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: Dec. 10, 2009
Issue Date: Oct. 9, 2012
Title: RECEIVER DETERMINED PROBE

Inter Partes Review No.: IPR2024-00430

DECLARATION OF JAMES BERTONIS IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF U.S. PAT. NO. 8,284,690

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I, Mr. James G. Bertonis, declare that I have personal knowledge of the facts set forth in this declaration and, if called to testify as a witness, could and would do so competently.

I. INTRODUCTION

1. I have been retained as an expert witness on behalf of the Petitioner, Comcast Cable Communications, LLC, for the above-referenced *inter partes* review proceeding.

2. I have been asked to provide a declaration with my opinions regarding certain matters pertaining to the patentability of U.S. Patent No. 8,284,690 ("the '690 patent"). I understand that the '690 patent is owned by Entropic Communications, LLC ("Patent Owner").

3. I am being compensated at my usual consulting rate for my work on this matter. My compensation is in no way dependent upon my opinions or testimony or the outcome of this proceeding. I have no financial interest in the parties or in the outcome of this proceeding.

II. PROFESSIONAL BACKGROUND AND QUALIFICATIONS

4. I am currently the CEO of Azure Communications Inc. I founded Azure Communications in 2009. Azure Communications designs and develops

wireless broadband solutions and advanced radio technology. My current curriculum vitae is attached as Appendix A and some highlights follow.

5. I received a B.S. in Electrical Engineering from Syracuse University in 1976, and an MBA from Santa Clara University in 1986.

6. While at Syracuse University, I concentrated my senior year studies on communications engineering, including graduate level courses in this area taken as an elective. I also worked for the University part time as a paid assistant in their communications engineering lab during my last two years at the University.

7. After graduating from Syracuse University, my entire career has been devoted to the field of RF and wireless communications, both as an accomplished RF circuit design engineer, as well as the founding CEO of four wireless communications companies, and one continuing as the CTO post merger.

8. I have also worked as a consulting engineer on several occasions, both in the area of wireless circuit/product design engineering, and later during my career as an expert in the field of wireless communications technology.

9. In 2000, I presented a paper titled "High Speed Wireless Internet over Unlicensed Radio Bands - An Innovative Approach" which was published in Private Wireless & Broadband Magazine, June 2000. The paper focused on the application of the cable standard DOCSIS for use in wireless Internet networks.

10. During my time at ARCi, and later Arcwave Inc. (from 2000 to 2008), I was involved with numerous DOCSIS related engineering activities. This included developing a RF communications system for the cable industry, which extended the reach of cable modems by using a RF link to bring DOCSIS to areas not served by coaxial or fiber cable infrastructure. This product was purchased by all of the major cable operators and incorporated into numerous cable services.

11. Among my work related achievements, I was awarded four patents in the area of DOCSIS and wireless communications stemming from my work adapting the DOCSIS cable modem protocol, which became the leading broadband standard in the world, to operate over wireless communications channels. This technology was successfully employed by ARCi, and later Arcwave Inc., where I was involved with designing and bringing this technology to market.

12. During my time at Azurecomm (from 2009 until now), I was involved with engineering a mobile WiMAX (802.16e) micro base station product. This work included developing the RF and baseband electronic modules and operating PHY and MAC software compliant to the WiMAX standard, to be sold and licensed to other wireless infrastructure equipment providers. During this time developing a WiMAX (802.16e) product, I was involved with designing the multi-carrier RF modulators and demodulators, which were configured to process the

OFDMA signal. OFDMA was the specified modulation and multiplexing format used by WiMAX.

13. During my time working for ADBS Corp., and also working as a consulting engineer (from 1990 to 2000), I was involved with numerous wireless local area network (WLAN) engineering activities. This included developing a WLAN module for Toshiba laptop computers (1990-1992), developing a WLAN for the golfing industry (1995-1996), and actively participating in the IEEE 802.11 WLAN standards body (1992-2000).

14. I believe that my extensive industry experience and educational background qualify me as an expert in the relevant field of communication networks. I am knowledgeable of the relevant skill set that would have been possessed by a hypothetical person of ordinary skill in the art at the time of the alleged invention of the ’690 Patent, which I (as I discuss below) have assumed is December 15, 2008.

III. MATERIALS REVIEWED

15. In connection with my study of this matter and reaching the opinions stated herein, I have reviewed a number of documents including the exhibits listed in Appendix B.

IV. UNDERSTANDING OF APPLICABLE LEGAL STANDARDS

16. Although I am not an attorney, I have a general understanding of the applicable legal standards pertaining to the patentability issues presented in this proceeding.

17. I understand that, in this *inter partes* review (IPR), Petitioner is challenging the patentability of the claims of the ’690 patent. I understand that Petitioner has the burden of proving that each challenged claim is unpatentable by a preponderance of the evidence.

18. I understand that to be valid, a patent claim must be “novel,” and is invalid if “anticipated” by a single prior art reference. I further understand that a reference anticipates if it discloses each and every element as arranged in the claim, so as to enable a person of ordinary skill in the art (“POSITA”) to make and use the claimed invention without undue experimentation.

19. I understand that a patent claim is unpatentable if, at the time of the invention, it would have been obvious to a POSITA to combine the teachings of the prior art to yield the patent claim. I also understand that it is not required (although it is acceptable) that each element/limitation of a patent claim be found in a single reference in order to find a patent claim obvious. For a patent claim to be found obvious, all the elements/limitations of the patent claim may be found in a combination of references at which a person of ordinary skill in the art would

have been reasonably expected to arrive. I understand that a proper analysis of whether an invention is unpatentable for obviousness includes a review of the scope and content of the prior art, the differences between the patent claims at issue and the prior art, the level of ordinary skill in the field of the invention at the time of the invention, and other objective considerations identified below.

20. It is my understanding that the prior art and claimed invention should be viewed through the knowledge and understanding of a person of ordinary skill in the art – one should not use his or her own insight or hindsight in deciding whether a claim is obvious. I further understand that a claim may be rendered obvious if a person of ordinary skill in the art can implement the claimed invention as a predictable variation of a known product. I also understand that a person of ordinary skill in the art is presumed to have knowledge of the relevant prior art at the time of the claimed invention, which comprises any prior art that was reasonably pertinent to the particular problems the inventor faced.

21. I understand that a showing of obviousness requires some articulated reasoning with a rational underpinning to support the combination of the references. I understand that in consideration of the issue of obviousness it is important to identify whether a reason existed at the time of the invention that would have led a POSITA to combine elements of the references in a way that yields the claimed invention.

22. I understand that a claim may be considered unpatentable for obviousness for various reasons. I have been informed that the following exemplary rationales may support a finding of obviousness:

(A) combining prior art elements according to known methods to yield predictable results;

(B) simply substituting one known element for another to obtain predictable results;

(C) use of a known technique to improve similar devices in the same way;

(D) applying a known technique to a known device ready for improvement to yield predictable results;

(E) choosing from a finite number of identified, predictable solutions with a reasonable expectation of success;

(F) known work in a field that prompts variations in the work in the same or a different field that leads to predictable results; and

(G) some teaching, suggestion, or motivation in the prior art that would have led a person of ordinary skill in the art to modify a prior art reference or combine multiple prior art references or teachings to arrive at the claimed invention.

23. I understand that various objective or "real world" factors, also referred to as secondary considerations, may be indicative of non-obviousness. I understand that such factors/considerations include:

(A) the commercial success of the claimed invention;

(B) the existence of a long-felt, unresolved need for a solution to the problem solved by the claimed invention;

(C) failed attempts to solve the problem solved by the claimed invention;

(D) copying of the claimed invention;

(E) unexpected results of the claimed invention;

(F) praise for the claimed invention by others in the relevant field; and

(G) willingness of others to accept a license under the patent because of the merits of the claimed invention.

24. It is my understanding that the prior art references themselves may provide a suggestion, motivation, or reason to combine, but other times the link may be common sense. I further understand that the obviousness analysis recognizes that market demand, rather than scientific literature, often drives innovation, and that is sufficient motivation to combine references.

25. It is my understanding that a particular combination may be proven obvious merely by showing that it was obvious to try the combination. For example, common sense is a good reason for a person of ordinary skill to pursue

known options when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions.

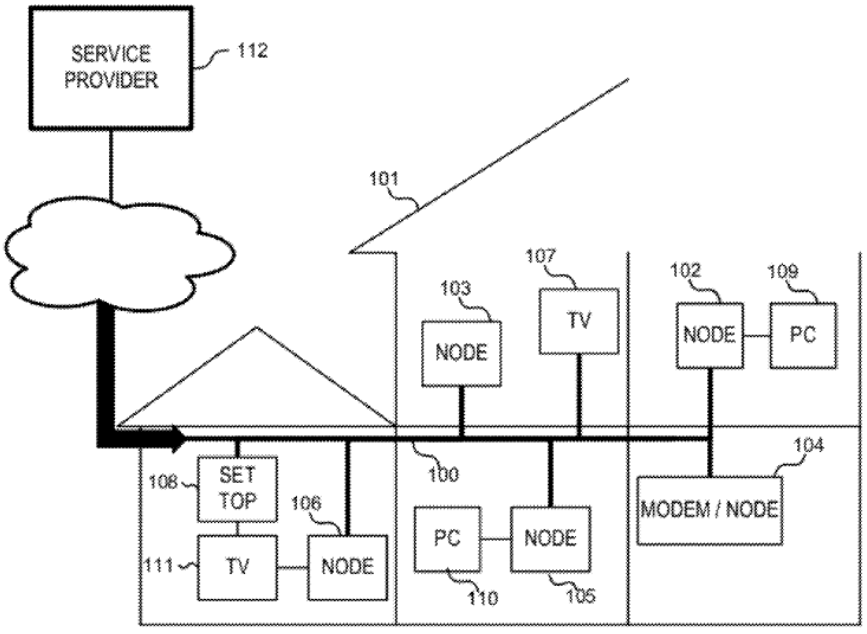
26. I further understand that a proper obviousness analysis focuses on what was known or obvious to a person of ordinary skill in the art, not just the patentee. Accordingly, it is my understanding that any need or problem known in the field at the time of invention and addressed by the patent can provide a reason for combining the limitations in the manner claimed.

V. OVERVIEW OF THE '690 PATENT

27. The '690 patent "relates generally to communication networks, and more particularly, some embodiments relate to channel assessment probes." Ex. 1001, 1:12-14. In discussing the related art, the '690 patent explains that "it is helpful to characterize the communication channel over which data is to be sent between nodes of the network." Ex. 1001, 1:41-43. The '690 patent admits that it was known to send probes between network nodes "in order to allow a receiving node on the network to determine some of the characteristics of the channel between the receiving node and the transmitting node." Ex. 1001, 1:48-52. The patent further acknowledges that "[t]hese probes are typically well defined." Ex. 1001, 1:52-53. The patent explains that because the probes are known in advance (i.e., predetermined), the receiving node can determine some channel characteristics. Ex. 1001, 1:53-57. However, the patent notes that this use of

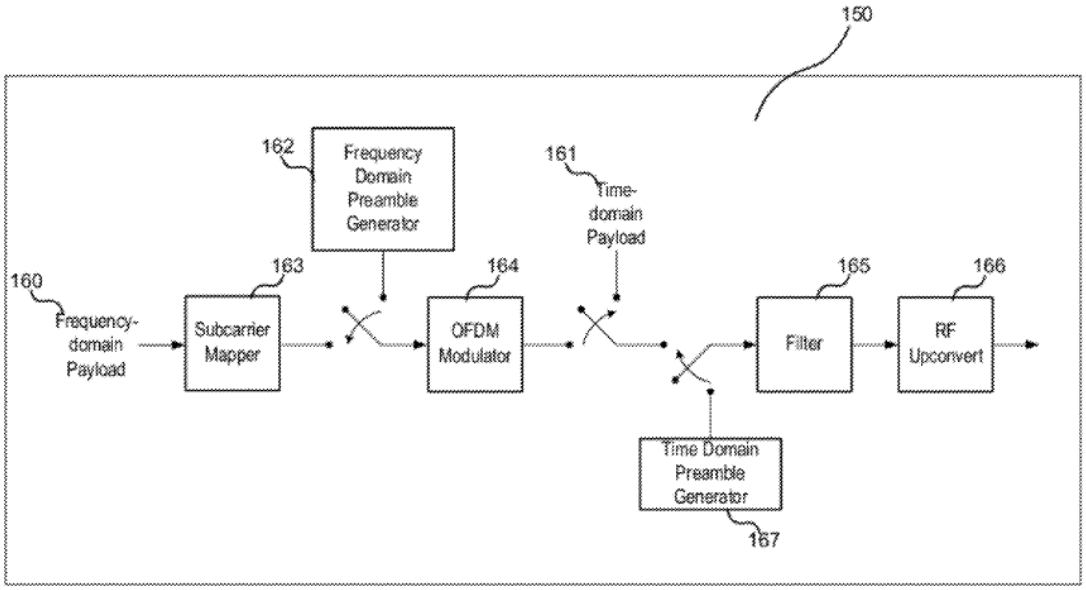
predetermined probes "reduces the amount [of] flexibility of the characterization process." Ex. 1001, 1:57-59.

28. With this in mind, the '690 patent describes a probe request (sent from the receiving node to the transmitting node) that specifies parameters for dictating a form of the probe (also referred to as a probe response) sent from the transmitting node to the receiving node. Ex. 1001, 1:66-2:19. As shown with respect to Figure 1 (below), the receiving node and transmitting node may be different nodes among the plurality of nodes 102-106 within a residence 101. Ex. 1001, 3:24-38, FIG. 1.



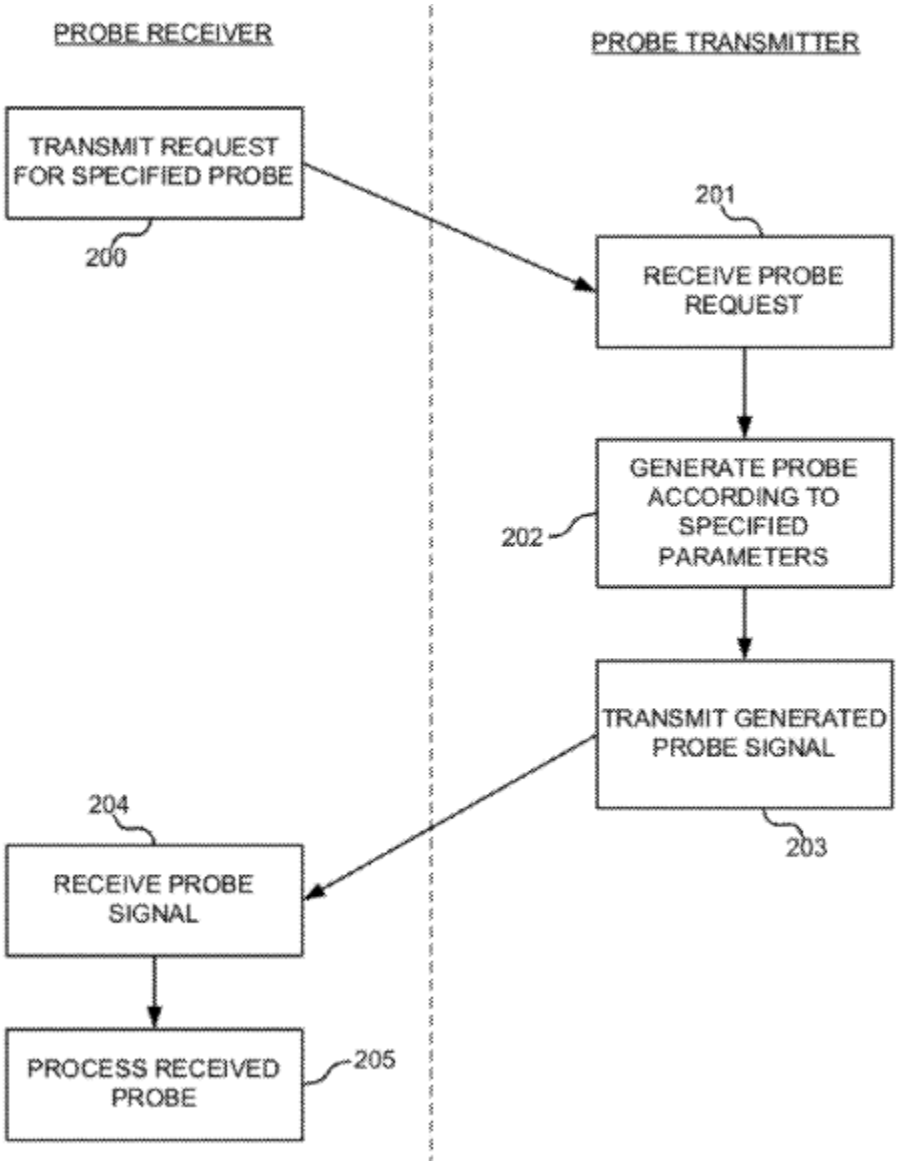
Ex. 1001, FIG. 1

29. The ’690 patent explains that the communications medium 100 connecting the nodes may be a wired medium (e.g., coaxial cable, Ethernet, etc.) or a wireless transmission system. Ex. 1001, 3:28-35. A POSITA would have understood that a typical residential wireless transmission system would include Wi-Fi, which uses the 802.11 protocols. Ex. 1001, 12:2-20. The ’690 patent also states that the nodes “can be associated with a variety of devices” (e.g., computers 109-110, a module of a television 111, a media playing device 103 for playing music). Ex. 1001, 4:10-24. Further, the ’690 patent describes that communications on the network of nodes may use orthogonal frequency division multiplexing (OFDM). Ex. 1001, 4:39-64. It also states that the network employs orthogonal frequency division multiple access (OFDMA) “to allow multiple nodes to have simultaneous access to the channel.” Ex. 1001, 4:65-66. In Figure 3 (below), the patent provides a high-level block diagram of a transmitter module 150 that could be used within the nodes to transmit OFDMA packets. Ex. 1001, 5:57-6:16, FIG. 3. A POSITA would have understood that there is nothing new or interesting about this module – it is just seeking to capture known functionalities of OFDMA transmissions.



Ex. 1001, FIG. 3

30. Then, with respect to Figure 4 (below), the patent provides a method of transmitting a probe request and probe. Ex. 1001, 6:17-7:11, FIG. 4.



Ex. 1001, FIG. 4

31. As shown above, the method involves a receiving node (or probe receiver) transmitting a probe request with parameters for specifying a probe to a transmitting node (or probe transmitter). Ex. 1001, 6:33-36. The specified parameters are disclosed with respect to Figure 5. Ex. 1001, 6:36-38, 7:29-9:54, FIG. 5. The transmitting node then generates the probe according to the specified

parameters and transmits the probe. Ex. 1001, 6:38-56. The receiving node then receives the probe and can generate a report for a network administrator. Ex. 1001, 6:57-7:11.

32. The ’690 patent explains that “probes can be used to diagnose problems” with the network. Ex. 1001, 4:34-35. It also states that “a probe can replicate a potential problem, reach or discover a distant or previously undetected node on the network, or assist with network admissions procedures.” Ex. 1001, 4:35-38.

VI. RELATED PROSECUTION HISTORY

33. The ’690 patent was filed on December 10, 2009 and assigned U.S. Patent Application No. 12/635,649 (“the ’649 application”). The ’690 patent claims priority to two provisional applications: U.S. Provisional Application No. 61/122,687 and U.S. Provisional Application No. 61/179,454. I note that there are no other related U.S. applications (e.g., no continuations of the ’690 patent). However, a PCT application (PCT/US09/67586) was also filed on the same day as the ’649 application. I understand that the PCT application was then used to pursue applications in other countries, so I have not analyzed those prosecution histories and only address the prosecution history of the ’690 patent below.

34. It is my understanding that the ’649 application was filed with 24 claims including independent claims 1, 9, and 17. Ex. 1003, 35-39. The following shows independent claim 1 as filed.

1.	A method comprising:	
	a)	receiving in a first node, a probe request specifying a plurality of parameters associated with the generation and transmission of a probe, including the content of a payload of the probe; and
	b)	transmitting from the first node to a second node the probe having a form dictated by the parameters specified by the probe request.

Ex. 1003, 35.

35. On December 21, 2011, the examiner issued a non-final Office Action rejecting claims 5 and 19 under 35 U.S.C. § 112. Ex. 1003, 92-94. In particular, the examiner rejected claims 5 and 9 because the claims were indefinite because claim 5 lacked sufficient antecedent bases for the claim limitation of “the modulation profile” and claim 19 recited “a third node” twice. Ex. 1003, 94. In addition, the Office Action also included rejections of all claims as being anticipated over U.S. Pat. Pub. No. 2008/0117833 to Borran et al (hereinafter “Borran”) or obvious over Borran in view of U.S. Pat. No. 7,124,199 to Miller et al (hereinafter “Miller”). Ex. 1003, 94-115. The applicant filed a response to the non-final Office Action on May 21, 2012, amending claims 1, 5, 9, 17, and 19. Ex. 1003, 124-138. For example, independent claim 1 was amended as follows.

1. (Currently Amended) A method comprising:

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 ~~including the content of a~~ content payload of the probe and a second node;

b) determining a second plurality of parameters associated with generation and transmission of the probe;

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

[[b]] d) transmitting the probe from the first node to [[a]] the second node ~~the probe having a form dictated by the parameters specified by the probe request~~.

Ex. 1003, 125.

36. In their response, the applicant argued that Borran was silent regarding the limitations of "**a probe request** specifying a first plurality of parameters associated with the generation and transmission of a probe" and "determining **a second plurality of parameters** associated with generation and transmission of [a] probe" as well as "generating [a] probe in accordance with [a] first plurality of parameters and [a] second plurality of parameters, wherein the probe has a form dictated by the first plurality of parameters" as recited in claim 1. Ex. 1003, 131 (emphasis in the original).

37. The response was apparently successful as a Notice of Allowance was filed on June 11, 2012, stating that 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." Ex. 1003, 147. The issue fee was paid on September 11, 2012 and the patent issued on October 9, 2012. Ex. 1003, 156, 161.

38. In my opinion, the examiner erred by failing to appreciate that a probe would have been generated in accordance with both a plurality of parameters in a probe request message and a plurality of parameters determined by the node/device that receives the probe request for generating and transmitting the probe. The prior art relied on in my analysis below clearly teaches the claimed "second plurality of parameters" and therefore is significantly better than the Borran reference relied on by the examiner during prosecution.

VII. RELATED LITIGATION

39. I understand that the '690 patent is one of the patents in suit in the following pending litigation: *Entropic Communications, LLC v. Comcast Corp.*, Case No. 2:23-cv-1050-JWH-KES in the United States District Court for the Central District of California. I understand that Patent Owner sued Petitioner for alleged infringement of the '690 patent. Ex. 1004. In particular, Petitioner asserted claims 7, 8, 11, 15, and 16.

40. I understand that the '690 patent is also involved in *Entropic Communications, LLC v. Charter Communications, Inc.*, Case No. 2-22-cv-00125

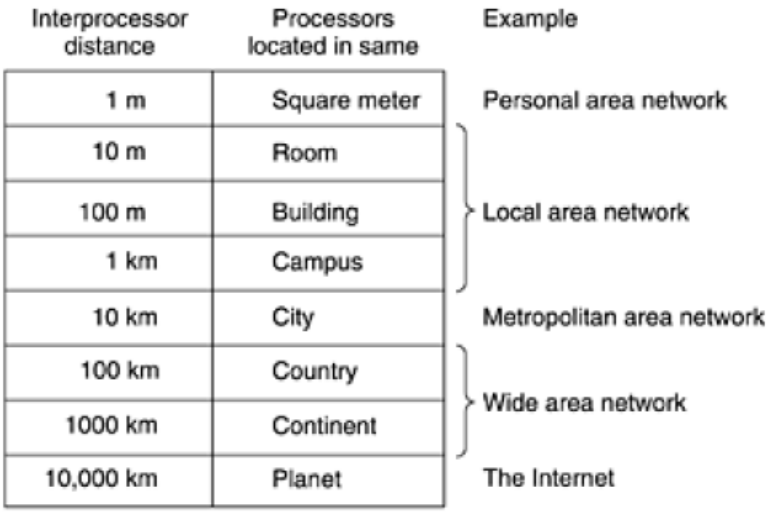
in the United States District Court for the Eastern District of Texas. Ex. 1005. I understand that this case is ongoing, and that there has been some claim constructions.

41. I understand that the ’690 patent is also involved in *Entropic Communications, LLC v. Cox Communications, Inc.*, Case No. 2-23-cv-01049 in the United States District Court for the Central District of California. Ex. 1006. I understand that this case is ongoing, and that there has not been any claim constructions at this time.

VIII. TECHNICAL BACKGROUND

A. Communication Network Architecture

42. A communication network is a collection of computers connected together to transmit data. Ex. 1021, 11-12. Data is transferred as packets over a network, and each network utilizes different hardware and communication protocols to transfer the data packets. Ex. 1021, 19-21. The networks may be private or public and are usually classified based on the computers’ geographic proximity. Ex. 1021, 11, 20-21, 24-25. For example, local computers or processors located within a house may utilize a Local Area Network (“LAN”) while the entire planet shares the Internet. Ex. 1021, 20-21. Further examples of well-known networks are described in Fig. 1-6 below.



Ex. 1021, FIG. 1-6.

43. Well-known cable television distribution systems at the time of the ’690 patent included headends (also referred to as “head-ends”, “head ends” and “cable head ends”) (**green**), STBs (Set-Top Boxes), modems, and home networks. Television and data communication channels are sent to subscribers as broadcast signals. The headends act as a central hub of the television distribution system by modifying the received television or data signals into a format required for subscriber use. The signals are then sent downstream to the subscriber, either to the subscriber's home network, STBs, and/or modem, to be further processed and displayed on a TV.

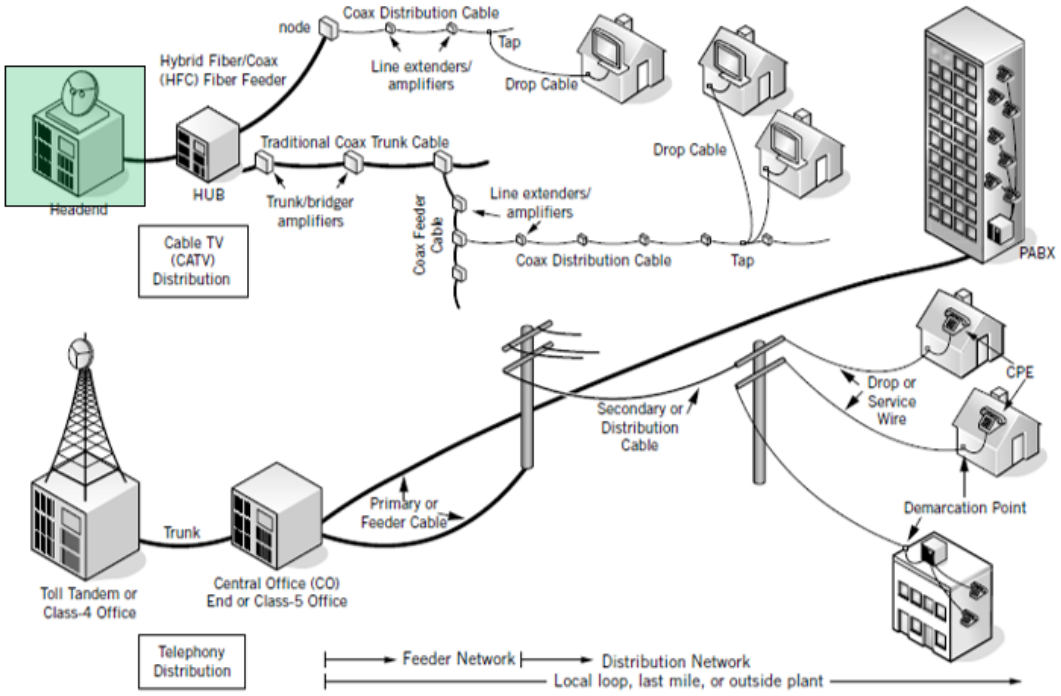


FIGURE 4.1

PSTN and CATV wired access network

Ex. 1022, FIG. 4.1

44. After receiving the television channel signals, the headends may determine that "the television program signal may need to be compressed, combined/multiplexed, encoded, mapped, modulated, upconverted and amplified." Ex.1023, 7:63-66, 4:5-13, FIG. 4. For example, different homes and cable devices may require different programming channels, accommodate different signal bandwidths, and comprise unique encryption codes. Ex.1023, 3:49-67, 13:53-67. Headends may employ demodulators, demultiplexers, combiners, modulators, and encoders, in combination with a controller, to modify the signal. Ex.1023, 11:64-

12:18. After modifying the signal, the headends deliver the modified signals over transmission frequencies to a viewer's home. Ex. 1023, 2:9-17.

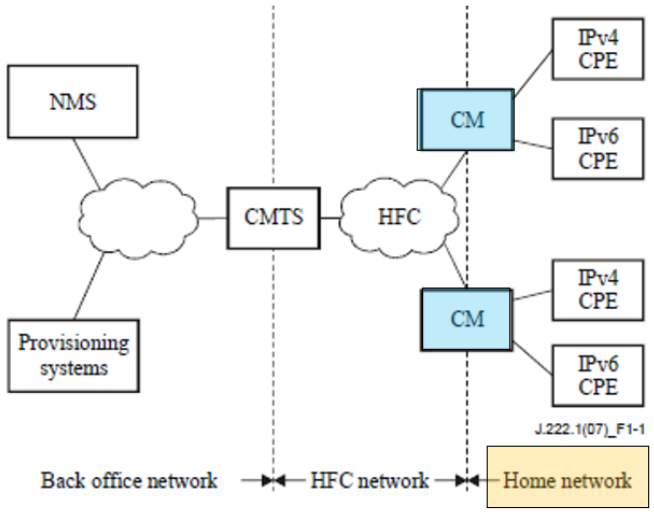
45. A home network is the internal connection of electronic devices within a subscriber's home. Ex.1022, 149, 178. Even at the time of the ’690 patent, households involved multiple different electronic equipment requiring access to the Internet, Wi-Fi, and/or television signals. Ex.1022, 178. For example, printers, gaming devices, PCs, television sets, cameras, etc., require access to the Internet but are also formatted for different bandwidths. Ex.1022, 178. A home network controls and modifies the data transmission to the electronic components linked to the home network. Ex.1022, 178.

