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. 8,284,690
Filing Date: December 10, 2009
Issue Date: October 9, 2012
Title: RECEIVER DETERMINED PROBE

Inter Partes Review No.: IPR2024-00430

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

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EXHIBITS

Ex. 1001:	U.S. Patent No. 8,284,690 ("the '690 patent")
Ex. 1002:	Expert Declaration of James Bertonis
Ex. 1003:	Certified Prosecution History of the '690 patent
Ex. 1004:	Excerpts from *Entropic Communications, LLC v. Comcast Corp. et al.*, No. 2:23-cv-01050 (C.D. Cal.) ("CDCA Litigation")
Ex. 1005:	Excerpts from *Entropic Communications, LLC. v. Charter Communications, Inc. et al.*, No. 2:22-cv-00125 (E.D. Tex.)
Ex. 1006:	Excerpts from *Entropic Communications, LLC v. Cox Communications, Inc. et al.*, No. 2:23-cv-01049 (C.D. Cal.)
Ex. 1007:	U.S. Patent Application Publication No. 2007/0223402 to Waxman ("Waxman")
Ex. 1008:	U.S. Patent Application Publication No. 2008/0198826 to Won ("Won")
Ex. 1009:	U.S. Patent Application Publication No. 2005/0124340 to Giesberts et al. ("Giesberts")
Ex. 1010:	Data-Over-Cable Service Interface Specifications, DOCSIS 2.0 – Radio Frequency Interface Specification, CM-SP-RFIv2.0-I11-060602, June 2006 ("DOCSIS-2.0")
Ex. 1011:	ANSI/IEEE Std 802.2, 1998 Edition, IEEE Standard for Information Technology – Telecommunications and information exchange between systems - local and metropolitan area networks – specific requirements, Part 2: Logical Link Control, redesignated as ISO/IEC 8802-2:1998 ("ISO8802-2")
Ex. 1012:	IEEE Std 802.11, 2007 revision of 1999 Edition, IEEE Standard for Information Technology – Telecommunications and information exchange between systems - local and metropolitan area networks – specific requirements, Part 11:

	Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications ("IEEE-802.11")
Ex. 1013:	IEEE Std 802.16-2004, IEEE Standard for local and metropolitan area networks, Part 16: Air Interface for Fixed Broadband Wireless Access Systems, October 1, 2004 ("IEEE-802.16")
Ex. 1014:	IEEE Std 802.16e-2005, IEEE Standard for local and metropolitan area networks, Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems, Amendment 2: Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Bands, February 28, 2006 ("IEEE-802.16e")
Ex. 1015:	Veeral S. Shah, *Timing and Frequency Synchronization in OFDM Broadband Wireless Systems* (2001)
Ex. 1016:	U.S. Patent Application Publication No. 2007/0121573 to Zuckerman et al. ("Zuckerman")
Ex. 1017:	Armin Dammann & Simon Plass, *Cyclic Delay Diversity: Effective Channel Properties and Applications* (2006)
Ex. 1018:	U.S. Patent No. 6,842,487 to Larsson ("Larsson")
Ex. 1019:	U.S. Patent No. 7,403,578 to Min et al. ("Min")
Ex. 1020:	U.S. Patent Application Publication No. 2007/0183383 to Bitran et al. ("Bitran")
Ex. 1021:	Andrew S. Tanenbaum, *Computer Networks* (4th ed. 2003)
Ex. 1022:	Ran Giladi, *Network Processors, Architecture, Programming, and Implementation* (2008)
Ex. 1023:	U.S. Patent No. 7,269,841 to Hendricks et al. ("Hendricks")
Ex. 1024:	Gerard O'Driscoll, *Next Generation IPTV Services and Technologies* (2008)

Ex. 1025:	ITU-T J.222.1, *Series J: Cable Networks and Transmission of Television, Sound Programme and Other Multimedia Signals* (Jul. 2007)
Ex. 1026:	Data-Over-Cable Service Interface Specifications, DOCSIS 1.0 – Radio Frequency Interface Specification, SP-RFI-C01-011119, March 1997 ("DOCSIS-1.0")
Ex. 1027:	Data-Over-Cable Service Interface Specifications, DOCSIS 1.1 – Radio Frequency Interface Specification, SP-RFIv1.1-I01-990311, March 1999, ("DOCSIS-1.1")
Ex. 1028:	Cliff Anderson, *Tuners for DOCSIS 3.0 cable modems*, EE Times, August 22, 2007
Ex. 1029:	Saifur Rahman, *DOCSIS Migration Methodology*, CableFax (November 1, 2007), cablefax.com/archives/docsis-migration-methodology
Ex. 1030:	U.S. Patent Application Publication No. 2007/0171994 to Parker et al. ("Parker")
Ex. 1031:	U.S. Patent No. 8,503,546 to Ashrafi ("Ashrafi")
Ex. 1032:	Declaration of Sylvia Hall-Ellis
Ex. 1033:	Declaration of Curtis Knittle

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. 8,284,690 ("the '690 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 '690 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.*, No. 2:23-cv-01050 (C.D. Cal.) ("CDCA Litigation"). The earliest date of service on any Comcast entity named in the CDCA Litigation was February 16, 2023.

The '690 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.*, No. 2:23-cv-01049 (C.D. Cal.).

The ’690 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. et al.*, No. 2:22-cv-00125 (E.D. Tex.) which was terminated pursuant to a settlement on December 10, 2023.

No prior petitions for *inter partes* review, post-grant review, or covered business method review have been filed against the ’690 patent.

This is the sole petition for *inter partes* review filed by Petitioner against the ’690 patent.

According to the Office’s records, the ’690 patent is a non-provisional of U.S. provisional Application No. 61/122,687, filed Dec. 15, 2008, and U.S. provisional Application No. 61/179,454, filed May 19, 2009.

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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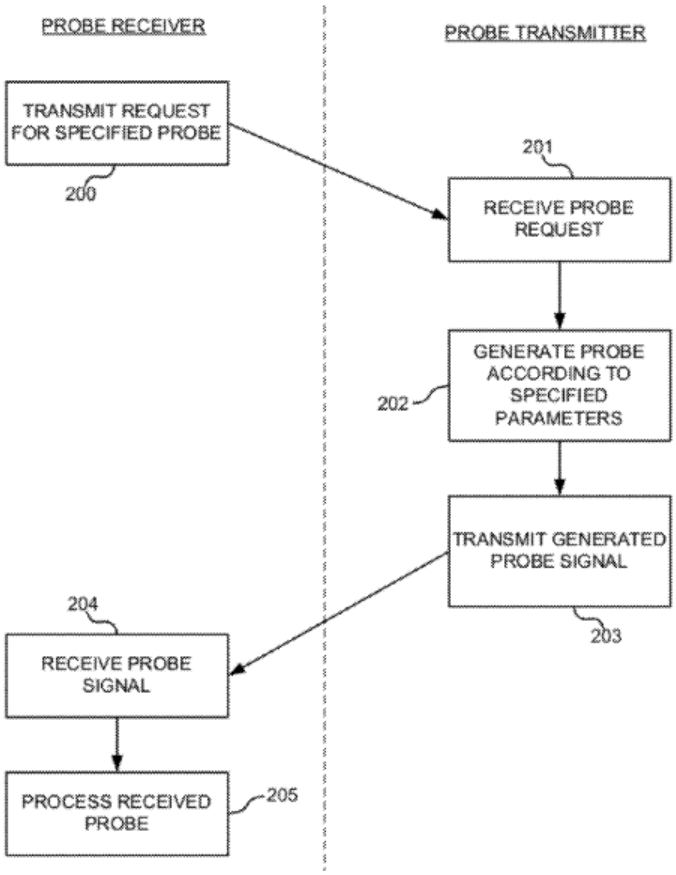
I. INTRODUCTION

Comcast Cable Communications, LLC ("Petitioner") requests cancellation of claims 1-24 of U.S. Patent No. 8,284,690 ("the '690 patent"). The '690 patent claims a simple back-and-forth communication where a request specifies parameters for the response. As the prior art demonstrates, these communications and the various claimed parameters were known or obvious. Multiple grounds based primarily on two standards (WiMAX and DOCSIS) and a patent publication (Waxman) show the claims are unpatentable in different ways.

II. '690 PATENT OVERVIEW

A. Summary

The '690 patent describes a receiver sending a probe request specifying first parameters (e.g., modulation profile) for a probe and a transmitter generating the probe accordingly and sending it back:



Ex. 1001, FIG. 4

Ex. 1001, 6:17-66. The '690 patent is not limited to any particular network or devices. *Id.*, 3:24-35, 4:10-24. It admits that probes were well-known, but suggests (incorrectly as demonstrated herein) that probes must be predetermined. *Id.*, 1:48-62; Ex. 1002, ¶¶27-32.

B. Prosecution History

The '690 patent was initially rejected. Ex. 1003, 92-116. The claims were amended to, among other things, add the concept of determining a "second plurality of parameters." *Id.*, 124-134. The examiner then allowed the application stating: the prior art "fail[s] to teach or make obvious to a method comprising generating the

probe in accordance with the first plurality of parameters and the second plurality of parameters within a structure of the claim." *Id.*, 147; Ex. 1002, ¶¶33-38.

C. Priority

For purposes of this proceeding, the earliest possible priority date of December 15, 2008 is assumed.

III. STATE OF THE ART

A. Technical Background

The field of communication networks includes various protocols, using well-known access schemes (e.g., OFDMA) and modulation techniques (e.g., OFDM), to control communications over various wired/wireless network architectures. Ex. 1002, ¶¶42-75.

B. Prior Art

All relied-upon references relate to communication networks and are analogous. Ex. 1002, ¶¶76-114.

Reference	Qualifications	Basis (pre-AIA)
IEEE-802.16	Published by 12/5/2004. Ex. 1032, ¶¶59-64.	§§102(a),(b)
Won	Filed 2/21/2008; Published 8/21/2008	§§102(a),(e)
Waxman	Filed 3/21/2006; Published 9/27/2007	§§102(a),(b),(e)
Giesberts	Filed 9/24/2004; Published 6/9/2005	§§102(a),(b),(e)
Zuckerman	Filed 11/22/2006; Published 5/31/2007	§§102(a),(e)

DOCSIS-2.0	Published by 6/15/2006. Ex. 1032; Ex. 1033.	§§102(a),(b)
ISO8802-2	Published by 6/3/1998. Ex. 1032, ¶¶53-58.	§§102(a),(b)

IV. IDENTIFICATION OF CHALLENGE

Petitioner requests review of claims 1–24 on the following grounds.

Ground	References	Basis	Claims Challenged
A	IEEE-802.16	§102	1-7, 9-10, 14-15
B	IEEE-802.16	§103	3-5, 8, 11-13, 16-24
C	IEEE-802.16 and Won	§103	8, 16, 24
D	Waxman	§102	1-11, 14-19, 22-24
E	Waxman	§103	1-11, 14-19, 22-24
F	Waxman and Giesberts	§103	3-5, 12-13, 20-21
G	Waxman and Zuckerman	§103	5, 10-11, 18-19
H	Waxman, Giesberts, and Zuckerman	§103	5
I	Waxman and Won	§103	7-8, 15-16, 23-24
J	DOCSIS-2.0	§102	1-2, 6-7, 9, 14-15
K	DOCSIS-2.0 and ISO8802-2	§103	1-2, 6-7, 9, 14-15
L	DOCSIS-2.0 and Zuckerman	§103	8, 10-11, 16-19, 22-24
M	DOCSIS-2.0, ISO8802-2, and Zuckerman	§103	8, 10-11, 16-19, 22-24

The petition is supported by Mr. Bertonis' expert testimony and Exhibits 1001-1033. Ex. 1002, ¶¶1-751. Mr. Bertonis is at least a POSITA. *Id.*, ¶¶4-14.

V. 314(a) DISCRETION DOES NOT APPLY

The *Fintiv* factors favor institution.

Factor one appears neutral. Petitioner has filed IPR petitions challenging all eight patents in the CDCA Litigation. If instituted, 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, PO has filed an Amended Complaint, and Petitioner will renew its Motion to Dismiss in order to seek dismissal of the operative complaint. No schedule beyond claim construction has been entered, and no trial date is set.

Factor three favors institution. The investment in the CDCA Litigation has been limited to considering motions to dismiss.

Factor four strongly favors institution. Petitioner challenges all claims while Patent Owner asserted only claims 7-8.

Factor five does not warrant denial as Petitioner is a defendant in the CDCA Litigation.

Factor six favors institution. Petitioner presents compelling unpatentability challenges.

VI. 325(d) DISCRETION DOES NOT APPLY

The grounds herein are not the same or substantially the same as the art (e.g., Barron and Miller) and arguments raised during prosecution. None of the references relied on herein were even cited during prosecution. The Examiner erred by failing to appreciate that the prior art teaches determining a second plurality of parameters

for use, with a first plurality of parameters, in generating and transmitting a probe. The examiner's reasons for allowance (§II.B) are incorrect, as demonstrated below.

VII. LEVEL OF ORDINARY SKILL

A POSITA would have had a bachelor's degree in electrical engineering, computer engineering, or a similar discipline, and three to four years of experience working in signal processing and/or communication systems/networks. Additional education may substitute for experience, and significant work experience may substitute for formal education. Ex. 1002, ¶¶115-120.

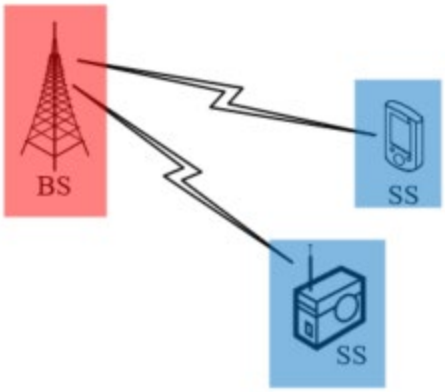
VIII. CLAIM CONSTRUCTION

All terms have been given their plain and ordinary meaning. 37 C.F.R. § 42.100(b). In related proceedings, certain constructions were adopted. Ex. 1005, 78-89; Ex. 1002, ¶¶121-127. For the reasons herein, the art teaches the claim limitations under any reasonable construction.

IX. SPECIFIC GROUNDS FOR UNPATENTABILITY

A. Grounds A-C: IEEE-802.16 (Anticipation and Obviousness) And IEEE-802.16 In View Of Won

IEEE-802.16 (commonly "WiMAX") discloses the interface, including a medium access control (MAC) layer and physical (PHY) layer, for connecting **subscriber stations (SS)** to **base stations (BS)** in a wireless access system:



Ex. 1013, 1-2; Ex. 1002, ¶¶130-132. IEEE-802.16 discloses a ranging procedure—disclosing the claimed probing procedure—that includes sending a Ranging Request on an uplink and a Ranging Response on a downlink. Ex. 1013, 174-182, 199-213.

IEEE-802.16 anticipates or renders obvious all claims. It is combined with Won if PO argues the trivial feature of claims 8, 16, and 24.

1. Claim 1

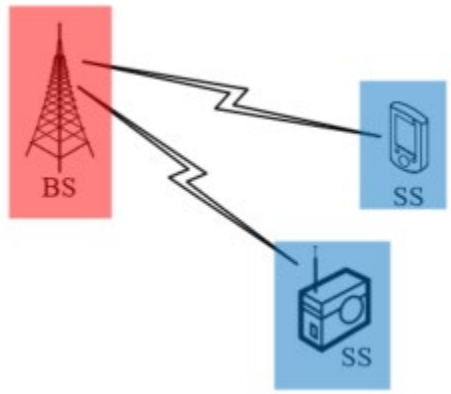
a. [1PRE]

IEEE-802.16 describes various processes for its system, including ranging. Ex. 1013, 121-218. Ranging includes two uplink procedures (initial ranging for SS to join the network and periodic ranging to adjust transmission parameters) and downlink burst profile management. Ex. 1013, 174-182, 199-213; Ex. 1002, ¶¶133-134.

IEEE-802.16's various processes collectively or the ranging procedure alone discloses the claimed "method" as either comprises [1A]-[1D]. *See* §§IX.A.1.b-e; Ex. 1002, ¶135.

b. [1A]

IEEE-802.16's system includes a **BS** ("first node") communicating with one or more **SSs** ("second node"):



Ex. 1002, ¶136.

IEEE-802.16's ranging procedure includes the **SS** receiving a Ranging Request from the **BS**. Ex. 1013, 49-51, 199-213. The Ranging Request ("probe request"), along with a Ranging Response ("probe"), is used to acquire correct transmission parameters and maintain the RF link's quality. Ex. 1013, 199, 202. The Ranging Request includes a Management Message Type, Downlink Channel ID, and Type/Length/Value (TLV) Encoded Information:

Table 19—RNG-REQ message format

Syntax	Size	Notes
RNG-REQ_Message_Format() {		
Management Message Type = 4	8 bits	
Downlink Channel ID	8 bits	
TLV Encoded Information	*variable*	TLV specific
}		

Ex. 1013, 49; Ex. 1002, ¶¶137-138.

The TLV Information varies. Ex. 1013, 49, 723. For example, when the SS is attempting to join the network, it includes the "Requested Downlink Burst Profile" and "SS MAC Address" parameters. Ex. 1013, 49. Table 364 shows the TLV encodings:

Table 364—RNG-REQ message encodings

Name	Type (1 byte)	Length	Value (variable-length)	PHY Scope
Requested Downlink Burst Profile	1	1	Bits 0–3: DIUC of the downlink burst profile requested by the SS for downlink traffic. Bits 4–7: 4 LSB of Configuration Change Count value of DCD defining the burst profile associated with DIUC.	All
SS MAC Address	2	6	The MAC address of the SS	All
Ranging Anomalies	3	1	A parameter indicating a potential error condition detected by the SS during the ranging process. Setting the bit associated with a specific condition indicates that the condition exists at the SS. Bit #0 — SS already at maximum power. Bit #1 — SS already at minimum power. Bit #2 — Sum of commanded timing adjustments is too large.	All
AAS broadcast capability	4	1	0 = SS can receive broadcast messages 1 = SS cannot receive broadcast messages	SCa, OFDM, OFDMA

Ex. 1013, 664; Ex. 1002, ¶¶138-139.

Using the Requested Downlink Burst Profile parameter, the SS requests a specific downlink burst profile. Ex. 1013, 49, 71, 199. The downlink interval usage code (DIUC) in the Downlink Burst Profile parameter is mapped to a downlink burst profile depending on the PHY layer:

Table 143—Mapping of burst profile to DIUC

Burst profile	DIUC
Downlink Burst Profile 1	0
Downlink Burst Profile 2	1
Downlink Burst Profile 3	2
Downlink Burst Profile 4	3
Downlink Burst Profile 5	4
Downlink Burst Profile 6	5
Downlink Burst Profile 7	6
Downlink Burst Profile 8	7
Downlink Burst Profile 9	8
Downlink Burst Profile 10	9
Downlink Burst Profile 11	10
Downlink Burst Profile 12	11
Downlink Burst Profile 13	12
reserved	13
Gap	14
End of DL-MAP	15

Table 276—OFDMA DIUC values

DIUC	Usage
0–12	Different burst profiles
13	Gap/PAPR reduction
14	End of map
15	Extended DIUC

Ex. 1013, 315, 522; Ex. 1002, ¶139. The downlink burst profile includes multiple parameters, including modulation type and forward error correction (FEC) Code type. Ex. 1013, 7, 314-315, 547. IEEE-802.16 supports different modulation types (e.g., BPSK). *Id.*, 370. The downlink burst profile dictates the modulation for the downlink, which is used for the Ranging Response. *Id.*, 329; Ex. 1002, ¶140.

For the WirelessMAN-OFDMA PHY,[1] the downlink burst profile encodings are in Tables 359 and 363:

Table 359—DCD PHY-common burst profile encodings

Name	Type (1 byte)	Length	Value (variable length)
Frequency	1	4	Downlink frequency (kHz)

Table 363—DCD burst profile encodings—WirelessMAN-OFDMA

Name	Type (1 byte)	Length	Value (variable length)
FEC Code type	150	1	0 = QPSK (CC) 1/2 1 = QPSK (CC) 3/4 2 = 16-QAM (CC) 1/2 3 = 16-QAM (CC) 3/4 4 = 64-QAM (CC) 2/3 5 = 64-QAM (CC) 3/4 6 = QPSK (BTC) 1/2 7 = QPSK (BTC) 3/4 or 2/3 8 = 16-QAM (BTC) 3/5 9 = 16-QAM (BTC) 4/5 10 = 64-QAM (BTC) 2/3 or 5/8 11 = 64-QAM (BTC) 5/6 or 4/5 12 = QPSK (CTC) 1/2 13 = QPSK (CTC) 2/3 14 = QPSK (CTC) 3/4 15 = 16-QAM (CTC) 1/2 16 = 16-QAM (CTC) 3/4 17 = 64-QAM (CTC) 2/3 18 = 64-QAM (CTC) 3/4 19 = 64-QAM (CTC) 5/6 20 = QPSK (ZT CC) 1/2 21 = QPSK (ZT CC) 3/4 22= 16-QAM (ZT CC) 1/2 23= 16-QAM (ZT CC) 3/4 24= 64-QAM (ZT CC) 2/3 25= 64-QAM (ZT CC) 3/4 26..255 = *Reserved*
DIUC Mandatory exit threshold	151	1	0–63.75 dB CINR at or below where this DIUC can no longer be used and where this change to a more robust DIUC is required, in 0.25 dB units. See Figure 81.
DIUC Minimum entry threshold	152	1	0–63.75 dB The minimum CINR required to start using this DIUC when changing from a more robust DIUC is required, in 0.25 dB units. See Figure 81.

[1] Used as an example here, but downlink burst profiles for other PHYs also apply.

Ex. 1013, 660, 663. As shown, the FEC Code type parameter specifies the modulation type (e.g., QPSK), FEC type (e.g., convolutional code (CC)), and code rate (e.g., 1/2). *Id.*, 663; Ex. 1002, ¶¶141-142.

