Saey and Prodan-Gross teach the limitations of claims 7-8. Cooper is equally applicable to Prodan-Saey-Pai and Prodan-Gross-Pai.

For the reasons discussed in Section VI.H, a POSITA would have found it obvious and been motivated to configure the processor in Prodan-Saey-Pai's/Prodan-Gross-Pai's CMTS: (i) to determine the location of CMs in a cable network, and then assign the CMs among a plurality of service groups based on such a location (satisfying claim 16's requirement of "assign[ing] said cable modems among said plurality of service groups based on respective distances between said CMTS and said cable modems"), or (ii) to assign a CM to one of a plurality of service groups based on the amplifier cascade depth (satisfying claim 17's requirement of "assign[ing] each of said cable modems among said plurality of service groups based on one or more branch amplifier that serves each of said cable modems"). Ex. 1002, ¶¶288-289; §VI.H. A POSITA would have had a reasonable expectation of success applying Cooper's teachings, which are performed by a microprocessor, to Prodan-Saey-Pai's/Prodan-Gross-Pai's CMTS as it would have only required straightforward modifications to the programming of the CMTS's processor, well within the capabilities of a POSITA. Ex. 1002, ¶¶288-289; Ex. 1020, [0179]-[0181], Fig. 6; Ex. 1005, [0008], [0023]-[0024]. Accordingly, for the reasons set forth with respect to Sections VI.H and VI.J.a, Prodan-Saey-Pai-Cooper/Prodan-Gross-Pai-Cooper comprise a processor that teaches and is configured to perform the limitations recited in claims 16-17. Ex. 1002, ¶¶288-289; §§VI.H, VI.J.a.

M. Grounds U-V: Claim 18 Is Rendered Obvious by Prodan-Saey-Pai-Monk-Cooper437 and Prodan-Gross-Pai-Monk-Cooper437

Claim 18 depends from claim 10 and is nearly identical to claim 9, except claim 18 recites that the claimed “network interface” is configured to perform the limitations recited in claim 9. Ex. 1002, ¶290. As discussed above in Section VI.J.a, Prodan-Saey-Pai/Prodan-Gross-Pai teach an interface 68 that communicates with network devices and controls the sending and receiving of data packets over the network. Ex. 1020, [0179]-[0181], Fig. 6; Ex. 1002, ¶290. And, as discussed in Section VI.I, applying the teachings of Monk and Cooper437 to Prodan-Saey and Prodan-Gross teaches the limitations of claim 9. Monk and Cooper437 are equally applicable to Prodan-Saey-Pai and Prodan-Gross-Pai. Accordingly, for the reasons set forth above with respect to Sections VI.I and VI.J.a, Prodan-Saey-Pai-Monk-Cooper437/Prodan-Gross-Pai-Monk-Cooper437 each comprise a network interface that teaches and is configured to perform the limitations recited in claim 18. *Id.*

VII. GROUNDS FOR STANDING & FEE PAYMENT

Petitioner certifies that the '682 patent is available for, and Petitioner is not barred or estopped from requesting, review.

The undersigned authorizes the charge of any required fees to Deposit Account No. 19-0733.

VIII. CONCLUSION

Review should be instituted and claims 1-18 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 13,967, which is less than the 14,000 allowed under 37 CFR § 42.24(a)(1)(i). This total includes 13,967 words as counted by the Word Count feature of Microsoft Word and 0 words used in annotations.

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

BANNER & WITCOFF, LTD

Dated: February 15, 2024

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §42.105, I hereby certify that I caused a true and correct copy of this Petition for *Inter Partes* Review in connection with U.S. Patent No. 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.