46. Set-top boxes (“STBs”) operate as receivers and convert received data signals into a format required by a television set. Ex. 1024, 194. The STBs support two-way data transfer, interactive TV applications, and interfacing with the home network. Ex. 1024, 194. Set-top boxes are configurable to have a wide variety of uses, including digital video recording, video teleconferencing, IP telephony, video on demand, and high-speed internet TV services. Ex. 1024, 197-199.

47. To display the received data signals on a TV, the STB decodes the data according to a standard algorithm and synchronizes the audio and video streams for display. Ex. 1024, 200, 203-209. When needed, the STBs will correct

the data streams for lost video frames, data congestion, and other signal degradations. Ex. 1024, 200.

48. Modems, or cable modems ("CM") (**blue**), are used in television signal transport as a bridge between the incoming television service signal and the home network (**yellow**). Ex. 1025, 2.



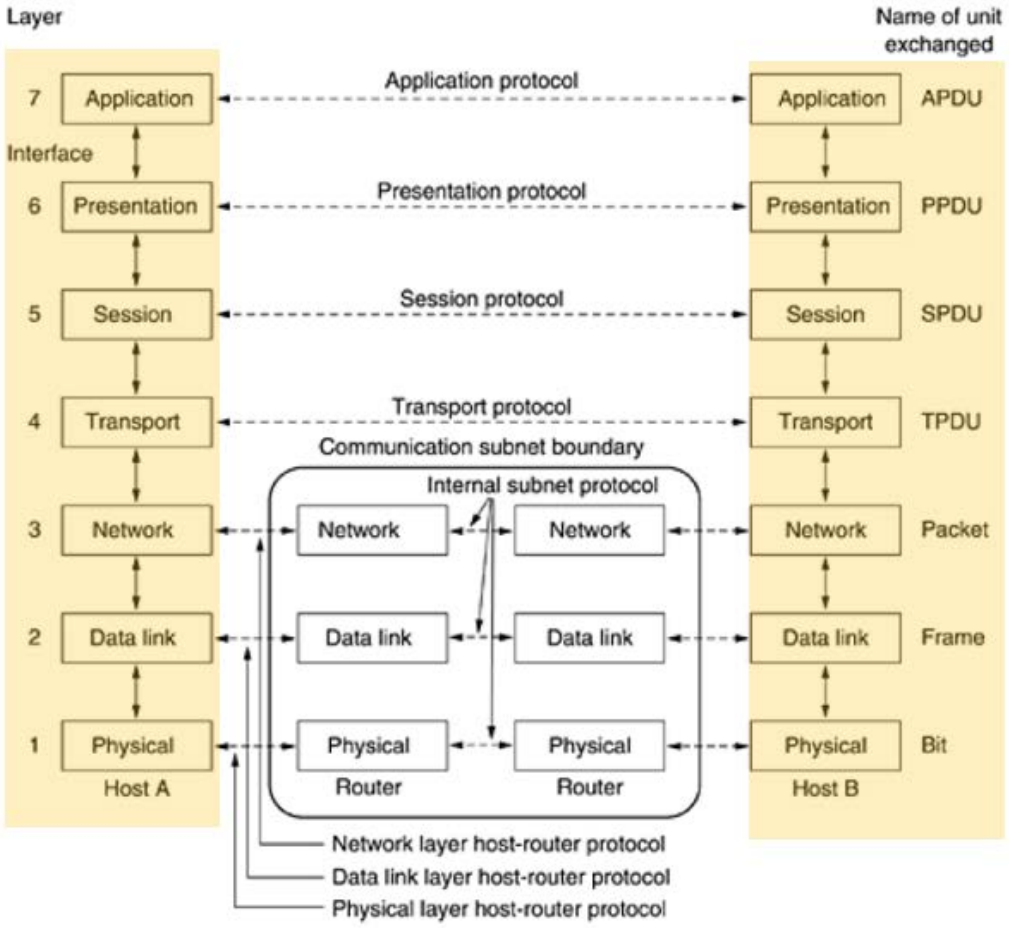
Ex. 1025, FIG. 1-1.

At the time of the '690 patent, television companies often employed high-speed data services on cable television systems. Ex. 1025, 2-3. The cable modems are compatible with the current CATV infrastructure and operate with high-speed data transfer by modulating or demodulating received signals according to the system requirements. Ex. 1025, 7, 15-16, 100-101. For example, the cable modem may demodulate contiguous channels of a single bandwidth. Ex. 1025, 7, 89; Ex. 1024, 37, 222. Further, cable modems transmit requests for television channels from a

user and receive the requested television channels, sending the channels to the set-top boxes. Ex. 1024, 37, 222.

B. Network Communications

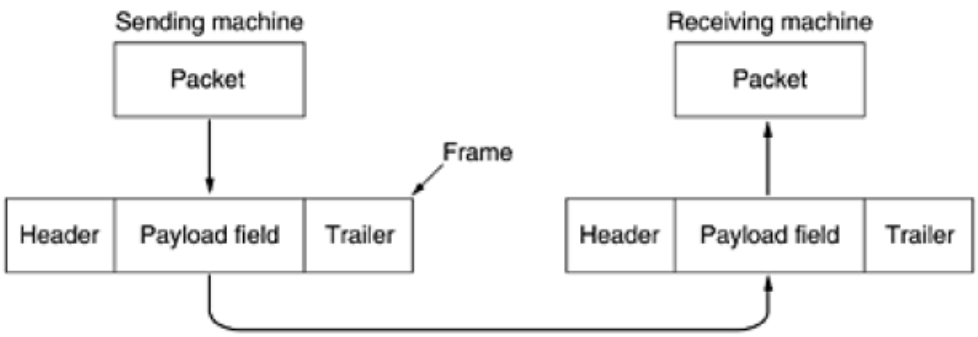
49. Communication protocols are standardized to allow communication between different layers (services or responsibilities) within the network. Ex. 1021, 28-31. The Open Systems Interconnection (OSI) model describes a well-known network communication structure at the time of the ’690 patent. Ex. 1021, 37. The OSI model contains seven layers, each interacting with the layers immediately above and below. Ex. 1021, 37. The seven layers are the physical layer, the data link layer, the network layer, the transport layer, the session layer, the presentation layer, and the application layer. Ex. 1021, 37-40. Further, each layer may communicate with a particular protocol to its associated layer in a neighboring device, depending partially on the kind of transmission media (i.e., wired, wireless, satellite). Ex. 1021, 35-37, 69.



Ex. 1021, Figure 1-20.

50. The physical layer, the first layer in the OSI model, relates to transmitting digital bits over the network. Ex. 1021, 35-37, 69. The physical layer defines the timing, mechanical, electrical, and physical network characteristics required for transmitting the data bits. Ex. 1021, 35-38, 69; Ex. 1024, 114-115.

51. The data link layer encapsulates received data into frames for transmission over the network. Ex. 1021, 35-38, 138-139.



Ex. 1021, Fig. 3-1.

The frames may include a frame header, a payload field for the transmitted data, a frame trailer, a destination address, a source address, and codes for identifying the type of protocol used in forming the frames. Ex. 1021, 138; Ex. 1024, 113-114. For more efficient transmission, the data packet frames may be divided up, numbered, and transmitted individually. Ex. 1021, 138-139. Further, the data link layer performs error checking and correcting functions to ensure safe and complete delivery of the data packet. Ex. 1021, 38, 140-141; Ex. 1024, 113-114. For example, at the data packet's destination, the data link layer verifies that all the frames have been received and are in the correct order. Ex. 1021, 140.

52. The data link layer may be divided into a logical link control (LLC) sublayer and a medium access control (MAC) sublayer. Ex. 1021, 313-314. The LLC sublayer controls data flow and error corrections, while the MAC sublayer transfers traffic to and from a network. Ex.1021, 220; Ex. 1024, 113-114.

53. The network layer determines and controls how packets are transmitted to the receiving device. Ex. 1021, 38, 259-260. To avoid overloading communication lines and leaving others idle, the network layer requires a working knowledge of the required operating parameters for each accessible device on the network. Ex. 1021, 38, 259-260. The network layer uses the IP (Internet Protocol) protocol. Ex. 1021, 259-260, 329-332.

54. The transport layer is charged with segmenting the encapsulated data packets and sending the segments over the network. Ex. 1021, 39. The transport layer is the first end-to-end layer of the OSI model, which means that the layer communicates directly with the associated transport layer in the destination machine. Ex. 1021, 39. To communicate with the different devices running on the network, the transport layer may employ various protocols, like transmission control protocol (TCP) and used datagram protocol (UDP). Ex. 1021, 39, 41, 299, 401-426.

55. The session layer is responsible for establishing communications (or sessions) between the devices, organizing and synchronizing transmitted data, managing the services offered during the communication, and, terminating the session after determining the session is complete. Ex. 1021, 39. The presentation layer defines and manages the data structure of the information within the packets. Ex. 1021, 39. It is common to structure network models without the session layer

and the presentation layer, and to assign their functions to be carried out by other layers if needed. Ex. 1021, 39, 41, 43, 45.

56. The application layer is the closest layer to the user and uses a variety of protocols like HTTP, Telnet, FTP, SMTP, and DNS. Ex. 1021, 39, 41. These protocols allow the user to access email, transfer files, work from home, and connect with the WWW. Ex. 1021, 41. Further, the application layer may handle security issues like user authentication and encryption checks. Ex. 1021, 558, 596.

57. Below I discuss various protocols used for network communications.

58. **MoCA:** The MoCA (Multimedia over Coax Alliance) protocol may be used in a home network to increase the data processing speed in an existing coaxial cable connection. Ex. 1024, 178, 185, 311. MoCA takes advantage of unused bandwidth available on coaxial cables by dividing this portion of the spectrum into segments. Ex. 1024, 311-312. The signals are modulated by orthogonal frequency division multiplexing (OFDM) at the physical layer. Ex. 1024, 311-313.

59. **IEEE 802.11:** The Institute of Electrical and Electronics Engineers published the IEEE 802.11 standard as a protocol run at the intersection of the physical and MAC layers for a wireless local area network (LAN) structure. Ex. 1021, 62, 59, 128, 203. The 802.11 standard is made up of multiple family members, each having a unique protocol depending on the transmission method

employed. Ex. 1021, 62, 203. Therefore, numerous transmission techniques are allowed at the physical layer, enabling transmission flexibility. Ex. 1021, 220. For example, infrared, short-range radio, OFDM, and HR-DSSS are employed to transmit data at different parts of the spectrum. Ex. 1021, 220.

60. **DOCSIS:** In the 1990s, CableLabs developed DOCSIS (Data Over Cable Service Interface Specification) as a software and hardware platform to enable high-speed, bi-directional data transmission over broadband cable networks. Ex. 1026, 2, 7. Specifically, the DOCSIS protocol standardized data communications through all-coaxial cable or hybrid fiber/coax (HFC) cable networks between subscribing customer's equipment (usually a cable modem CM computer interface) as well as the interface between the home network and cable service headends (typically a cable modem termination system CMTS). Ex. 1026, 2, 7. The DOCSIS communication protocol employed a modified OSI stack for high-speed data transmissions, which may comprise different and/or additional protocol layers, such as MAC and LLC layers. Ex. 1026, 10-11.

61. In the earliest version, DOCSIS 1.0, the CMs and CMTS function as IP and LLC hosts using the IEEE 802 standard. Ex. 1026, 10-11. Configuring the network required particular physical layer parameters, such as modulation and symbol rate, to produce desired network characteristics, such as packet rate loss and forwarding rates. Ex. 1026, 7-8.

62. A few years after releasing DOCSIS 1.0, CableLabs introduced DOCSIS 1.1, adding additional Quality of Service (QoS) features to the standard DOCSIS protocol. Ex. 1028, 1; Ex. 1027, 47, 117-133, 265. DOCSIS 1.0 and DOCSIS 1.1 (collectively referred to as DOCSIS 1.X) allowed for downstream speeds of around 40 Mb/s and upstream speeds of about 10 Mb/s. Ex. 1028, 1. However, the new QoS features in DOCSIS 1.1 allowed users to run applications requiring more efficient bandwidth allocations and greater latency requirements, such as Voice over Internet Protocol (VoIP). Ex. 1028, 1; Ex. 1027, 47, 117-133, 265.

63. Further, the DOCSIS 1.1 protocol organizes data transmission into service flows. Ex. 1027, 47-48. A service flow is a unidirectional mapping between a CM and the CMTS. Ex. 1027, 47-48. Each service flow is assigned a Service Flow ID (SFID) relative to the configuration the CM requires. Ex. 1027, 47-48.

64. Due to the increasing demands for more asymmetric upstream and downstream speeds, required for running gaming applications and video conferencing, CableLabs published DOCSIS 2.0 which increased the upstream speed to 30 Mb/s. Ex. 1028, 1. Further, DOCSIS 2.0 added the 64-QAM Upstream modulation as an option for the modulation parameter set by the physical layer. Ex. 1028, 3.

65. In 2006, CableLabs published DOCSIS 3.0 to compete with the up-and-coming fiber optic networks by providing a telecommunication service with about 160 Mb/s downstream and 120 Mb/s upstream speeds. Ex. 1028, 1-2. Further significant improvements published in version 3.0 include an increased 128 QAM modulation scheme for bonding channels at both the upstream and downstream levels, increased upstream frequency range, and support for IP v. 6. Ex. 1024, 36-39.

66. At the physical layer, CMs and CMTSs function within the 50-1002 MHz frequency band for downstream communications; for upstream data transfers, the modules employ either the 5-42 MHz or 5-85 MHz range. Ex. 1024, 39-42. Version 3.0 continues implementing TDMA and S-CDMA schemes to gain access to the physical network with various modulation techniques. Ex. 1024, 39-42.

67. Additionally, DOCSIS 3.0 introduced a channel bonding technique that increased the upstream and downstream data transmissions. Ex. 1024, 41-43. This technique combines channels to form a larger channel, producing increased bandwidth capabilities and reducing delays associated with data traffic congestion. Ex. 1024, 41-43. The channels are then accessed by implementing multiple tuners. Ex. 1024, 41-43. However, packets distributed among multiple channels are more susceptible to jitter and latency, resulting in packets arriving out of order at the destination. Ex. 1024, 41-43. To alleviate this possibility, version 3.0 tags the

packets with a sequence number, added to the MAC header, that allows for proper resequencing of the packets. Ex. 1024, 41-42.

68. Performance management of the system was also improved in the areas of event and health monitoring. Ex. 1024, 43-44. Protocols such as internet protocol detail record (IPDR) and simple network management protocol (SNMP) collect event and error data occurring at the physical, MAC, and IP layers to better assess the health status of the network. Ex. 1024, 16, 43-44. Any reported issue may be identified, resolved, and logged. Ex. 1024, 16, 43-44.

C. Orthogonal Frequency Division Multiplexing (OFDM)

69. OFDM is a carrier multi-plexing method for efficiently transmitting large amounts of data over a signal processing network. Ex. 1030, ¶ [0002]. The bandwidth (channel), reserved for data traffic, is divided into multiple and narrower sub-bands (sub-channels). Ex. 1030, ¶ [0002]. The data is also divided into lower data rate channels, each encoded on different subcarrier frequencies for transmission over the network. Ex. 1030, ¶ [0002]. The subcarrier frequencies are mutually orthogonal so that the frequencies are simultaneously transported to and accurately retrieved at the receiver. Ex. 1030, ¶ [0002]. The subcarriers maintain orthogonality by being spaced at frequency intervals 1/T, where T represents the OFDM symbol period. Ex. 1030, ¶ [0002]. This approach reduces intersymbol

interferences (ISI) by extending the symbol duration relative to the channel's delay spread. Ex. 1030, ¶¶ [0002], [0005].

70. An OFDM symbol is generated by calculating an inverse Fourier transform on a set of symbols. Ex. 1030, ¶ [0003]. Each symbol of the set of symbols defining the OFDM symbol represents a specific plurality of data bits and may be retrieved by performing the Fourier transform on the OFDM symbol. Ex. 1030, ¶ [0003]. In this way, only one symbol will be generated for any subcarrier frequency. Ex. 1030, ¶ [0003]. Further, because transmitted data is divided over multiple carrier sub-bands (sub-channels), the symbol intervals become longer, proportional to the number of sub-bands, than if transmitting data over a single band (channel). Ex. 1030, ¶ [0005]. Longer symbol intervals reduce ISI when the symbol period overtakes the channel spread, as any ISI is then spread over fewer symbols. Ex. 1030, ¶ [0005].

71. Similarly, OFDMA (Orthogonal Frequency-Division Multiple Access) transmits data over several sub-bands with different carrier frequencies. Ex. 1030, ¶¶ [0060], [0090]-[0091]. With OFDMA, multiple users are assigned a subset of subcarriers that are orthogonal to each other. Ex. 1030, ¶¶ [0060], [0090]-[0091].

D. Quadrature Phase Shift Keying (QPSK)

72. QPSK is a common modulation technique. Ex. 1024, 47, 62, 220. QPSK employs two identical carrier signal waves orthogonal to each other. Ex. 1024, 220. QPSK modulation employs four different points in the constellation diagram, as indicated above. Ex. 1021, 99, Fig. 2-25. Therefore, each symbol modulated using QPSK represents two bites of data. Ex. 1024, 220. QPSK effectively doubles the bandwidth of the network and allows for efficient use of the frequency spectrum. Ex. 1024, 220.

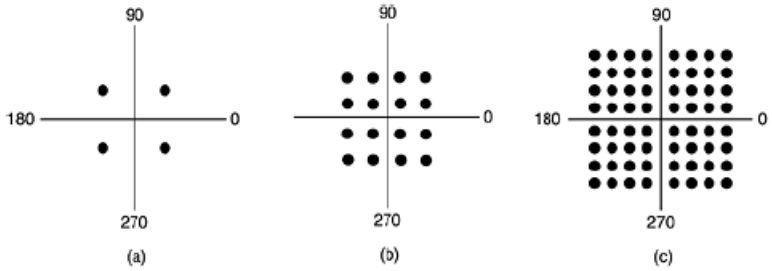
E. Quadrature Amplitude Modulation (QAM)

73. Transmitting data over a cable network requires encoding the data onto a carrier wave by modulation. Ex. 1031, Abstract, 1:10-43; Ex. 1021, 89-90, 98-101. Modulation entails changing the carrier wave's amplitude, frequency, and/or phase according to the desired transmitted data. Ex. 1021, 98-99. After transmitting the encoded carrier wave over the network, the data is extracted from the carrier wave by demodulation at the receiver. Ex. 1031, 1:44-53; Ex. 1021, 89-90. One data modulation technique is called Quadrature Amplitude Modulation (QAM). Ex. 1031, 1:10-43.

74. QAM employs two carrier signals within the same frequency band that are orthogonal to each other. Ex. 1031, 1:10-43. The two carrier signals are called an in-phase signal (I) and quadrature signal (Q). Ex. 1031, 1:10-43. The

carrier signals are modulated and then combined for network transmission. Ex. 1031, 1:10-43. During modulation, the data bits are divided into groups called symbols. Ex. 1021, 98-99. For example, in 16-QAM, each symbol represents four bits. Ex. 1021, 98-99. As each bit is either a zero or a one, grouping four bits together results in 16 combinations of zeros and ones (e.g., 0001, 0011, 0111, 1111, 1000, 1001, etc.). Each group is represented by a symbol encoded on the carrier wave with a unique amplitude and phase shift modulation. Ex. 1021, 98-99. Constellation diagrams map all the possible modulation options to each of the 16 symbols within the particular modulation scheme, as shown below. Ex. 1021, 98-99.

Figure 2-25. (a) QPSK. (b) QAM-16. (c) QAM-64.



Ex. 1021, FIG. 2-25.

75. Each point in the constellation diagram represents a unique amplitude and phase used to encode the signal onto the carrier wave. Ex. 1021, 98-99. During demodulation, each symbol's amplitude and modulation are detected and looked up on the constellation diagram, resulting in decoding the original bits. Ex.

1021, 98-99; Ex. 1031, 5:10-31. A timing feature is employed to determine the start of each new symbol. Ex. 1031, 1:26-53.

IX. OVERVIEW OF PRIOR ART

A. U.S. Patent Application Publication No. 2007/0223402 A1 ("Waxman")

76. Waxman (Ex. 1007) is a U.S. patent application publication filed on March 21, 2006, and published on September 27, 2007. I understand that Waxman qualifies as prior art under pre-AIA 35 U.S.C. § 102(a), § 102(b), and § 102(e) because of its earlier filing date and publication date. Waxman relates to data transmission (e.g., wireless transmission of a plurality of data packets) in a communication network. Ex. 1007, Abstract, ¶¶ [0001]-[0002], [0012]-[0013]. Therefore, it is my opinion that Waxman is analogous to the '690 patent.

77. Waxman describes sending request packets over a wireless network in order to ascertain the receiver's transmission parameters. Ex. 1007, ¶ [0030], Abstract, Fig. 3. A wireless Access Point (AP) may transmit data packets to a station, where the header is not formatted in a structure readable by the station. Ex. 1007, ¶¶ [0001]-[0002]. Further, a station may require different transmission formats depending on proximity between the station and the AP. Ex. 1007, ¶ [0045]. Since the station cannot process the data packet, the data transfer breaks down at that station. Ex. 1007, ¶¶ [0001]-[0002]. In order to ensure continued data

transfer and extend the connectivity range within the network, probes may be sent requesting transmission format parameters. Ex. 1007, ¶¶ [0001]-[0002].

78. The transmission format parameters may include instructions to use an extended-range transmission scheme, such as TADS, STBC, BF or other scheme. Ex. 1007, ¶ [0030]. Additionally, the probe may ask for a number of transmission antennas used or additional transmission parameters. Ex. 1007, ¶¶ [0022]-[0023], [0025], [0035].

79. Stations in the network may transmit the probes to the APs requesting that transmissions to the station be in a particular format. Ex. 1007, ¶ [0030]. The request packet may be a probe request used for active scanning by a station. Ex. 1007, ¶ [0035]. The probe requests from the stations may have a Requested Transmission Scheme (RTS) field indicating a required transmission scheme. Ex. 1007, ¶ [0030]. Alternatively, the AP may ascertain a station's required transmission format directly from the request probe. Ex. 1007, ¶ [0030]. After receiving the probe request, the AP may transmit to the station a probe response. Ex. 1007, ¶ [0037]. The probe response may acknowledge the request and be formatted in the requested transmission scheme. Ex. 1007, ¶ [0037]. In this way, the AP may send communications in different transmission formats, as required by different stations. Ex. 1007, ¶ [0041].

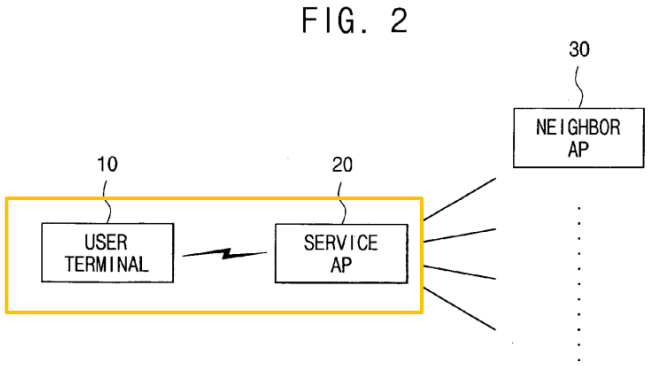
B. U.S. Patent Application Publication No. 2008/0198826 ("Won")

80. Won (Ex. 1008) is a U.S. patent application publication filed on February 21, 2008, and published on August 21, 2008. I understand that Won qualifies as prior art under pre-AIA 35 U.S.C. § 102(a) and § 102(e) because of its earlier filing date and publication date. Won relates to detecting communications (such as a duplicate service set identifier (SSID)) in a communication network (such as a wireless local area network (WLAN)). Ex. 1008, Abstract, ¶ [0003]. Therefore, it is my opinion that Won is analogous to the '690 patent.

81. Won describes generating a probe request packet to monitor for hidden duplicate SSIDs in a communication network. Ex. 1008, ¶¶ [0012]-[0013]. As SSIDs are used to identify different access points ("APs") within the internet, two APs using the same SSID may cause disruptions during browsing and other abnormal data services, such as bandwidth congestion and increased user fees. Ex. 1008, ¶¶ [0009], [0041]. Therefore, discovering duplicate SSIDs is an important maintenance measure to avoid authentication failures due to shared SSIDs between neighboring APs and to maintain browser reliability. Ex. 1008, ¶¶ [0009], [0042]. Won explains that hidden duplicate SSIDs, undiscoverable by then-conventional scanning techniques, may be found by sending a probe request packet with the SSID of the requesting AP. Ex. 1008, ¶¶ [0010], [0039]. The requesting AP subsequently receives probe response packets comprising neighboring AP

information. Ex. 1008, ¶ [0039]. A duplicate SSID detector 23 within the requesting AP determines whether the same SSID is within the probe response packet. Ex. 1008, ¶ [0032]. Further, any complications that would occur due to duplicate SSIDs during the procedure may alert the user to the shared SSID. Ex. 1008, ¶ [0039].

82. To implement this method, a user terminal 10 may send a scan request to a service AP 20, as shown in Won's Figure 2 below. Ex. 1008 ¶ [0026].

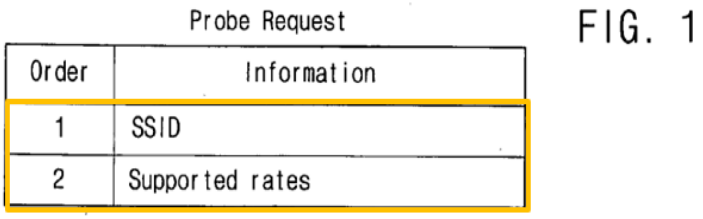


Ex. 1008 FIG. 2 (annotated)

The scan request instructs the service AP to scan for neighboring APs 30 with duplicate SSIDs. Ex. 1008, ¶ [0007].

83. More specifically, after receiving the scanning request, the service AP 20 generates a probe request in the form of a probe request packet to send to neighboring APs 30. Ex. 1008, ¶ [0026]. The probe request packet is formed by "insert[ing] into an SSID field in a probe request frame" the service AP's SSID, "which is then broadcast to neighbor APs in a corresponding channel." Ex. 1008, ¶

[0031]. The probe request packet may include additional information such as supported rates. Ex. 1008, ¶ [0021], FIG. 1.



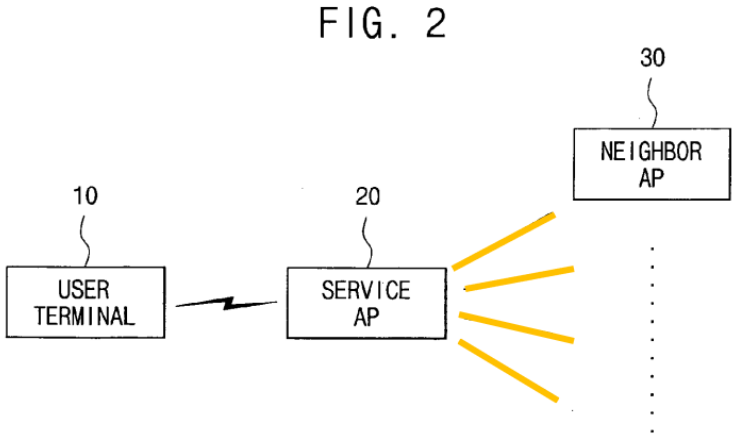
Probe Request

Order	Information
1	SSID
2	Supported rates

FIG. 1

Ex. 1008 FIG. 1 (annotated)

Using a packet transceiver, the service AP "transmits a probe request packet to neighbor APs and receives probe response packets therefrom." Ex. 1008, ¶¶ [0026], [0029], FIG. 2.



Ex. 1008 FIG. 2 (annotated)

84. After receiving the probe request packets, the neighboring APs determine "if the SSID of any of the neighbor APs is the same as the SSID in the probe request frame." Ex. 1008, ¶ [0031]. On the occasions that the neighbor APs

share the same SSID as listed in the probe request frame, "the neighbor AP … transmits a probe response packet to the user AP by inserting its own SSID thereinto." Ex. 1008, ¶ [0031]. Further, the probe response packet may include additional information, such as timestamps, capability information, and additional parameter information. Ex. 1008, ¶ [0021], FIG. 1.

Probe Response

Order	Information	Notes
1	Timestamp	
2	Beacon interval	
3	Capability Information	
4	SSID	
5	Supported rates	
6	FH Parameter Set	The FH Parameter Set Information element is present within Probe Response frames generated by STAs using frequency-hopping PHYs.
7	DS Parameter Set	The DS Parameter Set Information element is present within Probe Response frames generated by STAs using direct sequence PHYs.
8	CF Parameter Set	The CF Parameter Set Information element is only present within Probe Response frames generated by APs supporting a PCF.
9	IBSS Parameter Set	The IBSS Parameter Set Information element is only present within Probe Response frames generated by STAs in an IBSS.

Ex. 1008, FIG. 1 (annotated)

85. The probe response packets are received at the service AP by the packet transceiver and analyzed for duplicate SSIDs by a duplicate SSID detector. Ex. 1008, ¶¶ [0029], [0032]. The duplicate SSID detector "detects SSID fields from all the packets, collected by the packet collector 22, and conducts inspection to detect any duplicate SSID that is the same as the SSID of the service AP." Ex. 1008, ¶ [0032]. The duplicate SSID result detector transmits the analysis result to a

duplicate SSID result reporter. Ex. 1008, ¶ [0032]. In return, the duplicate SSID result reporter generates a report indicating overlapping SSIDs and transmits the report to the user. Ex. 1008, ¶ [0033]. The report generated by the SSID result reporter may also indicate that neighboring APs do not share the same SSID. Ex. 1008, ¶ [0034].

C. U.S. Patent Application Publication No. 2005/0124340 ("Giesberts")

86. Giesberts (Ex. 1009) is a U.S. patent application publication filed on September 24, 2004, and published on June 9, 2005. I understand that Giesberts qualifies as prior art under pre-AIA 35 U.S.C. § 102(a), § 102(b), and § 102(e) because of its earlier filing date and publication date. Giesberts relates to wireless communication systems, such as wireless local area networks (LANs). Ex. 1009, ¶ [0002]. Therefore, it is my opinion that Giesberts is analogous to the '690 patent.