The Ranging Request (an example MAC Management message for the payload of a MAC PDU) includes headers with additional parameters:

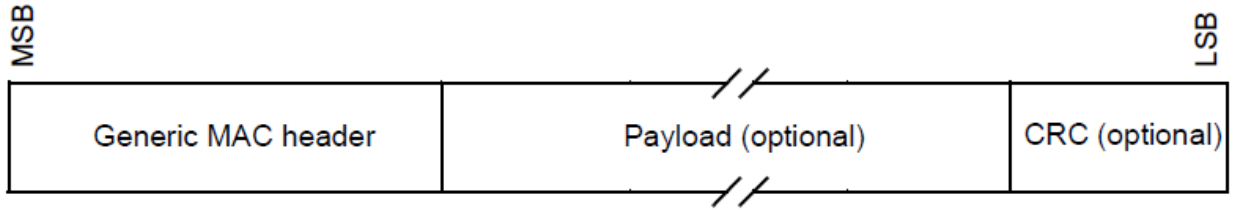


Figure 18—MAC PDU formats

Ex. 1013, 35-43; Ex. 1002, ¶143. Figure 19 shows one MAC header format:

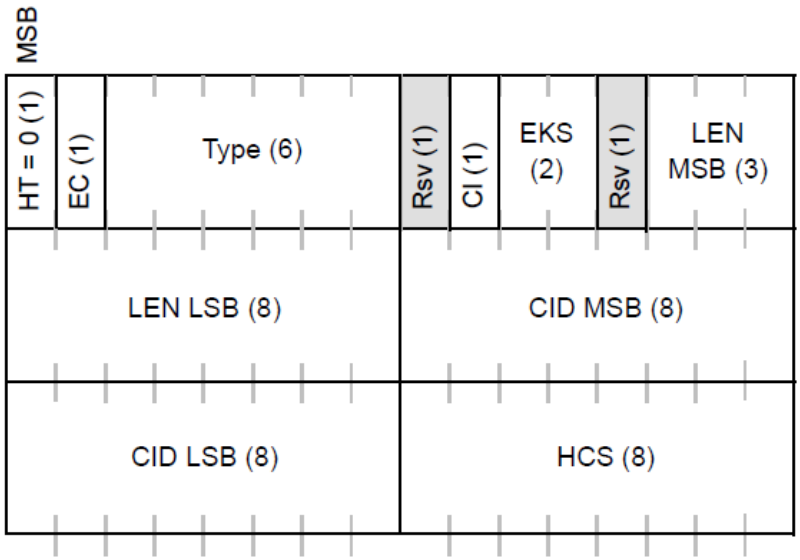


Figure 19—Generic MAC header format

Ex. 1013, 35-36; Ex. 1002, ¶144. As shown, the MAC header includes numerous parameters, which are defined in Table 5:

Table 5—Generic MAC header fields

Name	Length (bits)	Description
CI	1	CRC Indicator 1 = CRC is included in the PDU by appending it to the PDU Payload after encryption, if any 0 = No CRC is included
CID	16	Connection identifier
EC	1	Encryption Control 0 = Payload is not encrypted 1 = Payload is encrypted
EKS	2	Encryption Key Sequence The index of the Traffic Encryption Key (TEK) and Initialization Vector used to encrypt the payload. This field is only meaningful if the EC field is set to 1.
HCS	8	Header Check Sequence An 8-bit field used to detect errors in the header. The transmitter shall calculate the HCS value for the first five bytes of the cell header, and insert the result into the HCS field (the last byte of the MAC header). It shall be the remainder of the division (Modulo 2) by the generator polynomial $g(D = D^8 + D^2 + D + 1$ of the polynomial D^8 multiplied by the content of the header excluding the HCS field. (Example: [HT EC Type]=0x80, BR=0xAAAA, CID=0x0F0F; HCS should then be set to 0xD5).
HT	1	Header Type. Shall be set to zero.
LEN	11	Length. The length in bytes of the MAC PDU including the MAC header and the CRC if present.
Type	6	This field indicates the subheaders and special payload types present in the message payload.

Ex. 1013, 37; Ex. 1002, ¶¶145-146. Thus, the Ranging Request specifies numerous parameters ("first plurality of parameters"). Moreover, its parameters (e.g., the Requested Downlink Burst Profile) are used for forming the Ranging Response, which the BS generates and transmits in response to the Ranging Request ("associated with the generation and transmission of a probe"). Ex. 1013, 50, 199-213; Ex. 1002, ¶147.

Further, the Ranging Response includes its own TLV Information, having numerous parameters (e.g., Timing Adjust, Power Adjust, etc.):

Table 20—RNG-RSP message format

Syntax	Size	Notes
RNG-RSP_Message_Format() {		
Management Message Type = 5	8 bits	
Uplink Channel ID	8 bits	
TLV Encoded Information	*variable*	TLV specific
}		

Table 367—RNG-RSP message encodings

Name	Type (1 byte)	Length	Value (variable-length)	PHY Scope
Timing Adjust	1	4	Tx timing offset adjustment (signed 32-bit). The time required to advance SS transmission so frames arrive at the expected time instance at the BS. Units are PHY specific (see 10.3).	All
Power Level Adjust	2	1	Tx Power offset adjustment (signed 8-bit, 0.25 dB units) Specifies the relative change in transmission power level that the SS is to make in order that transmissions arrive at the BS at the desired power. When subchannelization is employed, the subscriber shall interpret the power offset adjustment as a required change to the transmitted power density.	All
Offset Frequency Adjust	3	4	Tx frequency offset adjustment (signed 32-bit, Hz units) Specifies the relative change in transmission frequency that the SS is to make in order to better match the BS. (This is fine-frequency adjustment within a channel, not reassignment to a different channel.)	All
Ranging Status	4	1	Used to indicate whether uplink messages are received within acceptable limits by BS. 1 = continue, 2 = abort, 3 = success, 4 = rerange	All
Downlink frequency override	5	4	Center frequency, in kHz, of new downlink channel where the SS should redo initial ranging. If this TLV is used, the Ranging Status value shall be set to 2. Shall be used for licensed bands only.	SCa OFDM OFDMA
Uplink channel ID override	6	1	Licensed bands: The identifier of the uplink channel with which the SS is to redo initial ranging (not used with PHYs without channelized uplinks). License-exempt bands: The Channel Nr (see 8.5.1) where the SS should redo initial ranging.	All

Table 367—RNG-RSP message encodings *(continued)*

Name	Type (1 byte)	Length	Value (variable-length)	PHY Scope
Downlink Operational Burst Profile	7	2	This parameter is sent in response to the RNG-REQ Requested Downlink Burst Profile parameter. Byte 0: Specifies the least robust DIUC that may be used by the BS for transmissions to the SS. Byte 1: Configuration Change Count value of DCD defining the burst profile associated with DIUC.	All
SS MAC Address	8	6	SS MAC Address in MAC-48 format	All
Basic CID	9	2	Basic CID assigned by BS at initial access.	All
Primary Management CID	10	2	Primary Management CID assigned by BS at initial access.	All
AAS broadcast permission	11	1	0 = SS may issue contention-based Bandwidth Requests permission 1 = SS shall not issue contention-based Bandwidth Request	SCa OFDM OFDMA
Frame number	12	3	Frame number where the associated RNG_REQ message was detected by the BS. Usage is mutually exclusive with SS MAC Address (Type 8). The opportunity within the frame is assumed to be 1 (the first) if the Initial Ranging Opportunity field is not supplied.	SCa OFDM
Initial ranging opportunity number	13	1	Initial Ranging opportunity (1–255) in which the associated RNG_REQ message was detected by the BS. Usage is mutually exclusive with SS MAC Address (Type 8).	SCa OFDM

Ex. 1013, 50, 665-666; Ex. 1002, ¶¶148-149. One of the parameters is the CID, which is also one of the parameters of the Ranging Request. Ex. 1013, 49-50, 665-666. Because the CID is in the Ranging Response which is the payload of a MAC PDU, the CID parameter in the Ranging Request specifies content/data (the CID itself) transmitted in the Ranging Response payload ("the first plurality of parameters at least specify content payload of the probe"). *Id.*, 35, 42-43, 49-50. The "ranging code index" is another example of data that is in a Ranging Request parameter and used for the Ranging Response payload. Ex. 1013, 49-51, 204-213, 576-579, 665-666; Ex. 1002, ¶149.

Another Ranging Request parameter is the SS MAC Address. Ex. 1013, 49, 664. This SS MAC Address specifies the SS ("specify…a second node") that

transmits the Ranging Request and receives the Ranging Response. Ex. 1013, 33, 168, 664-666; Ex. 1002, ¶150.

Accordingly, IEEE-802.16 discloses receiving in a BS, a Ranging Request specifying numerous parameters associated with generating and transmitting a Ranging Response, wherein the parameters (e.g., CID and SS MAC Address) specify a payload of the Ranging Response and the SS. Ex. 1002, ¶151.

c. [1B]

The Ranging Request causes the BS to determine parameters for inclusion within and to generate and transmit the Ranging Response ("probe"). Ex. 1013, 49-50, 199-213. The Ranging Response includes numerous parameters ("second plurality of parameters"):

Table 20—RNG-RSP message format

Syntax	Size	Notes
RNG-RSP_Message_Format() {		
Management Message Type = 5	8 bits	
Uplink Channel ID	8 bits	
TLV Encoded Information	*variable*	TLV specific
}		

Table 367—RNG-RSP message encodings

Name	Type (1 byte)	Length	Value (variable-length)	PHY Scope
Timing Adjust	1	4	Tx timing offset adjustment (signed 32-bit). The time required to advance SS transmission so frames arrive at the expected time instance at the BS. Units are PHY specific (see 10.3).	All
Power Level Adjust	2	1	Tx Power offset adjustment (signed 8-bit, 0.25 dB units) Specifies the relative change in transmission power level that the SS is to make in order that transmissions arrive at the BS at the desired power. When subchannelization is employed, the subscriber shall interpret the power offset adjustment as a required change to the transmitted power density.	All
Offset Frequency Adjust	3	4	Tx frequency offset adjustment (signed 32-bit, Hz units) Specifies the relative change in transmission frequency that the SS is to make in order to better match the BS. (This is fine-frequency adjustment within a channel, not reassignment to a different channel.)	All
Ranging Status	4	1	Used to indicate whether uplink messages are received within acceptable limits by BS. 1 = continue, 2 = abort, 3 = success, 4 = rerange	All
Downlink frequency override	5	4	Center frequency, in kHz, of new downlink channel where the SS should redo initial ranging. If this TLV is used, the Ranging Status value shall be set to 2. Shall be used for licensed bands only.	SCa OFDM OFDMA
Uplink channel ID override	6	1	Licensed bands: The identifier of the uplink channel with which the SS is to redo initial ranging (not used with PHYs without channelized uplinks). License-exempt bands: The Channel Nr (see 8.5.1) where the SS should redo initial ranging.	All

Table 367—RNG-RSP message encodings *(continued)*

Name	Type (1 byte)	Length	Value (variable-length)	PHY Scope
Downlink Operational Burst Profile	7	2	This parameter is sent in response to the RNG-REQ Requested Downlink Burst Profile parameter. Byte 0: Specifies the least robust DIUC that may be used by the BS for transmissions to the SS. Byte 1: Configuration Change Count value of DCD defining the burst profile associated with DIUC.	All
SS MAC Address	8	6	SS MAC Address in MAC-48 format	All
Basic CID	9	2	Basic CID assigned by BS at initial access.	All
Primary Management CID	10	2	Primary Management CID assigned by BS at initial access.	All
AAS broadcast permission	11	1	0 = SS may issue contention-based Bandwidth Requests permission 1 = SS shall not issue contention-based Bandwidth Request	SCa OFDM OFDMA
Frame number	12	3	Frame number where the associated RNG_REQ message was detected by the BS. Usage is mutually exclusive with SS MAC Address (Type 8). The opportunity within the frame is assumed to be 1 (the first) if the Initial Ranging Opportunity field is not supplied.	SCa OFDM
Initial ranging opportunity number	13	1	Initial Ranging opportunity (1–255) in which the associated RNG_REQ message was detected by the BS. Usage is mutually exclusive with SS MAC Address (Type 8).	SCa OFDM

Ex. 1013, 50, 665-666; Ex. 1002, ¶152. These parameters are determined to generate and transmit the Ranging Response. Ex. 1002, ¶153. For example, the BS determines the Ranging Status to be abort, continue, or success and determines timing and power corrections. *Id.*; Ex. 1013, 50, 199-213.

Accordingly, IEEE-802.16 discloses the BS determining numerous parameters associated with generating and transmitting the Ranging Response. Ex. 1002, ¶154.

d. [1C]

The Ranging Request's parameters ("first plurality of parameters") and Ranging Response's parameters ("second plurality of parameters") are used to generate the Ranging Response ("probe"). Ex. 1013, 49-50, 199-213. The Ranging

Request's parameters (e.g., CID, ranging code) are used by the BS to generate the Ranging Response, which is generated from the parameters in Table 20. *Id.*; Ex. 1002, ¶155.

Because the Requested Downlink Burst Profile of the Ranging Request provides a downlink burst profile (including a downlink frequency and FEC Code type that includes a modulation type) to be used by the BS to format and send the Ranging Response, the Requested Downlink Burst Profile parameter dictates the form of the Ranging Response ("probe"). Ex. 1013, 49-50, 199-201, 314-316, 547, 617, 660 (Table 359), 663 (Table 363). Ex. 1002, ¶¶156-157.

e. [1D]

The BS ("first node") transmits the Ranging Response ("probe") to the SS ("second node") in response to receiving the Ranging Request. Ex. 1013, 199-213; Ex. 1002, ¶158.

2. Claim 2

The BS ("first node") receives the Ranging Request having the Requested Downlink Burst Profile parameter that provides a burst profile for sending the Ranging Response. *See* §IX.A.1.b; Ex. 1013, 49-50, 199-213, 547, 663. This burst profile ("modulation profile") defines the downlink transmission properties and includes a modulation type. Ex. 1013, 7; Ex. 1002, ¶¶159-161.

3. Claim 3

a. [3PRE]

The ordinary meaning of claim 3 requires one parameter to indicate all pieces of information. To the extent claim 3 requires only one probe parameter to indicate only one piece, IEEE-802.16 discloses [3A] and thus anticipates claim 3. Alternatively, to the extent claim 3 encompasses multiple parameters that collectively indicate all pieces, IEEE-802.16 teaches parameters that collectively indicate each piece in [3A]-[3G] and thus renders claim 3 obvious. Ex. 1002, ¶¶162, 209.

b. [3A]

The Ranging Request includes the Requested Downlink Burst Profile parameter indicating a burst profile ("modulation profile") for the Ranging Response. *See* §IX.A.1.b, §IX.A.2; Ex. 1002, ¶¶163-164, 210.

c. [3B]

IEEE-802.16 does not expressly disclose [3B], but teaches contention resolution to address collisions. Ex. 1013, 165-166. Specifically, the SS performs a retry process of resending Ranging Requests until a maximum number of retries is reached if it does not receive a Ranging Response. Ex. 1013, 166, 177, 638. Likewise, the BS continues sending Ranging Responses for a number of retries. Ex. 1013, 176, 637 (Invited Ranging Retries parameter). The BS also determines if a

number of ranging correction retries is exhausted and aborts ranging or sends another Ranging Response. Ex. 1013, 181 (Figure 63), 202-203; Ex. 1002, ¶211.

Based on these teachings, it would have been obvious to modify the Ranging Request to include a parameter (e.g., in TLV information) indicating a number of times to transmit the Ranging Response ("probe"). Ex. 1013, 49-50, 307. A POSITA would have been motivated to do this because it improves the flexibility of contention resolution. Ex. 1013, 166; Ex. 1002, ¶¶212-213. Also, some Ranging Responses fail to reach the SS. Motivated to achieve successful delivery of Ranging Responses to obtain and maintain a quality RF link, a POSITA would have configured the Ranging Request to indicate the number of retries for sending the Ranging Response. Ex. 1002, ¶¶213-215.

d. [3C]

IEEE-802.16 does not expressly disclose [3C], but teaches the Ranging Request indicating a downlink burst profile that specifies the modulation, FEC code type, and code rate for the Ranging Response and thus dictates the number of symbols for the Ranging Response's payload. Ex. 1013, 49, 199, 494, 663; Ex. 1002, ¶216.

Based on these teachings, it would have been obvious to configure the Ranging Request to (e.g., in TLV information) indicate a number of symbols for the payload of the Ranging Response ("probe"). Ex. 1002, ¶217. A POSITA would

have been motivated to do this because it improves the SS's control over the amount of data it has to process when it receives the Ranging Response. *Id.* Also, this configuration enables deployment of different types of SSs capable of handling different payload sizes. *Id.* A POSITA would have been motivated to design the wireless network to provide flexibility so ranging is performed by devices with different capabilities. *Id.*, ¶¶217-219.

e. [3D]

IEEE-802.16 does not expressly disclose [3D], but teaches that, when using OFDMA, each frame begins with a preamble:

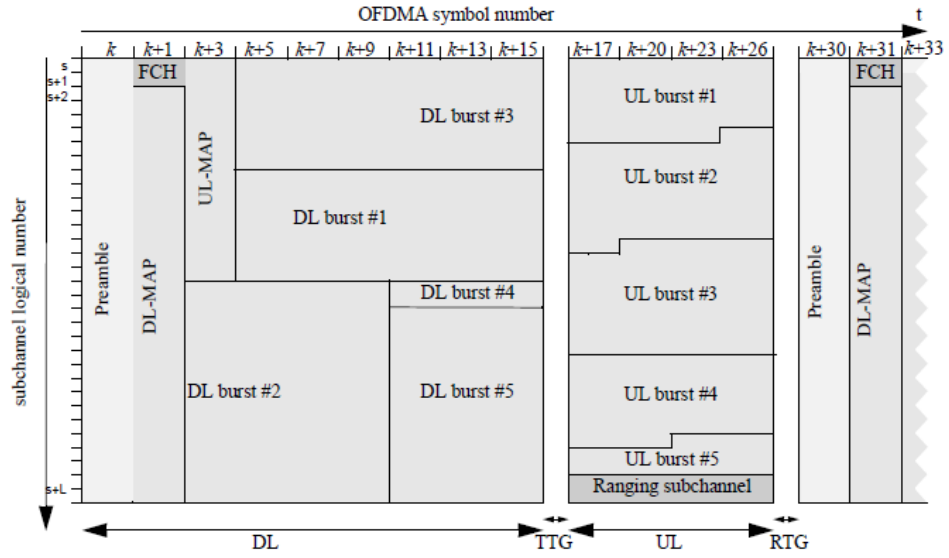


Figure 218—Time plan - one TDD time frame (with only mandatory zone)

Ex. 1013, 499, 501. There are different types of preambles (e.g., regular preamble, AAS DL preamble). Ex. 1013, 163-164, 507. Accordingly, the Ranging Request includes the AAS broadcast capability parameter, when appropriate, to instruct the

BS to use the AAS preamble for the Ranging Request on the downlink. Ex. 1013, 49; Ex. 1002, ¶¶220-221.

The adaptive antenna system (AAS) improves range and signal-to-noise ratio (SNR) gain and increases spectral efficiency. Ex. 1013, 162. These benefits would have motivated a POSITA to include the AAS capability parameter in the Ranging Request to instruct the BS to use AAS and send the AAS DL preamble for the Ranging Response. Ex. 1002, ¶221. Additionally, because the Ranging Request dictates the Ranging Response's form, it would have included a parameter that indicates a preamble type for the Ranging Response. *Id.*, ¶222; Ex. 1013, 531 ("Preamble Modifier Type"). Determining a preamble type is fundamental to sending the Ranging Response. Ex. 1013, 499, 501. Also, a POSITA would have wanted to give the SS the ability to control how the Ranging Response is formatted beyond just providing the downlink burst profile. Ex. 1002, ¶¶222-224.

f. [3E]

IEEE-802.16 does not expressly disclose [3E], but teaches forming a burst (for a payload) by prefixing a segment with a cyclic prefix (CP) of length *dU* symbols, where *U* and *d* are burst profile parameters:

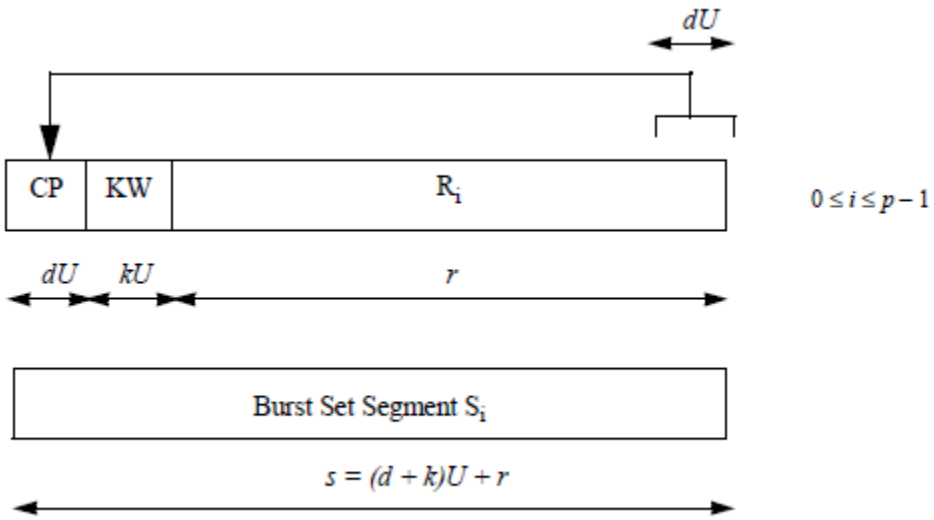


Figure 189—Forming a burst set segment from repeat segments

Ex. 1013, 387, 388. Likewise, an OFDMA symbol has a symbol period *Ts* that includes a cyclic prefix period *Tg* before a useful symbol period *Tb*, and IEEE-802.16 derives a CP Time (i.e., cyclic prefix length) from parameters for the OFDMA symbol. Ex. 1013, 494-495; Ex. 1002, ¶¶225-226.

Because the Ranging Request dictates the Ranging Response's form, it would have included a parameter (like *U* and *d*) that indicates a cyclic prefix length (or cyclic time *Tg*) for the payload of the Ranging Response. Ex. 1013, 199, 387-388. A POSITA would have been motivated to do this for the reasons IEEE-802.16 uses the Ranging Request to change the downlink burst profile—to give the SS control over the downlink format so that the SS maintains the downlink's quality. Ex. 1002, ¶227; Ex. 1013, 199. The CP is fundamental to downlink transmissions, and a POSITA would have wanted to specify its length when specifying the downlink burst profile. Ex. 1002, ¶¶227-229.

g. [3F]

IEEE-802.16 does not expressly disclose [3F], but discloses a mesh network in which all nodes transmit messages including the Nbr Xmt Power parameter:

Table 67—Nbr Logical IE

Syntax	Size	Notes
MSH-Nbr_Logical_IE() {		
Rcv Link Quality	3 bit	
Nbr burst Profile	4 bit	Burst profile Nbr shall use in next transmission to this node
Excess Traffic Demand	1 bit	0 = No, 1 = Yes
Nbr Xmt Power	4 bits	
Nbr Xmt Antenna	3 bits	
Short Preamble flag	1 bit	0 = Don't use, 1 = Use Requested/Use Confirmed
}		

Ex. 1013, 81-84. Nbr Xmt Power provides the transmit power for a neighbor node to use for communicating with the node sending it. Ex. 1013, 184; Ex. 1002, ¶¶230-231.