87. Giesberts describes transmitting messages across a communication network, such as a wireless network wherein all station transmissions are first sent to an access point. Ex. 1009, ¶ [0003]. Usually, the transmitting station will scan the neighborhood to identify all the nearby access points and send the transmission to the access point with the strongest link between the station and the access point. Ex. 1009, ¶ [0004]. However, Giesberts discloses selecting an access point based on roaming the nearby wireless channels and analyzing the channel's parameters,

such as correlation values, signal quality, and/or channel delay spread. Ex. 1009, ¶ [0005]. The transmitting station chooses to transmit to the access point with the channel associated with the best optimal parameters. Ex. 1009, ¶ [0005]. The channel parameters may be determined by analyzing the preambles and data of received packets or by transmitting probe requests and analyzing the response frames. Ex. 1009, ¶¶ [0024], [0030], [0031], [0033]-[0035], [0038], [0042], [0044], [0045].

D. 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 Std 802.11")

88. IEEE Std 802.11 (Ex. 1012) is a standard published by IEEE, in particular the LAN/MAN Standards Committee of IEEE. The face of the standard I have referenced indicates it was published on June 12, 2007. In my experience, this IEEE publication date is accurate and the date on which such IEEE standards are made available to the general public through IEEE's website. I understand that IEEE Std 802.11 qualifies as prior art under pre-AIA 35 U.S.C. § 102(a) and § 102(b) because of its earlier publication date. IEEE Std 802.11 relates to telecommunications and information exchange between systems. Ex. 1012, 1. Therefore, it is my opinion that IEEE Std 802.11 is analogous to the '690 patent.

89. IEEE Std 802.11 describes the specific standard requirements for scanning probes to determine each probe's characteristics and available resources. Ex. 1012, 317. Management frames may be used to supervise the probe scanning and are described and detailed in Std 802.11. Ex. 1012, 60-64, 74, 79-80. A probe scan may request a probe (or station) to run various tests associated with the probe's parameters. Ex. 1012, 82, 413-414, 422-423, 465. Further, the probe request may instruct the probe to report the test results within a Reporting Frame. Ex. 1012, 346, 351, 465-466.

90. IEEE Std 802.11 further describes information that may be incorporated into a probe request body. Ex. 1012, 82, 413-415, 422-423. For example, information that may be included in a probe request packet is described in Table 7-14 below.

Table 7-14—Probe Request frame body

Order	Information	Notes
1	SSID	
2	Supported rates	
3	Request information	May be included if dot11MultiDomainCapabilityEnabled is true.
4	Extended Supported Rates	The Extended Supported Rates element is present whenever there are more than eight supported rates, and it is optional otherwise.
Last	Vendor Specific	One or more vendor-specific information elements may appear in this frame. This information element follows all other information elements.

Ex. 1012 Table 7-14 (annotated)

Similarly, IEEE Std 802.11 details a probe response frame format. Ex. 1012, 83-85, 422-423, 465-466. The response frame format includes information the response probe may generate and transmit based on instructions transmitted by the probe request. Ex. 1012, 83-85, 422-423, 465-466. For example, the response probe may include the information listed in Table 7-15, as shown below.

Table 7-15—Probe Response frame body

Order	Information	Notes
1	Timestamp	
2	Beacon interval	
3	Capability	
4	SSID	
5	Supported rates	
6	FH Parameter Set	The FH Parameter Set information element is present within Probe Response frames generated by STAs using FH PHYs.
7	DS Parameter Set	The DS Parameter Set information element is present within Probe Response frames generated by STAs using Clause 15, Clause 18, and Clause 19 PHYs.
8	CF Parameter Set	The CF Parameter Set information element is present only within Probe Response frames generated by APs supporting a PCF.
9	IBSS Parameter Set	The IBSS Parameter Set information element is present only within Probe Response frames generated by STAs in an IBSS.
10	Country	Included if dot11MultiDomainCapabilityEnabled or dot11SpectrumManagementRequired is true.
11	FH Parameters	FH Parameters, as specified in 7.3.2.10, may be included if dot11MultiDomainCapabilityEnabled is true.
12	FH Pattern Table	FH Pattern Table information, as specified in 7.3.2.11, may be included if dot11MultiDomainCapabilityEnabled is true.
13	Power Constraint	Shall be included if dot11SpectrumManagementRequired is true.
14	Channel Switch Announcement	May be included if dot11SpectrumManagementRequired is true.
15	Quiet	May be included if dot11SpectrumManagementRequired is true.
16	IBSS DFS	Shall be included if dot11SpectrumManagementRequired is true in an IBSS.
17	TPC Report	Shall be included if dot11SpectrumManagementRequired is true.
18	ERP Information	The ERP Information element is present within Probe Response frames generated by STAs using ERPs and is optionally present in other cases.
19	Extended Supported Rates	The Extended Supported Rates element is present whenever there are more than eight supported rates, and it is optional otherwise.
20	RSN	The RSN information element is only present within Probe Response frames generated by STAs that have dot11RSNA-Enabled set to TRUE.
21	BSS Load	The BSS Load element is present when dot11QosOption-Implemented and dot11QBSSLoadImplemented are both true.
22	EDCA Parameter Set	The EDCA Parameter Set element is present when dot11QosOptionImplemented is true.
Last–*1*	Vendor Specific	One or more vendor-specific information elements may appear in this frame. This information element follows all other information elements, except the Requested Information elements.
Last–*n*	Requested information elements	Elements requested by the Request information element of the Probe Request frame.

Ex. 1012 Table 7-15 (annotated)

E. Data-Over-Cable Service Interface Specifications, DOCSIS 2.0, Radio Frequency Interface Specification, CM-SP-RFIv2.0-I11-060602 ("DOCSIS 2.0")

91. DOCSIS 2.0 (Ex. 1010) is a standard specification published by CableLabs. The Document Status Sheet of the specification indicates it was made publicly available on June 2, 2006. In my experience, this DOCSIS specification publication date is accurate and the date on which such specifications are made available to the general public through CableLabs' website. I understand that DOCSIS 2.0 qualifies as prior art under pre-AIA 35 U.S.C. § 102(a) and § 102(b) because of its earlier publication date. DOCSIS 2.0 "defines the second generation of radio-frequency interface specifications for high-speed data-over-cable systems." Ex. 1010, 1. Therefore, it is my opinion that DOCSIS 2.0 is analogous to the '690 patent.

92. DOCSIS 2.0 is a well-known standard developed by CableLabs for cable operators around the world. Ex. 1010, 1. DOCSIS 2.0 states that "[a]s cable operators have widely deployed high-speed data services on cable television systems, the demand for upstream bandwidth has increased, particularly with the popularity of more symmetric data applications. To this end, CableLabs' member companies have decided to add advanced modulation techniques to the DOCSIS® specification, for the purpose of increasing channel capacity and improving noise immunity." Ex. 1010, 2. DOCSIS 2.0 also states that "[t]he intended service will

allow transparent bi-directional transfer of Internet Protocol (IP) traffic, between the cable system head-end and customer locations, over an all-coaxial or hybrid-fiber/coax (HFC) cable network." Ex. 1010, 2. DOCSIS 2.0 belongs to a family of specifications, and is the one for defining the three RF interfaces: the interface between the cable modem and the cable network, the interface between the CMTS and the cable network in the downstream direction, and the interface between the CMTS and the cable network in the upstream direction. Ex. 1010, 5.

93. In Section 5, DOCSIS 2.0 provides a "high-level overview of the communication protocols that must be used in the data-over-cable system." Ex. 1010, 27. Section 5 describes the protocol stacks for the CMTS and CM. Ex. 1010, 27-31. It then gives details about the various layers, including the MAC layer, Network layer, Data Link layer, and Physical layer. Ex. 1010, 31-37. For example, it discusses the Physical Media Dependent (PMD) sublayer and, for the downstream direction, a Transmission Convergence sublayer. Ex. 1010, 36-37.

94. The downstream Transmission Convergence sublayer allows for multiple types of data transmission, such as video and data. Ex. 1010, 107. The downstream bitstream comprises a series of packets, each packet including a header and a payload. Ex. 1010, 107. The header contains information describing where the payload belongs (i.e., identifying the type of payload). Ex. 1010, 107. The downstream RF-modulated signal output must comply with particular

parameters, such as modulation type, symbol rate, frequency, and other characteristics. Ex. 1010, 99-101.

95. Upstream, the DOCSIS 2.0 PMD sublayer employs a FDMA/TDMA ("TDMA") mode or FDMA/TDMA/S-CDMA ("S-CDMA") mode burst type format. Ex. 1010, 39. Modes are configured by the CMTS using MAC messaging. Ex. 1010, 39. Each Cable Modem (CM) typically transmits on a single RF channel unless reconfiguration is required to change channels. Ex. 1010, 39. FDMA (Frequency Division Multiple Access) involves the allocation of multiple RF channels in the upstream band. Ex. 1010, 39. TDMA (Time Division Multiple Access) signifies that upstream transmissions occur in bursts, with a specific RF channel being shared by multiple CMs through a dynamic assignment of time slots. Ex. 1010, 39. S-CDMA (Synchronous Code Division Multiple Access) allows multiple CMs to transmit simultaneously on the same RF channel, during the same TDMA time slot, and utilizing different orthogonal codes to maintain separation. Ex. 1010, 39.

96. The PMD allows six possible modulation rates and various modulation formats, such as channel symbol rate for the TDMA mode (160 to 5120 ksps) and chip rate for the S-CDMA mode (1280 to 5120 kHz). Ex. 1010, 39. The reciprocal of the of the modulation rate is the modulation interval ("symbol period" for TDMA mode or "chip period" for S-CDMA mode). Ex.

1010, 39. Each signal burst comprises a preamble and data. Ex. 1010, 39. Further, each signal burst can be configured with a variable modulation order and rate, may include a customizable preamble, allow for the payload to be randomized, and support programmable Forward Error Correction (FEC) encoding. Ex. 1010, 83-84. Transmission parameters for the signal bursts may contain modulation rate information, a center frequency, preamble type, and other signal characteristics. Ex. 1010, 83-88, 135-143. Additionally, frames may include information relating to spectral shaping features and formats, processing times, symbol rates, reconfiguration details, and other transmission signal aspects. Ex. 1010, 76-106. Further, data and/or television transmissions may be constructed by employing user-unique parameters. Ex. 1010, 83-85, 421. User-unique parameters may comprise modulation configuration settings, preamble types, power level adjustment instructions, and other configuration parameters. Ex. 1010, 80-85, 421.

97. The MAC layer in DOCSIS 2.0 is at the data link layer. Ex. 1010, 35-36. Data transferred between two or more modules at the data link layer are structured in one or more MAC layer frames. Ex. 1010, 114-119. Each MAC layer frame may have a MAC header and a variable-length area for further data. Ex. 1010, 114-132. MAC headers may be designed specific to their function, and include timing headers, MAC management headers, request frame headers,

fragmentation headers, and concatenation headers. Ex. 1010, 120-129. Further, these headers may be extended to support additional functions and transmit further information relative to the service flow state. Ex. 1010, 116-119.

98. The MAC layer frames may include information regarding specific parameters and parameter field values. Ex. 1010, 111-143. The parameters may include upstream protocol requirements, such as modulation rates, frequencies, power requirements, preamble types, and mode selections. Ex. 1010, 135-143. Additionally, messages may include information relating to service flow parameters, including traffic characteristics and scheduling details. Ex. 1010, 160-169.

99. Transmissions between CMTS and one or more CMs may request information or a test result from the receiving device. Ex. 1010, 34-35, 144-186. The signal may request bandwidth for current or subsequent transmissions or may be a ranging or registration request. Ex. 1010, 118-123, 127, 152-154. Further, the request may be a dynamic service request message for creating a new service flow and requesting particular parameters. Ex. 1010, 129, 268. In response, the replying transmission may update a message to include a test result, a registration response, a format, a requested parameter, and/or an acknowledgment message. Ex. 1010, 28, 184-186, 438, 148-152, 154-186, 239-251. Further, response signals may be configured in response to requirements transmitted by the CMTS. Ex.

1010, 53, 74, 134-143. The CMTS may change upstream signal characteristics by sending Upstream Channel Descriptor messages to one or more CMs. Ex. 1010, 263-267. Additionally, new service flow requests may be transmitted in both the upstream and downstream directions. Ex. 1010, 277-311.

F. IEEE Std 802.16™-2004, IEEE Standard for Local and metropolitan area networks, Part 16: Air Interface for Fixed Broadband Wireless Access Systems ("IEEE Std 802.16-2004")

100. IEEE Std 802.16-2004 (Ex. 1013) is a standard published by IEEE, in particular the LAN/MAN Standards Committee of IEEE. The face of the standard indicates it was published on October 1, 2004. In my experience, this IEEE publication date is accurate and the date on which such IEEE standards are made available to the general public through IEEE's website. I understand that IEEE Std 802.16-2004 qualifies as prior art under pre-AIA 35 U.S.C. § 102(a) and § 102(b) because of its earlier publication date. IEEE Std 802.16-2004 relates to fixed wireless access systems. Ex. 1013, cover. Therefore, it is my opinion that IEEE Std 802.16-2004 is analogous to the '690 patent.

101. IEEE developed standard 802.16-2004 detailing communication protocols between a fixed broadband wireless access (BWA) systems and an air interface. Ex. 1013, Abstract. The MAC layer of this specification may operate in a point-to-multipoint (PMP) architecture and/or an optional mesh topology. Ex. 1013, Abstract. The MAC layer accommodates various physical layer (PHY)

specifications, each suitable for specific operational environments. Ex. 1013, Abstract. Single-carrier modulation is employed for operational frequencies above about 10 GHz, otherwise OFDM and OFDMA modulations may be implemented. Ex. 1013, Abstract.

102. In PMP systems, communications are transmitted between a base station (BS) and multiple subscriber stations (SS). Ex. 1013, 7. Data transmitted in the uplink direction is sent from the subscriber station (SS) to the base station (BS). Ex. 1013, 11. Data transmitted in the downlink direction is sent from the base station (BS) to the multiple subscriber stations (SS). Ex. 1013, 8. In this way, communications to and from subscriber stations (SS) are directed through a base station (BS). Ex. 1013, 31. Connections between base stations and subscriber stations are assigned a connection identifier (CID) which identifies a MAC connection between the devices. Ex. 1013, 7.

103. Transmissions on the downlink in PMP configurations may be broadcast from the base station to all the subscriber stations, multicast from the base station to a number of subscriber stations, or single cast to a specific subscriber station. Ex. 1013, 31. The subscriber stations analyze transmissions for their connection identifier (CID) and listen to the messages associated with their assigned CID. Ex. 1013, 7, 31. The connection identifier is associated with a service flow identifier (SFID). Ex. 1013, 7, 10. The service flow identifier

comprises the Quality of Service (QoS) parameters required for exchanging data on that connection in both the uplink and downlink directions. Ex. 1013, 7, 10, 31-32.

104. In mesh configurations, base stations (BS) and subscriber stations (SS) act as nodes. Ex. 1013, 9. The nodes are connected so that each subscriber station (SS) may directly communicate with other subscriber stations (SS). Ex. 1013, 186. Incoming data to the node is considered an uplink; outgoing data from the node is defined as a downlink. Ex. 1013, 32. Before transmission, the nodes are required to coordinate with each other for scheduling transmissions between nodes. Ex. 1013, 32. Service and QoS parameters are established per message, as opposed to per connection in PMP systems. Ex. 1013, 32. Additionally, service parameters are contained in the transmission header and read by the receiving node. Ex. 1013, 32. Service parameters describe target data rate, transmit energy for the connection, and an estimated packet error rate. Ex. 1013, 853.

105. In addition, IEEE Std 802.16 provides a number of procedures. One procedure is known as ranging. Ranging refers to the procedure of determining the correct timing offset and power adjustments so that the transmissions from the subscriber stations (SS) are synchronized/aligned. Ex. 1013, 174. Timing delays within the PHY are required to remain relatively stable. Ex. 1013, 174.

106. The subscriber station (SS) may send a range request message (RNG-REQ) during an Initial Ranging Interval set by the base station (BS). Ex. 1013, 174-175. A successfully transmitted range request triggers a response from the base station (BS). Ex. 1013, 175. If the subscriber station (SS) does not receive a response from the base station (BS) or receives a message requesting additional information, the subscriber station (SS) may re-transmit the range request. Ex. 1013, 176.

107. Further, IEEE Std 802.16-2004 employs an orthogonal frequency division multiple access (OFDMA) modulation scheme at the physical layer. Ex. 1013, 11, 494-499. As described above, an inverse Fourier transform is used to create the OFDMA waveform. Ex. 1013, 494. An OFDMA symbol, configured to represent a group of subcarriers, is characterized by the channel bandwidths, numbers of subcarriers used, sampling factors, and timing factors parameters. Ex. 1013, 494-495. OFDMA frames may comprise a preamble and multiple other zones. Ex. 1013, 494-507.

108. The standard also supports burst transmission formats for framing mechanisms and profiling at the physical layer. Ex. 1013, 307. Each frame may be configured individually via transmission parameters that include modulation protocols and coding schemes. Ex. 1013, 307. The uplink PHY may employ a TDMA (time division multiplexing access) burst transmission scheme; each

individual burst designed to transmit variable length MAC PDUs. Ex. 1013, 11, 307. The downlink PHY may comprise a Transmission Convergence sublayer and supports TDM (time division multiplexing) schemes. Ex. 1013, 11, 307. Further, the PHY randomizes the data bits from the Transmission Convergence layer or transmitter and maps them to a QAM signal constellation. Ex. 1013, 307.

109. The PHY downlink burst frame structures comprise a preamble followed by the transmitted data. Ex. 1013, 310. The preambles include information regarding burst profile type, preamble type, and modulation type. Ex. 1013, 311-313. Other parameters are also transmitted, including base station transmit power, PHY type, frame duration, modulation type and coding information. Ex. 1013, 314-316, 328.

110. As mentioned, multiple physical layers are specified. They are referred to as WirelessMAN-SC, WirelessMAN-SCa, WirelessMAN-OFDM, and WirelessMAN-OFDMA. Ex. 1013, 307, 355, 427, 493-494. WirelessMAN-SC and WirelessMAN-SCa use single-carrier technology while WirelessMAN-OFDM PHY and WirelessMAN-OFDMA PHY employ OFDM modulation. Ex. 1013, 307, 355, 427-430, 493-502. WirelessMAN-SC is targeted for the 10-66 GHz bands while the others are designed for frequency bands below 11 GHz. Ex. 1013, 307, 355, 427-430, 493-502.

G. IEEE Std 802.16e™-2005 and IEEE Std 802.16™-2004/Cor1-2005, 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 and Corrigendum 1 ("IEEE Std 802.16e-2005")

111. IEEE Std 802.16e-2005 (Ex. 1014) is a standard published by IEEE, in particular the LAN/MAN Standards Committee of IEEE. The face of the standard indicates it was published on February 28, 2006. In my experience, this IEEE publication date is accurate and the date on which such IEEE standards are made available to the general public through IEEE's website. I understand that IEEE Std 802.16e-2005 qualifies as prior art under pre-AIA 35 U.S.C. § 102(a) and § 102(b) because of its earlier publication date. IEEE Std 802.16e-2005 relates to fixed and mobile wireless access systems. Ex. 1014, I. Therefore, it is my opinion that IEEE Std 802.16e-2005 is analogous to the '690 patent.

112. Following the publication of IEEE Std 802.16-2004, IEEE released the IEEE Std 802.16e-2005 standard, which included quickly-moving mobile subscriber stations (SS), such as those found in vehicles. Ex. 1014, 1. To support mobile devices traveling at high speeds, the standard improved handover support between base stations. Ex. 1014, 1. Much of IEEE Std 802.16e-2005 continued to use the processes, messages, and PHY layers, such as WirelessMAN-SCa, WirelessMAN-OFDM, and WirelessMAN-OFDMA, that were disclosed in IEEE Std 802.16-2004. Ex. 1014, 3, 44-46.

H. U.S. Patent Application Publication No. 2007/0121573 ("Zuckerman")

113. Zuckerman (Ex. 1016) is a U.S. patent application publication filed on November 22, 2006, and published on May 31, 2007. I understand that Zuckerman qualifies as prior art under pre-AIA 35 U.S.C. § 102(a) and § 102(e) because of its earlier filing date and publication date. Zuckerman relates to communication systems, such as hybrid wired-wireless systems. Ex. 1016, ¶ [0002]. Therefore, it is my opinion that Zuckerman is analogous to the '690 patent.

114. Zuckerman describes extending a hybrid (i.e., wired and wireless) point-to-multipoint (PMP) communication network by employing multiple OFDM or OFDMA modulation sources and receivers. Ex. 1016, ¶¶ [0002], [0015], [0033], Abstract. A controller synchronizes communications over the MAC layer, controls the uplink and downlink access, and determines bandwidth allocation between devices. Ex. 1016, ¶¶ [0041], [0065], [0091]. The controller synchronizes communications based on the modulation parameters in the IEEE 802.16 and/or 802.16d/e standards. Ex. 1016, ¶¶ [0015], [0038], [0052], [0056], [0065]-[0066]. Further, a hybrid converter is employed to convert signals from a first to a second frequency. Ex. 1016, ¶ [0040]. The hybrid converter may modify wired signals to wireless signals and vice versa. Ex. 1016, ¶ [0040].

X. THE RELEVANT ART AND LEVEL OF ORDINARY SKILL IN THE RELEVANT ART

115. In my opinion, the relevant field of art for the ’690 patent is communication networks. Ex. 1001, 1:12-14.

116. I understand that obviousness is determined from the vantage point of a hypothetical person having ordinary skill in the art (POSITA) at the time of the alleged invention, which for purposes of this declaration I have assumed is the earliest claimed priority date of December 15, 2008. I have no opinion on whether the ’690 patent is entitled to this foreign priority date. Even if the ’690 patent was only entitled to a later filing date (e.g., December 10, 2009 – the filing date of the ’690 patent), my opinions herein would not change.

117. I understand that the following four factors may be considered when identifying the appropriate level of a POSITA: (i) the types of problems encountered by those working in the field and prior art solutions thereto; (ii) the sophistication of the technology in question, and the rapidity with which innovations occur in the field; (iii) the educational level of active workers in the field; and (iv) the educational level of the inventor. I understand that a POSITA is one who is presumed to be aware of all pertinent art, thinks along conventional wisdom in the art, and is a person of ordinary creativity.

118. It is my opinion that, for the ’690 patent, 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.

119. I worked in the relevant field with persons meeting this definition of a POSITA at, and leading up to, the time of the alleged invention of the '690 patent (*i.e.*, December 15, 2008). Therefore, I am familiar with the knowledge and skills that such persons had at the time. In my opinion, a POSITA's skill set would have included client side and headend side (e.g., server side) programming skills. More specifically, a POSITA's skill set would have included computer programming, network architecture design, and knowledge of various communication standards including MoCA, 802.11, 802.16 (WiMAX), and DOCSIS.

120. In this Declaration, wherever I refer to a POSITA, it should be understood that I'm referring to a hypothetical person at the time of the alleged invention of the '690 patent (*i.e.*, December 15, 2008) meeting the description I have provided in this section.

XI. CLAIM CONSTRUCTION

121. I understand that my analysis requires an understanding of the scope of the claims of the '690 patent. I understand that claim terms subject to *inter partes* review, absent some other definition provided in the patent, are given their plain and ordinary meaning to a POSITA in light of the patent specification. I

understand that Petitioner's position is that plain and ordinary meaning should apply to all terms for purposes of this proceeding. Therefore, in my analysis below, I have assumed that all claim terms are given their plain and ordinary meaning as would have been understood by a POSITA reading the patent specification at the time of the claimed invention (*i.e.*, December 15, 2008).

A. "probe"

122. This term appears in claims 1-3, 5, 7, 9-13, and 17-21.

123. My analysis below applies the plain and ordinary meaning of this term. I understand that this term was construed as meaning "a signal transmitted to a network node that the network node can compare to a reference signal having a known form in order to determine characteristics of the channel on which the signal was transmitted," in the Charter case. Ex. 1005, 84. However, this does not change my analysis below.

B. "physical layer probe"

124. This term appears in claims 9, 17, and 19.

125. I understand that the court's construction in the Charter case found that the plain meaning of this term, apart from the court's construction of "probe," applies. Ex. 1005, 84. Accordingly, I have applied the plain and ordinary meaning of this term.

C. "probe request"

126. This term appears in claims 1, 4, 6-11, 13-19, and 21-24.

127. My analysis below applies the plain and ordinary meaning of this term. I understand that this term was construed as meaning "a request, sent by one network node to another network node, that specifies the form of a probe to be generated and transmitted," in the Charter case. Ex. 1005, 87. However, this does not change my analysis below.

XII. ANALYSIS

128. For the reasons that I discuss in detail below, it is my opinion that, at least by December 15, 2008 (the earliest claimed priority date), claims 1-24 of the '690 patent would have been anticipated or obvious to a POSITA. In short, it is my opinion that:

- Claims 1-7, 9-10, and 14-15 are anticipated based on IEEE Std 802.16-2004;
- Claims 3-5, 8, 11-13, and 16-24 would have been obvious based on IEEE Std 802.16-2004 alone;
- Claims 8, 16, and 24 would have been obvious based on IEEE Std 802.16-2004 in view of Won;
- Claims 1-11, 14-19, and 22-24 are anticipated based on Waxman;
- Claims 1-11, 14-19, and 22-24 would have been obvious based on Waxman;
- Claims 3-5, 12-13, and 20-21 would have been obvious based on Waxman in view of Giesberts;

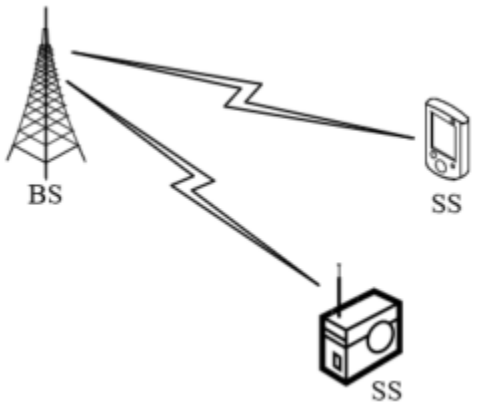
- Claims 5, 10, 11, 18, and 19 would have been obvious based on Waxman in view of Zuckerman;
- Claim 5 would have been obvious based on Waxman in view of Giesberts and Zuckerman;
- Claims 7, 8, 15, 16, 23, and 24 would have been obvious based on Waxman in view of Won;
- Claims 1-2, 6-7, 9, and 14-15 are anticipated based on DOCSIS 2.0 and would have been obvious based on DOCSIS 2.0 in view of ISO8802-2; and
- Claims 8, 10-11, 16-19, and 22-24 would have been obvious based on DOCSIS 2.0 in view of Zuckerman and based on DOCSIS 2.0 in view of ISO8802-2 and Zuckerman.

129. Further, I understand that Petitioner has assigned labels (e.g., [1PRE], [1A], [1B], etc.) to different limitations of the claims to facilitate analysis of the claims. Accordingly, in my analysis below, I have referred to the claim limitations using those same labels, which are shown in the Claim Listing Appendix attached to this declaration as Appendix C.

A. IEEE Std 802.16-2004 Anticipates Claims 1-7, 9-10, and 14-15

130. IEEE Std 802.16-2004 describes a fixed broadband wireless access (BWA) system in which a base station (BS) wirelessly connects (through an air interface) with multiple subscriber stations (SS). Ex. 1013, 1, 7, 11. This standard

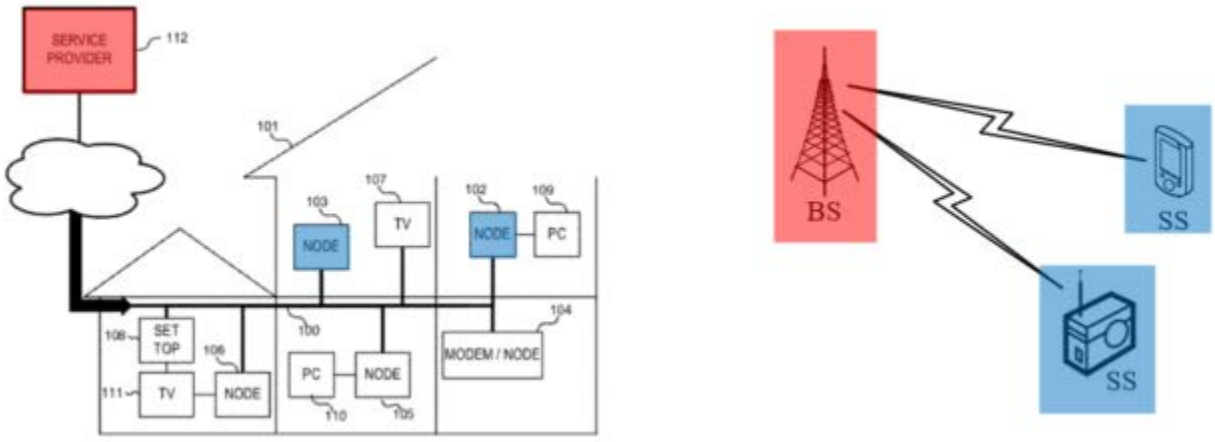
has also been commonly known as "WiMAX". A POSITA would have understood that this topology includes the following example, which shows a base station (e.g., cell or wireless tower) wirelessly communicating with two different subscriber stations (e.g., a mobile phone and a wireless access point). Ex. 1013, 7 (BS refers to generalized equipment providing service), 11 (SS refers to generalized equipment on the subscriber side).



Drawing 1

131. A POSITA would have understood that this system is analogous to the system in Figure 1 of the '690 patent, as shown by the side-by-side comparison below. The base station (BS) (**red**) corresponds to the service provider 112 (**red**) of the '690 patent. Ex. 1001, 4:20-24; Ex. 1013, 7. Just as the service provider 112 is connected to a plurality of nodes (e.g., nodes 102 and 103) (**blue**) via a communications medium 100 in the '690 patent, the BS is connected to a plurality of subscriber stations (SS) (**blue**) via an air interface/medium in IEEE Std 802.16-2004. Ex. 1001, 3:27-38, Fig. 1; Ex. 1013, 7, 11. A POSITA would have

understood that the IEEE Std. 802.16-2004 system being an air interface (wireless) to the SS presents no relevant technical difference with respect to the claims diagramed in Fig. 1 which might imply a cable interface to the nodes/SS.



Ex. 1001, Fig. 1 (left) and Drawing 1 (right) (both annotated)

132. The claims simply refer to first and second nodes and are not otherwise limited to any particular system architecture. A POSITA would have understood that the BS and SS are nodes, and the IEEE Std 802.16-2004 standard even describes them as nodes when describing their use in a mesh topology. Ex. 1013, 9 (definition of node), 32 (description of mesh mode). Likewise, the claims simply refer to two messages (a probe request and a probe), and are not otherwise limited to any particular protocol. Thus, a POSITA would have understood that the IEEE Std 802.16-2004 standard describes a relevant system and protocol. IEEE Std 802.16-2004 describes a number of messages that are communicated between its BS and SS nodes. The messages are used for providing various

procedures or mechanisms having various purposes (e.g., scheduling, bandwidth allocation, etc.). Ex. 1013, Sections 6.3.5 and 6.3.6. Some of the messages are used in one procedure while some of the other messages are used in another procedure for another purpose. Also, some messages are used in multiple different procedures. Depending on the scope of the claims (e.g., depending on how a probe is defined), IEEE Std 802.16-2004 may have multiple procedures using different messages that can be applied to the claims.

133. In any event, my analysis below focuses on the ranging procedure described in IEEE Std 802.16-2004 and how it applies to the claims. IEEE Std 802.16-2004 states that "Ranging is a collection of processes by which the SS and BS maintain the quality of the RF communication link between them." Ex. 1013, 199. As explained on a limitation-by-limitation basis below, the system and the method for operating it (and in particular the ranging procedure) anticipate many of the '690 patent's claims.

1. Independent Claim 1

a) [1PRE]: "A method comprising:"

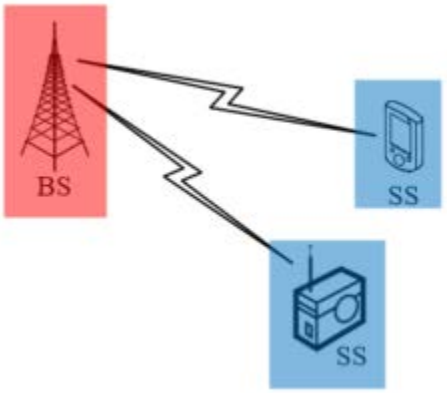
134. This preamble is disclosed by IEEE Std 802.16-2004. As I explained above, IEEE Std 802.16-2004 describes a fixed broadband wireless access (BWA) system and various processes performed by it. The various processes include automatic repeat request (ARQ) procedures, scheduling, bandwidth allocation,

duplexing, contention resolution, network entry and initialization, and ranging and these high-level processes include even more lower-level processes. Ex. 1013, Sections 6.3.4, 6.3.5, 6.3.6, 6.3.7, 6.3.8, 6.3.9, 6.3.10. For example, network entry and initialization includes scanning and synchronization procedures. Ex. 1013, 167-169. As another example, the ranging procedure includes two uplink procedures called "initial ranging" and "periodic ranging" as well as downlink burst profile management in which an "SS applies an algorithm to determine its optimal burst profile." Ex. 1013, 174-182, 199-213. IEEE Std 802.16-2004 explains that "Initial ranging (see 6.3.9.5) allows an SS joining the network to acquire correct transmission parameters, such as time offset and Tx power level, so that the SS can communicate with the BS. Following initial ranging, periodic ranging allows the SS to adjust transmission parameters so that the SS can maintain uplink communications with the BS." Ex. 1013, 202.

135. It is the collection of all the various processes that forms the method which meets the claimed "method." Alternatively, the ranging procedure alone (including initial and periodic ranging) meets the claimed "method." Lastly, as discussed below, IEEE Std 802.16-2004's method (either the collection of its various processes or the ranging procedure alone) comprises limitations [1A]-[1D]. See Sections XII.A.1.b-e, below. Thus, IEEE Std 802.16-2004 teaches limitation [1PRE].

b) [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;"

136. As shown in the drawing below, the system of IEEE Std 802.16-2004 includes a base station (BS) (**red**) communicating with a subscriber station (SS), such as a mobile phone and a wireless access point (**both blue**). The BS (**red**) in IEEE Std 802.16-2004 corresponds to the claimed "first node," and either one of the mobile phone or the wireless access point (or another type of subscriber station SS) (**blue**) in IEEE Std 802.16-2004 corresponds to the claimed "second node."



137. Further, the ranging procedure includes the step of "receiving" in limitation [1A]. As I explained above, IEEE Std 802.16-2004 states that "Ranging is a collection of processes by which the SS and BS maintain the quality of the RF communication link between them." Ex. 1013, 199. The processes and messages (including their parameters and the encodings of those parameters) related to ranging are described throughout IEEE Std 802.16-2004. Ex. 1013, 49-51, 174-

182, 199-213, 477-479, 576-579, 620, 664-666. In particular, IEEE Std 802.16-2004 also describes a Ranging Request message (RNG-REQ). Ex. 1013, 49. The Ranging Request message (RNG-REQ) is one of the MAC Management messages. Ex. 1013, 42-43. IEEE Std 802.16-2004 explains that "[a]n RNG-REQ shall be transmitted by the SS at initialization and periodically to determine network delay and to request power and/or downlink burst profile change." Ex. 1013, 49. IEEE Std 802.16-2004 further describes that the RNG-REQ is received by the BS. Ex. 1013, 50, 199-213. The format of the RNG-REQ message is shown in Table 19 (reproduced below). Ex. 1013, 49. This RNG-REQ message corresponds to the claimed "probe request."

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
}		

138. As shown above, the Ranging Request (RNG-REQ) message includes 3 main portions: a Management Message Type, Downstream Channel ID, and TLV Encoded Information. Ex. 1013, 49.[1] A POSITA would have understood that the TLV Encoded Information includes different parameters depending on the

[1] I note that TLV stands for "type/length/value." Ex. 1013, 16.

circumstances of the RNG-REQ message. Ex. 1013, 49 ("All other parameters are coded as TLV tuples"), 723. For example, when the SS is attempting to join the network, the RNG-REQ message shall include a "Requested Downlink Burst Profile" parameter and a "SS MAC Address" parameter. Ex. 1013, 49. As another example, after the SS has received a Ranging Response (RNG-RSP) message addressed to the SS from a previous ranging session, the RNG-REQ message may include a "Requested Downlink Burst Profile" parameter and a "Ranging Anomalies" parameter. Ex. 1013, 49. The TLV encodings are also shown in Table 364 (reproduced below). Ex. 1013, 664.

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

139. As shown in the table above, the Requested Downlink Burst Profile parameter has a Type equal to 1, a Length equal to 1 byte (=8 bits), and a value in

which bits 0-3 indicate the downlink interval usage code (DIUC) of the downlink burst profile requested by the SS for downlink traffic and bits 4-7 indicate the four least significant bits of the Configuration Change Count value of downlink channel descriptor (DCD) defining the burst profile associated with the DIUC. Ex. 1013, 664, 13. The Requested Downlink Burst Profile parameter of the RNG-REQ message allows the SS to request a specific downlink burst profile, thereby causing a downlink burst profile change. Ex. 1013, 49, 71 (discussing another message for changing the downlink burst profile and noting that "a change of downlink burst profile may also be requested by means of a RNG-REQ message as defined in 6.3.2.3.5"), 199 ("If a grant is not available and the SS requires a more robust burst profile on the downlink, the SS shall send a RNG-REQ message in an Initial Ranging interval."). The DIUC in the Requested Downlink Burst Profile parameter is mapped to one of the downlink burst profiles according to table (e.g., Table 143 or Table 276 (both reproduced below)) depending on the PHY layer. Ex. 1013, 315, 522.

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

140. The downlink burst profile includes the following parameters: modulation type, forward error correction (FEC) Code type, Last codeword length, DIUC mandatory exit threshold, DIUC minimum entry threshold, and a Preamble Presence. Ex. 1013, 7 (definition of burst profile), 314-315 (although the standard only mentions the downlink burst profiles in the DCD message, a POSITA would have understood that those are the same as the downlink burst profiles that may be in the RNG-REQ message which is another way of changing the downlink burst profile as explained above), 547 (Table 303). IEEE Std 802.16-2004 supports

different modulation types, such as Spread BPSK, BPSK, QPSK, 16-QAM, 64-QAM, and 256-QAM. Ex. 1013, 370. IEEE Std 802.16-2004 describes downlink modulation in, for example, Section 8.1.4.4.7 as follows. Ex. 1013, 329.

> **8.1.4.4.7 Downlink modulation**
>
> To maximize utilization of the airlink, the PHY uses a multilevel modulation scheme. The modulation constellation can be selected per subscriber based on the quality of the RF channel. If link conditions permit, then a more complex modulation scheme can be utilized to maximize airlink throughput while still allowing reliable data transfer. If the airlink degrades over time, possibly due to environmental factors, the system can revert to the less complex constellations to allow more reliable data transfer.
>
> In the downlink, the BS shall support QPSK and 16-QAM modulation and, optionally, 64-QAM.
>
> The sequence of modulation bits shall be mapped onto a sequence of modulation symbols $S(k)$, where k is the corresponding symbol number. The number of bits per symbol depends on the modulation type. For QPSK, $n = 2$; for 16-QAM, $n = 4$; and for 64-QAM, $n = 6$. $B(m)$ denotes the modulation bit of a sequence to be transmitted, where m is the bit number (m ranges from 1 through n). In particular, $B(1)$ corresponds to the first bit entering the modulator, $B(2)$ corresponds to the second bit entering the modulation, and so on.
>
> In changing from one burst profile to another, the BS shall use one of two power adjustment rules: maintaining constant constellation peak power (power adjustment rule = 0), or maintaining constant constellation mean power (power adjustment rule = 1). In the constant peak power scheme, corner points are transmitted at equal power levels regardless of modulation type. In the constant mean power scheme, the signal is transmitted at equal mean power levels regardless of modulation type. The power adjustment rule is configurable through the DCD Channel Encoding parameters (11.4.1).
>
> At the end of each burst, the final FEC-encoded message might not end exactly on a PS boundary. If this is the case, the end of the encoded message to the start of the next burst shall be filled with zero bits.
>
> The complex modulation symbol $S(k)$ shall take the value $I + jQ$. The following subclauses apply to the base-band part of the transmitter.

141. With respect to the WirelessMAN-OFDMA physical layer (PHY) specification,[2] the downlink burst profile encodings are shown in Table 359 and

[2] As discussed in the overview section, the standard is designed to work with a WirelessMAN-OFDMA physical layer (PHY) specification. Ex. 1013, ii (Abstract), iv (Introduction), 2 (PHY compliance). I have particularly addressed

Table 363 (both reproduced below). Ex. 1013, 660, 664. Table 359 shows common burst profile encodings, while Table 363 shows burst profile encodings for the WirelessMAN-OFDMA PHY. Ex. 1013, 660, 663.

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.

---

this PHY layer here because later claims deal with OFDMA, but downlink burst profiles for other PHY layers would also meet this claim.

142. As shown in Table 363, the FEC Code type parameter specifies the modulation type (e.g., QPSK, 16-QAM, or 64-QAM), the FEC type (e.g., convolutional code (CC), block turbo code (BTC), or convolution turbo code (CTC)), and the code rate (e.g., 1/2 or 3/4). Ex. 1013, 663.

143. In addition to these parameters, there are further parameters in the headers for the RNG-REQ message, which is just one of the MAC Management messages that may be carried in the payload portion of a MAC PDU. Ex. 1013, 35-43 (Table 14 shows that the Ranging Request message is the MAC Management Message when Type = 4). The format for the MAC PDU is shown in Figure 18 (reproduced below). Ex. 1013, 35.

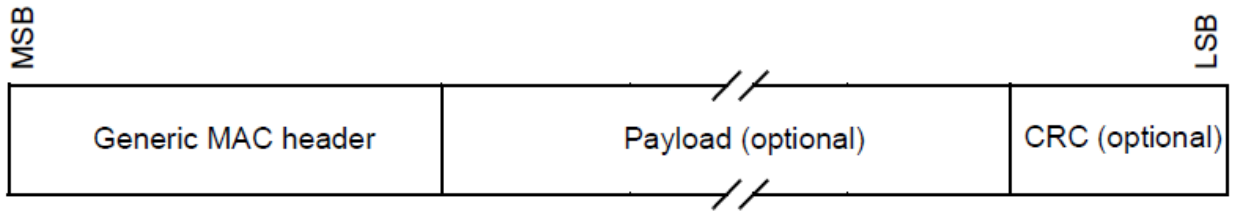


Figure 18—MAC PDU formats

144. IEEE Std 802.16-2004 explains that there are two MAC headers formats: a generic MAC header and a bandwidth request header. Ex. 1013, 35. The generic MAC header is shown in Figure 19 (reproduced below).

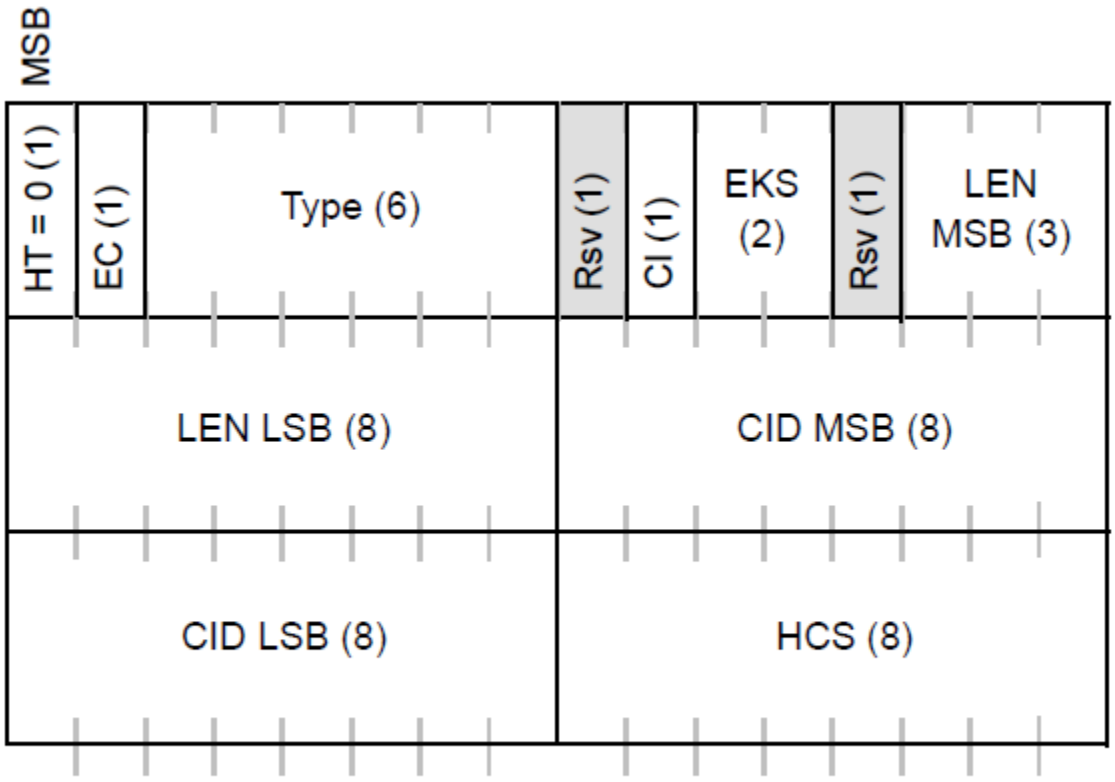


Figure 19—Generic MAC header format

145. As shown in Figure 19 above, the MAC header (which would be a header for the RNG-REQ message) includes numerous parameters (referred to as "fields"). Ex. 1013, 37. The parameters (or fields) of the MAC header are defined in Table 5 (reproduced below). Ex. 1013, 37.

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.

146. As shown from the table above, one of the parameters is a connection identifier (CI), which is discussed again further below. Ex. 1013, 37. Another parameter/field is the type field that indicates which subheaders are present in the payload portion of the MAC PDU. Ex. 1013, 37. There are five types of subheaders: Mesh, Fragmentation, FAST-FEEDBACK Allocation, Grant Management, and Packing. Ex. 1013, 39. These subheaders also include additional parameters. Ex. 1013, 39-42.

147. Thus, the Ranging Request (RNG-REQ) message, collectively from its different portions (i.e., MAC header, subheaders, payload, and CRC), specifies a plurality of parameters that meets the claimed "first plurality of parameters."

Moreover, the plurality of parameters of the RNG-REQ message (in particular, the Requested Downlink Burst Profile parameter which would be in the payload portion) are used for forming a Ranging Response (RNG-RSP) message (the claimed "probe"), which is generated in response to a received RNG-REQ message. Ex. 1013, 50, 199-213. Therefore, the plurality of parameters of the RNG-REQ message are "associated with the generation and transmission of a probe," as claimed.

148. Furthermore, IEEE Std 802.16-2004 provides the format for the RNG-RSP message in Table 20 (reproduced below). Ex. 1013, 50.

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
}		

149. As shown in the table above, the RNG-RSP message also includes TLV Encoded Information, which would have included numerous parameters like a Ranging Status parameter, Timing Adjust Information parameters, Power Adjust Information, etc. Ex. 1013, 50, 665-666 (Section 11.6 RNG-RSP management message encodings). IEEE Std 802.16-2004 explains that one of the parameters included in this TLV Encoded Information (of the RNG-RSP message) is the CID.

Ex. 1013, 50. As I explained above, this CID parameter was also one of the parameters of the RNG-REQ message. Ex. 1013, 49. Because the CID parameter is part of the TLV Encoded Information of the RNG-RSP message, it is part of the payload portion of the MAC PDU for sending the RNG-RSP message (which is also a type of MAC Management message). Ex. 1013, 35, 42-43, 50. Therefore, at least the CID parameter in the Ranging Request (RNG-REQ) message specifies content/data (the CID itself) transmitted in the payload for the Ranging Response (RNG-RSP) message. This teaches "wherein the first plurality of parameters at least specify content payload of the probe," as claimed. Ex. 1013, 49-50. The "ranging code index that was sent by the SS" is another example of data that is in a parameter of the RNG-REQ message and used for the payload of the RNG-RSP message. Ex. 1013, 49-51, 204-213 (Section 6.3.10.3 describing codes for OFDMA-based ranging), 576-579 (Section 8.4.7 describing codes for OFDMA ranging), 665-666 (Section 11.6 describing RNG-RSP management message encodings including ranging code in Table 369).

150. In addition and as I explained above, IEEE Std 802.16-2004 describes that another one of the parameters included in the RNG-REQ message is the SS MAC Address. Ex. 1013, 49, 664.[3] The SS MAC Address specifies the SS (the

[3] This SS MAC Address parameter is also one of the parameters in the payload of the RNG-RSP message. Ex. 1013, 50, 665-666.

claimed "second node"), which is the node that sent the RNG-REQ message and will receive the RNG-RSP message. Ex. 1013, 33 (explaining that each SS has a MAC address that uniquely defines it and that it is used during the initial ranging process), 168 ("Each SS contains the following information when shipped from the manufacturer: a) A 48-bit universal MAC address (per IEEE Std 802-2001) assigned during the manufacturing process. This is used to identify the SS to the various provisioning servers during initialization."), 664-666 (SS MAC Address in Table 364 for RNG-REQ message encodings and Table 367 for RNG-RSP message encodings). The inclusion of the SS MAC Address as one of the parameters of the RNG-REQ message teaches the "wherein the first plurality of parameters at least specify…a second node," as claimed.

151. In conclusion, IEEE Std 802.16-2004 teaches receiving in a BS, a Ranging Request (RNG-REQ) message specifying a plurality of parameters associated with the generation and transmission of a Ranging Response (RNG-RSP) message, wherein the plurality of parameters specify a payload of the Ranging Response message and the SS. This teaches the claimed "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" in limitation [1A]. Thus, IEEE Std 802.16-2004 teaches limitation [1A].

c) [1B]: "b) determining a second plurality of parameters associated with generation and transmission of the probe;"

152. As I explained above, the Ranging Request (RNG-REQ) message will cause the BS to generate and transmit the Ranging Response (RNG-RSP) message (the claimed "probe"). Ex. 1013, 49-50, 199-213. As shown in Table 20 (reproduced below), the Ranging Response message includes a plurality of parameters (the claimed "second plurality of parameters"), such as the Management Message Type parameter, the Uplink Channel ID parameter, and the parameters for the TLV Encoded Information (which includes numerous parameters, like a Ranging Status parameter, as explained above). Ex. 1013, 50.

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
}		

153. A POSITA would have understood that these parameters must be determined in order to generate and transmit the Ranging Response message. For example, the status for the Ranging Status parameter must be determined to be abort, continue, or success. Ex. 1013, 50, 199-213. As another example, the BS would have determined the timing and power corrections to be sent in the Ranging

Response message. Ex. 1013, 50, 199-213. Therefore, the plurality of parameters of the Ranging Response message are "associated with the generation and transmission of a probe," as claimed.

154. In conclusion, IEEE Std 802.16-2004 teaches the BS determining a plurality of parameters associated with the generation and transmission of the Ranging Response message. This teaches the claimed "determining a second plurality of parameters associated with generation and transmission of the probe" in limitation [1B]. Thus, IEEE Std 802.16-2004 teaches limitation [1B].

d) [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"

155. As I explained above, the plurality of parameters in the Ranging Request message (the claimed "first plurality of parameters") and the plurality of parameters for the Ranging Response message (the claimed "second plurality of parameters") are used to generate the Ranging Response message (the claimed "probe"). For example, the parameters in the Ranging Request message, such as the CID or ranging code, are used by the BS to generate the Ranging Response message, which is generated from the plurality of parameters in Table 20, like the Management Message Type, Uplink Channel ID, and TLV Encoded Information (which also includes numerous parameters). Ex. 1013, 49-50, 199-213.

156. Further, because the Requested Downlink Burst Profile parameter of the Ranging Request message provides a downlink burst profile (e.g., including the encodings in Table 359 which includes a downlink frequency and in Table 363 which includes a FEC Code type that includes a modulation type) to be used by the BS to format and send the Ranging Response message on the downlink to the SS, at least the Requested Downlink Burst Profile parameter (including its encodings) dictates the form of the Ranging Response message (the claimed "probe"). Ex. 1013, 49-50, 199-201, 314-316, 547, 617 ("adaptive modulation and coding shall be supported in the downlink"), 660 (Table 359), 663 (Table 363). A POSITA would have understood that the downlink frequency and/or FEC Code type (including a modulation type) are characteristics of the form of the Ranging Response message because they dictate how the Ranging Response message is formatted and transmitted.

157. In conclusion, IEEE Std 802.16-2004 teaches the BS generating the Ranging Response message in accordance with the plurality of parameters in the Ranging Request message and the plurality of parameters for the Ranging Response message, wherein the Ranging Response message has a form (e.g., frequency and modulation) dictated by the plurality of parameters in the Ranging Request message. This teaches the claimed "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" in limitation [1C]. Thus, IEEE Std 802.16-2004 teaches limitation [1C].

e) [1D]: "d) transmitting the probe from the first node to the second node."

158. As I explained above, IEEE Std 802.16-2004 teaches that the BS (the claimed "first node") transmits the Ranging Response message (the claimed "probe") to the SS (the claimed "second node") on the downlink in response to receiving the Ranging Request message. Ex. 1013, 199-213. In conclusion, IEEE Std 802.16-2004 teaches transmitting the Ranging Response message from the BS to the SS. This teaches the claimed "transmitting the probe from the first node to the second node" in limitation [1D]. Thus, IEEE Std 802.16-2004 teaches limitation [1D].

2. Dependent Claim 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."

159. Claim 2 of the '690 patent depends from claim 1, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 2 further requires "using within the first node, at least one of the probe parameters to determine a modulation

profile for the probe."[4] Ex. 1001, claim 2. IEEE Std 802.16-2004 also teaches this feature, which was actually shown above but will be specifically addressed below.

160. As discussed above with respect to claim 1, the BS (the claimed "first node") receives the Ranging Request message, which includes the Requested Downlink Burst Profile parameter that provides a burst profile (including modulation type) for the downlink that the Ranging Response is sent on. Ex. 1013, 49-50, 199-213, 547, 663. IEEE Std 802.16-2004 defines a burst profile as a "[s]et of parameters that describe the uplink or downlink transmission properties associated with an interval usage code. Each profile contains parameters such as modulation type, forward error correction (FEC) type, preamble length, guard times, etc." Ex. 1013, 7. Based on this, a POSITA would have understood that a burst profile is a modulation profile, and therefore the Requested Downlink Burst Profile parameter is "at least one of the probe parameters to determine a modulation profile for the probe" (as claimed) because it dictates how the Ranging Response message is to be modulated for transmission on the downlink.

[4] I note that the term "probe parameters" is not exactly included in independent claim 1 and therefore it is unclear whether this term refers to "the first plurality of parameters," "the second plurality of parameters" or both. For purposes of my analysis in this declaration, I have assumed "the probe parameters" refers to both "first plurality of parameters" and "second plurality of parameters."

161. In conclusion, IEEE Std 802.16-2004 teaches using within the BS, the Requested Downlink Burst Profile parameter (among the plurality of parameters of the Ranging Request message) to determine a downlink burst profile for the Ranging Response message. This teaches the claimed "using within the first node, at least one of the probe parameters to determine a modulation profile for the probe" in claim 2. Thus, IEEE Std 802.16-2004 teaches claim 2.

3. Dependent Claim 3

a) [3PRE]: "The method of claim 1, wherein at least one of the probe parameters indicates:"

162. Claim 3 of the '690 patent depends from claim 1, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 3 further includes a list of different pieces of data/information that the probe parameters indicate.[5] Ex. 1001, claim 3. In my opinion, the ordinary meaning of claim 3 requires one parameter to indicate all of the listed pieces of data/information. To the extent that claim 3 is considered to require only one of the probe parameters to indicate only one of the

[5] I note that the term "probe parameters" is not exactly included in independent claim 1 and therefore it is unclear whether this term refers to "the first plurality of parameters," "the second plurality of parameters" or both. For purposes of my analysis in this declaration, I have assumed "the probe parameters" refers to both "first plurality of parameters" and "second plurality of parameters."

listed pieces of data/information, I have shown how IEEE Std 802.16-2004 teaches at least limitation [3A] below.

b) [3A]: "a) a modulation profile for the probe;"

163. As discussed above with respect to claims 1 and 2, the Ranging Request message includes the Requested Downlink Burst Profile parameter that provides a burst profile (including modulation type) for the Ranging Response that is to be is sent on the downlink. Ex. 1013, 49-50, 199-213, 547, 663. IEEE Std 802.16-2004 defines a burst profile as a "[s]et of parameters that describe the uplink or downlink transmission properties associated with an interval usage code. Each profile contains parameters such as modulation type, forward error correction (FEC) type, preamble length, guard times, etc." Ex. 1013, 7. Based on this, a POSITA would have understood that a burst profile is a modulation profile, and therefore the Requested Downlink Burst Profile parameter is "at least one of the probe parameters" that indicates "a modulation profile for the probe" (as claimed) because it dictates how the Ranging Response message is to be modulated for transmission on the downlink.

164. In conclusion, IEEE Std 802.16-2004 teaches the Ranging Request message including a plurality of parameters wherein at least one of them indicates a downlink burst profile for the Ranging Response message. This teaches the claimed "wherein at least one of the probe parameters indicates…a modulation

profile for the probe" in limitation [3A]. Thus, IEEE Std 802.16-2004 teaches limitation [3A].

4. Dependent Claim 4: "The method of claim 3, wherein the probe request identifies a hidden node."

165. Claim 4 of the '690 patent depends from claim 3, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 4 further requires that "the probe request identifies a hidden node." Ex. 1001, claim 4. IEEE Std 802.16-2004 also teaches this feature as explained below.

166. When an initial Ranging Request message (the claimed "probe request") is sent (referred to as "initial ranging"), the SS is unknown to the BS that receives it. Ex. 1013, 167-177 (Section 6.3.9 describing how SS enters network by, unbeknownst to the BS, scanning for valid downlink signals, synchronizing itself, obtaining downlink parameters, and obtaining uplink parameters prior to performing initial ranging), 205-206 ("The BS cannot tell which SS sent the CDMA ranging request; therefore, upon successfully receiving a CDMA Ranging Code, the BS broadcasts a Ranging Response message that advertises the received Ranging Code as well as the ranging slot (OFDMA symbol number, subchannel, etc.) where the CDMA Ranging code has been identified."). Therefore, a POSITA would have understood that the SS is a "hidden node" at the time it transmits the initial Ranging Request message. The Ranging Request message identifies the SS as a hidden node because the BS, based on receiving the initial Ranging Request

message, learns of the existence of the SS even if it does not yet know all the information about the SS. Thus, the Ranging Request message "identifies a hidden node," as claimed in claim 4.

167. Claim 4 is also met in another way. In a case where the SS is attempting to join the network, the RNG-REQ message shall include a SS MAC Address parameter. Ex. 1013, 49, 664. A POSITA would have understood that this SS MAC address identifies the SS to the BS, which previously did not know the SS's MAC address, and therefore a POSITA would have considered the SS to be unknown or hidden prior to receipt of the RNG-REQ message with the SS MAC address. Thus, the Ranging Request message having the SS MAC Address parameter also "identifies a hidden node," as claimed in claim 4.

5. Dependent Claim 5: "The method of claim 3, wherein the modulation profile for the probe emulates an orthogonal frequency division multiple access (OFDMA) transmission."

168. Claim 5 of the '690 patent depends from claim 3, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 5 further requires that "the modulation profile for the probe emulates an orthogonal frequency division multiple access (OFDMA) transmission." Ex. 1001, claim 5. IEEE Std 802.16-2004 also teaches this feature as explained below.

169. IEEE Std 802.16-2004 teaches using a WirelessMAN-OFDMA physical layer (PHY) specification. Ex. 1013, ii (Abstract), iv (Introduction), 2-3

(PHY compliance). A POSITA would have understood that messages sent on this PHY layer emulate an OFDMA transmission. Ex. 1013, 493-501. The Ranging Response message (the claimed "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.

170. Further, as I explained above, the downlink burst profile encodings are shown in Table 359 and Table 363 (both reproduced below). Ex. 1013, 660, 663, 547 (Section 8.4.5.5 providing the OFDMA downlink burst profile format). Table 359 shows common burst profile encodings, while Table 363 shows burst profile encodings for the WirelessMAN-OFDMA PHY. Ex. 1013, 660, 663.

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.

171. As shown in Table 363, the FEC Code type parameter specifies, the modulation type (e.g., QPSK, 16-QAM, or 64-QAM), the FEC type (e.g., convolutional code (CC), block turbo code (BTC), or convolution turbo code (CTC)), and the code rate (e.g., 1/2 or 3/4). Ex. 1013, 663. As I explained above, a POSITA would have understood that the downlink burst profile for the Ranging Response message that is transmitted on the downlink is the claimed "modulation profile for the probe." Ex. 1013, 7, 199-213, 660, 663. Because the downlink burst profile modulates the Ranging Response message for transmission through

the OFDMA PHY layer, the downlink burst profile "emulates an orthogonal frequency division multiple access (OFDMA) transmission," as claimed.