Because the Ranging Request dictates the Ranging Response's form, it would have included a parameter (like Nbr Xmt Power) that indicates a power to be used by the BS in sending the Ranging Response. Ex. 1013, 81-84. A POSITA would have been motivated to do this for the reasons IEEE-802.16 uses the Ranging Request to change the downlink burst profile—to give the SS control over the downlink format so that the SS maintains the downlink's quality. Ex. 1002, ¶232; Ex. 1013, 199. Setting transmission power is fundamental to downlink

transmissions, and a POSITA would have wanted to specify it when specifying the downlink burst profile. Ex. 1002, ¶¶232-234.

h. [3G]

IEEE-802.16 does not expressly disclose [3G], but teaches that the Ranging Response includes a Power Adjust parameter, which indicates a transmit power scaling factor for adjusting subsequent transmissions. Ex. 1013, 50, 80; Ex. 1002, ¶235.

Because the Ranging Request dictates the Ranging Response's form, it would have included a parameter (like Power Adjust) that indicates a power scaling factor to be used by the BS in sending the Ranging Response. Ex. 1013, 50, 80. A POSITA would have been motivated to do this for the reasons IEEE-802.16 uses the Ranging Request to change the downlink burst profile—to give the SS control over the downlink format so that the SS maintains the downlink's quality. Ex. 1002, ¶236; Ex. 1013, 199. Setting transmission power is fundamental to downlink transmissions, and a POSITA would have wanted to specify it when specifying the downlink burst profile. Ex. 1002, ¶236. Because the scaling factor would have been for the Ranging Response, it applies to its payload. *Id.*, ¶¶236-238.

4. Claim 4

When an initial Ranging Request ("probe request") is sent, the SS is unknown to the BS that receives it. Ex. 1013, 167-177, 205-206. Therefore, a POSITA would

have understood that the SS is a "hidden node" at the time it transmits the initial Ranging Request. The Ranging Request identifies the SS as a hidden node because the BS, based on receiving the initial Ranging Request, learns of the existence of the SS even if it does not yet know all information about the SS. Thus, the Ranging Request "identifies a hidden node." Ex. 1002, ¶¶165-166, 239.

Alternatively, in a case where the SS is attempting to join the network, the Ranging Request shall include a SS MAC Address parameter. Ex. 1013, 49, 664. This SS MAC address identifies the SS to the BS, which previously did not know the SS's MAC address. Ex. 1002, ¶167. Therefore, the SS is unknown or hidden prior to receipt of the Ranging Request. *Id.* Thus, the Ranging Request having the SS MAC Address also "identifies a hidden node." *Id.*

5. Claim 5

Messages sent on IEEE-802.16's WirelessMAN-OFDMA PHY layer emulate an OFDMA transmission. Ex. 1013, iv, 2, 493-501. The Ranging Response ("probe") would have been transmitted through the OFDMA PHY layer and therefore would have been modulated for transmission through it. Ex. 1013, 50-51, 204-213; Ex. 1002, ¶¶168-169.

Further, the downlink burst profile ("modulation profile") for the Ranging Response includes a modulation type:

Table 363—DCD burst profile encodings—WirelessMAN-OFDMA

Name	Type (1 byte)	Length	Value (variable length)
FEC Code type	150	1	0 = QPSK (CC) 1/2 1 = QPSK (CC) 3/4 2 = 16-QAM (CC) 1/2 3 = 16-QAM (CC) 3/4 4 = 64-QAM (CC) 2/3 5 = 64-QAM (CC) 3/4 6 = QPSK (BTC) 1/2 7 = QPSK (BTC) 3/4 or 2/3 8 = 16-QAM (BTC) 3/5 9 = 16-QAM (BTC) 4/5 10 = 64-QAM (BTC) 2/3 or 5/8 11 = 64-QAM (BTC) 5/6 or 4/5 12 = QPSK (CTC) 1/2 13 = QPSK (CTC) 2/3 14 = QPSK (CTC) 3/4 15 = 16-QAM (CTC) 1/2 16 = 16-QAM (CTC) 3/4 17 = 64-QAM (CTC) 2/3 18 = 64-QAM (CTC) 3/4 19 = 64-QAM (CTC) 5/6 20 = QPSK (ZT CC) 1/2 21 = QPSK (ZT CC) 3/4 22= 16-QAM (ZT CC) 1/2 23= 16-QAM (ZT CC) 3/4 24= 64-QAM (ZT CC) 2/3 25= 64-QAM (ZT CC) 3/4 26..255 = *Reserved*
DIUC Mandatory exit threshold	151	1	0–63.75 dB CINR at or below where this DIUC can no longer be used and where this change to a more robust DIUC is required, in 0.25 dB units. See Figure 81.
DIUC Minimum entry threshold	152	1	0–63.75 dB The minimum CINR required to start using this DIUC when changing from a more robust DIUC is required, in 0.25 dB units. See Figure 81.

Ex. 1013, 547, 660, 663-664. Accordingly, the downlink burst profile for the Ranging Response emulates an OFDMA transmission for delivery through the OFDMA PHY layer. Ex. 1002, ¶¶170-172.

6. Claim 6

The Ranging Request ("probe request") is generated and transmitted by the SS ("second node"). *See* §§IX.A.1.b-d; Ex. 1013, 49, 199-213; Ex. 1002, ¶¶173-174.

7. Claim 7

The Ranging Request ("probe request") requests the BS to send the Ranging Response ("probe"). *See* §IX.A.1; Ex. 1013, 49-50, 199-213. Ranging is performed to acquire correct transmission parameters and maintain the quality of the RF link

between the BS and SS. Ex. 1013, 199, 202. Therefore, the Ranging Request assists in diagnosing a problem (e.g., timing or power problem) with the RF link ("network problem"). If the Ranging Request is not successful, the Ranging Response commands the SS to continue ranging and provides data (e.g., timing or power adjustments) for making adjustments in an attempt to improve the RF link. Ex. 1013, 202-213, 665-666; Ex. 1002, ¶¶175-176.

Also, initial ranging is performed when communication/synchronization is lost, so another network problem that ranging is used to diagnose is the loss of synchronization. Ex. 1013, 169-174, 477; Ex. 1002, ¶¶176-177.

8. Claim 8

IEEE-802.16 discloses the SS ("second node") generating the Ranging Request ("probe request"). Ex. 1013, 49, 199-213. IEEE-802.16 does not expressly disclose claim 8, but a POSITA would have found it obvious.

The MAC layer inserts the Ranging Request into a MAC PDU. Ex. 1013, 35, 42-43. The MAC layer includes sublayers with service access points (SAPs) for interfacing the sublayers with management entities and/or the network management system:

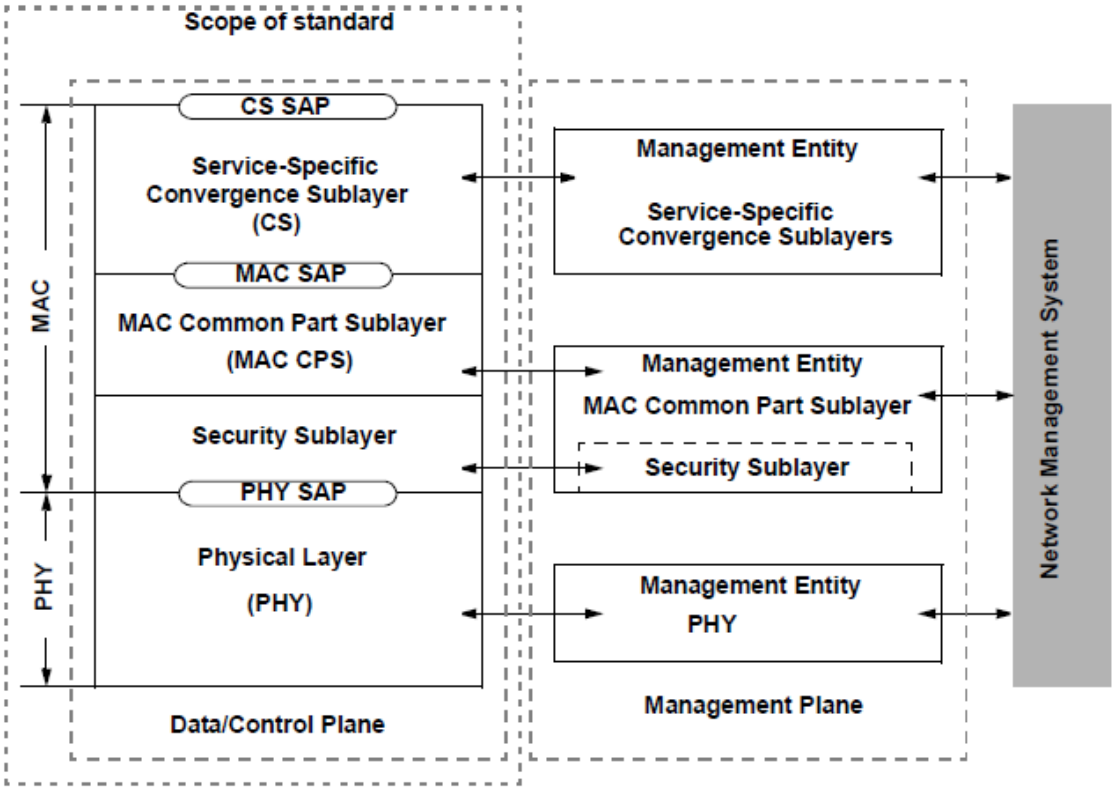


Figure 1—IEEE Std 802.16 protocol layering, showing SAPs

Ex. 1013, 3-4. These management entities and/or network management system are a "network operator" because they manage the MAC layer of the SS. Ex. 1002, ¶¶241-243.

IEEE-802.16 also teaches that the MAC CPS receives data from various CSs and gives an example MAC CPS service in Annex C. Ex. 1013, 4. Annex C provides example primitives to describe the information that is exchanged between the MAC and the CSs to enable each to perform its requirements. Ex. 1013, 841. A POSITA would have understood that the management entities and/or network management system use the MAC_CREATE_SERVICE FLOW.request primitive to create/generate MAC request messages, like the Ranging Request. Ex. 1013, 841-

842; Ex. 1002, ¶244. A POSITA would have also understood that the created Ranging Request is then uploaded to the MAC layer for insertion into a MAC PDU. Ex. 1002, ¶244.

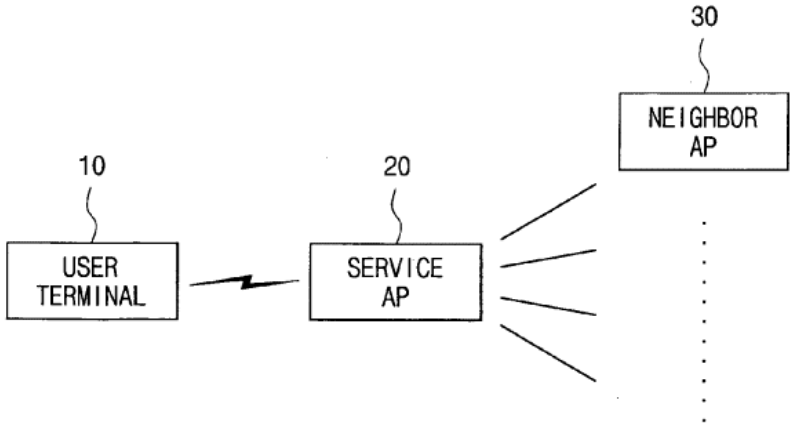
Further, a POSITA would have found it obvious to use the management entities and/or network management system (separate from the MAC layer) to generate the Ranging Request and upload it to the SS for transmission to the BS. A POSITA would have been motivated to do this because it reduces the processing burden of the MAC layer and shifts some of that burden to the network management entities and/or network management system. Ex. 1002, ¶245. Shifting this burden to the network management entities/system (which are already available to manage the MAC), enables the MAC layer to use its processing power for other functions, like packaging messages into MAC PDUs. *Id.*, ¶¶245-246.

A POSITA would have also been motivated to use a separate entity/system to generate the Ranging Request for the SS to configure the SS for remote access/control. *Id.*, ¶247. And, a POSITA would have been motivated by known practices. In practice, the MAC layer of a receiver/transmitter is generally operated with a separate processor/computer. *Id.*, ¶244; Ex. 1020, [0052]-[0054], [0064], FIGs. 3-4 (WiMax compatible terminal 22 having separate host processor 42 for generating data for the MAC layer). A POSITA would have also expected to achieve success in using a separate system to generate the Ranging Request and send/upload

it to the SS, particularly since the MAC layer already has SAPs that provide management of the SS. Ex. 1002, ¶246.

To the extent IEEE-802.16 alone does not teach claim 8, IEEE-802.16 combined with Won does. Like IEEE-802.16, Won discusses wireless communications (including probing) between nodes. Ex. 1008, Abstract, [0003], [0012]-[0015]. Won's system includes a user terminal 10 and service AP 20 that broadcasts a probe request and receives probe responses from neighboring APs 30:

FIG. 2



Ex. 1008, [0026]-[0031], [0035], FIG. 2; Ex. 1002, ¶¶319-320.

User terminal 10 sends a scan request to AP 20, and in response, AP 20 generates and sends a probe request. Ex. 1008, [0014], [0019], [0026]-[0027]. From this teaching of probe requests originating from user terminal 10, it would have been obvious to use a user terminal to generate a Ranging Request and upload it to IEEE-802.16's SS for transmission upstream. Ex. 1002, ¶¶321-322. In other words, it

would have been obvious to combine user terminal 10 with IEEE-802.16's system, such that user terminal 10 ("network operator") generates IEEE-802.16's Ranging Request and uploads it to the SS. *Id.*

Won's teaching of terminal 10 causing AP 20 to send a probe request would have motivated a POSITA to use a terminal for generating and uploading IEEE-802.16's similar Ranging Request to its SS because Won's terminal gives users/administrator more control over probe requests. Ex. 1002, ¶322. A POSITA would have been motivated to use terminal 10 in this way because it would have been desirable to give users/administrators at the SS-side control over the timing and/or configuration of IEEE-802.16's network entry process, .e.g. when the SS has difficulty synchronizing to a downlink from the BS and/or difficulty obtaining downlink/uplink parameters. *Id.* This would have motivated a POSITA to incorporate terminal 10 to generate and upload the Ranging Request in IEEE-802.16's system. *Id.* To address problems connecting to the BS as they arise (e.g., due to low power or interference), a POSITA would have been motivated to give (via a separate terminal) users/administrators control to initiate ranging as they desire. *Id.*

IEEE-802.16-Won merely combines known elements (IEEE-802.16's system with Won's terminal 10) according to known methods (Won's configuring terminal 10 to cause AP 20 to transmit a probe request) to yield predictable results (a user

terminal generating a Ranging Request and uploading it to SS). *Id.*, ¶323. IEEE-802.16-Won also uses a known technique (using terminal 10 to control AP to send probe request) to improve similar devices (IEEE-802.16's SS and Won's terminal 10) in the same way (enabling a network operator to initiate ranging/probing). *Id.*, ¶324. A POSITA would have expected success in these results given the POSITA's programming and network design skills (e.g., configuring SS's for control by separate processors/computers). *Id.*, ¶325.

Accordingly, IEEE-802.16 alone, or IEEE-802.16-Won, teaches the Ranging Request being generated by a network operator and uploaded to the SS, thereby rendering claim 8 obvious. *Id.*, ¶¶248, 326.

9. Claim 9

a. [9PRE]

Claim 9 is similar to claim 1, but flips the first and second nodes. IEEE-802.16's various processes collectively or the ranging procedure alone discloses the claimed "method" as either comprises [9A]-[9B]. *See* §§IX.A.9.b-c; Ex. 1002, ¶178.

b. [9A]

IEEE-802.16's SS ("first node") transmits a Ranging Request ("probe request") to a BS ("second node") and specifies parameters for the Ranging Response ("specifying a first plurality of probe parameters for a physical layer probe"), the parameters comprising a form for the Ranging Response including a burst profile for it ("modulation profile for the probe"). *See* §§IX.A.1.b-e,

§IX.A.3.b; Ex. 1002, ¶¶179-190. The Ranging Response is a "physical layer probe" because it is transmitted through the PHY layer to maintain the RF link's quality and ensure correct timing and preferred power for transmissions over the PHY layer. Ex. 1013, 174-182, 199; Ex. 1002, ¶¶191-192.

c. [9B]

IEEE-802.16's SS ("first node") receives the Ranging Response ("probe") from the BS ("second node"), wherein the Ranging Response is generated according to the Ranging Request's parameters and Ranging Response's parameters as determined by the BS. *See* §§IX.A.1.b-e; Ex. 1002, ¶¶194-196.

10. Claim 10

As discussed, the Ranging Request is configured with the burst profile that dictates the form of the Ranging Response (§§IX.A.1.b-d) and the Ranging Response emulates an OFDMA transmission (§IX.A.5). Ex. 1002, ¶¶197-201.

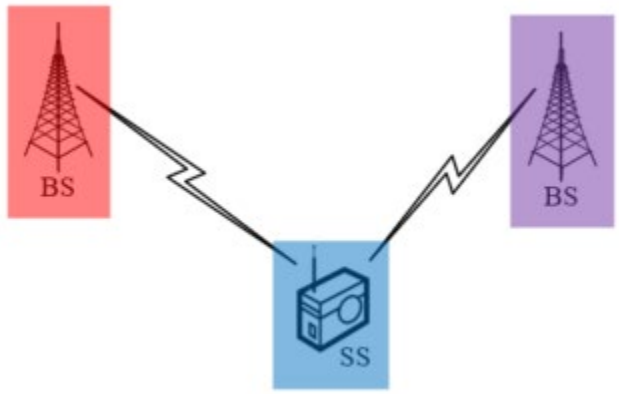
11. Claim 11

a. [11PRE]

Claim 11 adds (i) a second instance of probing, (ii) using OFDMA, and (iii) transmitting two probes "simultaneously." IEEE-802.16 discloses (i) and (ii) as discussed for claims 9 and 10. *See* §§IX.A.9-10. IEEE-802.16 does not expressly disclose (iii), but a POSITA would have found this obvious. Ex. 1002, ¶249.

b. [11A]

As discussed (§IX.A.9.b), the SS ("first node") transmits a Ranging Request to a BS. Ex. 1013, 49-50, 199-213. A POSITA would have understood that IEEE-802.16's system includes the SS communicating with multiple BSs (e.g., **first BS** and **second BS**):

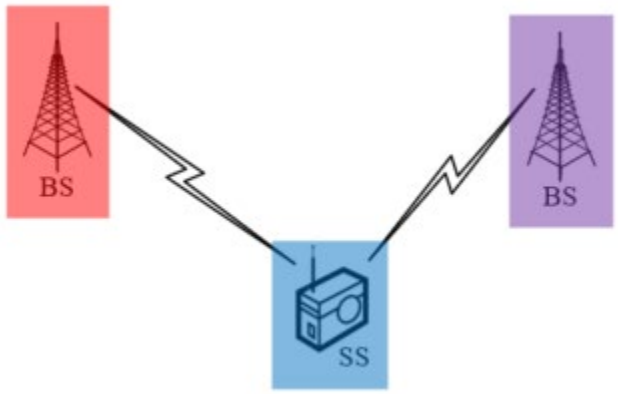


Ex. 1013, 166 (multiple flows), 227, 274 (simultaneous keys); Ex. 1016, [0065]-[0070], [0131]-[0134], FIGs. 1A-1C (stations connected to multiple base stations). The SS transmits a first Ranging Request to the **first BS** ("second node" in claim 9) and a second Ranging Request ("second probe request") to the **second BS** ("third node"). Ex. 1013, 49-51, 177 (Note 2); Ex. 1002, ¶¶250-252.

c. [11B]

The **SS** ("first node") receives a first Ranging Response ("probe" in claim 9) from the **first BS** ("second node"), wherein that first Ranging Response is generated according to the first Ranging Request ("probe request" in claim 9). *See* §IX.A.9.c. For the same reasons, IEEE-802.16 teaches the **SS** receiving a second Ranging

Response ("second probe") from the **second BS** ("third node"), wherein the second Ranging Response is generated according to the second Ranging Request:

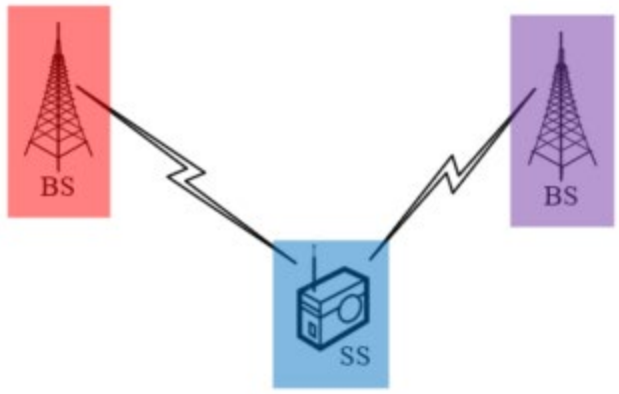


Ex. 1002, ¶¶253-254.

d. [11C]

The first Ranging Response ("first probe") is transmitted using OFDMA. *See* §IX.A.10. For the same reasons, the second Ranging Response ("second probe") is transmitted using OFDMA too. Ex. 1002, ¶¶255-256.

These two Ranging Responses would have been transmitted simultaneously using OFDMA, because the base stations are different and would use separate downlinks. Ex. 1002, ¶257. The transmission timing for each Ranging Response is based on when a BS receives a Ranging Request and when the BS has a slot for transmitting Ranging Responses. *Id.* This timing for the downlink between the **first BS** and **SS** is independent from this timing for the downlink between the **second BS** and **SS**. *Id.*



A POSITA would have understood that there would have been situations in which the **SS** has simultaneous communication sessions with two base stations, such that the **first BS** transmits the first Ranging Response and the **second BS** transmits the second Ranging Response, simultaneously. *Id.*, ¶257; Ex. 1013, 166 (multiple flows), 227, 274 (simultaneously active keys). These situations would have occurred because the **SS** would have sent multiple Ranging Requests on different uplinks. Ex. 1002, ¶258. A POSITA would have been motivated to configure the **SS** to perform ranging with multiple BSs simultaneously because it enables the SS to determine an optimal connection to the network. *Id.* One of the goals or advantages of OFDMA is to more efficiently use bandwidth so that multiple points have simultaneous access to the network. Ex. 1013, 494-495. This goal provides further motivation for the **first BS** and **second BS** to simultaneously transmit Ranging Responses using OFDMA. Ex. 1002, ¶¶258-259.

12. Claim 12

Claim 12 includes information that the probe parameters (collectively) comprise. Claim 12 would have been obvious for the same reasons as claim 3:

Claim 12	Analysis
[12A]	Nearly identical to [3B]. *See* §IX.A.3.c.
[12B]	Identical to [3C]-[3D]. *See* §IX.A.3.d-e.
[12C]	Identical to [3E]-[3F]. *See* §IX.A.3.f-g.
[12D]	Identical to [3G]. *See* §IX.A.3.h.

Ex. 1002, ¶¶260-264.

13. Claim 13

IEEE-802.16 discloses claim 13 for similar reasons as claim 4. *See* §IX.A.4. The Ranging Request ("probe request") triggers the BS to transmit the Ranging Response ("probe") back to the SS. Ex. 1013, 50-51, 199-213. At the time of receiving the Ranging Request, the SS is a hidden node. *See* §IX.A.4; Ex. 1013, 167-184. The Ranging Response identifies the SS, which is still the "hidden node" at the time the initial Ranging Response is sent because the SS is not registered, by sending a Ranging Response with a MAC Address of the SS and/or a Ranging Code that the SS supplied in its Ranging Request. Ex. 1013, 664-666 (MAC Address in

Table 367), 205 (Ranging Response with the received Ranging Code), 167-184 (ranging before entry).

Accordingly, the Ranging Request is configured such that the Ranging Response identifies a new SS. Ex. 1002, ¶¶265-268.

14. Claim 14

The SS transmits the Ranging Request at times in a ranging interval (providing ranging transmission opportunities) allocated by the BS. Ex. 1013, 174-175. Such ranging transmission opportunities are specific times based on previous synchronization. Ex. 1013, 167-171. Accordingly, the Ranging Request is transmitted at a specific time specified by the ranging transmission opportunity. Ex. 1002, ¶¶202-204.

15. Claim 15

IEEE-802.16 discloses claim 15 for similar reasons as claim 7. *See* §IX.A.7. The Ranging Request ("probe request") triggers the BS to transmit the Ranging Response ("probe") back to the SS. Ex. 1013, 199-213. Ranging is performed to acquire correct transmission parameters and maintain the RF link's quality. Ex. 1013, 199, 202-213, 665-666. Therefore, the Ranging Request is configured to diagnose a problem with the RF link ("network problem"). It is also configured to diagnose loss of synchronization. *See* §IX.A.7.

Accordingly, the Ranging Request is configured to diagnose a problem with the RF link (e.g., timing and power of SS transmissions on it or loss of synchronization) between the SS and BS. Ex. 1002, ¶¶205-207.

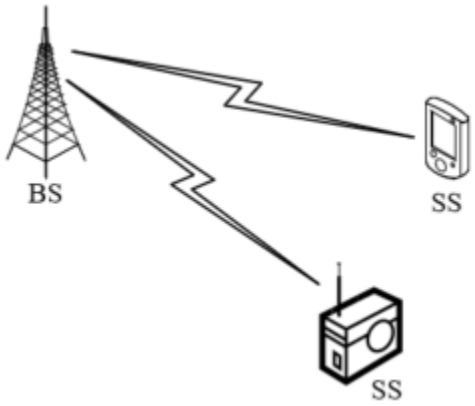
16. Claim 16

IEEE-802.16 renders claim 16 obvious for the same reasons as claim 8, except SS is the "first node." *See* §IX.A.8; Ex. 1002, ¶¶269, 327.

17. Claim 17

a. [17PRE]

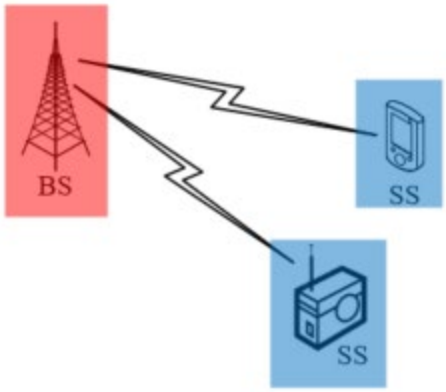
Claim 17 is similar to claims 1 and 9, but claims a system, which is disclosed by IEEE-802.16's system:



See §IX.A.1, §IX.A.9, §§IX.A.17.b-g; Ex. 1002, ¶¶270-271.

b. [17A]

IEEE-802.16's system includes a wireless network ("communications network") including one or more **SSs** ("first node") communicating with a **BS** ("second node"):



A POSITA would have understood that a SS comprises a processor and computer executable program code embodied on a computer readable medium because that was a well-known implementation for the protocol stack of the SS:

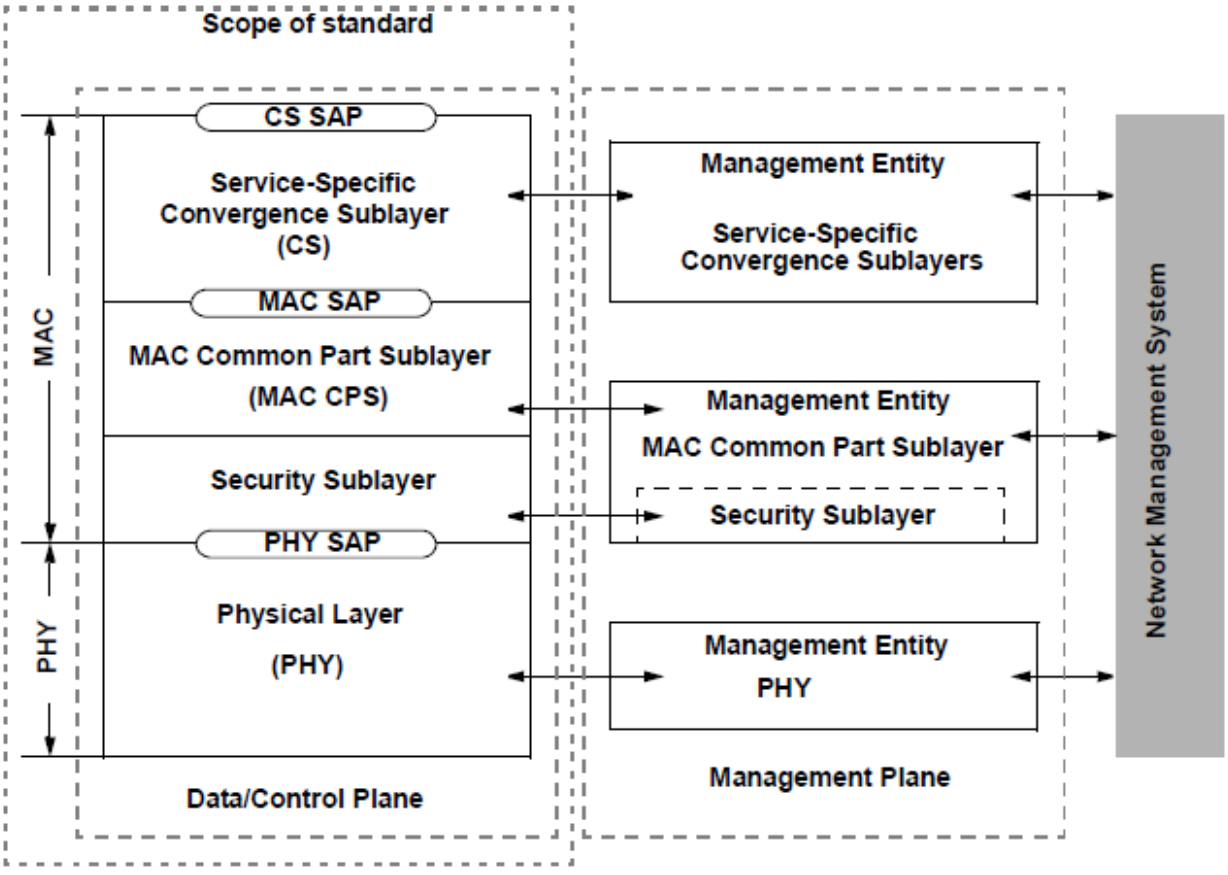


Figure 1—IEEE Std 802.16 protocol layering, showing SAPs

Ex. 1013, 3; Ex. 1002, ¶¶272-273. A POSITA would have understood that the computer executable program code would have been configured to carry out the procedures (e.g., ranging) of the layers in the stack and therefore would have performed the "transmit" in [17A]. *See* §IX.A.9.b; Ex. 1016, [0010]; Ex. 1002, ¶274.

The Ranging Request specifies parameters for a physical layer Ranging Response ("the probe request specifying a first plurality of probe parameters for a physical layer probe"). *See* §IX.A.1.b, §IX.A.9.b. And, the Ranging Request's parameters (e.g., CID, SS MAC Address, Requested Downlink Burst Profile parameters) comprise a payload content and burst profile for the Ranging Response ("a payload content for the probe and a modulation profile for the probe"). *See* §IX.A.1.b, §IX.A.2, §IX.A.9.b; Ex. 1002, ¶¶275-289.

c. [17B]

A POSITA would have understood that the BS ("second node") comprises a processor and computer executable program code embodied on a computer readable medium because that was the well-known implementation for the protocol stack of the BS too:

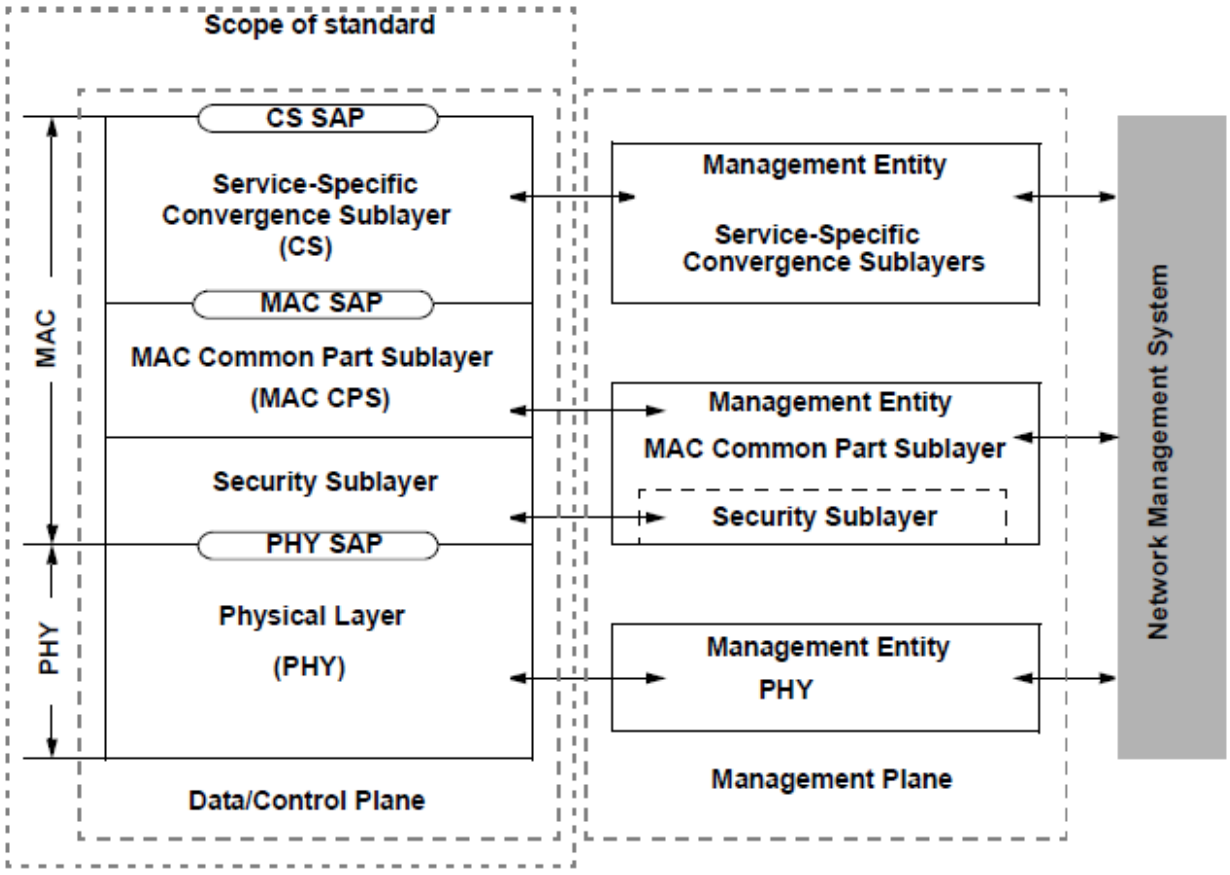


Figure 1—IEEE Std 802.16 protocol layering, showing SAPs

Ex. 1013, 3; Ex. 1002, ¶290. A POSITA would have understood that the computer executable program code would have been configured to carry out the procedures (e.g., ranging) of the layers in the stack. Ex. 1013, 46 (programmable BS); Ex. 1016, [0010]; Ex. 1002, ¶291. Specifically, the BS's program code would have been configured to perform [17C]-[17F]. *See* §§IX.A.17.d-g; Ex. 1002, ¶292.

d. [17C]

The BS receives the Ranging Request. *See* §IX.A.1.b, §IX.A.9.c; Ex. 1002, ¶293.

e. [17D]

The BS determines parameters associated with generating and transmitting the Ranging Response. *See* §IX.A.1.c; Ex. 1002, ¶294.

f. [17E]

The BS generates the Ranging Response according to the Ranging Request's parameters and the Ranging Response's parameters, wherein the Ranging Response has a form (e.g., modulation) dictated by the Ranging Request's parameters. *See* §IX.A.1.d; Ex. 1002, ¶295.

g. [17F]

The BS transmits the Ranging Response to the SS. *See* §IX.A.1.e; Ex. 1002, ¶296.

18. Claim 18

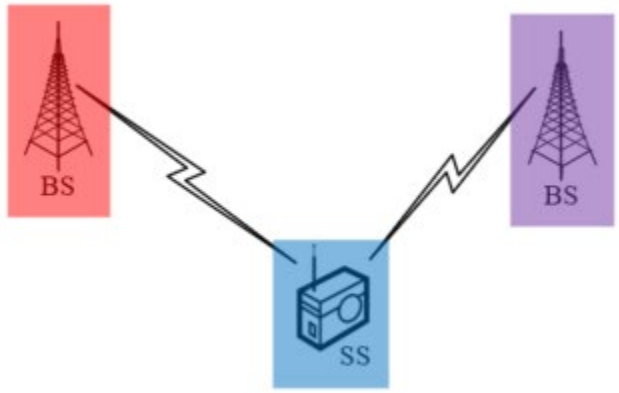
IEEE-802.16 discloses claim 18 for the same reasons as claim 10. *See* §IX.A.10; Ex. 1002, ¶297.

19. Claim 19

a. [19A]

IEEE-802.16 discloses a second instance of probing and using OFDMA. *See* §§IX.A.9-11, §§IX.A.17-18. IEEE-802.16 does not expressly disclose transmitting two probes simultaneously, but a POSITA would have found this obvious.

The **SS's** code is configured to transmit a second Ranging Response (specifying parameters for the second Ranging Response) to a **second BS** on the wireless network:



See §IX.A.9.b, §IX.A.11.b; Ex. 1002, ¶¶298-301.

b. [19B]

The second Ranging Request's parameters comprise a second payload content and second downlink burst profile for the second Ranging Response. *See* §IX.A.17.b; Ex. 1002, ¶302.

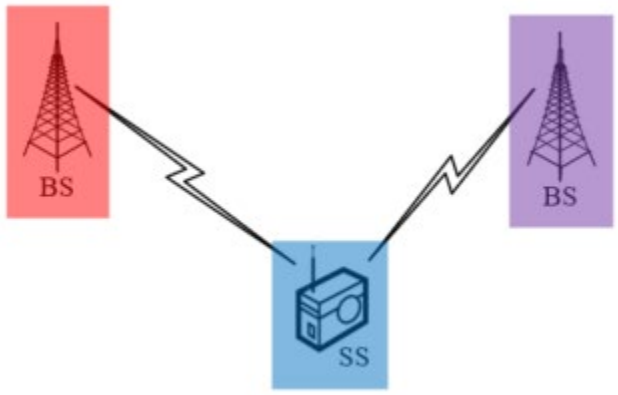
c. [19C]

The Ranging Request has numerous parameters for generating and transmitting a Ranging Response (§IX.A.1), and any two groups/subsets of those parameters teaches the "different second plurality of parameters" and "third first plurality of probe parameters." Ex. 1002, ¶303.

The second Ranging Request specifies a second group/subset of parameters associated with the generation and transmission of the second Ranging Response. *See* §IX.A.1.b, §IX.A.9.b, §IX.A.17.b, §IX.A.19.a; Ex. 1002, ¶304.

d. [19D]

[19D] is similar to [17B]-[17F], except it is for the third node. The **second BS** ("third node") performs the same steps as the **first BS** to generate the second Ranging Response transmitted to the **SS** on the wireless network:



See §§IX.A.17.c-g; Ex. 1002, ¶305.

e. [19E]

[19E] is identical to [11C]. *See* §IX.A.11.d; Ex. 1002, ¶306.

20. Claims 20-24

Except for their dependencies, claims 20-24 are the same, and obvious for the same reasons, as claims 12-13, 6, and 15-16, respectively. *See* §§IX.A.12-13, §IX.A.6, §§IX.A.15-16; Ex. 1002, ¶¶307-317, 328.

B. Grounds D-E: Waxman (Anticipation and Obviousness)

1. Claim 1

a. [1PRE]

Waxman discloses a method. Ex. 1007, Abstract, [0006]; Ex. 1002, ¶¶329-332.

b. [1A]

Waxman provides a wireless system for extended connectivity range between wireless access points (APs) and communication stations. Ex. 1007, [0012]. Waxman's wireless AP 105 constitutes the "first node" and any one of Waxman's stations 101, 102, 103 constitutes the "second node." Ex. 1007, [0012]-[0017], [0028], [0045], FIG. 1, Ex. 1002, ¶¶333-341. As part of an active scanning process, Waxman's station transmits a probe request to AP 105, which receives it ("receiving in a first node, a probe request"). Ex. 1007, [0030], [0046]-[0048], [0052]-[0054], FIGs. 2-3.

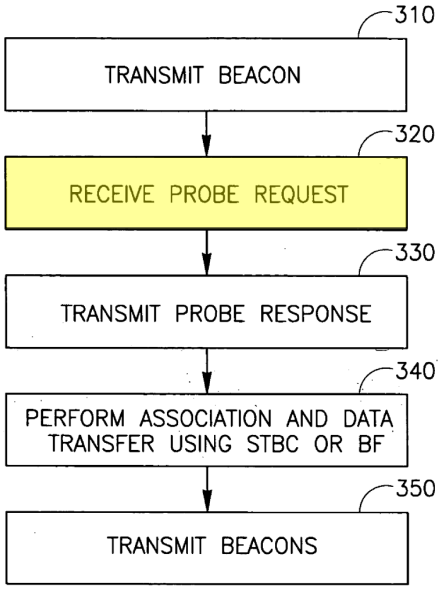


FIG.3

Ex. 1007, FIG. 3 (annotated); Ex. 1002, ¶¶335-337.

Waxman's probe request provides numerous parameters ("first plurality of parameters") for a probe response, including "a requested transmission scheme, a requested number of transmission antennas to be used, and/or other attributes of a requested transmission scheme." Ex. 1007, [0030]-[0035]; Ex. 1002, ¶¶342-344.

Waxman's AP generates and transmits a probe response having preamble and data portions, based on the probe request's parameters. Ex. 1007, [0042]-[0043], [0056]; Ex. 1002, ¶343. These parameters specify payload content and the requesting station as the recipient of the probe response ("content payload of the probe and second node"). Ex. 1007, [0037], [0049], FIG. 2; Ex. 1002, ¶¶343-346.

c. [1B]

In generating the probe response, Waxman's AP determines based on the probe request and other information that a certain extended-range transmission scheme is requested (e.g., TADS). Ex. 1007, [0030], [0054].

Waxman's various transmission schemes use different parameters for transmissions to stations. The STBC scheme encodes the data stream in blocks, which are distributed among spaced antennas and across time. *Id.*, [0023]. To send the probe response using STBC, the AP determines parameters for a matrix, e.g., based on a number of antennas and time slots for blocks of data. *Id.*; Ex. 1002, ¶¶347-349.

Also, for a BF scheme, Waxman's AP multiplies an information signal by a number of weights equal to the number of antennas used to transmit it. Ex. 1007, [0025]. This involves determining complex weights and/or adapting weights. *Id.*, [0027]-[0028]. For the AP to send the probe response using BF, the AP would have had to determine parameters for setting beam direction, including determining weights. Ex. 1002, ¶350. Additionally, the AP determines other parameters when using Cyclic Delay Diversity or IEEE 802.11. Ex. 1007, [0019], [0031]; Ex. 1002, ¶¶351-352.

Waxman also describes using different schemes for different portions (e.g., preamble, header, data) of packets. Ex. 1007, [0043]-[0044]. Thus, the AP also

determines parameters for matching packet portions with transmission schemes. Ex. 1002, ¶¶353-354.

To the extent that Waxman does not explicitly disclose the "second plurality of parameters," it would have been obvious for the AP to determine multiple parameters for sending the probe response because Waxman teaches dynamically generating a probe response according to the requested transmission scheme and other attributes in the probe response. Ex. 1002, ¶355. This implementation merely uses a known technique (Waxman's determining of multiple parameters to generate a probe request) to improve similar methods (Waxman's method for generating a probe response) in the same way. *Id*. As Waxman discusses that the AP ("first node") determines how to generate and transmit a probe response based on the probe request and that various processes (e.g., weighting) are used for generating the probe response, a POSITA would have understood that the AP determines multiple parameters for generating and transmitting the probe response and would have had a reasonable expectation of success in setting these parameters. Ex. 1002, ¶¶355-356.

d. [1C]

Waxman's AP generates a probe response ("probe") according to the parameters described for [1A] and [1B]. Ex. 1007, [0037]-[0039], [0049], [0055], FIG. 2 (copied and annotated below), FIG. 3.