172. In conclusion, IEEE Std 802.16-2004 teaches that the downlink burst profile for the Ranging Response message emulates an OFDMA transmission for delivery through the OFDMA PHY layer. This teaches the "wherein the modulation profile for the probe emulates an orthogonal frequency division multiple access (OFDMA) transmission" in claim 5. Thus, IEEE Std 802.16-2004 teaches claim 5.

6. Dependent Claim 6: "The method of claim 1, wherein the probe request is generated by the second node."

173. Claim 6 of the '690 patent depends from claim 1, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 6 further requires that "the probe request is generated by the second node." Ex. 1001, claim 6. IEEE Std 802.16-2004 also teach this feature, which was actually shown above but will be specifically addressed below.

174. As I explained above with respect to claim 1, the Ranging Request message (the claimed "probe request") is generated and transmitted by the SS (the claimed "second node"). Ex. 1013, 49, 199-213. This teaches the claimed "wherein the probe request is generated by the second node" in claim 6. Thus, IEEE Std 802.16-2004 teaches claim 6.

7. Dependent Claim 7: "The method of claim 1, wherein the probe request requests a probe that assists in diagnosing a network problem."

175. Claim 7 of the '690 patent depends from claim 1, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 7 further requires that "the probe request requests a probe that assists in diagnosing a network problem." Ex. 1001, claim 7. IEEE Std 802.16-2004 also teaches this feature as explained below.

176. As I explained above with respect to claim 1, the Ranging Request message (the claimed "probe request") requests the BS to send the Ranging Response message (the claimed "probe"). Ex. 1013, 49-50, 199-213. Further, IEEE Std 802.16-2004 states that "Ranging is a collection of processes by which the SS and BS maintain the quality of the RF communication link between them." Ex. 1013, 199. Therefore, the Ranging Request message assists in diagnosing a problem with the RF communication link between the SS and the BS (the claimed "network problem"). If the Ranging Request message is not successful, the BS may send a Ranging Response message with a ranging status parameter that commands the SS to continue ranging and with data (e.g., timing adjustment data, power level adjustment data, or offset frequency adjustment data) for making adjustments in an attempt to improve the RF communication link. Ex. 1013, 202-213, 665-666 (Section 11.6 describing RNG-RSP management message encodings). Alternatively, if the Ranging Request message has not been successful

for a number of tries, the BS may send a Ranging Response message with a ranging status parameter that commands the SS to abort, such that the process of trying to manage the communications between the SS and BS is terminated. Ex. 1013, 202-213, 665-666 (Section 11.6 describing RNG-RSP management message encodings). Also, IEEE Std 802.16-2004 explains that initial ranging is performed when communication/synchronization is lost, so another (albeit similar) network problem that ranging is used to diagnose is the loss of synchronization with the BS. Ex. 1013, 169-174 (Sections 6.3.9.1-6.3.9.5 describing that when a signal is lost, the SS scans for a valid downlink signal, obtains downlink and uplink parameters, and then performs initial ranging), 477 (Section 8.3.7.2 describing that initial ranging is performed "when synchronization is lost").

177. In conclusion, IEEE Std 802.16-2004 teaches that the Ranging Request message requests the Ranging Response message that assists in diagnosing a problem with the RF communication link (such as the timing and power of SS transmission on it) between the SS and the BS. This teaches the claimed "wherein the probe request requests a probe that assists in diagnosing a network problem" in claim 7. Thus, IEEE Std 802.16-2004 teaches claim 7.

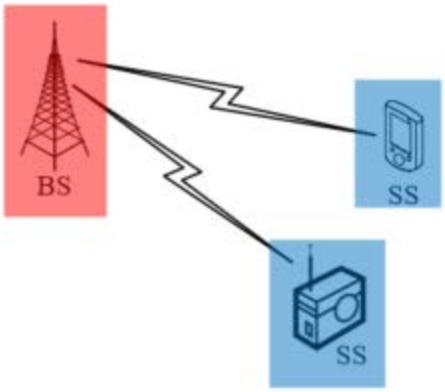
8. Independent Claim 9

a) [9PRE]: "A method comprising:"

178. This preamble is disclosed by IEEE Std 802.16-2004 for the same reasons provided above for limitation [1PRE]. Independent claim 9 is similar to independent claim 1, but is written from the perspective of the node that sends the probe request and receives the probe response. As such, the first node in claim 9 corresponds to the second node in claim 1, while the second node in claim 9 corresponds to the first node in claim 1. As I will explain below, IEEE Std 802.16-2004's method (either the collection of its various processes or the ranging procedure alone) comprises limitations [9A]-[9B]. See Sections XII.A.8.b-c, below. Thus, IEEE Std 802.16-2004 teaches limitation [9PRE].

b) [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;"

179. As shown in the drawing below, the system of IEEE Std 802.16-2004 includes a base station (BS) (**red**) communicating with a subscriber station (SS), such as a mobile phone and a wireless access point (**both blue**). Either one of the mobile phone or the wireless access point (or another type of subscriber station SS) (**blue**) in IEEE Std 802.16-2004 corresponds to the claimed "first node." The BS (**red**) in IEEE Std 802.16-2004 corresponds to the claimed "second node."



180. Further, the ranging procedure includes the step of "transmitting" in limitation [9A]. As I explained above, IEEE Std 802.16-2004 states that "Ranging is a collection of processes by which the SS and BS maintain the quality of the RF communication link between them." Ex. 1013, 199. The processes and messages (including their parameters and the encodings of those parameters) related to ranging are described throughout IEEE Std 802.16-2004. Ex. 1013, 49-51, 174-182, 199-213, 477-479, 576-579, 620, 664-666. In particular, IEEE Std 802.16-2004 also describes a Ranging Request message (RNG-REQ). Ex. 1013, 49. The Ranging Request message (RNG-REQ) is one of the MAC Management messages. Ex. 1013, 42-43. IEEE Std 802.16-2004 explains that "[a]n RNG-REQ shall be transmitted by the SS at initialization and periodically to determine network delay and to request power and/or downlink burst profile change." Ex. 1013, 49. IEEE Std 802.16-2004 further describes that the RNG-REQ is received by the BS. Ex. 1013, 50, 199-213. The format of the RNG-REQ message is shown in Table 19

(reproduced below). Ex. 1013, 49. This RNG-REQ message corresponds to the claimed "probe request."

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
}		

181. As shown above, the Ranging Request (RNG-REQ) message includes 3 main portions: a Management Message Type, Downstream Channel ID, and TLV Encoded Information. Ex. 1013, 149.[6] A POSITA would have understood that the TLV Encoded Information includes different parameters depending on the circumstances of the RNG-REQ message. Ex. 1013, 49 ("All other parameters are coded as TLV tuples"), 723. For example, when the SS is attempting to join the network, the RNG-REQ message shall include a "Requested Downlink Burst Profile" parameter and a "SS MAC Address" parameter. Ex. 1013, 49. As another example, after the SS has received a Ranging Response (RNG-RSP) message addressed to the SS from a previous ranging session, the RNG-REQ message may include a "Requested Downlink Burst Profile" parameter and a "Ranging

[6] I note that TLV stands for "type/length/value." Ex. 1013, 16.

Anomalies" parameter. Ex. 1013, 49. The TLV encodings are also shown in Table 364 (reproduced below). Ex. 1013, 664.

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

182. As shown in the table above, the Requested Downlink Burst Profile parameter has a Type equal to 1, a Length equal to 1 byte (=8 bits), and a value in which bits 0-3 indicate the downlink interval usage code (DIUC) of the downlink burst profile requested by the SS for downlink traffic and bits 4-7 indicate the four least significant bits of the Configuration Change Count value of downlink channel descriptor (DCD) defining the burst profile associated with the DIUC. Ex. 1013, 13, 664. The Requested Downlink Burst Profile parameter of the RNG-REQ message allows the SS to request a specific downlink burst profile, thereby causing a downlink burst profile change. Ex. 1013, 49, 71 (discussing another message for

changing the downlink burst profile and noting that "a change of downlink burst profile may also be requested by means of a RNG-REQ message as defined in 6.3.2.3.5"), 199 ("If a grant is not available and the SS requires a more robust burst profile on the downlink, the SS shall send a RNG-REQ message in an Initial Ranging interval."). The DIUC in the Requested Downlink Burst Profile parameter is mapped to one of the downlink burst profiles according to table (e.g., Table 143 or Table 276 (both reproduced below)) depending on the PHY layer. Ex. 1013, 315, 522.

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

183. The downlink burst profile includes the following parameters: modulation type, forward error correction (FEC) Code type, Last codeword length, DIUC mandatory exit threshold, DIUC minimum entry threshold, and a Preamble Presence. Ex. 1013, 7 (definition of burst profile), 314-315 (although the standard only mentions the downlink burst profiles in the DCD message, a POSITA would have understood that those are the same as the downlink burst profiles that may be in the RNG-REQ message which is another way of changing the downlink burst profile as explained above) , 547 (Table 303). IEEE Std 802.16-2004 supports different modulation types, such as Spread BPSK, BPSK, QPSK, 16-QAM, 64-QAM, and 256-QAM. Ex. 1013, 370. IEEE Std 802.16-2004 describes downlink modulation in, for example, Section 8.1.4.4.7 as follows. Ex. 1013, 329.

8.1.4.4.7 Downlink modulation

To maximize utilization of the airlink, the PHY uses a multilevel modulation scheme. The modulation constellation can be selected per subscriber based on the quality of the RF channel. If link conditions permit, then a more complex modulation scheme can be utilized to maximize airlink throughput while still allowing reliable data transfer. If the airlink degrades over time, possibly due to environmental factors, the system can revert to the less complex constellations to allow more reliable data transfer.

In the downlink, the BS shall support QPSK and 16-QAM modulation and, optionally, 64-QAM.

The sequence of modulation bits shall be mapped onto a sequence of modulation symbols $S(k)$, where k is the corresponding symbol number. The number of bits per symbol depends on the modulation type. For QPSK, $n = 2$; for 16-QAM, $n = 4$; and for 64-QAM, $n = 6$. $B(m)$ denotes the modulation bit of a sequence to be transmitted, where m is the bit number (m ranges from 1 through n). In particular, $B(1)$ corresponds to the first bit entering the modulator, $B(2)$ corresponds to the second bit entering the modulation, and so on.

In changing from one burst profile to another, the BS shall use one of two power adjustment rules: maintaining constant constellation peak power (power adjustment rule = 0), or maintaining constant constellation mean power (power adjustment rule = 1). In the constant peak power scheme, corner points are transmitted at equal power levels regardless of modulation type. In the constant mean power scheme, the signal is transmitted at equal mean power levels regardless of modulation type. The power adjustment rule is configurable through the DCD Channel Encoding parameters (11.4.1).

At the end of each burst, the final FEC-encoded message might not end exactly on a PS boundary. If this is the case, the end of the encoded message to the start of the next burst shall be filled with zero bits.

The complex modulation symbol $S(k)$ shall take the value $I + jQ$. The following subclauses apply to the base-band part of the transmitter.

184. With respect to the WirelessMAN-OFDMA physical layer (PHY) specification,[7] the downlink burst profile encodings are shown in Table 359 and Table 363 (both reproduced below). Ex. 1013, 660, 664. Table 359 shows

[7] As discussed in the overview section, the standard is designed to work with a WirelessMAN-OFDMA physical layer (PHY) specification. Ex. 1013, ii (Abstract), iv (Introduction), 2 (PHY compliance). I have particularly addressed this PHY layer here because later claims deal with OFDMA, but downlink burst profiles for other PHY layers would also meet this claim.

common burst profile encodings, while Table 363 shows burst profile encodings for the WirelessMAN-OFDMA PHY. Ex. 1013, 660, 663.

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.

185. As shown in Table 363, the FEC Code type parameter specifies, the modulation type (e.g., QPSK, 16-QAM, or 64-QAM), the FEC type (e.g., convolutional code (CC), block turbo code (BTC), or convolution turbo code (CTC)), and the code rate (e.g., 1/2 or 3/4). Ex. 1013, 663.

186. In addition to these parameters, there are further parameters in the headers for the RNG-REQ message, which is just one of the MAC Management messages that may be carried in the payload portion of a MAC PDU. Ex. 1013, 35-43 (Table 14 shows that the Ranging Request message is the MAC Management Message when Type = 4). The format for the MAC PDU is shown in Figure 18 (reproduced below). Ex. 1013, 35.

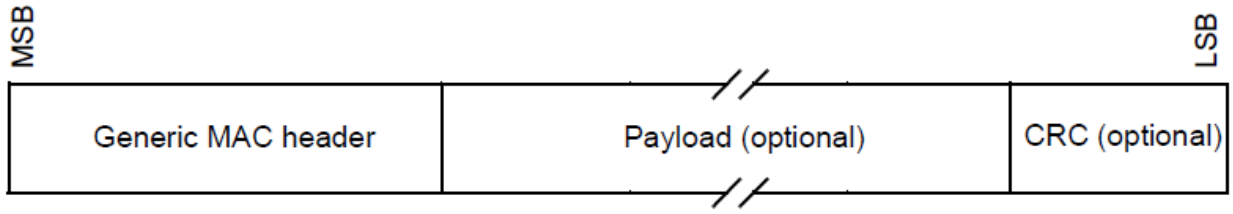


Figure 18—MAC PDU formats

187. IEEE Std 802.16-2004 explains that there are two MAC headers formats: a generic MAC header and a bandwidth request header. Ex. 1013, 35. The generic MAC header is shown in Figure 19 (reproduced below).

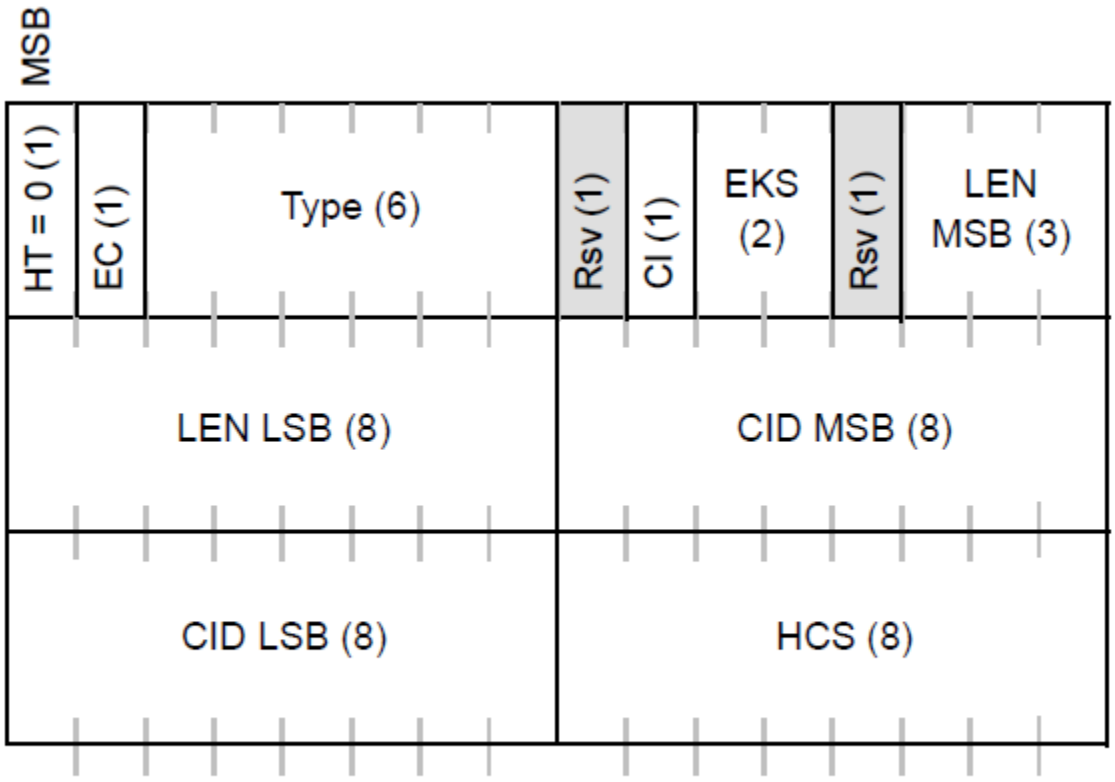


Figure 19—Generic MAC header format

188. As shown in Figure 19 above, the MAC header (which would be a header for the RNG-REQ message) includes numerous parameters (referred to as "fields"). Ex. 1013, 37. The parameters (or fields) of the MAC header are defined in Table 5 (reproduced below). Ex. 1013, 37.

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.

189. As shown from the table above, one of the parameters is a connection identifier (CI), which is discussed again further below. Ex. 1013, 37. Another parameter/field is the type field that indicates which subheaders are present in the payload portion of the MAC PDU. Ex. 1013, 37. There are five types of subheaders: Mesh, Fragmentation, FAST-FEEDBACK Allocation, Grant Management, and Packing. Ex. 1013, 39. These subheaders also include additional parameters. Ex. 1013, 39-42.

190. Thus, the Ranging Request (RNG-REQ) message, collectively from its different portions (i.e., MAC header, subheaders, payload, and CRC), specifies a plurality of parameters that meets the claimed "first plurality of parameters."

Moreover, the plurality of parameters of the RNG-REQ message (in particular, the Requested Downlink Burst Profile parameter which would be in the payload portion) are used for forming a Ranging Response (RNG-RSP) message (the claimed "physical layer probe"), which is generated in response to a received RNG-REQ message. Ex. 1013, 50, 199-213. Therefore, the plurality of parameters of the RNG-REQ message comprise "a form for the probe including a modulation profile for the probe," as claimed.

191. In addition, the Ranging Response (RNG-RSP) message is the claimed "physical layer probe" at least because it is configured to "maintain the quality of the RF communication link," which is the PHY layer, between the SS and BS. Ex. 1013, 199. A POSITA would have also understood that the Ranging Response message is a "physical layer probe" because it is transmitted to ensure the correct timing and preferred power for transmissions over the PHY layer. Ex. 1013, 174-182. IEEE Std 802.16-2004 provides the format for the RNG-RSP message in Table 20 (reproduced below). Ex. 1013, 50.

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
}		

192. As shown in the table above, the RNG-RSP message also includes TLV Encoded Information, which would have included numerous parameters like a Ranging Status parameter, Timing Adjust Information parameters, Power Adjust Information, etc. Ex. 1013, 50, 665-666 (Section 11.6 RNG-RSP management message encodings). The "ranging code index" is another example of data that is in the payload of the RNG-RSP message. Ex. 1013, 49-51, 204-213 (Section 6.3.10.3 describing codes for OFDMA-based ranging), 576-579 (Section 8.4.7 describing codes for OFDMA ranging), 665-666 (Section 11.6 describing RNG-RSP management message encodings including ranging code in Table 369).

193. In conclusion, IEEE Std 802.16-2004 teaches a SS transmitting a Ranging Request message to a BS, the Ranging Request message specifying a plurality of parameters for the physical layer Ranging Response message, the plurality of parameters comprising a form for the Ranging Response message including a downlink burst profile for the Ranging Response message. This teaches "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" in limitation [9A]. Thus, IEEE Std 802.16-2004 teaches limitation [9A].

c) [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."

194. As I explained above, the Ranging Request (RNG-REQ) message will cause the BS (the claimed "second node") to generate and transmit the Ranging Response (RNG-RSP) message (the claimed "probe"). Ex. 1013, 49-50, 199-213. IEEE Std 802.16-2004 describes that the Ranging Request message has a plurality of parameters (the claimed "first plurality of parameters") used to generate the Ranging Response message, which is received by the SS (the claimed "first node"). Ex. 1013, 49-51, 199-213. As shown in Table 20 (reproduced below), the Ranging Response message also includes a plurality of parameters (the claimed "second plurality of parameters"), such as the Management Message Type parameter, the Uplink Channel ID parameter, and the parameters for the TLV Encoded Information (which includes numerous parameters, like a Ranging Status parameter, as explained above). Ex. 1013, 50.

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
}		

195. A POSITA would have understood that these parameters must be determined in order to generate and transmit the Ranging Response message. For example, the status for the Ranging Status parameter must be determined to be abort, continue, or success. Ex. 1013, 50, 199-213. As another example, the BS would have determined the time and power corrections to be sent in the Ranging Response message. Ex. 1013, 50, 199-213. Therefore, the plurality of parameters in the Ranging Request message (the claimed "first plurality of parameters") and the plurality of parameters for the Ranging Response message (the claimed "second plurality of parameters") are used to generate the Ranging Response message (the claimed "probe").

196. In conclusion, IEEE Std 802.16-2004 teaches the SS receiving the Ranging Response message from the BS, wherein the Ranging Response message is generated in accordance with the plurality of parameters in the Ranging Request message and in accordance with the plurality of parameters for the Ranging Response message as determined by the BS. This teaches "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" in limitation [9B]. Thus, IEEE Std 802.16-2004 teaches limitation [9B].

9. Dependent Claim 10: "The method of claim 9, wherein the probe request is configured such that the probe emulates an OFDMA transmission."

197. Claim 10 of the '690 patent depends from claim 9, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 10 further requires that "the probe request is configured such that the probe emulates an OFDMA transmission." Ex. 1001, claim 10. IEEE Std 802.16-2004 also teaches this feature as explained below. Claim 10 is similar to claim 5 and thus the reasons below are similar to the reasons given above for claim 5.

198. IEEE Std 802.16-2004 teaches using a WirelessMAN-OFDMA physical layer (PHY) specification. Ex. 1013, ii (Abstract), iv (Introduction), 2 (PHY compliance). A POSITA would have understood that messages sent on this PHY layer emulate an OFDMA transmission. Ex. 1013, 493-501. The Ranging Response message (the claimed "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.

199. Further, as I explained above, the Requested Downlink Burst Profile parameter of the Ranging Request message (the claimed "probe request") provides a downlink burst profile to be used by the BS to format and send the Ranging Response message on the downlink to the SS. Ex. 1013, 49, 199-201, 314-316, 547, 660, 663. The downlink burst profile encodings are shown in Table 359 and

Table 363 (both reproduced below). Ex. 1013, 660, 663, 547 (Section 8.4.5.5 providing the OFDMA downlink burst profile format). Table 359 shows common burst profile encodings, while Table 363 shows burst profile encodings for the WirelessMAN-OFDMA PHY. Ex. 1013, 660, 663.

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.

200. As shown in Table 363, the FEC Code type parameter specifies, the modulation type (e.g., QPSK, 16-QAM, or 64-QAM), the FEC type (e.g.,

convolutional code (CC), block turbo code (BTC), or convolution turbo code (CTC)), and the code rate (e.g., 1/2 or 3/4). Ex. 1013, 663. Because the Ranging Request message provides the downlink burst profile and downlink burst profile modulates the Ranging Response message for transmission through the OFDMA PHY layer, the Ranging Request message is configured such that the Ranging Response message emulates an OFDMA transmission.

201. In conclusion, IEEE Std 802.16-2004 teaches that the Ranging Request message is configured such that the Ranging Response message emulates an OFDMA transmission for delivery through the OFDMA PHY layer. This teaches the "wherein the probe request is configured such that the probe emulates an OFDMA transmission" in claim 10. Thus, IEEE Std 802.16-2004 teaches claim 10.

10. Dependent Claim 14: "The method of claim 9, wherein the probe request is transmitted at a specific time."

202. Claim 14 of the '690 patent depends from claim 9, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 14 further requires that "the probe request is transmitted at a specific time," but says nothing about what the specific time is or how it is determined. Ex. 1001, claim 14. IEEE Std 802.16-2004 also teaches this feature, which was previously shown above but will be specifically addressed below.

203. IEEE Std 802.16-2004 explains that: "First, an SS shall synchronize to the downlink and learn the uplink channel characteristics through the UCD MAC management message. At this point, the SS shall scan the UL-MAP message to find an Initial Ranging Interval. The BS shall allocate an Initial Ranging Interval consisting of one or more transmission opportunities." Ex. 1013, 174-175. IEEE Std 802.16-2004 further states that "the SS shall put together a RNG-REQ message to be sent in an Initial Ranging Interval" and that "[w]hen the Initial Ranging transmission opportunity occurs, the SS shall send the RNG-REQ message." Ex. 1013, 175. Such ranging transmission opportunities are specific times based on the synchronization that the SS performs prior to ranging. Ex. 1013, 167-171.

204. In conclusion, the Ranging Request message is transmitted at a specific time specified by the ranging transmission opportunity. This teaches "wherein the probe request is transmitted at a specific time" in claim 14. Thus, IEEE Std 802.16-2004 teaches claim 14.

11. Dependent Claim 15: "The method of claim 9, wherein the probe request is configured to diagnose a network problem."

205. Claim 15 of the '690 patent depends from claim 9, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 15 further requires that "the probe request is configured to diagnose a network problem," but says nothing about what the network problem is. Ex. 1001, claim 15. IEEE Std 802.16-2004

also teaches this feature as explained below. Claim 15 is similar to claim 7 and thus the reasons below are similar to the reasons given above for claim 7.

206. The Ranging Request message (the claimed "probe request") is configured to cause the BS to send the Ranging Response message. Ex. 1013, 49-50, 199-213. Further, IEEE Std 802.16-2004 states that "Ranging is a collection of processes by which the SS and BS maintain the quality of the RF communication link between them." Ex. 1013, 199. Therefore, the Ranging Request message assists in diagnosing a problem with the RF communication link between the SS and the BS (the claimed "network problem"). If the Ranging Request message is not successful, the BS may send a Ranging Response message with a ranging status parameter that commands the SS to continue ranging and data (e.g., timing adjustment data, power level adjustment data, or offset frequency adjustment data) for making adjustments in an attempt to improve the RF communication link. Ex. 1013, 202-213, 665-666 (Section 11.6 describing RNG-RSP management message encodings). Alternatively, if the Ranging Request message has not been successful for a number of tries, the BS may send a Ranging Response message with a ranging status parameter that commands the SS to abort, such that the process of trying to manage the communications between the SS and BS is terminated. Ex. 1013, 202-213, 665-666 (Section 11.6 describing RNG-RSP management message encodings). Also, IEEE Std 802.16-2004 explains that initial ranging is performed

when communication/synchronization is lost, so another (albeit similar) network problem that ranging is used to diagnose is the loss of synchronization with the BS. Ex. 1013, 169-174 (Sections 6.3.9.1-6.3.9.5 describing that when a signal is lost, the SS scans for a valid downlink signal, obtains downlink and uplink parameters, and then performs initial ranging), 477 (Section 8.3.7.2 describing that initial ranging is performed "when synchronization is lost").

207. In conclusion, IEEE Std 802.16-2004 teaches that the Ranging Request message is configured to diagnose a problem with the RF communication link (such as the timing and power of transmission on it) between the SS and the BS. This teaches the claimed "wherein the probe request is configured to diagnose a network problem" in claim 15. Thus, IEEE Std 802.16-2004 teaches claim 15.

B. IEEE Std 802.16-2004 Renders Obvious Claims 3-5, 8, 11-13, and 16-24

208. Above I addressed how IEEE Std 802.16-2004 anticipates many of the '690 patent's claims. It is my opinion that IEEE Std 802.16-2004 does not expressly disclose the remaining claims, but it does render them obvious as I explain below.

1. Dependent Claim 3

a) [3PRE]: "The method of claim 1, wherein at least one of the probe parameters indicates:"

209. Claim 3 of the '690 patent depends from claim 1, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 3 further includes a list of different pieces of data/information that the probe parameters indicate.[8] Ex. 1001, claim 3. In my opinion, the ordinary meaning of claim 3 requires one parameter to indicate all of the listed pieces of data/information. To the extent that claim 3 is considered to encompass multiple parameters that collectively indicate all of the listed pieces of data/information, I have shown how IEEE Std 802.16-2004 teaches each of the pieces of the data/information listed in claim 3. Specifically, below I have shown how IEEE Std 802.16-2004 teaches each of limitations [3A]-[3G].

b) [3A]: "a) a modulation profile for the probe;"

210. As I explained above, IEEE Std 802.16-2004 teaches limitation [3A]. See Section XII.A.3.b.

[8] I note that the term "probe parameters" is not exactly included in independent claim 1 and therefore it is unclear whether this term refers to "the first plurality of parameters," "the second plurality of parameters" or both. For purposes of my analysis in this declaration, I have assumed "the probe parameters" refers to both "first plurality of parameters" and "second plurality of parameters."

c) [3B]: "b) the number of times to transmit the probe;"

211. IEEE Std 802.16-2004 does not expressly describe a Ranging Request message including a number of times that the BS should transmit the same Ranging Response message. However, IEEE Std 802.16-2004 recognizes that collisions during ranging may occur and therefore teaches contention resolution. Ex. 1013, 165-166. As part of the contention resolution, IEEE Std 802.16-2004 teaches a SS performing a retry process of resending Ranging Request messages if it does not receive a Ranging Response as expected. Ex. 1013, 166 (IEEE Std 802.16-2004 describes that response is deemed lost if there is "no response within T3 for initial ranging), 177 ("It is possible that the RNG-RSP may be lost after transmission by the BS."), 638 (Table 342 showing T3 – "Ranging Response reception timeout following the transmission of a Ranging Request"). IEEE Std 802.16-2004 also teaches that the SS will continue to retry sending of the Ranging Request message until a "maximum number…of retries has been reached." Ex. 1013, 166. Likewise, the BS will continue sending Ranging Response messages for a number of retries. Ex. 1013, 176 (referring to retry counts in Table 342), 637 (Table 342 showing Invited Ranging Retries parameter for specifying the "Number of retries on inviting Ranging Requests"). Further, IEEE Std 802.16-2004 teaches the BS determining if a number of ranging correction retries has been exhausted and aborting ranging if so or sending another RNG-RSP message to continue

ranging if not. Ex. 1013, 181 (Figure 63's step of "Ranging Correction Retries exhausted"), 202-203 (describing process of aborting ranging if a "sufficient number of correction messages are issued" and showing this in Figure 82).

212. Based on the above teachings of IEEE Std 802.16-2004, a POSITA would have found it obvious to modify the Ranging Request message to include a parameter that indicates a number of times to transmit the Ranging Response message (the claimed "probe"). In particular, it would have been obvious to include the number of times to transmit the Ranging Response message as an encoded TLV in the Ranging Request message. The TLV encoded information is variable in size and intended to provide network administrators (or service providers) with the desired flexibility to include information in MAC management messages like the Ranging Request message. Ex. 1013, 49, 50 ("To provide for flexibility," message parameters are encoded in a TLV form.), 307 (evidencing that service providers want the flexibility to optimize system deployments).

213. A POSITA would have been motivated to include, in the Ranging Request, a parameter that indicates the number of times that the BS should transmit the Ranging Response message. A POSITA would have been motivated to do this because it improves "flexibility in controlling the contention resolution" which would have been desirable as evidenced by IEEE Std 802.16-2004. Ex. 1013, 166 ("The BS has much flexibility in controlling the contention resolution."). A

POSITA would have understood that the Ranging Response message might get lost or missed by the intended SS because of a collision and a POSITA would have wanted the Ranging Response message to be successfully delivered to the intended SS. A POSITA would have wanted the Ranging Response message to be successfully delivered so that the ranging procedure is successfully performed which is done to obtain and maintain a good quality RF communication link between the SS and BS. Therefore, a POSITA would have been motivated to implement a process by which the BS retries sending the Ranging Response message in case it is unsuccessful. A POSITA would have been motivated to have the Ranging Request message indicate the number of retries for the Ranging Response because it is the Ranging Request message that causes the Ranging Response message to be sent. A POSITA would have configured the system to have the SS decide the number of retries and including it in the Ranging Request message as opposed to having it be a fixed number, so that the system had more flexibility. A POSITA would have realized that there are certain situations in which the number of Ranging Response messages should be higher, such as when a SS is located far from a BS. A POSITA would have wanted to enable an SS that is far from a BS to be able to indicate a higher number of times that the Ranging Response message should be sent in comparison to another SS that is closer to the BS.

214. In addition, given the POSITA's skill set, which would have included programming skills to add or modify parameters in various messages including MAC layer messages, a POSITA would have been successful in modifying the Ranging Request message to include a parameter that indicates a number of times to transmit the Ranging Response message. This would have been straightforward to do by adding it to the TLV Encoded information of the Ranging Request message, which has a variable size to permit such additions. Ex. 1013, 49.

215. In conclusion, based on IEEE Std 802.16-2004, a POSITA would have found it obvious to configure the Ranging Request message to include a plurality of parameters wherein at least one of them indicates a number of times to transmit the Ranging Response message. This teaches the claimed "wherein at least one of the probe parameters indicates…the number of times to transmit the probe" in limitation [3B]. Thus, IEEE Std 802.16-2004 teaches limitation [3B].

d) [3C]: "c) a number of symbols for the payload of the probe;"

216. IEEE Std 802.16-2004 does not expressly disclose a parameter indicating a number of symbols for the payload of the Ranging Response message (the claimed "probe"). However, as I explained above, IEEE Std 802.16-2004 teaches the Ranging Request Message indicating a downlink burst profile that should be used to send the Ranging Response message in response. Ex. 1013, 49, 199. The downlink burst profile specifies the modulation type, FEC code type, and

code rate. Ex. 1013, 663. This information would dictate the number of symbols for the payload of the Ranging Request message. As explained with respect to the OFDMA PHY layer, the basic structure of the Ranging Request message and Ranging Response message sent on the OFDMA PHY layer is the OFDMA symbol. Ex. 1013, 494. IEEE Std 802.16-2004 explains that "An OFDMA symbol is made up of subcarriers, the number of which determines the FFT size used." Ex. 1013, 494. These subcarriers include data subcarriers, which are used for data transmission (i.e., payloads). A POSITA would have understood that payload of the Ranging Response message is measured in terms of number of symbols.

217. Therefore, because the Ranging Request message dictates the form that the Ranging Response message is to be sent with and the data that is to be sent in the payload of the Ranging Response message, it follows that the Ranging Request message would have been implemented to include the number of symbols for the payload of the Ranging Request message. A POSITA would have been motivated to include, in the Ranging Request message, a parameter that indicates the number of symbols for the payload of the Ranging Response message. A POSITA would have been motivated to do this because it improves the ability of the SS to control the amount of data that the SS would have to process when the Ranging Response message is returned. This in turn allows for different types of

SSs to be manufactured and deployed in the wireless network. For example, a manufacturer would have developed a SS that is capable of handling more data and therefore prefers to receive Ranging Response messages with larger payloads (e.g., including more parameters for making adjustments to maintain the RF link). A POSITA would have been motivated to design the wireless network in accordance with IEEE Std 802.16-2004 so that various SSs with various capabilities were able to be deployed. In other words, a POSITA would have designed the wireless network described in IEEE Std 802.16-2004 to provide flexibility in how Ranging Request messages and Ranging Response messages are formulated so that ranging would have been performed by various devices with different capabilities.

218. In addition, given the POSITA's skill set, which would have included programming skills to add or modify parameters in various messages including MAC layer messages, a POSITA would have been successful in modifying the Ranging Request message to include a parameter that indicates a number of symbols for the payload of the Ranging Response message. This would have been straightforward to do by adding it to the TLV Encoded information of the Ranging Request message, which has a variable size to permit such additions. Ex. 1013, 49.

219. In conclusion, based on IEEE Std 802.16-2004, a POSITA would have found it obvious to configure the Ranging Request message to include a plurality of parameters wherein at least one of them indicates a number of symbols

for the payload of the Ranging Response message. This teaches the claimed "wherein at least one of the probe parameters indicates… a number of symbols for the payload of the probe" in limitation [3C]. Thus, IEEE Std 802.16-2004 teaches limitation [3C].

e) [3D]: "d) a preamble type for the probe;"

220. IEEE Std 802.16-2004 does not expressly disclose a parameter indicating a preamble type for the Ranging Response message (the claimed "probe"). However, IEEE Std 802.16-2004 teaches that each frame in a downlink transmission (like the Ranging Response message) begins with a preamble when the OFDMA PHY layer is used. Ex. 1013, 499, 501 (Figure 219 showing that the preamble must appear in every frame). IEEE Std 802.16-2004 provides an example of such frame in Figure 218 (reproduced below), which shows the preamble.

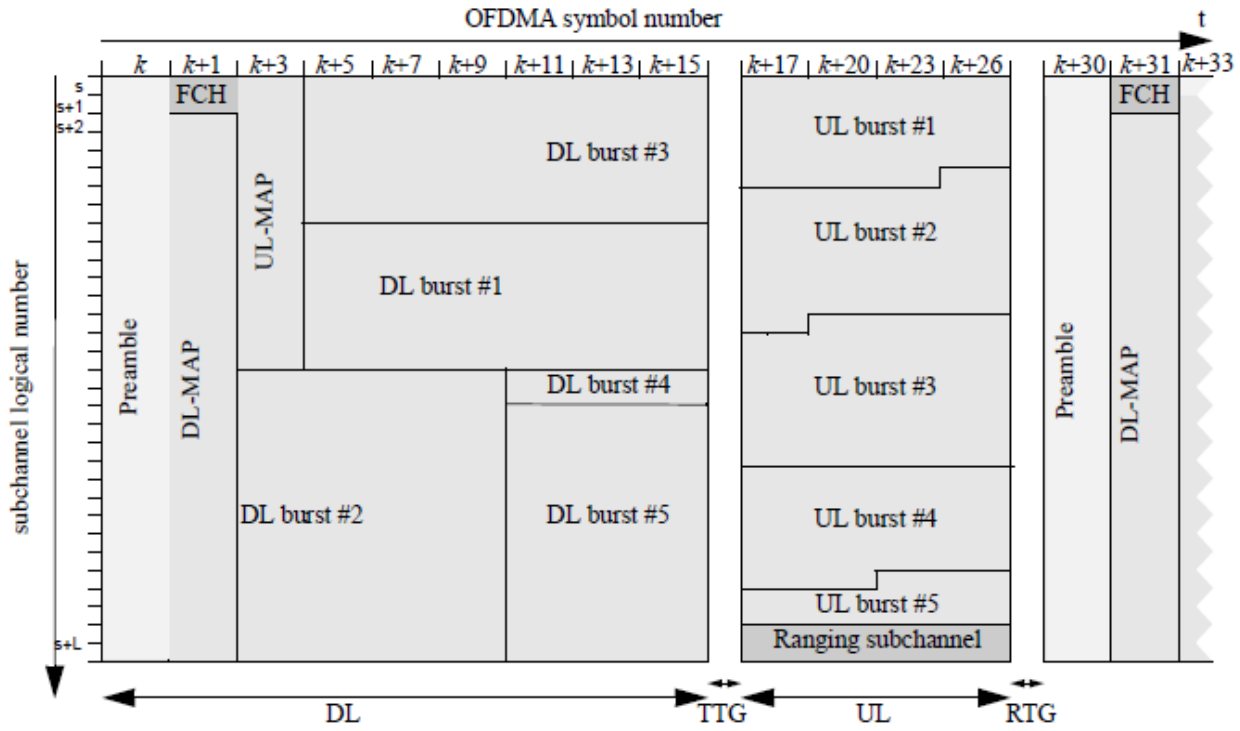


Figure 218—Time plan - one TDD time frame (with only mandatory zone)

221. IEEE Std 802.16-2004 also teaches that there are different types of preambles, such as the preamble for a downlink in an adaptive antenna system (AAS). Ex. 1013, 163-164 (IEEE Std 802.16-2004 describing an "AAS specific Preamble" and showing a "Regular DL Preamble" in Figures 52 and 53), 507 (IEEE Std 802.16-2004 describing the AAS DL preamble). IEEE Std 802.16-2004 also teaches that the Ranging Request message may include a parameter called "AAS broadcast capability." Ex. 1013, 49. Therefore, a POSITA would have understood that this parameter of the Ranging Request message would indicate to the BS that it should use the AAS DL preamble for the Ranging Response message to be sent on the downlink in response. IEEE Std 802.16-2004 explains that

"AAS…can improve range and system capacity by adapting the antenna pattern and concentrating its radiation to each individual subscriber." Ex. 1013, 162. IEEE Std 802.16-2004 also recognizes the additional benefits of AAS including increased spectral efficiency, improved signal-to-noise ratio (SNR) gain, and reduction in interference. These benefits would have motivated a POSITA to use AAS, and therefore to include the AAS broadcast capability parameter in the Ranging Request message to indicate that the BS should use AAS (whenever possible) to send the Ranging Response message, which means sending the AAS DL preamble for the Ranging Response message.

222. Further, because the Ranging Request message dictates the form of the Ranging Response message to be sent on the downlink, it follows that the Ranging Request message would have been implemented to include a parameter that indicates a preamble type for the Ranging Response. Ex. 1013, 531 (IEEE Std 802.16-2004 describing a "Preamble Modifier Type" parameter for setting a characteristic of a downlink.) For example, the Ranging Request message would have been implemented to include a parameter that indicates whether an AAS DL preamble should be used or another preamble should be used for the Ranging Response message. A POSITA would have been motivated to include, in the Ranging Request message, a parameter that indicates the preamble to be used for the Ranging Response message. A POSITA would have been motivated to do this

because the preamble is a fundamental part of the Ranging Response message and the BS would have had to determine a type of preamble to be sent for the Ranging Response message. Ex. 1013, 499, 501. Also, a POSITA would have wanted to give the SS the ability to control how the Ranging Response message is formatted beyond just providing the downlink burst profile. For example, if an SS was AAS capable, it would have wanted to control the formatting of the Ranging Response message to use the AAS DL preamble, thereby availing itself of the above discussed advantages of AAS.

223. In addition, given the POSITA's skill set, which would have included programming skills to add or modify parameters in various messages including MAC layer messages, a POSITA would have been successful in modifying the Ranging Request message to include a parameter that indicates a preamble type for the Ranging Response message. This would have been straightforward to do by adding it to the TLV Encoded information of the Ranging Request message, which has a variable size to permit such additions. Ex. 1013, 49.

224. In conclusion, based on IEEE Std 802.16-2004, a POSITA would have found it obvious to configure the Ranging Request message to include a plurality of parameters wherein at least one of them indicates a preamble type for the Ranging Response message. This teaches the claimed "wherein at least one of

the probe parameters indicates… a preamble type for the probe" in limitation [3D]. Thus, IEEE Std 802.16-2004 teaches limitation [3D].

f) [3E]: "e) a cyclic-prefix length for the payload of the probe;"

225. IEEE Std 802.16-2004 does not expressly disclose a parameter indicating a cyclic-prefix length for the payload of the Ranging Response message (the claimed "probe"). However, IEEE Std 802.16-2004 teaches a framing procedure including a step 5 of forming a burst (which just refers to the payload portion and not the preamble) by prefixing a segment with a cyclic prefix (CP) of length *dU* symbols, where *U* and *d* are burst profile parameters. Ex. 1013, 387 (Section 8.2.1.4.4.1 describing a Framing procedure with a step 1 that says "The Unique Word length, *U*, is a burst profile parameter."), 388 (includes a step 5 for explaining how CP length is determined). Figure 189 (reproduced below) of IEEE Std 802.16-2004 shows the CP length equal to *dU*. Ex. 1013, 388.

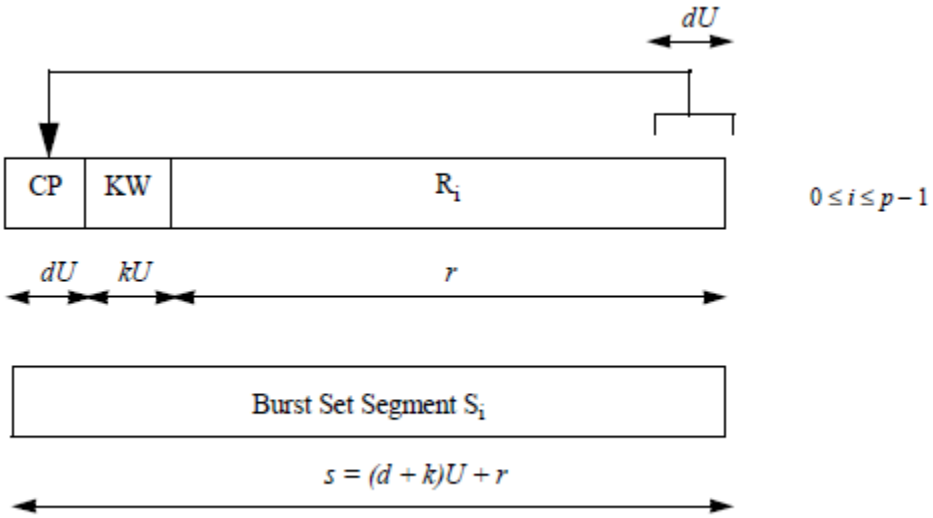


Figure 189—Forming a burst set segment from repeat segments

226. With respect to the OFDMA PHY layer, IEEE Std 802.16-2004 also describes the OFDMA symbol and how it has a symbol period *Ts* that includes a cyclic prefix period *Tg* before a useful symbol period *Tb*. Ex. 1013, 494. IEEE Std 802.16-2004 also explains that the CP Time (which is a cyclic prefix length) is derived from the primitive parameters that characterize the OFDMA symbol. Ex. 1013, 495.

227. Because the Ranging Request message dictates the form of the Ranging Response message to be sent on the downlink by specifying a downlink burst profile, it follows that the Ranging Request message would have been implemented to include a parameter (similar to the *U* and *d* burst profile parameters) that indicates a cyclic prefix length (or cyclic time *Tg*) for the payload of the Ranging Response message. Ex. 1013, 199, 387-388. A POSITA would have been motivated to do this for the same reasons that the downlink burst profile

can be changed by the Ranging Request message, which is to give the SS control over the format of the downlink so that the SS can maintain the quality of the downlink. Ex. 1013, 199. The CP is a fundamental part of downlink transmissions, and a POSITA would have wanted to specify its length whenever specifying the downlink burst profile of the downlink.

228. In addition, given the POSITA's skill set, which would have included programming skills to add or modify parameters in various messages including MAC layer messages, a POSITA would have been successful in modifying the Ranging Request message to include a parameter that indicates a cyclic-prefix length for the payload of the Ranging Response message. This would have been straightforward to do by adding it to the TLV Encoded information of the Ranging Request message, which has a variable size to permit such additions. Ex. 1013, 49.

229. In conclusion, IEEE Std 802.16-2004 teaches the Ranging Request message including a plurality of parameters wherein at least one of them indicates a cyclic-prefix length for the payload of the Ranging Response message. This teaches the claimed "wherein at least one of the probe parameters indicates… a cyclic-prefix length for the payload of the probe" in limitation [3E]. Thus, IEEE Std 802.16-2004 teaches limitation [3E].

g) [3F]: "f) a transmit power for the probe; and"

230. IEEE Std 802.16-2004 does not expressly disclose a parameter indicating a transmit power for the Ranging Response message (the claimed "probe"). However, IEEE Std 802.16-2004 teaches that all nodes (both BS and SS) may be in a mesh network in which they shall transmit MSH-NCFG messages, which are a type of MAC management message. Ex. 1013, 81 ("MSH-NCFG messages provide a basic level of communication between nodes in different nearby networks whether from the same or different equipment vendors or wireless operators."). In Table 65, IEEE Std 802.16-2004 teaches that the MSH-NCFG message includes MSH-Nbr Logical IE, which is shown in Table 67 (reproduced below). Ex. 1013, 81-84.

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
}		

231. As shown in Table 67, this Nbr Logical IE includes a transmit power parameter called "Nbr Xmt Power." Ex. 1013, 184. The Nbr Xmt Power parameter is a four bit value that provides the suggested transmit power for the

neighbor node to use for communicating on the link with the node sending this parameter. Ex. 1013, 184-185.

232. Because the Ranging Request message dictates the form of the Ranging Response message to be sent on the downlink by specifying a downlink burst profile, it follows that the Ranging Request message would have been implemented to include a parameter (similar to the Nbr Xmt Power parameter) that indicates a power to be used by the BS in sending the Ranging Response message on the downlink. Ex. 1013, 81-84. A POSITA would have been motivated to do this for the same reasons that the downlink burst profile can be changed by the Ranging Request message, which is to give the SS control over the format of the downlink so that the SS can maintain the quality of the downlink. Ex. 1013, 199. Transmission power is a fundamental part of downlink transmissions, and a POSITA would have wanted to specify it whenever specifying the downlink burst profile of the downlink.

233. In addition, given the POSITA's skill set, which would have included programming skills to add or modify parameters in various messages including MAC layer messages, a POSITA would have been successful in modifying the Ranging Request message to include a parameter that indicates a transmit power for the Ranging Response message. This would have been straightforward to do

by adding it to the TLV Encoded information of the Ranging Request message, which has a variable size to permit such additions. Ex. 1013, 49.

234. In conclusion, based on IEEE Std 802.16-2004, a POSITA would have found it obvious to configure the Ranging Request message to include a plurality of parameters wherein at least one of them indicates a transmit power for the Ranging Response message. This teaches the claimed "wherein at least one of the probe parameters indicates… a transmit power for the probe" in limitation [3F]. Thus, IEEE Std 802.16-2004 teaches limitation [3F].

h) [3G]: "g) a transmit power scaling factor for the payload of the probe."

235. IEEE Std 802.16-2004 does not expressly disclose a parameter indicating a transmit power scaling factor for the payload of the Ranging Response message (the claimed "probe"). However, IEEE Std 802.16-2004 teaches that the Ranging Response message includes a Power Adjust Information parameter. Ex. 1013, 50. A POSITA would have understood that the Power Adjust Information parameter provides a transmit power scaling factor for controlling the node that receives this parameter to adjust its power for subsequent transmissions. Ex. 1013, 80 (describing a similar Power Adjust parameter that expresses the change in power level in multiples of 0.25 dB).

236. Because the Ranging Request message dictates the form of the Ranging Response message to be sent on the downlink by specifying a downlink

burst profile, it follows that the Ranging Request message would have been implemented to include a parameter (similar to the Power Adjust Information and Power Adjust parameters) that indicates a power scaling factor to be used by the BS in sending the Ranging Response message on the downlink. Ex. 1013, 49-50, 80. A POSITA would have been motivated to do this for the same reasons that the downlink burst profile can be changed by the Ranging Response message, which is to give the SS control over the format of the downlink so that the SS can maintain the quality of the downlink. Ex. 1013, 199. Transmission power is a fundamental part of downlink transmissions, and a POSITA would have wanted to specify it whenever specifying the downlink burst profile of the downlink. Further, the BS would have already had a set (e.g., default or preset) transmit power for the downlink, so it would have been obvious for the SS to provide a scaling factor by which the BS should adjust its previously set transmit power. Also, because the scaling factor would be for the entire Ranging Response message, it would have been for the payload of the Ranging Response message as well. Alternatively, in some instances, a POSITA would have configured the system to use a higher power for just the payload portion of the Ranging Response message, and therefore the scaling factor would have been provided to specifically adjust the payload portion. A POSITA would have been motivated to configure the BS to specifically increase the power of the payload to ensure successful delivery.

237. In addition, given the POSITA's skill set, which would have included programming skills to add or modify parameters in various messages including MAC layer messages, a POSITA would have been successful in modifying the Ranging Request message to include a parameter that indicates a transmit power scaling factor for the payload of the Ranging Response message. This would have been straightforward to do by adding it to the TLV Encoded information of the Ranging Request message, which has a variable size to permit such additions. Ex. 1013, 49.

238. In conclusion, based on IEEE Std 802.16-2004, a POSITA would have found it obvious to configure the Ranging Request message to include a plurality of parameters wherein at least one of them indicates a transmit power scaling factor for the payload of the Ranging Response message. This teaches the claimed "wherein at least one of the probe parameters indicates… a transmit power scaling factor for the payload of the probe" in limitation [3G]. Thus, IEEE Std 802.16-2004 teaches limitation [3G].

2. Dependent Claim 4: "The method of claim 3, wherein the probe request identifies a hidden node."

239. Claim 4 depends from claim 3. If only obviousness is found for claim 3, then obviousness should be found for claim 4. As I explained above, IEEE Std 802.16-2004 teaches claim 4. See Section XII.A.4.

3. Dependent Claim 5: "The method of claim 3, wherein the modulation profile for the probe emulates an orthogonal frequency division multiple access (OFDMA) transmission."

240. Claim 5 depends from claim 3. If only obviousness is found for claim 3, then obviousness should be found for claim 5. As I explained above, IEEE Std 802.16-2004 teaches claim 5. See Section XII.A.5.

4. Dependent Claim 8: "The method of claim 7, wherein the probe request is generated by a network operator and uploaded to the second node."

241. Claim 8 of the '690 patent depends from claim 7, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 8 further requires that "the probe request is generated by a network operator and uploaded to the second node." Ex. 1001, claim 8. Although IEEE Std 802.16-2004 does not expressly disclose this feature, in my opinion a POSITA would have understood that it teaches this feature as explained below.

242. As I explained above with respect to claim 6, IEEE Std 802.16-2004 teaches that the Ranging Request message (the claimed "probe request") is generated and transmitted by the SS (the claimed "second node"). Ex. 1013, 49, 199-213. IEEE Std 802.16-2004 also teaches that the Ranging Request message is a MAC management message and that MAC management messages are "carried in the Payload of the MAC PDU." Ex. 1013, 42-43. The MAC layer puts the MAC Management messages, such as the Ranging Request message, in the MAC PDU.

Ex. 1013, 35. The MAC layer includes three sublayers as illustrated in Figure 1 of IEEE Std 802.16-2004 (reproduced below). Ex. 1013, 3.

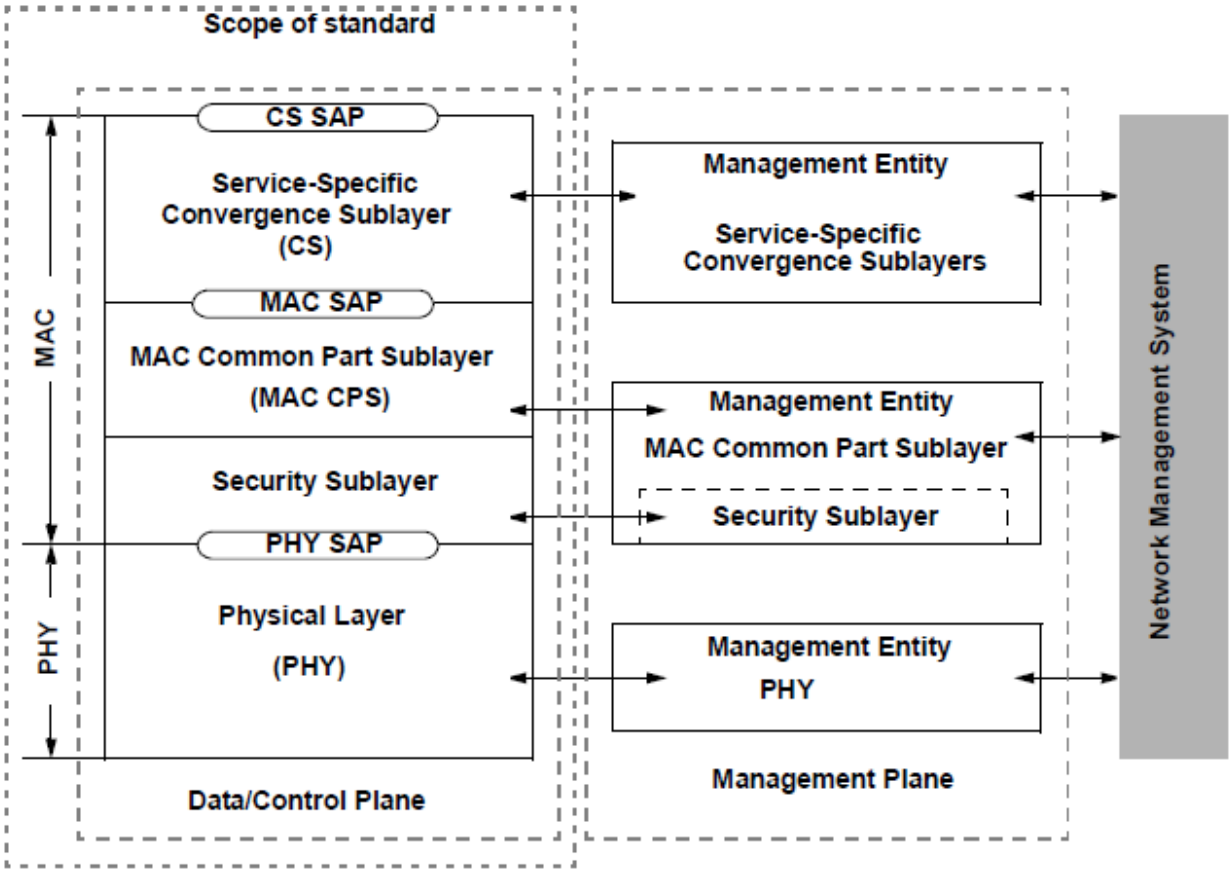


Figure 1—IEEE Std 802.16 protocol layering, showing SAPs

243. As shown in the figure above, the three sublayers of the MAC are the Service-Specific Convergence Sublayer (CS), the MAC Common Part Sublayer (MAC CPS), and the Security Sublayer. Ex. 1013, 3-4. The figure above also illustrates (i) the CS service access point (CS SAP) that enables the MAC to receive external network data; (ii) the MAC service access point (MAC SAP) that enables the CS sublayer to pass MAC SDUs to the CPS sublayer; and (iii) the PHY

layer service access point (PHY SAP) that enables the MAC layer to transfer data, PHY control, and statistics to the PHY layer. Ex. 1013, 3-4. In addition, the figure above shows that the management plane including management entities that allow the network management system to interface with the MAC layer. Ex. 1013, 3. A POSITA would have understood that these network management entities and/or network management system correspond to the claimed "network operator" because they manage or operate the MAC layer of the SS.

244. Further, IEEE Std 802.16-2004 states that "The MAC CPS provides the core MAC functionality of system access, bandwidth allocation, connection establishment, and connection maintenance. It receives data from the various CSs, through the MAC SAP, classified to particular MAC connections. An example of MAC CPS service definition is given in Annex C." Ex. 1013, 4. Annex C "describes services between the MAC and the CSs" and provides example primitives for the purpose of "describe[ing] the information that must necessarily be exchanged between the MAC and the CSs to enable each to perform its requirements as specified in the remainder of [IEEE Std 802.16-2004]." Ex. 1013, 841. IEEE Std 802.16-2004 explains that "the information flow across the boundaries between the layers can be defined in terms of primitives that represent different items of information and cause actions to take place." Ex. 1013, 841. IEEE Std 802.16-2004 gives several example primitives, one of which is

MAC_CREATE_SERVICE FLOW.request. A POSITA would have understood that this primitive would have been used by a network management entity and/or network management system to create/generate MAC management messages, such as the Ranging Request message. Ex. 1013, 841-842 (MAC_CREATE_SERVICE FLOW.request "is issued by a CS entity in a BS or SS unit to request the dynamic addition of a connection"). A POSITA would have further understood that the created Ranging Request message would then be uploaded to the MAC layer for insertion into a MAC PDU (which I described above). A POSITA would have known that, in practice, the MAC layer of a receiver and/or transmitter is generally managed/operated with a separate processor (commonly referred to as a network operator). For example, Bitran teaches a WiMax compatible terminal 22 having a separate host processor 42 for generating data for the MAC layer of the terminal 22. Ex. 1020, [0052]-[0054], [0064], Figs. 3 and 4. A POSITA would have understood that this arrangement for terminal 22 is one example implementation of the SS in IEEE Std 802.16-2004. Ex. 1020, [0004], [0044]-[0045].

245. In any event, a POSITA would have found it obvious to use the network management entities and/or network management system (which may be implemented with a processor separate from the MAC layer) to generate the Ranging Request message and send it (i.e., upload it) to the SS for transporting 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. Moreover, a POSITA would have been motivated to shift this burden to the network management entities and/or network management system because that system is already in place to manage the MAC layer. Also, by shifting this burden to the network management entities and/or network management system, the MAC layer is able to use its processing power to do other functions, like packaging messages into MAC PDUs.

246. A POSITA would have also expected to achieve success in having the network management entities and/or network management system generate the Ranging Request message and send/upload it to the SS. The MAC layer already has service access points (SAPs) that provide the capability to manage the SS. Indeed, a POSITA would have understood that the service access points (SAPs) of the MAC layer were designed to give administrators flexibility in managing their subscriber stations so that certain functions (like generating Ranging Request messages) may be off loaded from the SS's MAC layer.