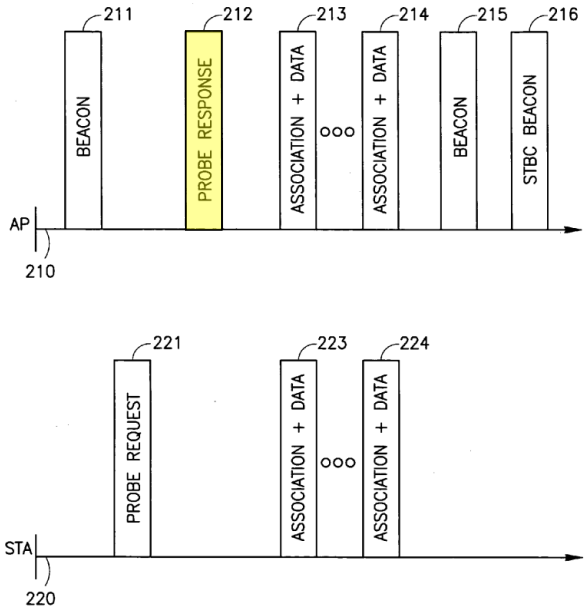


FIG.2

The probe response parameters specify a transmission scheme for the probe response, which dictates its form ("probe has a form dictated by the first plurality of parameters"). Ex. 1002, ¶¶357-362.

e. [1D]

Waxman's AP transmits the probe response to the station ("second node") that sent the probe request. Ex. 1007, [0037], [0049], [0055], FIG. 2, FIG. 3 (copied and annotated below); Ex. 1002, ¶¶363-365.

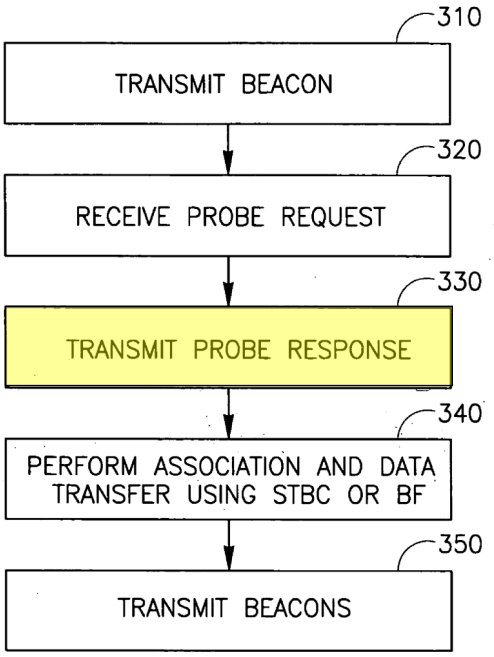


FIG. 3

Thus, Waxman anticipates or renders obvious claim 1. Ex. 1002, ¶366.

2. Claim 9

Claim 9 is unpatentable for similar reasons as claim 1, but one of Waxman's stations is the "first node" and Waxman's AP is the "second node." *See* §IX.B.1; Ex. 1002, ¶¶395-421. Other comparisons are identified below.

Claim 9	**Analysis**
[9PRE]	Identical to [1PRE]. §IX.B.1.a; Ex. 1002, ¶395.
[9A]	Nearly identical to [1A], but recites "physical layer probe" and that the first plurality of parameters "compris[e] a form for the probe

	including a modulation profile for the probe." §IX.B.1.b; Ex. 1002, ¶¶396-408.
[9B]	Nearly identical to [1B]-[1D] and of the same scope. §§IX.B.1.b-e; Ex. 1002, ¶¶409-421.

Waxman's probe response is a physical layer probe to the extent the '690 patent's probe is. Ex. 1001, 3:42-58, 7:64-8:58; Ex. 1007, [0042]-[0043], [0056]; Ex. 1002, ¶404.

Waxman's probe request specifies an RTS parameter that instructs the AP to use a particular transmission scheme (e.g., STBC or BF). Ex. 1007, [0032]-[0033]. By specifying the transmission scheme, the RTS parameter specifies a modulation profile because STBC and BF perform different modulations. Ex. 1007, [0022]-[0028]; Ex. 1002, ¶¶405-407. Thus, the RTS parameter comprises a form for the probe response including a modulation profile for it. Ex. 1002, ¶406.

3. Claim 17

Claim 17 is unpatentable for similar reasons as claim 1, but one of Waxman's stations is the "first node" and Waxman's AP is the "second node." *See* §IX.B.1; Ex. 1002, ¶440.

Claim 17	**Analysis**

[17PRE]	Similar to [1PRE], but recites a system, which is met by Waxman's system. §IX.B.1.a; Ex. 1007, Title, Abstract, [0004], [0009], [0012]-[0014], [0052], [0060], FIG. 1; Ex. 1002, ¶¶439-440.
[17A]-[17C]	Similar to [1A], but recites "a communications network" and "a first processor and a first computer executable program code embodied on a first a computer readable medium," that transmits the probe request, and "a second processor and a second computer executable program code embodied on a second computer readable medium, the second executable program code configured to" receive the probe request, which are also taught by Waxman. Ex. 1007, [0001], [0012], [0014]-[0028], [0045], [0060], FIG. 1. Similar to [9A], [17A] also recites "a physical layer probe" and "a modulation profile." §IX.B.1.b, §IX.B.2; Ex. 1002, ¶¶441-456.
[17D]	Nearly identical to [1B] and of the same scope. §IX.B.1.c; Ex. 1002, ¶457.
[17E]	Nearly identical to [1C] and of the same scope. §IX.B.1.d; Ex. 1002, ¶458.
[17F]	Nearly identical to [1D] and of the same scope. §IX.B.1.e; Ex. 1002, ¶459.

4. Claim 2

Waxman's AP uses the RTS parameter to determine a modulation profile for the probe response. *See* §IX.B.2; Ex. 1002, ¶¶367-370.

5. Claim 3

To the extent claim 3 requires only one probe parameter to indicate only one of [3A]-[3G], Waxman teaches [3A]-[3B] and [3D]. Ex. 1002, ¶371.

a. [3A]

Waxman's RTS parameter indicates a modulation profile for the probe response. §IX.B.2, §IX.B.4; Ex. 1002, ¶¶372-374.

b. [3B]

Using STBC, the AP "transmit[s] multiple copies of a data stream across multiple antennas." Ex. 1007, [0022]-[0023]. Additionally, in response to a probe request, Waxman's AP transmits signals "repeatedly or periodically" using the specified transmission scheme. Ex. 1007, [0036], [0054], [0057]. A POSITA would have understood this "repeated" would have entailed indicating a number of times to transmit the probe. Ex. 1002, ¶¶375-377. A POSITA would have found it obvious to set an indication of number of copies of the probe because doing so would have improved the station's communications with the AP. Ex. 1002, ¶¶376-377.

c. [3D]

By specifying the transmission scheme, including a transmission scheme for the preamble portion, Waxman's RTS parameter indicates a preamble type for the

probe because a preamble type depends on the transmission scheme. Ex. 1007, [0042]-[0043]; Ex. 1002, ¶¶378-379.

6. Claim 4

To the extent the '690 patent's probe request identifies a hidden node, Waxman's probe request does too.

Like the '690 patent (Ex. 1001, 8:59-9:24), Waxman provides a method for improving extended connectivity range in wireless communications. Ex. 1007, [0002]. When a station does not receive an AP's beacon signal, or has a low reception reliability, it transmits a probe request to instruct an AP to use an extended-range transmission scheme. Ex. 1007, [0029]-[0030]. The probe request serves to identify the station as a hidden node because the AP 105 would not have all identification for the station prior to the probe request. Ex. 1002, ¶¶380-383.

7. Claims 5, 10, and 18

Waxman's probe request specifies a transmission scheme, thereby specifying a form (particularly a modulation profile) for the probe response. *See* §IX.B.2. Waxman's system also uses OFDM and is intended for access by multiple stations. Ex. 1007, [0009], [0012]. Based on these disclosures, Waxman teaches using OFDMA (an OFDM-based multiple access scheme), such that probe request is configured to cause the probe response (and therefore its modulation profile) to emulate an OFDMA transmission. Ex. 1002, ¶386. Further, a POSITA would have

been motivated to use OFDMA because of the known advantages of OFDMA (simultaneous network access) and because it would have been well-within the POSITA's ability to do so. Ex. 1002, ¶¶384-387, 422-425, 460.

8. Claims 6 and 22

Waxman's stations perform an active scanning process to transmit the probe request. Ex. 1007, [0030], [0035]. A POSITA would have understood that the active scanning process entails generating the probe request. Ex. 1002, ¶¶388-389, 468.

9. Claims 7, 15, and 23

Waxman describes a problem of not achieving an extended connectivity range (e.g., a station might not receive a beacon signal or experience unreliable reception). Ex. 1007, [0001]-[0009], [0029]. Waxman's stations diagnose this problem by sending a probe request configured to request a probe response and instruct the AP to use a transmission scheme that reliably reaches stations. Ex. 1007, [0040]-[0045], [0054]-[0056]; Ex. 1002, ¶¶390-391, 433-434, 469.

10. Claims 8, 16, and 24

Waxman's stations generate and transmit probe requests in an active scanning process. Ex. 1007, [0030], [0035]. A POSITA would have understood that this active scanning process is initiated by a network operator, which initiates it by generating the probe request and uploading it to a station. Ex. 1002, ¶¶392-394, 435-438, 470.

11. Claim 11

a. [11PRE]

Waxman teaches claim 11 for similar reasons as claims 9 and 10. *See* §IX.B.2, §IX.B.7; Ex. 1002, ¶426.

b. [11A]

Waxman's method applies to multiple APs. Ex. 1007, [0052]; Ex. 1002, ¶427. Accordingly, for the reasons for [1A] and 9, Waxman's station transmits another probe request ("second probe request") to another AP ("third node"). Ex. 1007, [0030], [0045], [0048], [0052], [0054], FIGs. 2-3; Ex. 1002, ¶427.

c. [11B]

Waxman's station receives another probe response from the other AP based on parameters specified in the probe request sent to that AP ("second probe is generated according to the second probe request"). Ex. 1007, [0030], [0037]-[0039], [0049], [0054]-[0055]; Ex. 1002, ¶428.

d. [11C]

Waxman teaches transmitting probe responses using OFDMA. *See* §IX.B.7; Ex. 1007, [0009], [0031]. OFDMA beneficially allocates bandwidth for simultaneous transmissions, which would have included simultaneous probe responses to the station. Ex. 1002, ¶¶429-430.

12.Claim 14

Waxman describes "a certain time slot" for transmission. Ex. 1007, [0024], [0021], [0023]. Additionally, the active scanning process would have been initiated at a specific time such that the probe request is transmitted at a specific time. Ex. 1007, [0030], [0035]; Ex. 1002, ¶¶431-432.

13. Claim 19

Claim 19 depends from claim 17 and is similar to claim 11:

Claim 19	Analysis
[19A]	Similar to [11PRE]-[11A], but recites a system, first code further configured to transmit the second probe request, and the second probe request "specifying a third first plurality of probe parameters for a second physical layer probe." §§IX.B.11.a-b. Waxman teaches [19A] for the same reasons as [11A] and [17A]. Ex. 1002, ¶¶461-462.
[19B]	Similar to [17A], but relates to the second probe request. Waxman teaches [19B] for the same reasons as [17A] and claim 11. §IX.B.3, §IX.B.11; Ex. 1002, ¶463.
[19C]	Similar to [17D], but relates to the second probe request. Waxman teaches [19C] for the same reasons as [17D] and claim 11. §IX.B.3, §IX.B.11; Ex. 1002, ¶¶464-465.

[19D]	Similar to [11B] and [17B]-[17F], but recites "the third node on the communications network," comprising "a third processor and a third computer executable program code embodied on a third computer readable medium" and that the third code is configured to "receive the second probe request, generate the second probe according to the received probe request, and transmit the second probe to the first node on the communications network." §IX.B.3, §IX.B.11.c; Ex. 1002, ¶¶428, 454-459. Waxman teaches [19D] for the same reasons as [11B] and [17B]-[17F]. 1002, ¶466.
[19E]	Similar to [11C] and of the same scope. §IX.B.11.d; Ex. 1002, ¶467.

C. Ground F: Waxman in view of Giesberts

1. Claims 3, 12, 20

a. [3PRE], [12PRE], [20PRE]

To the extent claim 3 encompasses multiple parameters that collectively indicate all information like claims 12 and 20, Waxman combined with Giesberts teaches claims 3, 12, and 20. Giesberts teaches the remaining parameters for similar probe requests and responses. Ex. 1009, [0014]-[0015], [0041]-[0043], FIGs. 8-9, claim 25; Ex. 1002, ¶¶475, 503, 509.

It would have been obvious to combine Giesberts with Waxman, such that Waxman's probe requests include Giesberts' parameters. Ex. 1002, ¶¶471-474. A POSITA would have been motivated to combine Waxman and Giesberts because it would have been desirable to build a wireless communication system that sets parameters to more efficiently leverage available communication schemes. Ex. 1009, [0025]-[0026], [0041]-[0047]; Ex. 1002, ¶¶476-478. Where multiple schemes are contemplated, as in both Waxman and Giesberts, a POSITA would have been motivated to specify parameters that optimize communications. Ex. 1002, ¶477.

Waxman-Giesberts involves using known techniques (Giesberts' techniques for AP selection using parameters specified in probe requests) to improve similar devices (Waxman's stations and APs similar to Giesberts' stations and APs) in the same way (setting parameters to optimize AP-station communications). Ex. 1002, ¶478. A POSITA would have expected success in achieving Waxman-Giesberts given a POSITA's skills and that Waxman already teaches various parameters for its probes. Ex. 1002, ¶479; Ex. 1007, [0022]-[0028], [0032]-[0033]; Ex. 1009, [0026], [0044]-[0047].

b. [3A]

Waxman and Giesberts each teach indication of a probe modulation profile. §IX.B.5.a; Ex. 1009, [0027], [0029]; Ex. 1002, ¶¶480-482.

c. [3B], [12A], [20A]

Waxman and Giesberts each teach specifying a number of times to transmit the probe. §IX.B.5.b; Ex. 1009, [0024], [0035]; Ex. 1002, ¶¶483-486, 504, 510.

d. [3C], [12B], [20B]

Giesberts discloses transmitting the maximum number of training symbols after a preamble, e.g., for each transmitter antenna. Ex. 1009, [0044], claim 29. Thus, there would have been a parameter that specifies a number of symbols for the payload of Waxman's probe response. Ex. 1002, ¶¶487-488, 505, 511.

e. [3D], [12B], [20C]

Waxman and Giesberts each teach specifying probe preamble types. §IX.B.5.c; Ex. 1009, [0041], [0044]; Ex. 1002, ¶¶489-491, 505, 512.

f. [3E], [12C], [20D]

Giesberts explains that long training symbols, when implemented with IEEE 802.11, "are a repetition of a symbol and a cyclic prefix." Ex. 1009, [0030]. Long training symbols are specified in the payload of the frames for probe requests and probe responses. Ex. 1009, [0044], FIGs. 8-9. Thus, Giesberts' parameters specify a cyclic-prefix length for the probe payload. Ex. 1002, ¶¶492-493, 506, 513.

g. [3F], [12C], [20E]

Giesberts' APs and stations exchange frames for probes "containing information of the transmit power level limits," e.g., as set by 802.11h/D2.0. Ex.

1009, [0018]. Giesberts' parameters thus specify a transmit power for the probe. Ex. 1002, ¶¶494-495, 506, 514.

h. [3G], [12D], [20F]

Giesberts specifies a transmit power for the probe and payload-specific parameters. §IX.C.1.g; Ex. 1009, [0044]. A POSITA would have understood that Giesberts teaches specifying a transmit power scaling factor for the payload as part of specifying such payload transmissions. Ex. 1002, ¶496.

Waxman also explains different transmission schemes for preambles and payloads. Ex. 1007, [0043]-[0044]. Thus, in Waxman-Giesberts, where the payload is sent with a specified transmission scheme and transmit power and the preamble portion is sent with a specified transmission scheme and transmit power, a POSITA would have understood that the probe request would have included a transmit power scaling factor for the payload of Waxman's probe response in order for the probe response to be transmitted as specified. Ex. 1002, ¶¶497-498, 507, 515.

2. Claims 4 and 5

Waxman-Giesberts teaches claims 4 and 5 for the same reasons Waxman alone does. §§IX.B.6-7; Ex. 1002, ¶¶499-502.

3. Claims 13 and 21

Waxman-Giesberts teaches claims 13 and 21 for the same reasons Waxman teaches claim 4. §IX.B.6, §IX.C.2; Ex. 1002, ¶¶508, 516.

D. Grounds G-H: Waxman in view of Zuckerman or Waxman in view of Giesberts and Zuckerman

1. Claims 5, 10, and 18

To the extent PO argues that Waxman does not teach using OFDMA, Zuckerman does. Ex. 1002, ¶¶517-519, 524, 533.

Like Waxman, Zuckerman describes wireless communications. Ex. 1016, Abstract, [0002]-[0006], [0015], [0064], [0066]-[0068]; Ex. 1002, ¶520. In Zuckerman, a centralized controller 7 (e.g., an AP) communicates with wireless clients. Ex. 1016, [0041], [0064]-[0065], FIG. 1G. Zuckerman describes interchangeably applying OFDMA and OFDM to its communication system. Ex. 1016, [0006]-[0008], [0047]-[0051], [0134], [0145]-[0146], [0237], claims 6, 15.

It would have been obvious to combine Waxman (or Waxman-Giesberts) with Zuckerman, such that Waxman's probe requests (specifying modulation profiles) are configured to cause probe responses to emulate OFDMA transmissions, as taught by Zuckerman. Ex. 1002, ¶521. That is, a POSITA would have modified Waxman to use OFDMA instead of OFDM based on Zuckerman. Zuckerman's controller 7 (e.g., an AP) performs similar functions to that of Waxman's AP 105 in generating transmissions in accordance with specified schemes, and interchangeably uses OFDM or OFDMA. Ex. 1016, [0064]-[0066]; Ex. 1002, ¶520.

A POSITA also would have found it obvious to include Zuckerman's OFDMA modulation techniques in Waxman's extended-range communication

system because doing so would have more efficiently handled multiple-user communications. Ex. 1016, [0007]-[0008], [0094], [0104]; Ex. 1002, ¶522. Waxman-Zuckerman (or Waxman-Giesberts-Zuckerman) merely uses a known technique (Zuckerman's OFDMA) to improve similar devices (Waxman's wireless network similar to Zuckerman's wireless network) in the same way (the way OFDMA provides multiple access to Zuckerman's network). Ex. 1002, ¶¶522-523.

2. Claims 11 and 19

To the extent Waxman does not teach simultaneous OFDMA transmissions, Zuckerman does. Ex. 1002, ¶¶525-526, 534-535.

Zuckerman specifically teaches using OFDMA for simultaneous transmissions on the same channel. Ex. 1016, [0008], [0176], [0211]-[0212], [0215]-[0216]; Ex. 1002, ¶527.

As OFDMA is beneficial to allocate bandwidth to allow for simultaneous transmissions, it would have been obvious to configure Waxman's stations to employ OFDMA to receive communications (like Waxman's probe responses) simultaneously, as taught by Zuckerman. Ex. 1002, ¶528. Thus, it would have been obvious to combine Waxman and Zuckerman to transmit probe responses simultaneously using OFMDA because a POSITA would have been motivated to take advantage of the benefits of using OFDMA including more efficient

simultaneous communications. Ex. 1016, [0007]-[0008], [0094], [0104]; Ex. 1002, ¶¶529-532.

Thus, Waxman-Zuckerman teaches two of Waxman's probe responses being transmitted simultaneously using OFDMA. Ex. 1002, ¶¶530-531.

E. Ground I: Waxman in view of Won

1. Claims 7, 15, and 23

To the extent Waxman does not disclose these claims, Won does. Ex. 1002, ¶¶540-541, 553-554, 556.

Won addresses problems relating to "unintended presence of the same SSID" or "a hidden SSID, which cannot be detected using conventional scanning schemes." Ex. 1008, [0012]. Won's process is able to "quickly find and monitor a problem" with a service AP that "can detect the presence of an AP, which has a hidden SSID, by transmitting the probe request packet having the SSID of the service AP and then acquiring neighbor AP information using the probe response packets, received from the neighbor APs" so that "the user can readily understand a problem in a data service, which would take place due to the presence of a duplicate SSID." Ex. 1008, [0012], [0039]; Ex. 1002, ¶¶536-537.

Won also explains that its scanning function prevents unstable network service, as well as bandwidth or service costs issues. Ex. 1008, [0040]-[0041]. Won's scanning function detects an AP using a hidden SSID, and therefore

addresses network problems associated with an AP using a hidden SSID. Ex. 1008, [0042]; Ex. 1002, ¶541.

A POSITA would have been motivated to combine Waxman and Won, such that Waxman's station would have performed an active scanning process that employs techniques of Won's scanning process to identify duplicate/hidden SSIDs. Ex. 1002, ¶¶536-539. As such, a POSITA would have utilized Won's scan function to identify duplicate/hidden SSIDs that may cause network problems. Ex. 1008, [0026]-[0027], [0035]-[0042]; Ex. 1002, ¶¶540-542. Won's teachings of using a scanning process to detect APs having duplicate SSIDs or hidden APs that are otherwise undetectable provides motivation for combining Waxman with Won to diagnose potential network problems. Ex. 1002, ¶543.

The known elements include Waxman's stations that use an active scanning process to optimize communication with neighbor APs, and Won's scanning process for detecting APs using duplicate/hidden SSIDs. Ex. 1007, [0030], [0035]; Ex. 1008, [0026]-[0027], [0035]-[0042]; Ex. 1002, ¶544. The combination of Waxman and Won would have the predictable result of adding, to Waxman's active scanning process, a technique for evaluating probe response for detecting APs using duplicate/hidden SSIDs (which would have identified APs causing network issues). Ex. 1002, ¶544.