247. To the extent that the claimed "network operator" must be physically separate from the claimed "second node," it also would have been obvious to implement the network management entities and/or network management system in IEEE Std 802.16-2004 to be physically separate from the SS. A POSITA would have been motivated to use the network management entities and/or network

management system to manage the SS (for example, by sending MAC messages such as the Ranging Request message to it) in order to allow the SS to be controlled remotely (e.g., from a remote location away from the SS). A POSITA would have also been familiar with programming a SS and a separate device so that the SS is remotely controlled by the separate device. In particular, where the SS is a wireless access point in a remote location (e.g., at a home when a user of the network operator device is at work or, vice versa, at work when a user of the network operator device is at home) and is having issues connecting to a BS, a user of the network operator would have desired the capability to remotely control the wireless access point to cause it to transmit the Ranging Request message. A POSITA would have appreciated this desire and would have implemented the SS and a network operator device such that the network operator device had this remote control/management capability. Designing devices for remote control (e.g., over the Internet) was a routine skill for a POSITA, and therefore, a POSITA would have expected to achieve success in this modification.

248. In conclusion, IEEE Std 802.16-2004 teaches that the Ranging Request message is generated by a network operator and uploaded to the SS. This teaches the claimed "wherein the probe request is generated by a network operator and uploaded to the second node" in claim 8. Thus, IEEE Std 802.16-2004 teaches claim 8.

5. Dependent Claim 11

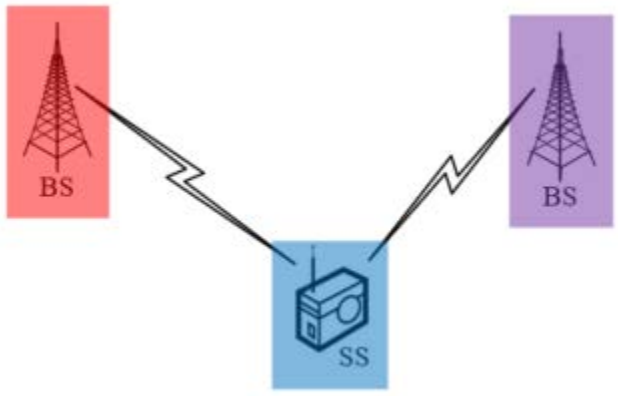
a) [11PRE]: "The method of claim 9, further comprising:"

249. Claim 11 of the '690 patent depends from claim 9, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 11 adds a second instance of sending a probe request and receiving a probe to the first instance in independent claim 9 and the feature of using OFDMA that was in claim 10. It also adds the concept of transmitting two probes "simultaneously." Although IEEE Std 802.16-2004 does not expressly disclose this "simultaneously" feature, in my opinion a POSITA would have understood that it teaches all features of claim 11 as explained below, and therefore teaches limitation [11PRE].

b) [11A]: "a) the first node transmitting a second probe request to a third node;"

250. As I explained above, IEEE Std 802.16-2004 explains that "[a]n RNG-REQ shall be transmitted by the SS at initialization and periodically to determine network delay and to request power and/or downlink burst profile change." Ex. 1013, 49. IEEE Std 802.16-2004 further describes that the RNG-REQ is received by a BS. Ex. 1013, 50, 199-213. As shown in the drawing below, a POSITA would have understood that the system of IEEE Std 802.16-2004 includes a subscriber station (SS), such as a wireless access point (**blue**) communicating with multiple base stations (BS) (**red** and **purple**). Ex. 1013, 166 (IEEE Std 802.16-2004 describes that "an SS can have multiple uplink service

flows (each with its own CID)"), 227 ("Since multiple service flows may exist, there may be multiple state machines active, one for every service flow."), 274 (an SS "shall be able to support up to two simultaneously active AKs" which are authorization keys); Ex. 1016, ¶¶ [0065], [0067] (describing wireless links for IEEE 802.16), [0069]-[0070], [0131]-[0132], [0134], FIGs. 1A-1C (showing subscriber stations 50 and 51 each connected to multiple base stations 20 and 21). The wireless access point (or another type of subscriber station SS) (**blue**) in IEEE Std 802.16-2004 corresponds to the claimed "first node." One of the base stations (**red**) in IEEE Std 802.16-2004 corresponds to the claimed "second node" while the other base station (**purple**) in IEEE Std 802.16-2004 corresponds to the claimed "third node."



251. A POSITA would have understood that the SS transmits one Ranging Request message to one base station and another Ranging Request message to the other base station. Ex. 1013, 49-51. For limitation [9A] above, I relied on the SS (**blue**) sending a Ranging Request message to the BS (**red**). For limitation [11A]

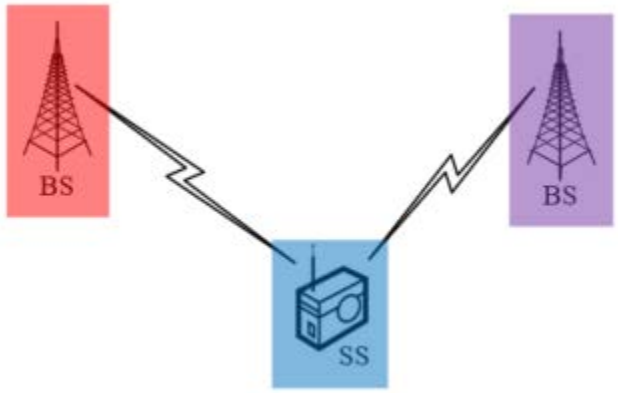
here, I rely on the SS (**blue**) sending another Ranging Request message to the other BS (**purple**). A POSITA would have understood that the SS sends this additional Ranging Request message at least because IEEE Std 802.16-2004 describes that "the SS shall attempt initial ranging on every suitable uplink channel before moving to the next available downlink channel." Ex. 1013, 177 (see Note 2).

252. In conclusion, IEEE Std 802.16-2004 teaches the SS transmitting another Ranging Request message (in addition to the Ranging Request described for limitation [9A]) to another BS (in addition to the BS described for limitation [9A]). This teaches "the first node transmitting a second probe request to a third node" in limitation [11A]. Thus, IEEE Std 802.16-2004 teaches limitation [11A].

c) [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"

253. As I explained above, IEEE Std 802.16-2004 describes the SS receiving a Ranging Response message from a BS, wherein the Ranging Response message is generated according to a Ranging Request message (e.g., in response to the Ranging Request message and based on a Requested Downlink Burst Profile parameter or ranging code in the Ranging Request message). Ex. 1013, 49-51, 199-213, 576-579. As shown in the drawing below (which is the same drawing provided above for limitation [11A]), a POSITA would have understood that the SS (**blue**) receives another Ranging Response message (in addition to the Ranging

Response message in claim 9) from the BS (**purple**), wherein this other Ranging Response message is generated according to the Ranging Request sent from the SS (**blue**) to the BS (**purple**).

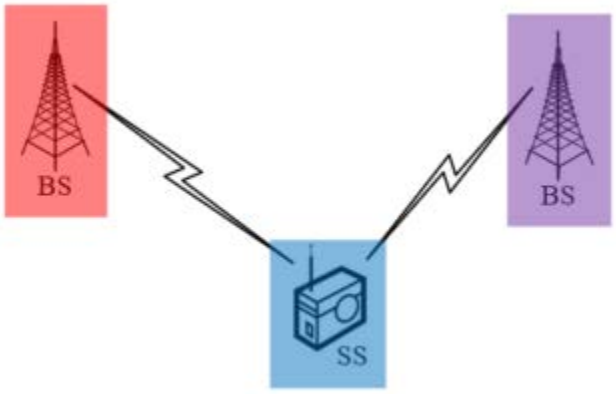


254. In conclusion, IEEE Std 802.16-2004 teaches the SS receiving a second Ranging Response message from another BS (**purple**), wherein the second Ranging Response message is generated according to the Ranging Request message sent from the SS to the BS (**purple**). This teaches "the first node receiving a second probe from the third node, wherein the second probe is generated according to the second probe request" in limitation [11B]. Thus, IEEE Std 802.16-2004 teaches limitation [11B].

d) [11C]: "wherein the first probe and second probe are transmitted simultaneously using OFDMA."

255. First, I note that "the first probe" is not mentioned previously in claim 11 or in claim 9 from which claim 11 depends. I have been asked to treat "the first probe" as referring to "the probe" in claim 9.

256. As I explained above with respect to claim 10, IEEE Std 802.16-2004 teaches using a WirelessMAN-OFDMA physical layer (PHY) specification. Ex. 1013, ii (Abstract), iv (Introduction), 2 (PHY compliance). Any Ranging Response message from a BS to a SS transmitted through the OFDMA PHY layer would have been transmitted using OFDMA. Ex. 1013, 50-51, 204-213, 493-501. With respect to the drawing below (which is the same drawing provided above for limitations [11A] and [11B]), a POSITA would have understood that the SS (**blue**) receives a first Ranging Response message from the BS (**red**) and receives a second Ranging Response message from the BS (**purple**).



257. Further, a POSITA would have understood that these two Ranging Response messages would have been transmitted simultaneously using OFDMA. Because the base stations are different and would use separate downlinks, the base stations would transmit messages (such as the Ranging Response messages) without regard to each other's transmission schedule. The timing of the transmission of each Ranging Response message is based on when a BS receives a

Ranging Request message and when the BS has a slot for transmitting Ranging Responses. These times for one connection between a SS and BS are independent from similar times for another connection between the same SS and another BS. Therefore, with respect to the drawing above, a POSITA would have understood that there would be situations in which the SS has ongoing communication sessions with two different base stations and in which one base station (**red**) would have transmitted a Ranging Response message at the same time that another base station (**purple**) would have transmitted another Ranging Response message. Ex. 1013, 166 (IEEE Std 802.16-2004 describes that "an SS can have multiple uplink service flows (each with its own CID)"), 227 ("Since multiple service flows may exist, there may be multiple state machines active, one for every service flow."), 274 (an SS "shall be able to support up to two simultaneously active AKs" which are authorization keys).

258. These situations would have occurred because a SS would have sent multiple Ranging Request messages on different uplinks. The SS would attempt to connect with multiple BSs simultaneously in order for the SS to determine an optimal connection to the network. A POSITA would have been motivated to design the SS to attempt to connect to multiple BSs simultaneously and simultaneously perform ranging because a POSITA would have wanted the system to find and maintain a good quality RF link. Ex. 1013, 199, 202. In other words,

for the reasons that IEEE Std 802.16-2004 teaches the desire to perform ranging, a POSITA would have been motivated to perform ranging with more than one BS. Ex. 1013, 199, 202. Lastly, a POSITA would have understood that one of the goals or advantages of OFDMA is to more efficiently use bandwidth (by dividing a symbol into subchannels) so that multiple points have simultaneous access to the network. Ex. 1013, 494-495. Because IEEE Std 802.16-2004 uses OFDMA, a POSITA would have been motivated to configure an SS to perform ranging with two or more BSs simultaneously to make use of the advantages of OFDMA. It is also my opinion that this limitation is obvious because it merely covers the result of simultaneously performing steps that IEEE Std 802.16-2004 already expressly describes. Given the POSITA's skills and IEEE Std 802.16-2004's disclosed ranging procedure within a OFDMA system, a POSITA would have expected to successfully configure the system to perform the simultaneous transmission of two Ranging Response messages.

259. In conclusion, IEEE Std 802.16-2004 teaches the first Ranging Response message from the BS (**red**) to the SS and the second Ranging Response message from the BS (**purple**) to the same SS (**blue**) are transmitted simultaneously over the OFDMA PHY layer using OFDMA. This teaches "wherein the first probe and second probe are transmitted simultaneously using

OFDMA" in limitation [11C]. Thus, IEEE Std 802.16-2004 teaches limitation [11C].

6. Dependent Claim 12

a) [12PRE]: "The method of claim 9, wherein the probe parameters further comprises:"

260. Claim 12 of the '690 patent depends from claim 9, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 12 further includes a list of different pieces of data/information that the probe parameters comprise. Ex. 1001, claim 12. I note that the list in claim 12 is similar to the list in claim 3. Below I have shown how IEEE Std 802.16-2004 teaches each of limitations [12A]-[12D], and thus IEEE Std 802.16-2004 teaches [12PRE].

b) [12A]: "a) an indication of the number of times to transmit the probe;"

261. Limitation [12A] is nearly identical to limitation [3B], as it simply adds "an indication of" in limitation [12A]. Thus, IEEE Std 802.16-2004 teaches limitation [12A] for the same reasons as it teaches limitation [3B]. See Section XII.B.1.c.

c) [12B]: "b) a number of symbols for the payload of the probe; a preamble type for the probe;"

262. Limitation [12B] includes both limitations [3C] and [3D]. Thus, IEEE Std 802.16-2004 teaches limitation [12B] for the same reasons as it teaches limitations [3C] and [3D]. See Sections XII.B.1.d-e.

d) [12C]: "c) a cyclic-prefix length for the payload of the probe; a transmit power for the probe; and"

263. Limitation [12C] includes both limitations [3E] and [3F]. Thus, IEEE Std 802.16-2004 teaches limitation [12C] for the same reasons as it teaches limitations [3E] and [3F]. See Sections XII.B.1.f-g.

e) [12D]: "d) a transmit power scaling factor for the payload of the probe."

264. Limitation [12D] is identical to limitation [3G]. Thus, IEEE Std 802.16-2004 teaches limitation [12D] for the same reasons as it teaches limitation [3G]. See Sections XII.B.1.h.

7. Dependent Claim 13: "The method of claim 12, wherein the probe request is configured such that the probe identifies a hidden node."

265. Claim 13 of the '690 patent depends from claim 12, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 13 further requires that "the probe request is configured such that the probe identifies a hidden node." Ex. 1001, claim 13. IEEE Std 802.16-2004 also teaches this feature as explained below. Claim 13 is similar to claim 4 and thus the reasons below are similar to the reasons given above for claim 4.

266. When an initial Ranging Request message (the claimed "probe request") is sent (referred to as "initial ranging"), the SS is unknown to the BS that receives it. Ex. 1013, 167-177 (Section 6.3.9 describing how SS enters network

by, unbeknownst to the BS, scanning for valid downlink signals, synchronizing itself, obtaining downlink parameters, and obtaining uplink parameters prior to performing initial ranging), 205-206 ("The BS cannot tell which SS sent the CDMA ranging request; therefore, upon successfully receiving a CDMA Ranging Code, the BS broadcasts a Ranging Response message that advertises the received Ranging Code as well as the ranging slot (OFDMA symbol number, subchannel, etc.) where the CDMA Ranging code has been identified."). Therefore, a POSITA would have understood that the SS is a "hidden node" at the time it transmits the initial Ranging Request message.

267. The Ranging Request message triggers the BS to transmit the Ranging Response message (the claimed "probe") back to the SS. Ex. 1013, 50-51, 199-213. At the time of receiving the Ranging Request message, the SS is a hidden node because the BS would not have necessarily known of the existence of the SS. The SS scans for downlink channels, performs synchronization, and obtains downlink and uplink parameters without the BS's knowledge, and therefore a POSITA would have understood that the SS stays hidden during those processes. Ex. 1013, 167-184. The Ranging Response message identifies the SS, which is still the claimed "hidden node" at the time the initial Ranging Response message is sent back to the SS because the SS is not registered with the BS, by sending a Ranging Response message with a MAC Address of the SS and/or a Ranging Code

that the SS supplied in its Ranging Request message. Ex. 1013, 664-666 (SS MAC Address in Table 367 for RNG-RSP message encodings), 205 ("upon successfully receiving a CDMA Ranging Code, the BS broadcasts a Ranging Response message that advertises the received Ranging Code"), 167-184 (IEEE Std 802.16-2004 describes that ranging occurs prior to registration which is the "process by which the SS is allowed entry into the network").

268. In conclusion, the Ranging Request message is configured such that the Ranging Response message identifies a new (not yet registered) SS. This teaches "wherein the probe request is configured such that the probe identifies a hidden node" in claim 13. Thus, IEEE Std 802.16-2004 teaches claim 13.

8. Dependent Claim 16: "The method of claim 15, wherein the probe request is generated by a network operator and uploaded to the first node."

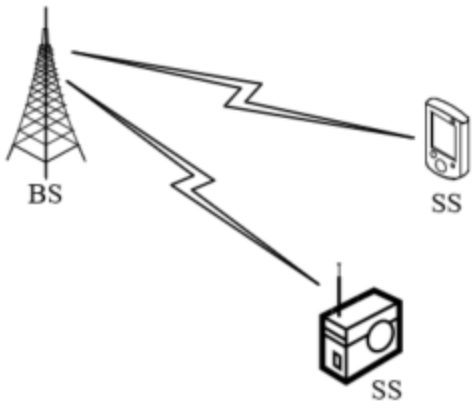
269. Claim 16 of the '690 patent depends from claim 15, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 16 further requires that "the probe request is generated by a network operator and uploaded to the first node." Ex. 1001, claim 16. Although IEEE Std 802.16-2004 does not expressly disclose this feature, in my opinion a POSITA would have understood that it teaches this feature. Claim 16 is the same as claim 8, but the "second node" is referred to as the "first node" because independent claim 9 is written from the perspective of the node that sends the probe request and receives the probe response. As such, the

first node in claims 9 and 16 corresponds to the second node in claims 1 and 8, while the second node in claims 9 and 16 corresponds to the first node in claims 1 and 8. Thus, IEEE Std 802.16-2004 teaches claim 16 for the same reasons it teaches claim 8, except that the SS of IEEE Std 802.16-2004 corresponds to the "first node" of claim 16.

9. Independent Claim 17

a) [17PRE]: "A system, comprising:"

270. This preamble is disclosed by IEEE Std 802.16-2004. IEEE Std 802.16-2004 describes a fixed broadband wireless access (BWA) system in which a base station (BS) wirelessly connects (through an air interface) with multiple subscriber stations (SS). Ex. 1013, 1, 7, 11. A POSITA would have understood that this topology includes the following example, which shows a base station (e.g., cell tower) wirelessly communicating with two different subscriber stations (e.g., a mobile phone and a wireless access point). Ex. 1013, 7 (BS refers to generalized equipment providing service), 11 (SS refers to generalized equipment on the subscriber side).

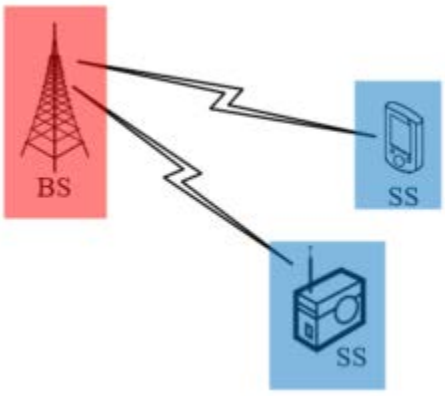


Drawing 1

271. As I explained above for claims 1 and 9, IEEE Std 802.16-2004 describes a ranging procedure that is performed by nodes (such as the BS and SSs) of this system. Ex. 1013, 174-182, 199-213. The BS and one of the SSs meet the claimed first and second nodes on the basis of their performing the ranging procedure. I note that independent claim 17 is similar to independent claims 1 and 9, but is a system claim as opposed to a method claim. The first and second nodes in independent claim 17 correspond to the first and second nodes in independent claim 9, respectively. As I will explain below, IEEE Std 802.16-2004's system includes the first and second nodes as defined below in limitations [17A]-[17F]. See Sections XII.B.9.b-g, below. Thus, IEEE Std 802.16-2004 teaches limitation [17PRE].

b) [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"

272. As shown below in the drawing below, the system of IEEE Std 802.16-2004 includes a base station (BS) (**red**) communicating with a subscriber station (SS), such as a mobile phone and a wireless access point (**both blue**). Either one of the mobile phone or the wireless access point (or another type of subscriber station SS) (**blue**) in IEEE Std 802.16-2004 corresponds to the claimed "first node." The BS (**red**) in IEEE Std 802.16-2004 corresponds to the claimed "second node."



273. Further, a POSITA would have understood that the SS 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 SS, which is shown in part in Figure 1 (reproduced below). Ex. 1013, 3.

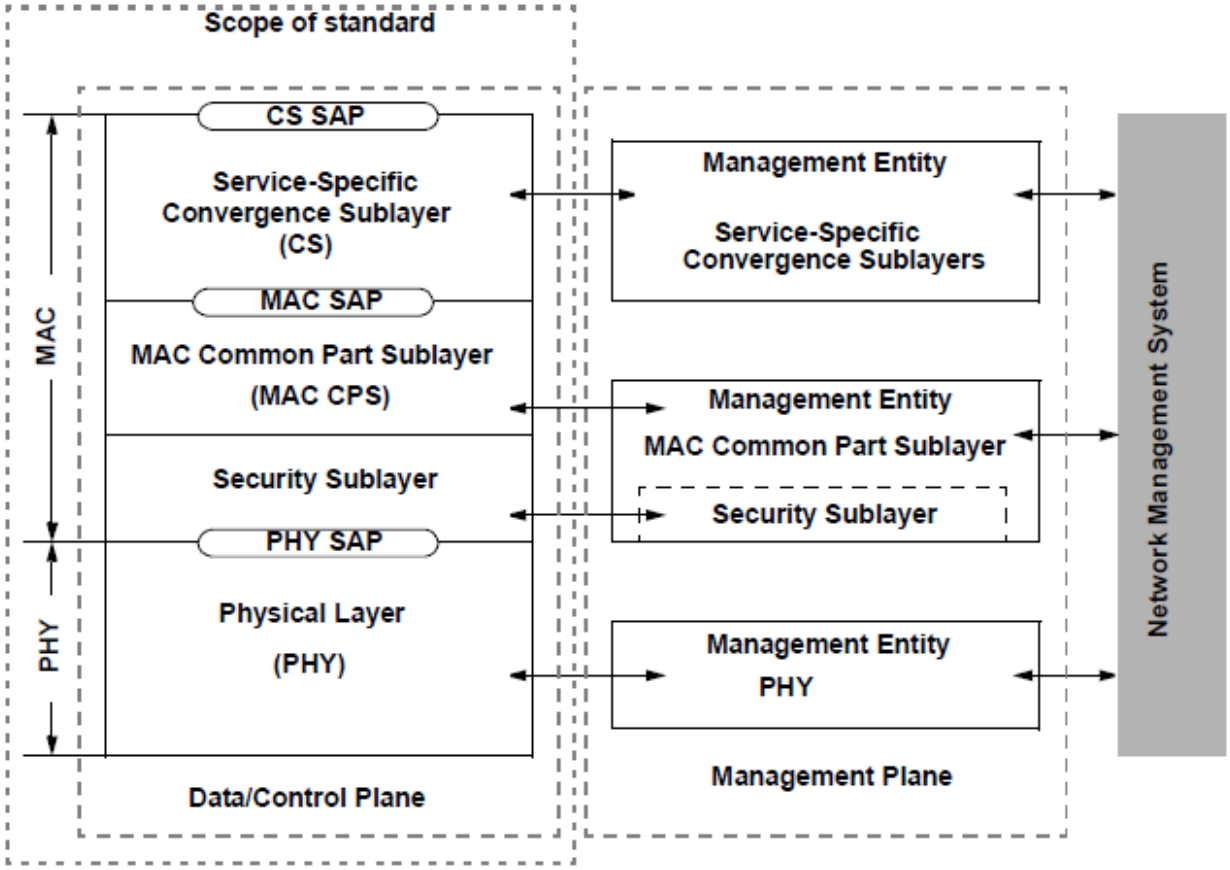


Figure 1—IEEE Std 802.16 protocol layering, showing SAPs

274. A POSITA would have understood that the computer executable program code would have been configured to carry out the various procedures/functions (e.g., ranging procedure) of the various layers in the stack. Ex. 1016, ¶ [0010]. A typical implementation of the SS would have been to use a processor for executing code stored on internal memory of the SS. It would not have been practical to use circuitry alone to implement the SS protocol stack. In

any event, a POSITA would have found it obvious to implement the SS in this manner. A POSITA would have been motivated to implement it this way because processors and memory are readily available and programming such processors would have been within the POSITA's skill set. A POSITA would have also been motivated to carry out this implementation because it is cost effective as it would have been cheaper and less time consuming to write a program and store it on memory for a processor to execute than it would have been to build a system from hardware components alone.

275. With respect to the functionality that would have been caused by the program code of the SS, the ranging procedure in IEEE Std 802.16-2004 includes the "transmit" function in limitation [17A] for similar reasons that it includes the "transmitting" step in limitation [9A]. As I explained above, IEEE Std 802.16-2004 states that "Ranging is a collection of processes by which the SS and BS maintain the quality of the RF communication link between them." Ex. 1013, 199. The processes and messages (including their parameters and the encodings of those parameters) related to ranging are described throughout IEEE Std 802.16-2004. Ex. 1013, 49-51, 174-182, 199-213, 477-479, 576-579, 620, 664-666. In particular, IEEE Std 802.16-2004 also describes a Ranging Request message (RNG-REQ). Ex. 1013, 49. The Ranging Request message (RNG-REQ) is one of the MAC Management messages. Ex. 1013, 42-43. IEEE Std 802.16-2004

explains that "[a]n RNG-REQ shall be transmitted by the SS at initialization and periodically to determine network delay and to request power and/or downlink burst profile change." Ex. 1013, 49. IEEE Std 802.16-2004 further describes that the RNG-REQ is transmitted on the wireless network (the claimed "communications network") to the BS. Ex. 1013, 49, 199-213. The format of the RNG-REQ message is shown in Table 19 (reproduced below). Ex. 1013, 49. This RNG-REQ message corresponds to the claimed "probe request."

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
}		

276. As shown above, the Ranging Request (RNG-REQ) message includes 3 main portions: a Management Message Type, Downstream Channel ID, and TLV Encoded Information. Ex. 1013, 149. A POSITA would have understood that the TLV Encoded Information includes different parameters depending on the circumstances of the RNG-REQ message. Ex. 1013, 49 ("All other parameters are coded as TLV tuples"), 723. For example, when the SS is attempting to join the network, the RNG-REQ message shall include a "Requested Downlink Burst Profile" parameter and a "SS MAC Address" parameter. Ex. 1013, 49. As another example, after the SS has received a Ranging Response (RNG-RSP) message

addressed to the SS from a previous ranging session, the RNG-REQ message may include a "Requested Downlink Burst Profile" parameter and a "Ranging Anomalies" parameter. Ex. 1013, 49. The TLV encodings are also shown in Table 364 (reproduced below). Ex. 1013, 664.

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

277. As shown in the table above, the Requested Downlink Burst Profile parameter has a Type equal to 1, a Length equal to 1 byte (=8 bits), and a value in which bits 0-3 indicate the downlink interval usage code (DIUC) of the downlink burst profile requested by the SS for downlink traffic and bits 4-7 indicate the four least significant bits of the Configuration Change Count value of downlink channel descriptor (DCD) defining the burst profile associated with the DIUC. Ex. 1013, 13, 664. The Requested Downlink Burst Profile parameter of the RNG-REQ

message allows the SS to request a specific downlink burst profile, thereby causing a downlink burst profile change. Ex. 1013, 49, 71 (discussing another message for changing the downlink burst profile and noting that "a change of downlink burst profile may also be requested by means of a RNG-REQ message as defined in 6.3.2.3.5"), 199 ("If a grant is not available and the SS requires a more robust burst profile on the downlink, the SS shall send a RNG-REQ message in an Initial Ranging interval."). The DIUC in the Requested Downlink Burst Profile parameter is mapped to one of the downlink burst profiles according to table (e.g., Table 143 or Table 276 (both reproduced below)) depending on the PHY layer. Ex. 1013, 315, 522.

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

278. The downlink burst profile includes the following parameters: modulation type, forward error correction (FEC) Code type, Last codeword length, DIUC mandatory exit threshold, DIUC minimum entry threshold, and a Preamble Presence. Ex. 1013, 7 (definition of burst profile), 314-315 (although the standard only mentions the downlink burst profiles in the DCD message, a POSITA would have understood that those are the same as the downlink burst profiles that may be in the RNG-REQ message which is another way of changing the downlink burst profile as explained above), 547 (Table 303). IEEE Std 802.16-2004 supports

different modulation types, such as Spread BPSK, BPSK, QPSK, 16-QAM, 64-QAM, and 256-QAM. Ex. 1013, 370. IEEE Std 802.16-2004 describes downlink modulation in, for example, Section 8.1.4.4.7 as follows. Ex. 1013, 329.

> **8.1.4.4.7 Downlink modulation**
>
> To maximize utilization of the airlink, the PHY uses a multilevel modulation scheme. The modulation constellation can be selected per subscriber based on the quality of the RF channel. If link conditions permit, then a more complex modulation scheme can be utilized to maximize airlink throughput while still allowing reliable data transfer. If the airlink degrades over time, possibly due to environmental factors, the system can revert to the less complex constellations to allow more reliable data transfer.
>
> In the downlink, the BS shall support QPSK and 16-QAM modulation and, optionally, 64-QAM.
>
> The sequence of modulation bits shall be mapped onto a sequence of modulation symbols $S(k)$, where k is the corresponding symbol number. The number of bits per symbol depends on the modulation type. For QPSK, $n = 2$; for 16-QAM, $n = 4$; and for 64-QAM, $n = 6$. $B(m)$ denotes the modulation bit of a sequence to be transmitted, where m is the bit number (m ranges from 1 through n). In particular, $B(1)$ corresponds to the first bit entering the modulator, $B(2)$ corresponds to the second bit entering the modulation, and so on.
>
> In changing from one burst profile to another, the BS shall use one of two power adjustment rules: maintaining constant constellation peak power (power adjustment rule = 0), or maintaining constant constellation mean power (power adjustment rule = 1). In the constant peak power scheme, corner points are transmitted at equal power levels regardless of modulation type. In the constant mean power scheme, the signal is transmitted at equal mean power levels regardless of modulation type. The power adjustment rule is configurable through the DCD Channel Encoding parameters (11.4.1).
>
> At the end of each burst, the final FEC-encoded message might not end exactly on a PS boundary. If this is the case, the end of the encoded message to the start of the next burst shall be filled with zero bits.
>
> The complex modulation symbol $S(k)$ shall take the value $I + jQ$. The following subclauses apply to the base-band part of the transmitter.

279. With respect to the WirelessMAN-OFDMA physical layer (PHY) specification,[9] the downlink burst profile encodings are shown in Table 359 and

[9] As discussed in the overview section, the standard is designed to work with a WirelessMAN-OFDMA physical layer (PHY) specification. Ex. 1013, ii (Abstract), iv (Introduction), 2 (PHY compliance). I have particularly addressed

Table 363 (both reproduced below). Ex. 1013, 660, 664. Table 359 shows common burst profile encodings, while Table 363 shows burst profile encodings for the WirelessMAN-OFDMA PHY. Ex. 1013, 660, 663.

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.