A POSITA would have had an expectation of success in combining Waxman and Won given a POSITA's skills (e.g., operating a wireless communication system) and familiarity with diagnosing potential problems in a wireless network, and given that Waxman already teaches an active scanning process for a wireless system. Ex. 1007, [0030], [0035], [0052]-[0057]; Ex. 1008, [0007], [0010], [0035]-[0038]; Ex. 1002, ¶¶545-546.

2. Claims 8, 16, and 24

To the extent Waxman does not disclose these claims, Won does. Ex. 1002, ¶¶547-549, 555, 557.

As discussed, Waxman generates and transmits the probe request as part of a station performing an active scanning process. *See* §IX.B.1.c, §IX.B.8; Ex. 1007, [0030], [0035]. Like Waxman, Won also describes generating and transmitting a probe request as part of an active scanning process. Ex. 1008, [0007]-[0010]. While Waxman does not provide specific details as to how the active scanning process is initiated, Won does. Ex. 1002, ¶¶547-549.

Won's service AP that transmits a probe request to neighboring APs is coupled to a user terminal, and the request to initiate the scanning process is given by a user terminal. Ex. 1008, [0013]-[0014], [0019], [0026], [0035], FIGs. 2, 4. Won also teaches the user terminal ("network operator") generating the probe

request to be sent to the AP. Ex. 1008, [0006] ("the client transmits a probe request packet").

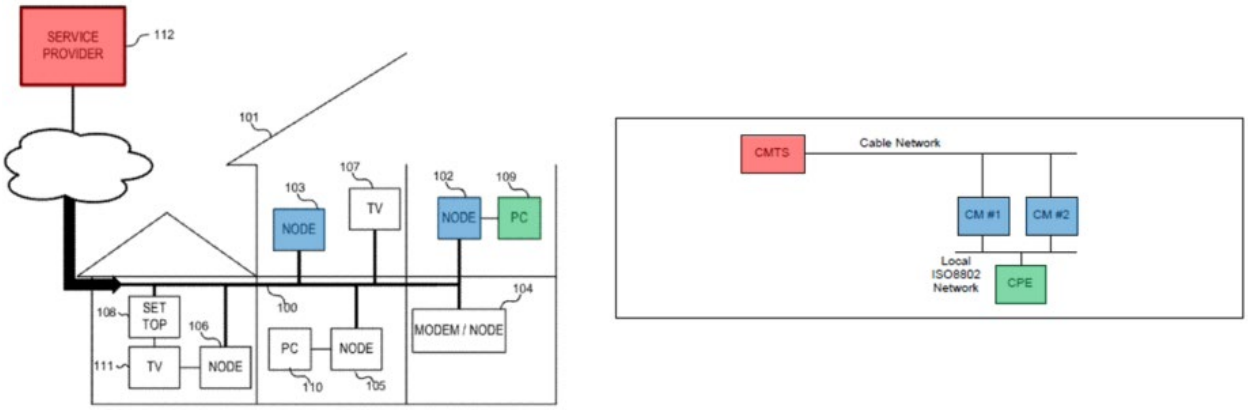
A POSITA would have understood the benefits of a probe request generated by a network operator operating a user terminal and been motivated to combine Waxman with Won to take advantage of them. Ex. 1002, ¶550. Specifically, enabling the user terminal to generate the probe request and initiate the scanning process gives users (e.g., network administrators) more control over when to perform scanning (e.g., when network connectivity is an issue, or a network issue indicates a potential hidden AP). Ex. 1008, [0039]-[0042]; Ex. 1002, ¶550. It also would have been obvious to enable the user terminal to generate the probe request so as to customize the probe request. Ex. 1002, ¶550. Therefore, the probe request would have been generated at Won's user terminal ("network operator") and uploaded to Waxman's station ("second node") to initiate Waxman's active scanning process. *Id.*

Waxman-Won merely combines known elements (Waxman's system with Won's terminal 10) according to known methods (configuring Won's terminal 10 to cause AP 20 to transmit a probe request) to yield predictable results (a user terminal generating/uploading a probe request). Ex. 1002, ¶¶549-550, 538-539. Waxman-Won also uses a known technique (using terminal 10 to control when to send probe requests) to improve similar devices (Waxman's station and Won's terminal 10) in

the same way (enabling a network operator to initiate probe requests). *Id*. A POSITA would have also expected to achieve success in using a user terminal to generate the probe request and send/upload it to the station, particularly since Waxman already teaches an active scanning process for a wireless system. Ex. 1002, ¶¶551-552.

F. Grounds J-K: DOCSIS-2.0 And DOCSIS-2.0 In View Of ISO8802-2

The systems of the '690 patent and DOCSIS-2.0 are similar:



Ex. 1001, FIG. 1 (left) and Ex. 1010, FIG. 5-3 (right) (both annotated)

Ex. 1001, 3:25-4:24; Ex. 1010, 1-5, 23-37. DOCSIS-2.0's ranging procedure anticipates numerous claims and its test procedure (which references ISO8802-2) renders obvious numerous claims. Ex. 1002, ¶¶558-560.

1. Claim 1

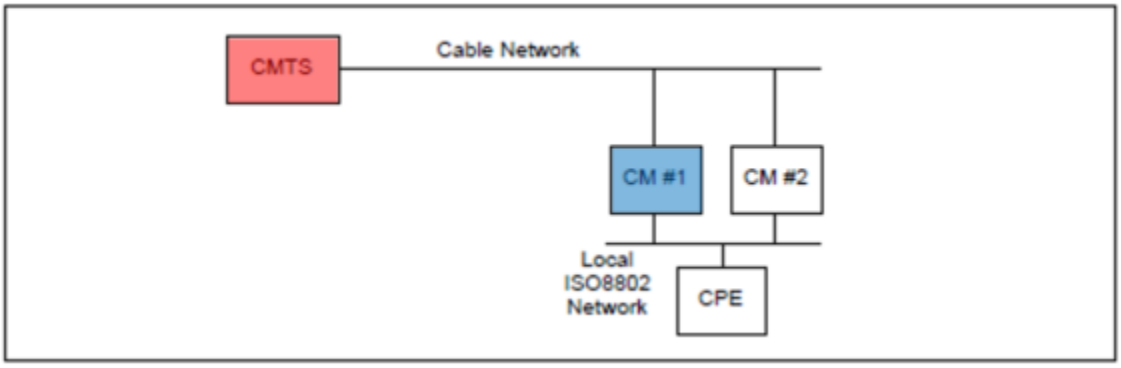
a. [1PRE]

DOCSIS-2.0 describes a data-over-cable system and method for operating it. Ex. 1010, 1, 23. DOCSIS-2.0's method, ranging procedure, or test procedure

discloses the claimed "method" as each comprises [1A]-[1D]. *See* §§IX.F.1.b-e; Ex. 1002, ¶¶561-562.

b. [1A]

CM#1 ("first node") communicates with **CMTS** ("second node"):



Ex. 1010, 29, FIG. 5-3; Ex. 1002, ¶¶563-564.

Ranging: DOCSIS-2.0's ranging acquires the correct timing to align CM#1's transmissions to the correct slot. Ex. 1010, 197. CM#1 obtains upstream channel characteristics from the Upstream Channel Descriptor (UCD) MAC management message and sends a Ranging Request. Ex. 1010, 22, 135, 197. The UCD message ("probe request") includes eight portions:

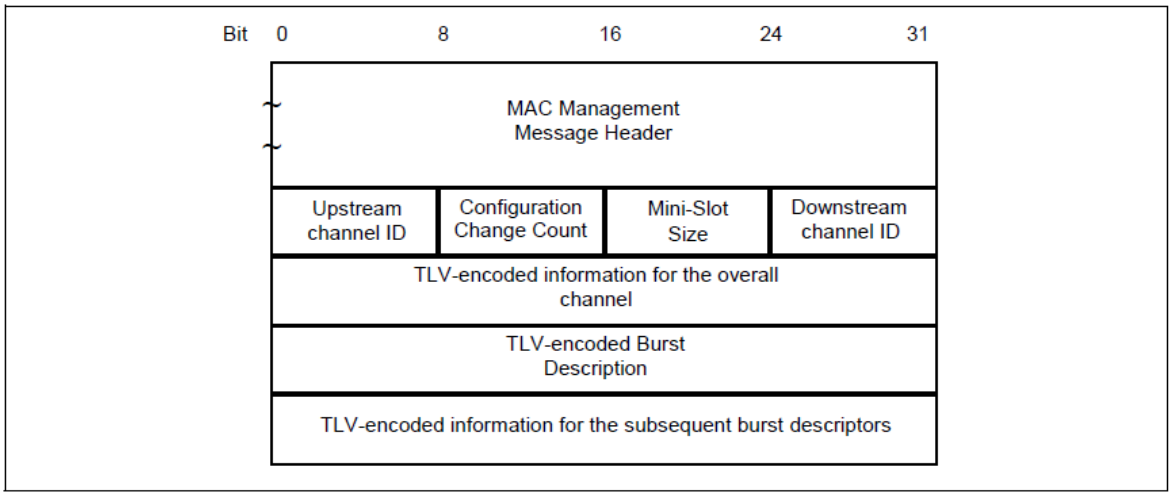


Figure 8-16 Upstream Channel Descriptor

Ex. 1010, 136; Ex. 1002, ¶565.

The TLV-Encoded Information for the channel includes a modulation rate, frequency, and power spectral density parameters for use in generating subsequent upstream signals:

Table 8-18 Channel TLV Parameters

Name	Type (1 byte)	Length (1 byte)	Value (Variable length)
Modulation Rate	1	1	Multiples of base rate of 160 kHz. (Value is 1, 2, 4, 8, 16, or 32.) A value of 32 means that this is a DOCSIS 2.0 Only Upstream. If S-CDMA mode is enabled then this parameter MUST have a value of 8, 16 or 32.
Frequency	2	4	Upstream center frequency (Hz)

…

Maintain Power Spectral Density	15	1	1=on;2=off. If this value is on and the modulation rate is different from the previous UCD, the CM MUST change its transmit power level to keep the power spectral density as close as possible to what it was prior to the modulation rate change. If this value is off or this parameter is omitted then the CM maintains the same power level that it was using prior to the modulation rate change. In any case the effect of this parameter only lasts until the CM receives a power adjustment in a RNG-RSP.
Ranging Required	16	1	0= no ranging required 1= unicast initial ranging required 2= broadcast initial ranging required If this value is non-zero and the UCD change count does not match the UCD currently in effect, the CM MUST perform ranging as specified by this TLV before using any other transmit opportunities with the new UCD parameters. If ranging is required, and the CM is already registered, then it MUST maintain its SIDs and not re-register. If this value is 0 or this TLV is omitted, no ranging is required.

Ex. 1010, 137-143. The ranging required parameter is used to require CM#1 to perform ranging on the upstream channel. Ex. 1010, 139; Ex. 1002, ¶¶566-567.

The UCD message also includes other TLV parameters for "Physical-layer attributes" like modulation type:

Table 8-19 Upstream Physical-Layer Burst Attributes

Name	Type (1 byte)	Length (1 byte)	Value (Variable Length)
Modulation Type	1	1	1 = QPSK 2 = 16QAM 3 = 8QAM 4 = 32QAM 5 = 64QAM 6 = 128QAM (S-CDMA only) Values greater than 2 MUST NOT be used in a descriptor encoded in a type 4 TLV.
Differential Encoding	2	1	1 = on, 2 = off. (see Section 6.2.13, "Symbol Mapping," on page 64).
Preamble Length	3	2	Up to 1536 bits for burst descriptors encoded in a type 5 TLV. Up to 1024 bits for descriptors encoded in a type 4 TLV. If this descriptor is encoded in a type 4 TLV then the substring of the Preamble Superstring defined by this parameter and the Preamble Value Offset MUST NOT include any bits from the Extended Preamble Pattern. The value must be an integral number of symbols (see Section 6.2.9, "Preamble Prepend," on page 53)

Ex. 1010, 140-142; Ex. 1002, ¶¶568-569.

The UCD message's header includes additional parameters, like source address (SA), etc.:

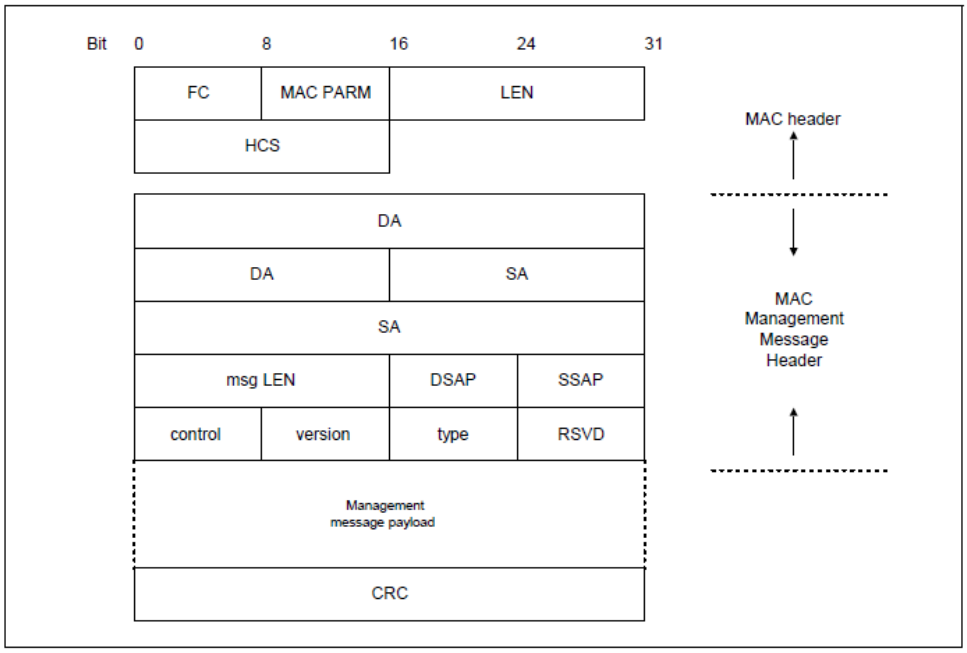


Figure 8-14 MAC Header and MAC Management Message Header Fields

Ex. 1010, 132-135; Ex. 1002, ¶570.

Thus, the UCD message specifies many parameters ("first plurality of parameters"). The UCD parameters (specifically, modulation rate and modulation type) are used for forming a Ranging Request ("probe"), when the ranging required parameter is '1' or '2'. Ex. 1010, 139, 146-147, 197-198. Therefore, the UCD parameters are associated with generating and transmitting the Ranging Request; Ex. 1002, ¶571.

Additionally, the UCD message includes the Downstream Channel ID, which is added to the Ranging Request's payload:

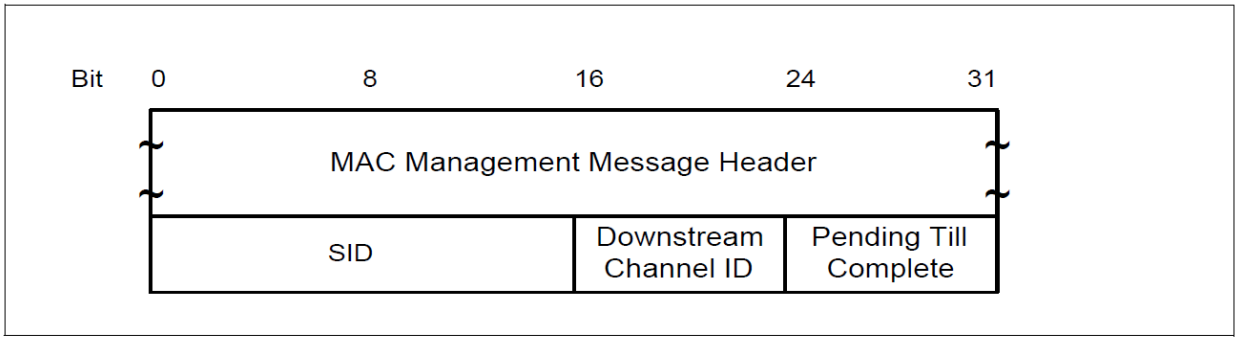


Figure 8-21 Packet PDU Following the Timing Header

Ex. 1010, 146-147. Therefore, the UCD's Downstream Channel ID specifies content (the identifier) for the Ranging Request's payload ("specify content payload of the probe"). Ex. 1010, 136-137, 146-147; Ex. 1002, ¶¶572-573.

The UCD parameters also include the source address, which specifies the CMTS ("specify…a second node") that transmits the UCD message and subsequently receives the Ranging Request. Ex. 1010, 133, 136, 146-147; Ex. 1002, ¶¶574-575.

Testing: In DOCSIS-2.0's test mode, CM#1 receives a Test Request ("probe request") from the CMTS. Ex. 1010, 28, 96, 98, 184-185. The Test Request is also a MAC Management Message and is used to force CM#1 into a test mode. Ex. 1010, 133-134, 184. The Test Request includes three portions:

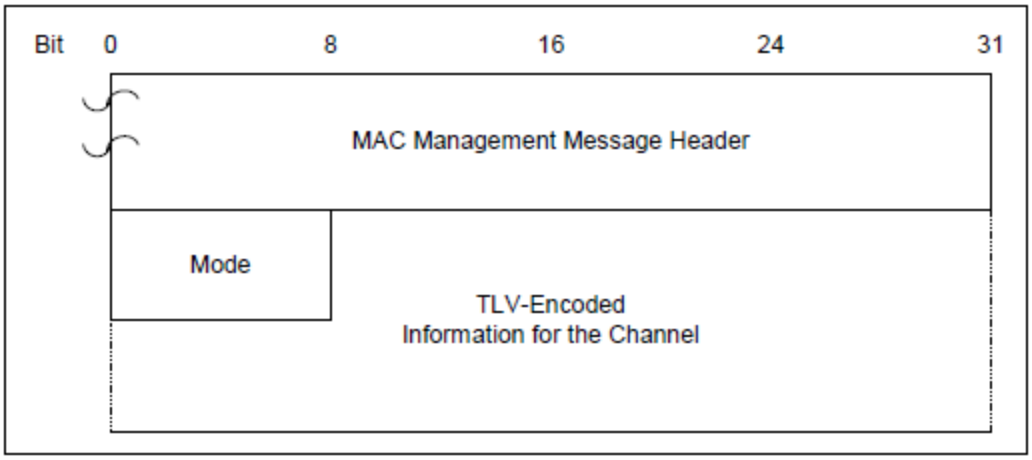


Figure 8-45 Test Request

Ex. 1010, 185. If the Mode is not 0, CM#1 begins the test mode, using the channel parameters included in the Test Request to transmit an upstream signal (hereinafter "Test Response") at the commanded modulation rate, carrier frequency, and power level. Ex. 1010, 185; Ex. 1002, ¶¶576-577.

These channel parameters are obtained from the Test Request's TLVs:

Table 8-22 Channel TLV Parameters

Name	Type (1 byte)	Length (1 byte)	Value (variable length)
Modulation Rate	1	1	Multiples of base rate of 160 kHzc. (Value is 1, 2, 4, 8, 16, or 32.). This TLV MUST be present if the test mode is 1.

Table 8-22 Channel TLV Parameters (Continued)

Frequency	2	4	Upstream carrier frequency (Hz). This TLV MUST be present if the test mode is 1 or 2.
Power	3	1	This TLV specifies the power (unsigned 8-bit, dBmV units) at which the CM MUST transmit the TST-REQ message. This TLV MUST be present if the test mode is 1 or 2.
S-CDMA US ratio numerator 'M'	4	2	The numerator (M) of the M/N ratio relating the downstream symbol clock to the upstream modulation clock. This TLV MUST be present if the test mode is 1. This TLV MUST be present if the test mode is 2 and the operation is synchronous.
S-CDMA US ratio denominator 'N'	5	2	The denominator (N) of the M/N ratio relating the downstream symbol clock to the upstream modulation clock. This TLV MUST be present if the test mode is 1. This TLV MUST be present if the test mode is 2 and the operation is synchronous.

Ex. 1010, 185-186; Ex. 1002, ¶¶577-578.

The Test Request's header includes additional parameters, like source address:

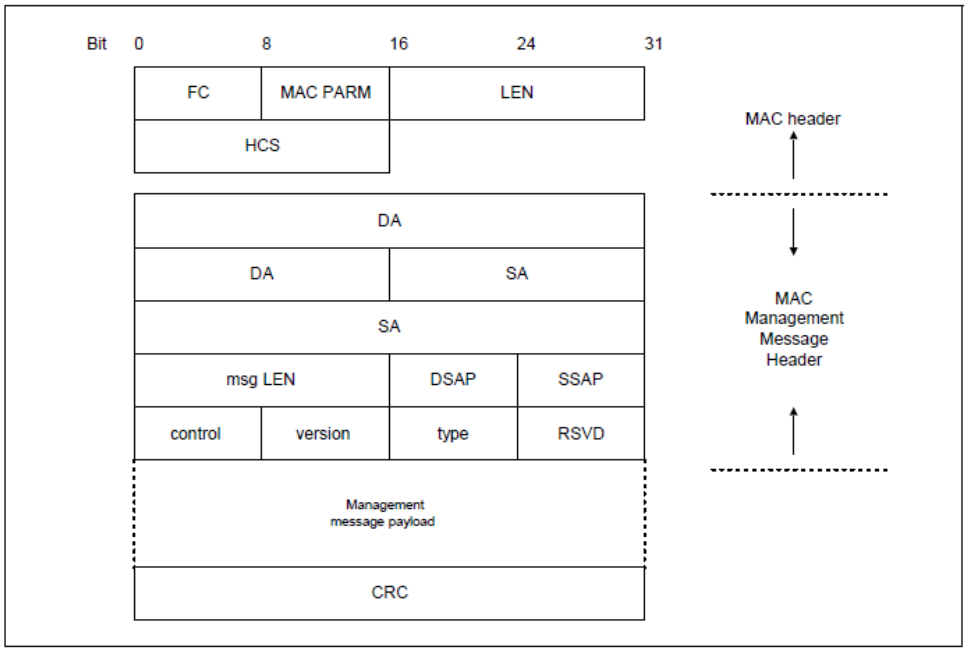


Figure 8-14 MAC Header and MAC Management Message Header Fields

Ex. 1010, 132-135; Ex. 1002, ¶578.

Thus, the Test Request specifies many parameters ("first plurality of parameters"). The Test Request's parameters (specifically, carrier frequency, modulation rate, and power level) are used for forming the Test Response ("probe"). Ex. 1010, 185. Therefore, the Test Request's parameters are associated with generating and transmitting the Test Response. Ex. 1002, ¶579.

Additionally, the Test Request's mode parameter specifies the Test Response and therefore specifies a payload for the Test Response ("specify content payload of the probe"). Per ISO8802-2, which would have been obvious to combine with DOCSIS-2 because DOCSIS-2 expressly states to do so (Ex. 1010, 28), the Test Response includes the Test Request's information field (i.e., Mode and channel parameters). Ex. 1011, 39, 53; Ex. 1002, ¶580.

The Test Request's parameters also include the source address, which specifies the CMTS ("specify…a second node") that transmits the Test Request and subsequently receives the Test Response. Ex. 1010, 133; Ex. 1002, ¶¶580-581.

c. [1B]

Ranging: The UCD message's ranging required parameter causes CM#1 to generate and transmit the Ranging Request ("probe"). Ex. 1010, 139, 146-147. The Ranging Request includes multiple parameters ("second plurality of parameters"):

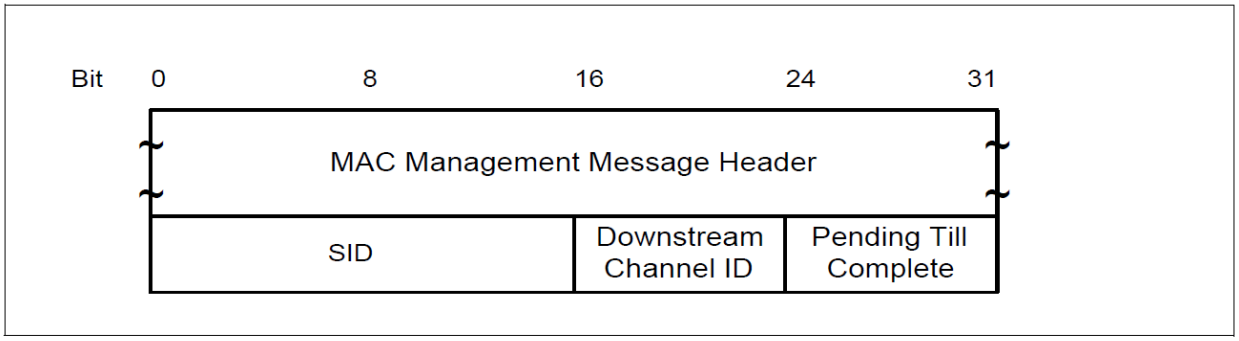


Figure 8-21 Packet PDU Following the Timing Header

Ex. 1010, 146-147. These parameters are determined to generate and transmit the Ranging Request ("associated with the generation and transmission of a probe"). Ex. 1002, ¶¶582-584.

Testing: Upon receiving a Test Request with a non-zero Mode, CM#1 generates and transmits the Test Response ("probe") based on the Test Request's parameters. Ex. 1010, 185. The Test Response is generated per ISO8802-2. Ex. 1010, 28; Ex. 1011, 53. Per ISO8802-2, the Test Response's PDU includes multiple parameters like DSAP and SSAP addresses:

DSAP address	SSAP address	Control	Information
8 bits	8 bits	8 or 16 bits	M*8 bits

DSAP address - Destination service access point address field
SSAP address - Source service access point address field
Control - Control field [16 bits for formats that include sequence numbering, and 8 bits for formats that do not (see 5.2)]
Information - Information field
* - Multiplication
M - An integer value equal to or greater than 0. (Upper bound of M is a function of the medium access control methodology used.)

Figure 4—LLC PDU format

Ex. 1011, 39, 53. Thus, CM#1 determines these PDU parameters ("second plurality of parameters") for generating and transmitting the Test Response. Ex. 1002, ¶¶585-587.

d. [1C]

Ranging: The UCD parameters ("first plurality of parameters") and Ranging Request's parameters ("second plurality of parameters") are used to generate the Ranging Request ("probe"). Specifically, the ranging required parameter causes CM#1 to generate the Ranging Request based on parameters in Figure 8-21 (e.g., SID parameter, Downstream Channel ID, etc.). Ex. 1010, 139, 147. Further, the UCD message's modulation rate and frequency parameters are used to dictate the Ranging Request's form. *Id.*, 137; Ex. 1002, ¶¶588-590.

Testing: The Test Request's parameters ("first plurality of parameters"), specifically the modulation rate, carrier frequency, and power level, and the PDU parameters used for the Test Response ("second plurality of parameters") are used to generate the Test Response. Ex. 1010, 185-186; Ex. 1011, 39, 53. Further, the Test Request's modulation rate, carrier frequency, and power level parameters are used to dictate the Test Response's form. Ex. 1010, 185-186; Ex. 1002, ¶¶591-593.

e. [1D]

CM#1 ("first node") transmits the Ranging Request ("probe") and Test Response (also "probe") to the CMTS ("second node"). Ex. 1010, 146-147, 185, 197-198, 246-247; Ex. 1011, 53; Ex. 1002, ¶¶594-597.

2. Claim 2

Ranging: CM#1 receives the UCD message having modulation rate and modulation type parameters, which are used within CM#1 to determine characteristics ("modulation profile") for modulating the Ranging Request. *See* §IX.F.1.b; Ex. 1010, 17, 146-147, 197-198; Ex. 1002, ¶¶598-600.

Test: CM#1 receives the Test Request having the modulation rate parameter, which is used within CM#1 to determine characteristics ("modulation profile") for modulating the Test Response. *See* §IX.F.1.b; Ex. 1010, 17, 137, 141, 185; Ex. 1002, ¶¶601-602.

3. Claim 6

The UCD message and Test Request are generated and transmitted by the CMTS. *See* §§IX.F.1.b-d; Ex. 1010, 135-137, 185; Ex. 1002, ¶¶603-605.

4. Claim 7

Ranging: The UCD message includes a ranging required parameter causing CM#1 to send the Ranging Request. *See* §IX.F.1; Ex. 1010, 135-139. The Ranging Request ("probe") assists in diagnosing a problem with the timing of CM#1 transmissions to the CMTS. Ex. 1010, 146-150, 197-198. If the Ranging Request

is not successful, the CMTS sends a Ranging Response commanding CM#1 to continue or abort ranging. Ex. 1010, 150, 198; Ex. 1002, ¶¶606-608.

Testing: The Test Request includes a Mode parameter causing CM#1 to send the Test Response. *See* §IX.F.1; Ex. 1010, 185. The Test Response ("probe") assists in diagnosing a problem with CM#1, specifically a problem with upstream signal timing or upstream required power. Ex. 1010, 184-185, 241-242 (need to acquire a valid downstream signal and re-acquire upstream timing), 489 (testing of SNR), 492-493 (testing adjacent interference), 625, 628; Ex. 1002, ¶¶609-610.

5. Claim 9

a. [9PRE]

DOCSIS-2.0's method, the ranging procedure, or test procedure disclose the claimed "method" as each comprises [9A]-[9B]. *See* §§IX.F.5.b-c; Ex. 1002, ¶611.

b. [9A]

Ranging: The CMTS ("first node") transmits the UCD message ("probe request") to CM#1 ("second node") and specifies parameters for the Ranging Request ("first plurality of probe parameters for a physical layer probe"), the UCD parameters comprising a form for the Ranging Request including a modulation rate and type for the Ranging Request ("form for the probe including a modulation profile for the probe"). *See* §§IX.F.1.b-e; Ex. 1002, ¶¶612-621. The Ranging Request is a "physical layer probe" because it is configured using physical-layer parameters (e.g., modulation rate). Ex. 1010, 24 (physical-layer parameters include modulation rate),

140-142 (upstream physical-layer burst attributes). It is also a "physical layer probe" because it is transmitted at initialization or to determine network delay and request power adjustment. Ex. 1010, 146; Ex. 1002, ¶¶622-623.

Testing: The CMTS transmits the Test Request ("probe request") to CM#1 and specifies parameters for the Test Response ("first plurality of probe parameters for a physical layer probe"), the Test Request's parameters comprising a form for the Test Response including a modulation rate and type for the Test Response ("form for the probe including a modulation profile for the probe"). *See* §§IX.F.1.b-e; Ex. 1002, ¶¶624-628. The Test Response is a "physical layer probe" because it is configured using physical-layer parameters (e.g., modulation rate). Ex. 1010, 24, 140-142. It is also a "physical layer probe" because it is used to test the timing of communications on the physical layer. Ex. 1010, 185 (using clocks for synchronization), 186 (M/N ratio for timing determination); Ex. 1002, ¶¶629-630.

c. [9B]

Ranging: The CMTS receives the Ranging Request ("probe") from CM#1, wherein the Ranging Request is generated in accordance with the UCD parameters and Ranging Request's parameters as determined by CM#1. *See* §§IX.F.1.b-e; Ex. 1002, ¶¶631-634.

Testing: The CMTS receives the Test Response ("probe") from CM#1, wherein the Test Response is generated in accordance with the Test Request's

parameters and Test Response's parameters as determined by CM#1. *See* §§IX.F.1.b-e; Ex. 1002, ¶¶635-639.

6. Claim 14

Ranging: The CMTS transmits the UCD message "at a periodic interval." Ex. 1010, 135, 22; Ex. 1002, ¶¶640-641.

Testing: The CMTS transmits the Test Request at the specific time it receives the operator's command. Ex. 1010, 184; Ex. 1002, ¶642.

7. Claim 15

The UCD message and Test Request are configured to cause transmission of the Ranging Request and Test Response, respectively, and so are configured to diagnose a network problem as discussed for claim 7. *See* §IX.F.4; Ex. 1002, ¶¶643-647.

G. Grounds L-M: DOCSIS-2.0 In View Of Zuckerman Or DOCSIS-2.0 In View Of ISO8802-2 and Zuckerman

1. Claim 8

Ranging: DOCSIS-2.0 discloses the CMTS ("second node") generating the UCD message ("probe request"). Ex. 1010, 135-137; Ex. 1002, ¶¶648-650. Claim 8 is not expressly disclosed, but it would have been obvious.

DOCSIS-2.0 teaches the CMTS receiving commands from a network operator to send other messages. Ex. 1010, 184 (command for TST-REQ), 182 (command for UP-DIS). DOCSIS-2.0 also teaches sending SNMP commands to the CMTS.

Ex. 1010, 182, 305, 326. And, it teaches remotely reprogramming the CMTS. Ex. 1010, 333; Ex. 1002, ¶650.

Further, DOCSIS-2.0 teaches an architecture in which the CMTS has interfaces (e.g., DOCS-OSSI or CMTS-NSI) with other systems (e.g., operations support systems or WAN) that assist in operating the CMTS:

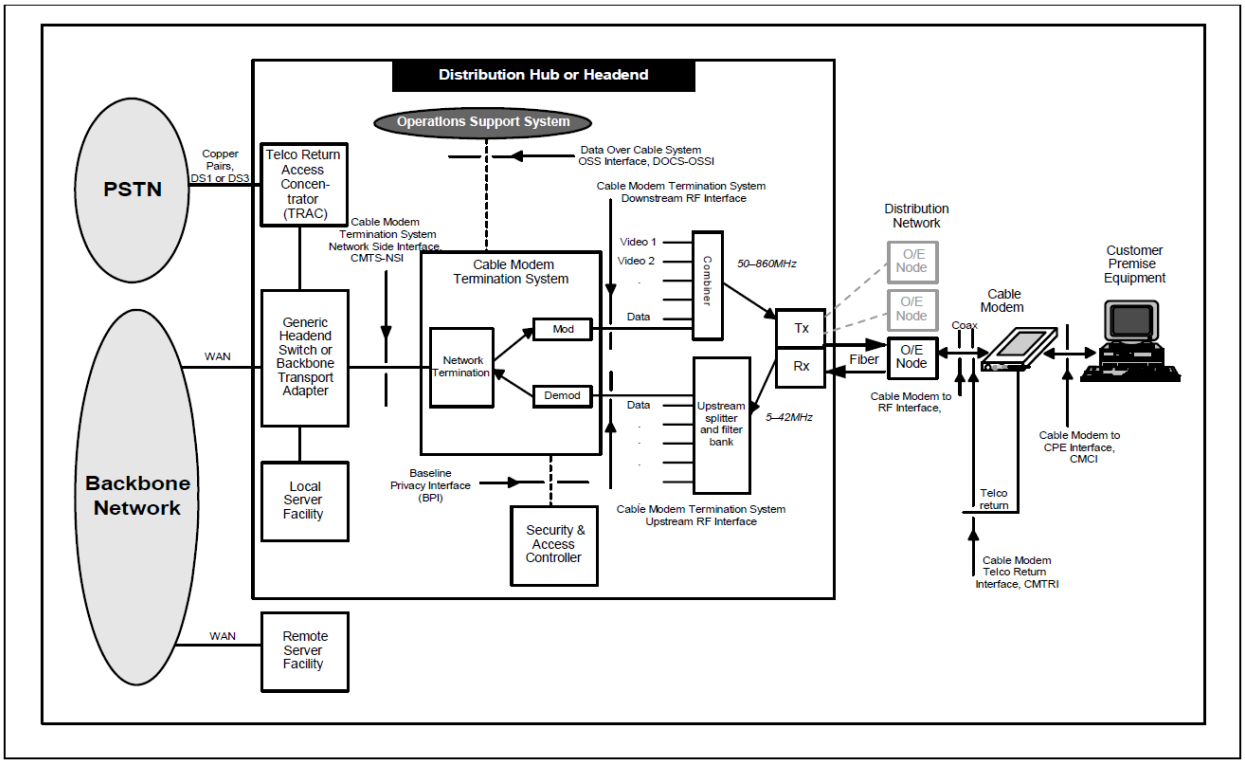


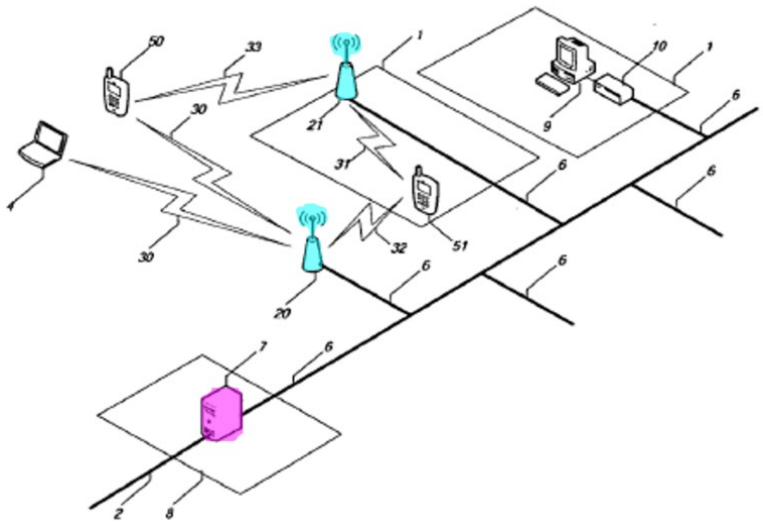
Figure 1-2 Data-Over-Cable Reference Architecture

Ex. 1010, 2-5; Ex. 1002, ¶651.

Based on these teachings, it would have been obvious to implement this architecture such that another system ("network operator") generates the UCD message and uploads it to the CMTS. Ex. 1002, ¶¶652-654. A POSITA would have implemented the CMTS with a separate system (e.g., computer) that controls certain

processes (e.g., UCD message generation) of the CMTS because this enables the CMTS to focus on managing the network traffic. Ex. 1002, ¶657. Indeed, it was known to use a separate system. Ex. 1002, ¶652; Ex. 1019, 9:32-34 (CPU 246 operating CMTS). A POSITA would have been motivated to carry out this implementation because offloading UCD message generation reduces processing burden on the CMTS and because it enables remote control of the CMTS (e.g., using IP packets over WAN). Ex. 1002, ¶¶654-657..

Further, Zuckerman teaches a **centralized synchronizing communication controller 7** that implements the MAC layer and is separate from **converters 20, 21** that transmit MAC messages:



Ex. 1016, FIG. 1A.

Ex. 1016, [0069]-[0070]. Zuckerman teaches demand for a centralized MAC layer separate from PHY layer nodes. Ex. 1016, [0041], [0044]-[0045]; Ex. 1002, ¶¶655-657.

Based on Zuckerman, it would have been obvious to use a separate network operator that implements the MAC function of generating the UCD message and uploads it the CMTS. Ex. 1002, ¶657. A POSITA would have been motivated to do this because it provides a more accessible, centralized location separate from the PHY layer components. *Id.*

Implementing the CMTS to use a separate system to generate and upload UCD messages to it is merely the combination of known elements (DOCSIS-2.0's CMTS and known systems for operating it) according to known methods (DOCSIS-2.0's interfaces for connecting with separate systems) to yield predictable results (system that generates the UCD message and uploads it to the CMTS). *Id.*, ¶658. This result is also achieved by applying known techniques (Zuckerman's creating of a central MAC) to a known device ready for improvement (the CMTS that would benefit from offloading generation of UCD messages). *Id.*, ¶659. Given the POSITA's programming and network design skills, the POSITA would have expected success in achieving this implementation. Ex. 1002, ¶¶660-661.

Testing: DOCSIS-2.0 discloses that the CMTS ("second node") transmits the Test Request ("probe request") "in response to an explicit command from the

operator." Ex. 1010, 184. In addition to the above-discussed reasons (including modification based on Zuckerman), this provides further motivation for the operator ("network operator") to generate the Test Request and upload it to the CMTS. Ex. 1002, ¶¶662-664.

2. Claim 10

DOCSIS-2.0 does not expressly disclose using OFDMA, but it would have been obvious to use it.

Zuckerman teaches that DOCSIS is used for transferring data over coax and that various modulations are used to carry data over coax. Ex. 1016, [0005]. Zuckerman then discusses the well-known advantages (e.g., high spectral efficiency, reducing interference) of OFDMA and presents a system using OFDMA for cable and wireless connections. Ex. 1016, [0006]-[0008], [0015], [0041], [0048]-[0054], [0058]-[0065], [0071]-[0072], [0076], [0110], [0134], [0141].

Based on Zuckerman's discussed advantages of OFDMA, a POSITA would have been motivated to implement DOCSIS-2.0's cable network to use OFDMA. Ex. 1002, ¶¶665-667. Accordingly, the UCD message and Test Request would have been configured such that the Ranging Request and Test Response each emulate an OFDMA transmission. *Id.*, ¶671. A POSITA would have been motivated to use OFDMA in DOCSIS 2.0's network because doing so would have improved network performance (e.g., bit error rate). *Id.*, ¶667. OFDMA enables simultaneous access

to the cable network by multiple users and supports high rate applications (e.g., video) by independently modulating subcarriers within frequency bands, and these benefits provide motivation to use OFDMA in DOCSIS-2.0's system. *Id.*; Ex. 1016, [0008]. A POSITA would have also used OFDMA because it addresses known problems with the DOCSIS-2.0 system (e.g., noise, network congestion). *Id.*

Combining DOCSIS-2.0 and Zuckerman merely combines known elements (cable network with OFDMA) according to known methods (Zuckerman's use of OFDMA for cable networks) to yield predictable results (DOCSIS-2.0 using OFDMA). *Id.*, ¶668. This combination also uses a known technique (OFDMA) to improve similar devices (DOCSIS-2.0's cable network and Zuckerman's cable network) in the same way (implementing OFDMA over coax). *Id.*, ¶669. A POSITA would have expected success given the POSITA's familiarity with deploying OFDMA. Ex. 1002, ¶¶670-671.

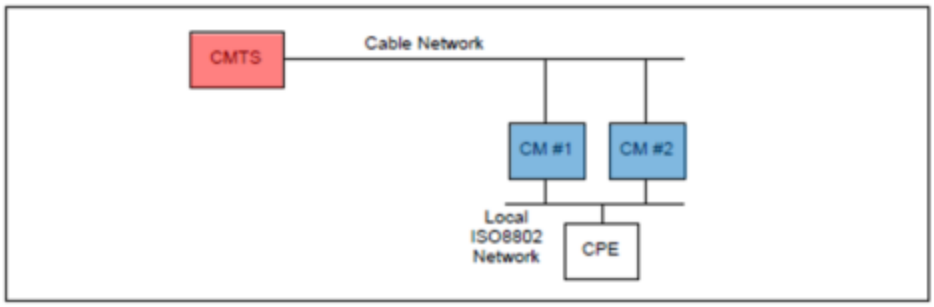
3. Claim 11

a. [11PRE]

DOCSIS-2.0-Zuckerman uses OFDMA for DOCSIS-2.0 (*see* §IX.G.2), which results in claim 11. Ex. 1002, ¶672.

b. [11A]

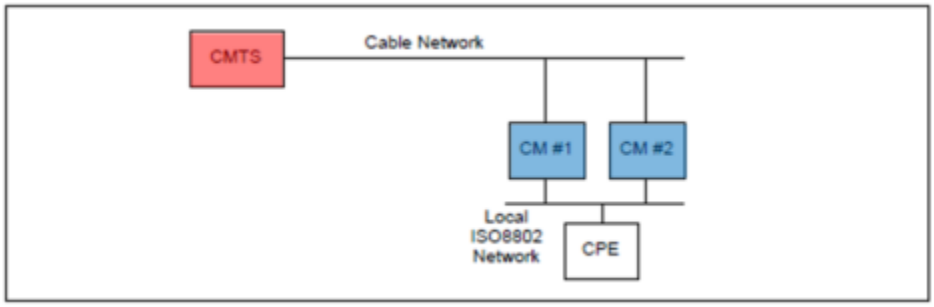
Ranging: In addition to transmitting a first UCD message to **CM#1**, the **CMTS** transmits a second UCD message ("second probe request") to **CM#2** ("third node"). *See* §IX.B.5.b; Ex. 1010, 135-136, 243-246; Ex. 1002, ¶¶673-674.



Testing: In addition to transmitting a first Test Request to **CM#1**, the **CMTS** transmits a second Test Request ("second probe request") to **CM#2** ("third node"). *See* §IX.B.5.b; Ex. 1010, 184-185; Ex. 1002, ¶¶675-676.

c. [11B]

Ranging: The **CMTS** receives a second Ranging Request ("second probe") from **CM#2**, wherein the second Ranging Request is generated according to the second UCD message. *See* §IX.F.5.c; Ex. 1002, ¶¶677-678.



Testing: The **CMTS** receives a second Test Response ("second probe") from **CM#2**, wherein the second Test Response is generated according to the second Test Request. *See* §IX.F.5.c; Ex. 1002, ¶¶679-680.

d. [11C]

As discussed (*see* §IX.G.2), it would have been obvious to use OFDMA for DOCSIS-2.0 transmissions. Ex. 1002, ¶681.

Both Ranging Requests or both Test Responses would have been transmitted simultaneously using OFDMA, because the messages that trigger them would have been sent simultaneously or near-simultaneously so that the ranging or test procedure would be performed on multiple channels simultaneously. Ex. 1002, ¶¶682, 685. A POSITA would have been motivated to configure the cable network using OFDMA to make these simultaneous transmissions to enable the same transmitter/receiver hardware and network to be used to provide service to multiple users efficiently. *Id.*, ¶¶683, 686; Ex. 1016, [0076], [0174], [0176], [0198]. Transmitting both Ranging Requests or both Test Responses simultaneously leverages the above-discussed advantages of OFDMA, which is designed for simultaneous transmissions. *See* §IX.G.2; Ex. 1016, [0080], [0210]-[0212] ; Ex. 1002, ¶¶683-684, 686-687.

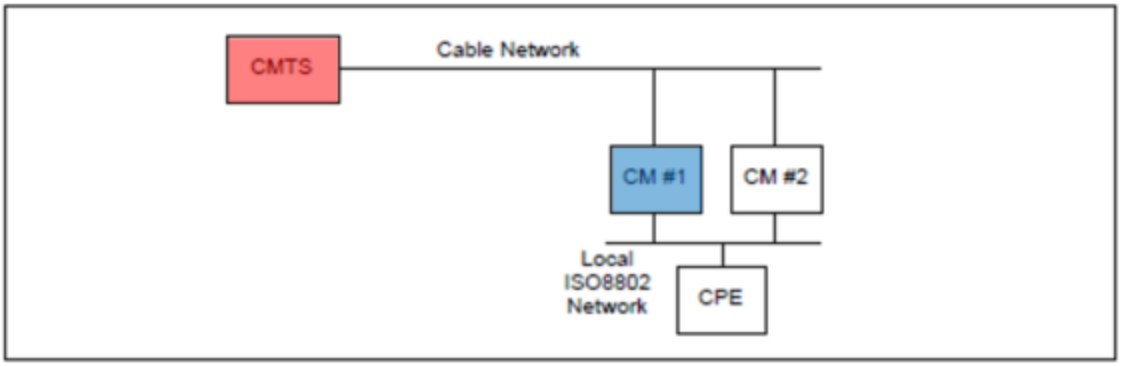
4. Claim 16

DOCSIS-2.0-Zuckerman teaches claim 16 for the same reasons as claim 8, except the CMTS is the "first node." *See* §IX.G.1; Ex. 1002, ¶688.

5. Claim 17

a. [17PRE]

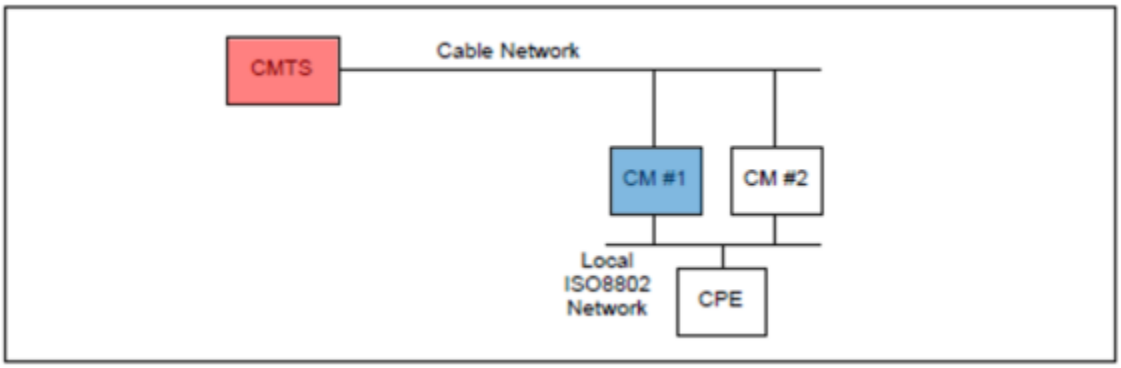
DOCSIS-2.0's system includes the nodes in [17A]-[17F]:



See §IX.F.1, §IX.F.9; Ex. 1002, ¶¶689-690.

b. [17A]

DOCSIS-2.0's system includes a cable network ("communications network") including the **CMTS** ("first node") communicating with **CM#1** ("second node"):



A POSITA would have understood that the CMTS comprises a processor and computer executable program code embodied on a computer readable medium because that was a well-known implementation for the protocol stack of the CMTS:

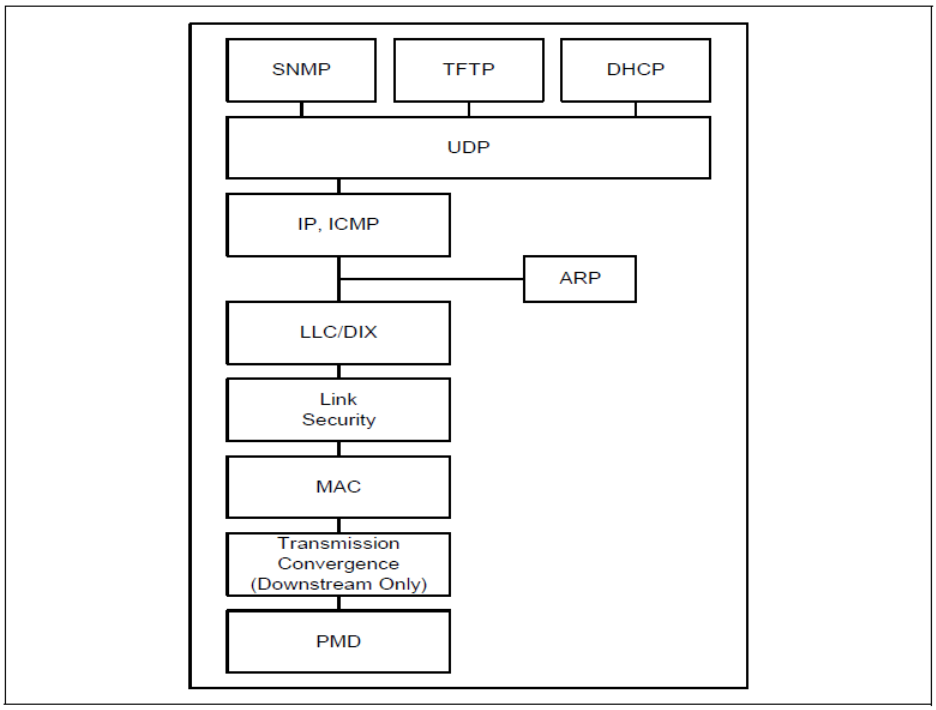


Figure 5-1 Protocol Stack on the RF Interface

Ex. 1010, 27, 118 ("processor" and "software"), 125, 239 ("non-volatile storage"); Ex. 1002, ¶¶691-692. A POSITA would have understood that the computer executable program code would have been configured to carry out the procedures (e.g., ranging and test procedures) of the layers in the stack and therefore would have performed the "transmit" in [17A]. *See* §IX.F.5.b; Ex. 1016, [0010]; Ex. 1002, ¶¶693-694.

Ranging: The UCD message specifies parameters for a physical layer Ranging Request. *See* §IX.F.1.b, §IX.F.5.b. And, the UCD parameters (e.g., Downstream Channel ID, modulation rate, modulation type parameters) comprise a payload content and modulation profile for the Ranging Request. *See* §IX.F.1.b, §IX.F.5.b; Ex. 1002, ¶¶695-706.

Testing: The Test Request specifies parameters for a physical layer Test Response. *See* §IX.F.1.b, §IX.F.5.b. And, the Test Request's parameters (e.g., mode and channel parameters like modulation rate) comprise a payload content and modulation profile for the Test Response. *See* §IX.F.1.b, §IX.F.5.b; Ex. 1002, ¶¶707-714.

c. [17B]

A POSITA would have understood that CM#1 ("second node") comprises a processor and computer executable program code embodied on a computer readable medium because that was the well-known implementation for the protocol stack of CM#1:

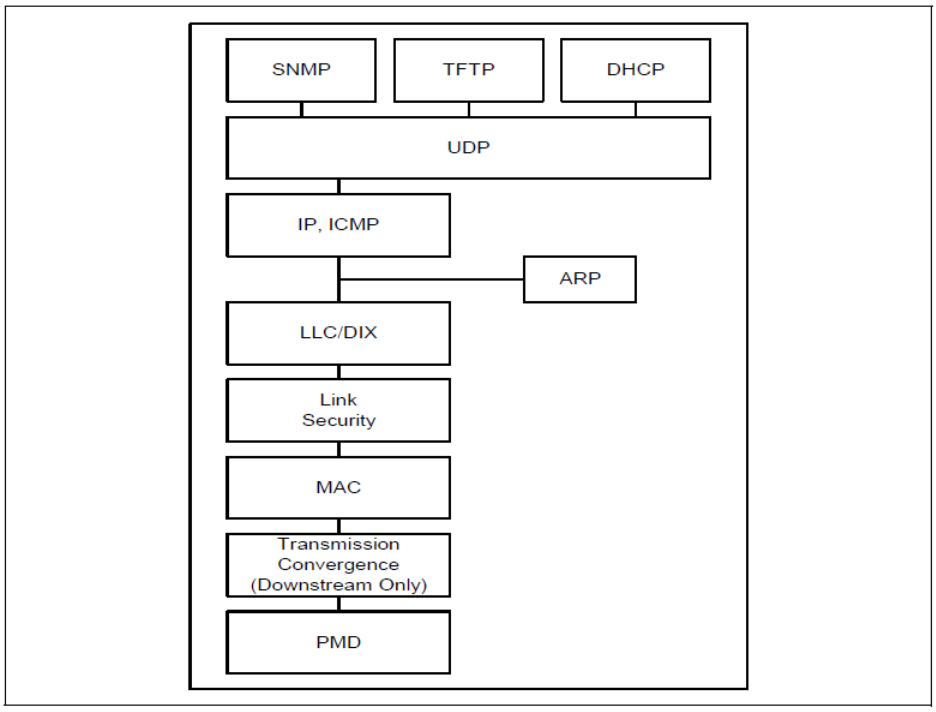


Figure 5-1 Protocol Stack on the RF Interface

Ex. 1010, 27, 118 ("processor" and "software"), 125; Ex. 1002, ¶715. A POSITA would have understood that the computer executable program code would have been configured to carry out the procedures (e.g., ranging and test procedures) of the layers in the stack. Ex. 1016, [0010]. CM#1's program code would have been configured to perform [17C]-[17F]. *See* §§IX.G.5.d-g; Ex. 1002, ¶¶716-718.

d. [17C]

CM#1 receives the UCD Message or Test Request. *See* §IX.F.1.b, §IX.F.5.c; Ex. 1002, ¶¶719-720.

e. [17D]

CM#1 determines parameters associated with generating and transmitting the Ranging Request or Test Response. *See* §IX.A.1.c; Ex. 1002, ¶¶721-722.

f. [17E]

CM#1 generates the Ranging Request according to the UCD parameters and the Ranging Request's parameters, wherein the Ranging Request has a form (e.g., modulation rate) dictated by the UCD parameters. *See* §IX.F.1.d; Ex. 1002, ¶723.

CM#1 generates the Test Response according to the Test Request's and Test Response's parameters, wherein the Test Response has a form (e.g., modulation rate) dictated by the Test Request's parameters. *See* §IX.F.1.d; Ex. 1002, ¶724.

g. [17F]

CM#1 transmits the Ranging Request or Test Response to the CMTS. *See* §IX.F.1.e; Ex. 1002, ¶¶725-728.

6. Claim 18

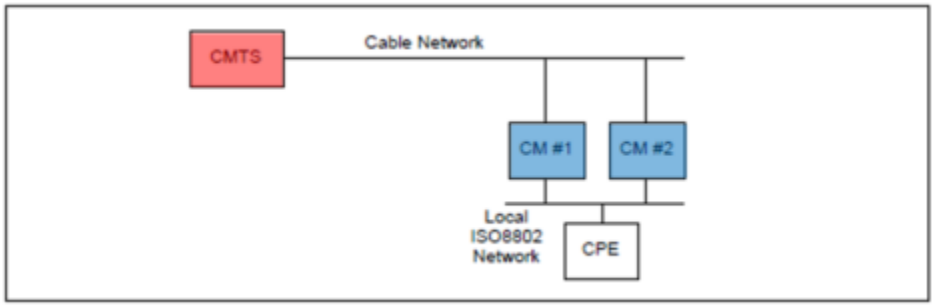
DOCSIS-2.0-Zuckerman discloses claim 18 for the same reasons as claim 10. *See* §IX.G.2; Ex. 1002, ¶729.

7. Claim 19

a. [19A]

DOCSIS-2.0-Zuckerman uses OFDMA for DOCSIS-2.0 (§IX.G.2), which results in claim 19.

The **CMTS's** code is configured to transmit a second UCD message (specifying parameters for a second Ranging Request) and a second Test Request (specifying parameters for a second Test Response) to CM#2 ("third node") on the wireless network:



See §IX.F.5.b, §IX.G.3.b; Ex. 1002, ¶¶730-736.

b. [19B]

The second UCD message's parameters comprise a second Downstream channel ID ("second payload content") and a second modulation rate and type

("second modulation profile") for the second Ranging Request. *See* §IX.G.5.b; Ex. 1002, ¶¶737-738.

The second Test Request's parameters comprise a second mode and channel parameters ("second payload content") and a second modulation rate ("second modulation profile") for the second Test Response. *See* §IX.G.5.b; Ex. 1002, ¶739.

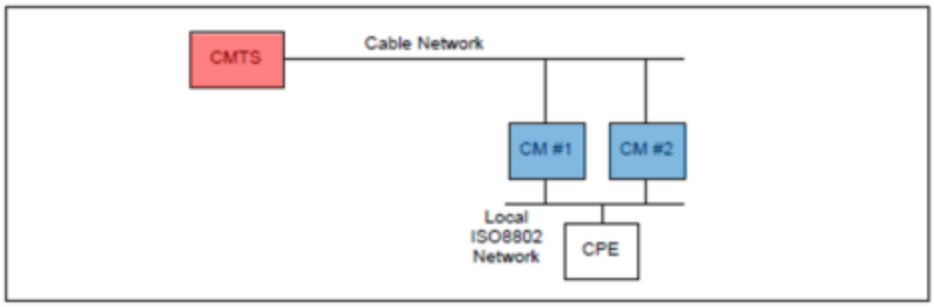
c. [19C]

Each UCD message or Test Request has numerous parameters for generating and transmitting a Ranging Request or Test Response (§IX.F.1), and any two groups/subsets of those parameters teaches the "different second plurality of parameters" and "third first plurality of probe parameters." Ex. 1002, ¶¶740-742.

Further, the second UCD message and second Test Request each specify a second group/subset of parameters for generating and transmitting the second Ranging Request or second Test Response. *See* §IX.F.1.b, §IX.F.5.b, §IX.G.5.b; Ex. 1002, ¶¶740-742.

d. [19D]

CM#2 ("third node") performs the same steps as **CM#1** to generate the second Ranging Request or second Test Response transmitted to the **CMTS** on the wireless network:



§§IX.G.5.c-g; Ex. 1002, ¶¶743-745.

e. [19E]

[19E] is identical to [11C]. *See* §IX.G.3.d; Ex. 1002, ¶746.

8. Claims 22-24

Except for their dependencies, claims 22-24 are the same, and obvious for the same reasons, as claims 6 and 15-16, respectively. *See* §IX.F.3, §IX.F.7, §IX.G.4; Ex. 1002, ¶¶747-749.

X. GROUNDS FOR STANDING & FEE PAYMENT

Petitioner certifies that the '690 patent is available for, and Petitioner is not barred or estopped from requesting, this *inter partes* review.

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

II. CONCLUSION

Inter partes review should be instituted and claims 1-24 canceled.

Dated: February 15, 2024

By: /Frederic M. Meeker/

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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 13,993, which is less than the 14,000 allowed under 37 CFR § 42.24(a)(1)(i). This total includes 13,993 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. 8,284,690 and supporting evidence to be served via FedEx Priority Overnight on February 15, 2024, on the following:

MCANDREWS HELD & MALLOY, LTD
500 WEST MADISON STREET
SUITE 3400
CHICAGO, IL 60661

Dated: February 15, 2024

By: /Frederic M. Meeker/

Frederic M. Meeker
Reg. No. 35,282

CLAIM LISTING APPENDIX

U.S. Pat. No. 8,284,690

Designation	Claim Language
Claim 1	
[1PRE]	A method comprising:
[1A]	a) receiving in a first node, a probe request specifying a first plurality of parameters associated with the generation and transmission of a probe, wherein the first plurality of parameters at least specify content payload of the probe and a second node;
[1B]	b) determining a second plurality of parameters associated with generation and transmission of the probe;
[1C]	c) generating the probe in accordance with the first plurality of parameters and the second plurality of parameters, wherein the probe has a form dictated by the first plurality of parameters; and
[1D]	d) transmitting the probe from the first node to the second node.
Claim 2	
2	The method of claim 1, further including using within the first node, at least one of the probe parameters to determine a modulation profile for the probe.
Claim 3	
[3PRE]	The method of claim 1, wherein at least one of the probe parameters indicates:
[3A]	a) a modulation profile for the probe;
[3B]	b) the number of times to transmit the probe;
[3C]	c) a number of symbols for the payload of the probe;
[3D]	d) a preamble type for the probe;
[3E]	e) a cyclic-prefix length for the payload of the probe;
[3F]	f) a transmit power for the probe; and
[3G]	g) a transmit power scaling factor for the payload of the probe.
Claim 4	
4	The method of claim 3, wherein the probe request identifies a hidden node.
Claim 5	

Designation	Claim Language
5	The method of claim 3, wherein the modulation profile for the probe emulates an orthogonal frequency division multiple access (OFDMA) transmission.
Claim 6	
6	The method of claim 1, wherein the probe request is generated by the second node.
Claim 7	
7	The method of claim 1, wherein the probe request requests a probe that assists in diagnosing a network problem.
Claim 8	
8	The method of claim 7, wherein the probe request is generated by a network operator and uploaded to the second node.
Claim 9	
[9PRE]	A method comprising:
[9A]	a) a first node transmitting a probe request to a second node, the probe request specifying a first plurality of probe parameters for a physical layer probe, the first plurality of probe parameters comprising a form for the probe including a modulation profile for the probe;
[9B]	b) the first node receiving the probe from the second node, wherein the probe is generated in accordance with the first plurality of parameters and in accordance with a second plurality of parameters determined by the second node.
Claim 10	
10	The method of claim 9, wherein the probe request is configured such that the probe emulates an OFDMA transmission.
Claim 11	
[11PRE]	The method of claim 9, further comprising:
[11A]	a) the first node transmitting a second probe request to a third node;
[11B]	b) and the first node receiving a second probe from the third node, wherein the second probe is generated according to the second probe request; and
[11C]	wherein the first probe and second probe are transmitted simultaneously using OFDMA.
Claim 12	

Designation	Claim Language
[12PRE]	The method of claim 9, wherein the probe parameters further comprises:
[12A]	a) an indication of the number of times to transmit the probe;
[12B]	b) a number of symbols for the payload of the probe; a preamble type for the probe;
[12C]	c) a cyclic-prefix length for the payload of the probe; a transmit power for the probe; and
[12D]	d) a transmit power scaling factor for the payload of the probe.
Claim 13	
13	The method of claim 12, wherein the probe request is configured such that the probe identifies a hidden node.
Claim 14	
14	The method of claim 9, wherein the probe request is transmitted at a specific time.
Claim 15	
15	The method of claim 9, wherein the probe request is configured to diagnose a network problem.
Claim 16	
16	The method of claim 15, wherein the probe request is generated by a network operator and uploaded to the first node.
Claim 17	
[17PRE]	A system, comprising:
[17A]	a) a first node on a communications network, the first node comprising a first processor and a first computer executable program code embodied on a first a computer readable medium, the first computer executable program code configured to transmit a probe request to a second node, on the communications network, the probe request specifying a first plurality of probe parameters for a physical layer probe, wherein the first plurality of probe parameters comprising at least a payload content for the probe and a modulation profile for the probe; and
[17B]	b) the second node on the communications network, the second node comprising a second processor and a second computer executable program code embodied on a second

Designation	Claim Language
	computer readable medium, the second executable program code configured to:
[17C]	receive the probe request;
[17D]	determine a second plurality of parameters associated with generation and transmission of the probe;
[17E]	generate the probe in accordance with the first plurality of parameters and the second plurality of parameters, wherein the probe has a form dictated by the first plurality of parameters; and
[17F]	transmit the probe to the first node.
Claim 18	
18	The system of claim 17, wherein the probe request is configured such that the probe emulates an OFDMA transmission.
Claim 19	
[19A]	The system of claim 17, wherein the first executable program code is further configured to transmit a second probe request to a third node on the communications network, the second probe request specifying a third first plurality of probe parameters for a second physical layer probe,
[19B]	the third plurality of probe parameters comprising a second payload content for the second probe and a second modulation profile for the probe,
[19C]	the second probe request further specifying a different second plurality of parameters associated with the generation and transmission of the second probe; and
[19D]	further comprising the third node on the communications network, the third node comprising a third processor and a third computer executable program code embodied on a third computer readable medium, the third executable program code configured to receive the second probe request, generate the second probe according to the received probe request, and transmit the second probe to the first node on the communications network; and
[19E]	wherein the first probe and second probe are transmitted simultaneously using OFDMA.
Claim 20	

Designation	Claim Language
[20PRE]	The system of claim 17, wherein the probe parameters further comprises:
[20A]	a) an indication of the number of times to transmit the probe;
[20B]	b) a number of symbols for the payload of the probe;
[20C]	c) a preamble type for the probe;
[20D]	d) a cyclic-prefix length for the payload of the probe;
[20E]	e) a transmit power for the probe; and
[20F]	f) a transmit power scaling factor for the payload of the probe.
Claim 21	
21	The system of claim 20, wherein the probe request is configured such that the probe identifies a hidden node.
Claim 22	
22	The system of claim 17, wherein the probe request is generated by the first node.
Claim 23	
23	The system of claim 17, wherein the probe request is configured to diagnose a network problem.
Claim 24	
24	The system of claim 23, wherein the probe request is generated by a network operator and uploaded to the first node.