---

this PHY layer here because later claims deal with OFDMA, but downlink burst profiles for other PHY layers would also meet this claim.

280. As shown in Table 363, the FEC Code type parameter specifies, the modulation type (e.g., QPSK, 16-QAM, or 64-QAM), the FEC type (e.g., convolutional code (CC), block turbo code (BTC), or convolution turbo code (CTC)), and the code rate (e.g., 1/2 or 3/4). Ex. 1013, 663.

281. In addition to these parameters, there are further parameters in the headers for the RNG-REQ message, which is just one of the MAC Management messages that may be carried in the payload portion of a MAC PDU. Ex. 1013, 35-43 (Table 14 shows that the Ranging Request message is the MAC Management Message when Type = 4). The format for the MAC PDU is shown in Figure 18 (reproduced below). Ex. 1013, 35.

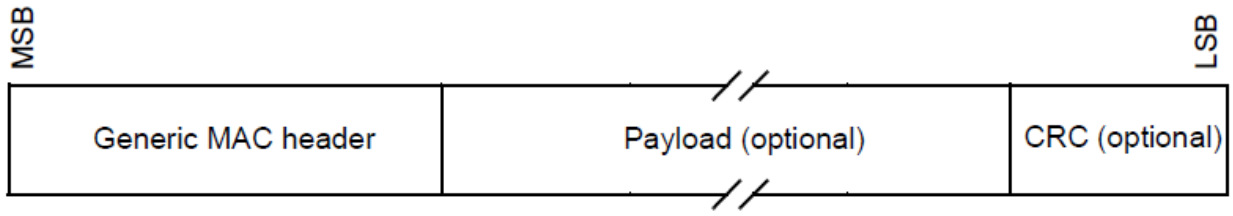


Figure 18—MAC PDU formats

282. IEEE Std 802.16-2004 explains that there are two MAC headers formats: a generic MAC header and a bandwidth request header. Ex. 1013, 35. The generic MAC header is shown in Figure 19 (reproduced below).

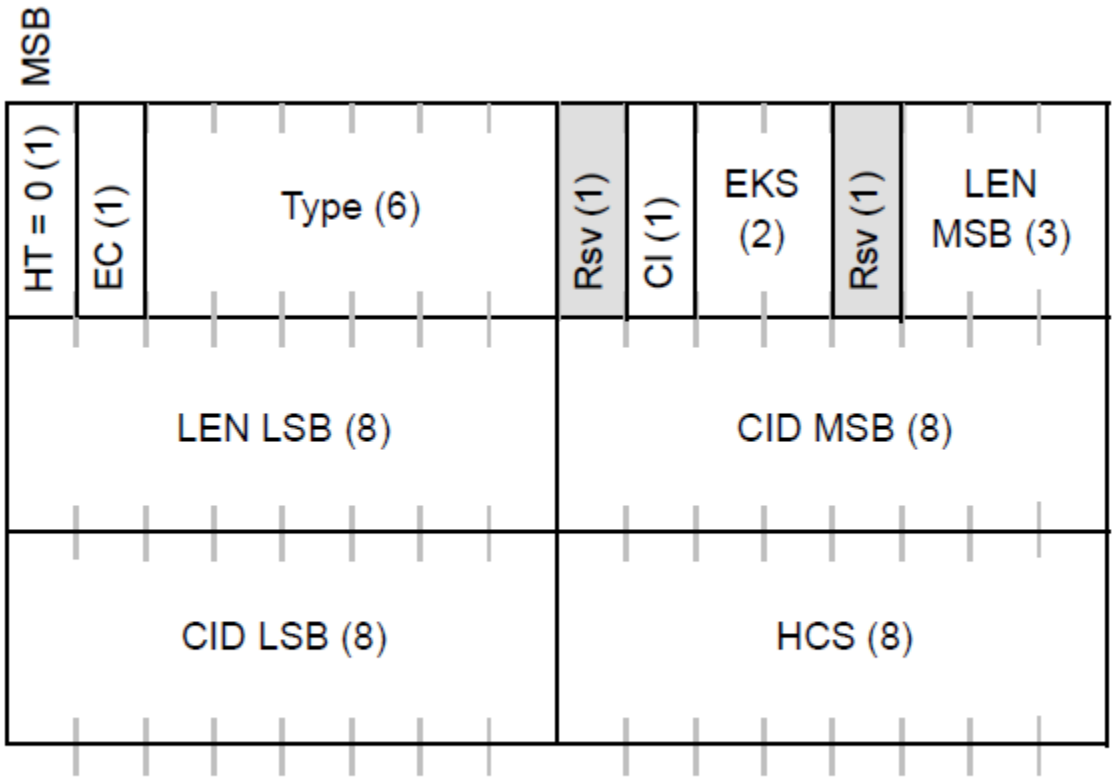


Figure 19—Generic MAC header format

283. As shown in Figure 19 above, the MAC header (which would be a header for the RNG-REQ message) includes numerous parameters (referred to as "fields"). Ex. 1013, 37. The parameters (or fields) of the MAC header are defined in Table 5 (reproduced below). Ex. 1013, 37.

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.

284. As shown from the table above, one of the parameters is a connection identifier (CI), which is discussed again further below. Ex. 1013, 37. Another parameter/field is the type field that indicates which subheaders are present in the payload portion of the MAC PDU. Ex. 1013, 37. There are five types of subheaders: Mesh, Fragmentation, FAST-FEEDBACK Allocation, Grant Management, and Packing. Ex. 1013, 39. These subheaders also include additional parameters. Ex. 1013, 39-42.

285. Thus, the Ranging Request (RNG-REQ) message, collectively from its different portions (i.e., MAC header, subheaders, payload, and CRC), specifies a plurality of parameters that meets the claimed "first plurality of parameters."

Moreover, the plurality of parameters of the RNG-REQ message (in particular, the Requested Downlink Burst Profile parameter which would be in the payload portion) are used for forming a Ranging Response (RNG-RSP) message (the claimed "physical layer probe"), which is generated in response to a received RNG-REQ message. Ex. 1013, 50, 199-213. Therefore, the RNG-REQ message "specif[ies] a first plurality of probe parameters for a physical layer probe," as claimed.

286. In addition, the Ranging Response (RNG-RSP) message is the claimed "physical layer probe" at least because it is configured to "maintain the quality of the RF communication link," which is the PHY layer, between the SS and BS. Ex. 1013, 199. A POSITA would have also understood that the Ranging Response message is a "physical layer probe" because it is transmitted to ensure the correct timing and preferred power for transmissions over the PHY layer. Ex. 1013, 174-182. IEEE Std 802.16-2004 provides the format for the RNG-RSP message in Table 20 (reproduced below). Ex. 1013, 50.

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
}		

287. As shown in the table above, the RNG-RSP message also includes TLV Encoded Information, which would have included numerous parameters like a Ranging Status parameter, Timing Adjust Information parameters, Power Adjust Information, etc. Ex. 1013, 50, 665-666 (Section 11.6 RNG-RSP management message encodings). IEEE Std 802.16-2004 explains that one of the parameters included in this TLV Encoded Information (of the RNG-RSP message) is the CID. Ex. 1013, 50. As I explained above, this CID parameter was also one of the parameters of the RNG-REQ message. Ex. 1013, 49. Because the CID parameters are part of the TLV Encoded Information of the RNG-RSP message, it is part of the payload portion of the MAC PDU for sending the RNG-RSP message (which is also a type of MAC Management message). Ex. 1013, 35, 42-43, 50. Therefore, at least the CID parameter in the Ranging Request (RNG-REQ) message specifies content/data (the CID itself) transmitted in the payload for the Ranging Response (RNG-RSP) message. This teaches "wherein the first plurality of probe parameters comprising at least a payload content for the probe," as claimed. Ex. 1013, 49-50. The "ranging code index that was sent by the SS" is another example of data that is in a parameter of the RNG-REQ message and used for the payload of the RNG-RSP message. Ex. 1013, 49-51, 204-213 (Section 6.3.10.3 describing codes for OFDMA-based ranging), 576-579 (Section 8.4.7 describing codes for OFDMA

ranging), 665-666 (Section 11.6 describing RNG-RSP management message encodings including ranging code in Table 369).

288. As I explained above in this section and with respect to limitation [3A], the Ranging Request message includes the Requested Downlink Burst Profile parameter that provides a burst profile (including modulation type) for the Ranging Response that is to be is sent on the downlink. Ex. 1013, 49-50, 199-213, 547, 663. IEEE Std 802.16-2004 defines a burst profile as a "[s]et of parameters that describe the uplink or downlink transmission properties associated with an interval usage code. Each profile contains parameters such as modulation type, forward error correction (FEC) type, preamble length, guard times, etc." Ex. 1013, 7. Based on this, a POSITA would have understood that a burst profile is a modulation profile, and therefore the Requested Downlink Burst Profile parameter is a probe parameter that indicates "a modulation profile for the probe" (as claimed) because it dictates how the Ranging Response message is to be modulated for transmission on the downlink. Therefore, the Ranging Request message includes a plurality of parameters "comprising…a modulation profile for the probe," as claimed.

289. In conclusion, IEEE Std 802.16-2004 teaches a SS on a wireless network, the SS comprising a processor and computer executable program code embodied on a SS's internal memory, the code configured to transmit the Ranging

Request message to the BS, on the wireless network, the Ranging Request message specifying a plurality of parameters for the physical layer Ranging Response message, wherein the plurality of parameters comprises at least a part of the payload of the Ranging Response message and a downlink burst profile for the Ranging Response message. This teaches "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[10] 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" in limitation [17A]. Thus, IEEE Std 802.16-2004 teaches limitation [17A].

c) [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 computer readable medium, the second executable program code configured to:"

290. As I explained above, the BS in IEEE Std 802.16-2004 corresponds to the claimed "second node." The BS is also on the wireless network and therefore teaches the "second node on the communications network," as claimed. Ex. 1013,

[10] I have treated this "a" as an extraneous word.

1, 7, 11. Further, a POSITA would have understood that the BS 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, which is the same as the SS and is also shown in Figure 1 (reproduced below). Ex. 1013, 3.

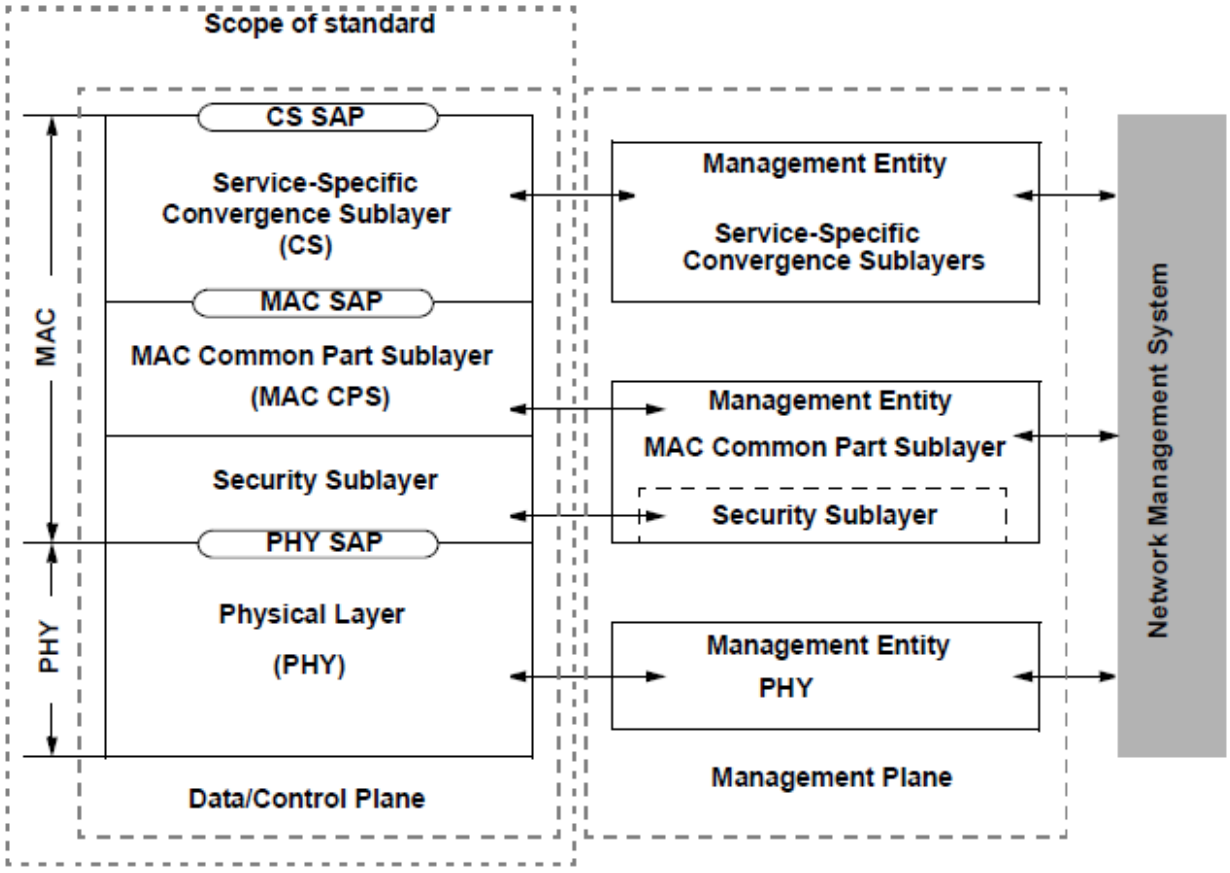


Figure 1—IEEE Std 802.16 protocol layering, showing SAPs

291. A POSITA would have understood that the computer executable program code would have been configured to carry out the various procedures/functions (e.g., ranging procedure) of the various layers in the stack. Ex. 1016, ¶ [0010]. A typical implementation of the BS would have been to use a

processor for executing code stored on internal memory of the BS. It would not have been practical to use circuitry alone to implement the BS protocol stack. Indeed, IEEE Std 802.16-2004 indicates the existence of the "processor" and "software" in the BS by describing that the "Base Station ID shall be programmable." Ex. 1013, 46. In any event, a POSITA would have found it obvious to implement the BS in this manner. A POSITA would have been motivated to implement it this way because processors and memory are readily available and programming such processors would have been within the POSITA's skill set. A POSITA would have also been motivated to carry out this implementation because it is cost effective as it would have been cheaper and less time consuming to write a program and store it on memory for a processor to execute than it would have been to build a system from hardware components alone.

292. In conclusion, IEEE Std 802.16-2004 teaches the BS on the wireless network, the BS comprising its own processor and computer executable program code embodied on the BS's internal memory, the code configured to cause the BS to carry out the ranging procedure, which includes the functions described below in limitations [17C]-[17F]. This teaches "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 computer readable medium, the

second executable program code configured to: [perform the functions in limitations [17C]-[17F]" in limitation [17B]. Thus, IEEE Std 802.16-2004 teaches limitation [17B].

d) [17C]: "receive the probe request;"

293. As I explained above with respect to independent claims 1 and 9, IEEE Std 802.16-2004 teaches that the BS receives the Ranging Request (RNG-REQ) message. Ex. 1013, 49-50, 199-213. The Ranging Request message in IEEE Std 802.16-2004 corresponds to the claimed "probe request" because it is used to perform ranging which is performed to maintain the quality of the link between the BS and SS. Ex. 1013, 199. Thus, IEEE Std 802.16-2004 teaches limitation [17C].

e) [17D]: "determine a second plurality of parameters associated with generation and transmission of the probe;"

294. As I explained above with respect to independent claims 1 and 9, IEEE Std 802.16-2004 teaches that the BS determines a plurality of parameters (e.g., such as the Management Message Type parameter, the Uplink Channel ID parameter, and the parameters for the TLV Encoded Information (which includes numerous parameters, like a Ranging Status parameter)) associated with generation and transmission of the Ranging Response message (the claimed "probe"). Ex. 1013, 50-51, 199-213. Thus, IEEE Std 802.16-2004 teaches limitation [17D].

f) [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"

295. As I explained above with respect to independent claims 1 and 9, IEEE Std 802.16-2004 teaches that the BS generates the Ranging Response message (the claimed "probe") in accordance with the parameters in the Ranging Request message (the claimed "first plurality of parameters") and the parameters determined for the Ranging Response message (the claimed "second plurality of parameters"). Ex. 1013, 49-51, 199-213. Further, because the Requested Downlink Burst Profile parameter of the Ranging Request message provides a downlink burst profile (e.g., including the encodings in Table 359 which includes a downlink frequency and in Table 363 which includes a FEC Code type that includes a modulation type) to be used by the BS to format and send the Ranging Response message on the downlink to the SS, at least the Requested Downlink Burst Profile parameter (including its encodings) dictates the form of the Ranging Response message (the claimed "probe"). Ex. 1013, 49-50, 199-201, 314-316, 547, 660 (Table 359), 663 (Table 363). A POSITA would have understood that the downlink frequency and/or FEC Code type (including a modulation type) are characteristics of the form of the Ranging Response message because they dictate how the Ranging Response message is formatted and transmitted. Thus, IEEE Std 802.16-2004 teaches limitation [17E].

g) [17F]: "transmit the probe to the first node."

296. As I explained above with respect to independent claims 1 and 9, IEEE Std 802.16-2004 teaches that the BS transmits the Ranging Response message (the claimed "probe") to the SS (the claimed "first node") in response to receiving the Ranging Request message. Ex. 1013, 50-51. Thus, IEEE Std 802.16-2004 teaches limitation [17F].

10. Dependent Claim 18: "The system of claim 17, wherein the probe request is configured such that the probe emulates an OFDMA transmission."

297. Claim 18 of the '690 patent depends from claim 17, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 18 further requires that "the probe request is configured such that the probe emulates an OFDMA transmission." Ex. 1001, claim 18. IEEE Std 802.16-2004 also teaches this feature. Claim 18 is the same as claim 10, except for its dependency. Thus, IEEE Std 802.16-2004 teaches claim 18 for the same reasons it teaches claim 10.

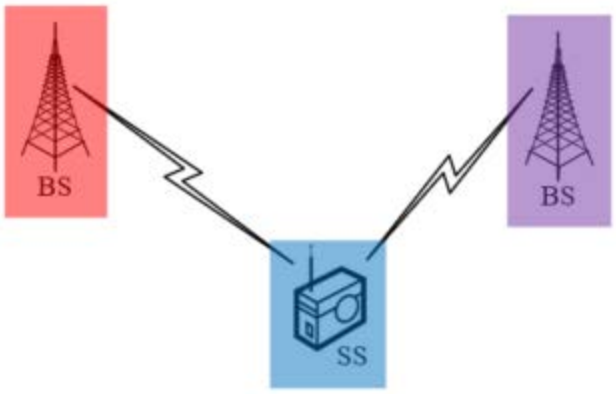
11. Dependent Claim 19

a) [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,"

298. Claim 19 of the '690 patent depends from claim 17, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 19 is similar to claim 11 in

that it adds a second instance of sending a probe request and receiving a probe to the first instance in independent claim 9 and the feature of using OFDMA. It also adds the concept of transmitting two probes "simultaneously." Although IEEE Std 802.16-2004 does not expressly disclose this "simultaneously" feature, in my opinion a POSITA would have understood that it teaches all features of claim 19 as explained below.

299. IEEE Std 802.16-2004 explains that "[a]n RNG-REQ shall be transmitted by the SS at initialization and periodically to determine network delay and to request power and/or downlink burst profile change." Ex. 1013, 49. IEEE Std 802.16-2004 further describes that the RNG-REQ is received by a BS. Ex. 1013, 50, 199-213. As shown in the drawing below, a POSITA would have understood that the system of IEEE Std 802.16-2004 includes a subscriber station (SS), such as a wireless access point (**blue**) communicating with multiple base stations (BS) (**red** and **purple**). The wireless access point (or another type of subscriber station SS) (**blue**) in IEEE Std 802.16-2004 corresponds to the claimed "first node." One of the base stations (**red**) in IEEE Std 802.16-2004 corresponds to the claimed "second node" while the other base station (**purple**) in IEEE Std 802.16-2004 corresponds to the claimed "third node."



300. A POSITA would have understood that the SS transmits one Ranging Request message to one base station and another Ranging Request message to the other base station. Ex. 1013, 49-51. For claim 17 above, I relied on the SS (**blue**) sending a Ranging Request message to the BS (**red**). For limitation [19A] here, I rely on the SS (**blue**) sending another Ranging Request message to the other BS (**purple**). This Ranging Request message to the BS (**purple**) would have included its own plurality of parameters for another physical layer Ranging Response message, for the reasons I explained above for limitation [17A].

301. In conclusion, IEEE Std 802.16-2004 teaches the code on the SS being configured to transmit another Ranging Request message (in addition to the Ranging Request described for limitation [17A]) to another BS (in addition to the BS described for limitation [17A]) on the wireless network, wherein this additional Ranging Request message specifies its own plurality of parameters for another physical layer Ranging Response message (in addition to the Ranging Response message described for limitation [17A]). This teaches "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" in limitation [19A]. Thus, IEEE Std 802.16-2004 teaches limitation [19A].

b) [19B]: "the third plurality of probe parameters comprising a second payload content for the second probe and a second modulation profile for the probe,"

302. Limitation [19B] is directed to a similar concept that is in the remaining part of limitation [17A], but relates to the second probe request and second probe. Limitation [19B] is taught for the same reasons given above with respect to limitation [17A]. Specifically, the plurality of parameters in the additional Ranging Request message to the additional BS (**purple**) comprises a payload content for the additional Ranging Response message to be sent back from the additional BS (**purple**) and another downlink burst profile for the additional Ranging Response message. This teaches "the third plurality of probe parameters comprising a second payload content for the second probe and a second modulation profile for the probe" in limitation [19B]. Thus, IEEE Std 802.16-2004 teaches limitation [19B].

c) [19C]: "the second probe request further specifying a different second plurality of parameters associated with the generation and transmission of the second probe; and"

303. First, this claim limitation does not specify how "a different second plurality of parameters" differs from the "third first plurality of probe parameters" in limitation [19A]. But, as explained above, any one Ranging Request message has numerous parameters for generating a Ranging Response message, so any two groups of those parameters teaches the "different second plurality of parameters" and "third first plurality of probe parameters" required in claim 19.

304. With respect to the rest of limitation [19C], IEEE Std 802.16-2004 teaches limitation [19C] for similar reasons that it teaches limitations [1A], [9A], [17A], and [19A]. Specifically, the additional Ranging Request message sent to the additional BS (**purple**) further specifies a different plurality of parameters associated with the generation and transmission of the additional Ranging Response message to be sent back from the additional BS (**purple**). This teaches "the second probe request further specifying a different second plurality of parameters associated with the generation and transmission of the second probe" in limitation [19C]. Thus, IEEE Std 802.16-2004 teaches limitation [19C].

d) [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"

305. Limitation [19D] is similar to limitations [17B]-[17F], except that it is with respect to the third node instead of the second node. IEEE Std 802.16-2004 teaches limitation [19D] for the similar reasons it teaches limitations [17B]-[17F], because the additional BS (**purple**) would have been configured in the same manner (using a processor and code on a computer readable medium) to perform the same steps that the other BS (**red**) performed to generate an additional Ranging Response message that is transmitted back to the SS on the wireless network. Thus, IEEE Std 802.16-2004 teaches limitation [19D].

e) [19E]: "wherein the first probe and second probe are transmitted simultaneously using OFDMA."

306. Limitation [19E] is the same as limitation [11C]. Thus, IEEE Std 802.16-2004 teaches limitation 19[E] for the same reasons it teaches limitation [11C].

12. Dependent Claim 20

a) [20PRE]: "The system of claim 17, wherein the probe parameters further comprises:"

307. Limitation [20PRE] is nearly identical to limitation [12PRE], but it is a system claim (not a method claim) and depends from claim 17 instead of claim 9. Thus, IEEE Std 802.16-2004 teaches limitation [20PRE] for the same reasons as it teaches limitation [12PRE]. See Sections XII.B.6.a.

b) [20A]: "a) an indication of the number of times to transmit the probe;"

308. Limitation [20A] is identical to limitation [12A]. Thus, IEEE Std 802.16-2004 teaches limitation [20A] for the same reasons as it teaches limitation [12A]. See Sections XII.B.6.b.

c) [20B]: "b) a number of symbols for the payload of the probe;"

309. Limitation [20B] is identical to the first part of limitation [12B]. Thus, IEEE Std 802.16-2004 teaches limitation [20B] for the same reasons as it teaches limitation [12B]. See Sections XII.B.6.c.

d) [20C]: "c) a preamble type for the probe;"

310. Limitation [20C] is identical to the second part of limitation [12B]. Thus, IEEE Std 802.16-2004 teaches limitation [20C] for the same reasons as it teaches limitation [12B]. See Sections XII.B.6.c.

e) [20D]: "d) a cyclic-prefix length for the payload of the probe;"

311. Limitation [20D] is identical to the first part of limitation [12C]. Thus, IEEE Std 802.16-2004 teaches limitation [20D] for the same reasons as it teaches limitation [12C]. See Sections XII.B.6.d.

f) [20E]: "e) a transmit power for the probe; and"

312. Limitation [20E] is identical to the second part of limitation [12C]. Thus, IEEE Std 802.16-2004 teaches limitation [20E] for the same reasons as it teaches limitation [12C]. See Sections XII.B.6.d.

g) [20F]: "f) a transmit power scaling factor for the payload of the probe."

313. Limitation [20F] is identical to limitation [12D]. Thus, IEEE Std 802.16-2004 teaches limitation [20F] for the same reasons as it teaches limitation [12D]. See Sections XII.B.6.e.

13. Dependent Claim 21: "The system of claim 20, wherein the probe request is configured such that the probe identifies a hidden node."

314. Claim 21 of the '690 patent depends from claim 20, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 21 further requires that "the probe request is configured such that the probe identifies a hidden node." Ex. 1001, claim 21. IEEE Std 802.16-2004 also teaches this feature. Claim 21 is the

same as claim 13, except for its dependency. Thus, IEEE Std 802.16-2004 teaches claim 21 for the same reasons it teaches claim 13.

14. Dependent Claim 22: "The system of claim 17, wherein the probe request is generated by the first node."

315. Claim 22 of the '690 patent depends from claim 17, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 22 further requires that "the probe request is generated by the first node." Ex. 1001, claim 22. IEEE Std 802.16-2004 also teaches this feature. Claim 22 is the same as claim 6, but the "second node" is referred to as the "first node" because independent claim 17 is written from the perspective of the node that sends the probe request and receives the probe response. As such, the first node in claims 17 and 22 corresponds to the second node in claims 1 and 6, while the second node in claims 17 and 22 corresponds to the first node in claims 1 and 6. Thus, IEEE Std 802.16-2004 teaches claim 22 for the same reasons it teaches claim 6, except that the SS of IEEE Std 802.16-2004 corresponds to the "first node" of claim 22.

15. Dependent Claim 23: "The system of claim 17, wherein the probe request is configured to diagnose a network problem."

316. Claim 23 of the '690 patent depends from claim 17, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 23 further requires that "probe request is configured to diagnose a network problem." Ex. 1001, claim 23. IEEE Std 802.16-2004 also teaches this feature. Claim 23 is the same as claim 15,

except for its dependency. Thus, IEEE Std 802.16-2004 teaches claim 23 for the same reasons it teaches claim 15.

16. Dependent Claim 24: "The system of claim 23, wherein the probe request is generated by a network operator and uploaded to the first node."

317. Claim 24 of the '690 patent depends from claim 23, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 24 further requires that "probe request is generated by a network operator and uploaded to the first node." Ex. 1001, claim 24. Although IEEE Std 802.16-2004 does not expressly disclose this feature, in my opinion a POSITA would have understood that it teaches this feature. Claim 24 is the same as claim 16 (and similar to claim 8), except for its dependency. Thus, IEEE Std 802.16-2004 teaches claim 24 for the same reasons it teaches claim 16.

C. IEEE Std 802.16-2004 In View Of Won Renders Obvious Claims 8, 16, and 24

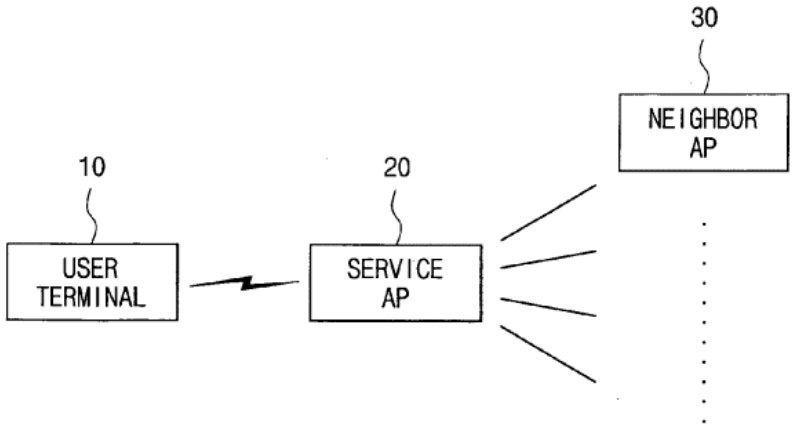
318. To the extent that claims 8, 16, and 24 (which are the same but for their dependencies) are not found obvious based on IEEE Std 802.16-2004 alone, it is my opinion that IEEE Std 802.16-2004 in view of Won renders these claims obvious as I explain below.

1. Dependent Claim 8: "The method of claim 7, wherein the probe request is generated by a network operator and uploaded to the second node."

319. Claim 8 of the '690 patent depends from claim 7, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 8 further requires that "the probe request is generated by a network operator and uploaded to the second node." Ex. 1001, claim 8. Although IEEE Std 802.16-2004 does not expressly disclose this feature, in my opinion a POSITA would have found this feature obvious in view of Won.

320. Like IEEE Std 802.16-2004, Won discusses wireless communications between nodes on a wireless network. Won, Abstract, [0003], [0012]-[0015]. Won describes a probing procedure which is similar to the ranging procedure in IEEE Std 802.16-2004. Ex. 1008, [0026]-[0031], [0035]. In particular, Won describes how a service access point (AP) broadcasts a probe request and receives probe responses from neighboring APs. Ex. 1008, [0026]-[0031], [0035]. As shown in Figure 2 (reproduced below), Won's system includes a user terminal 10, a service AP 20 for providing a data service to the user terminal 10, and a plurality of neighbor APs 30 for transmitting/receiving packets to/from the service AP 20. Ex. 1008 [0026], FIG. 2.

FIG. 2



321. With respect to Figure 2, Won describes that the user terminal 10 sends a scan request to the AP 20, and in response to the scan request, the AP 20 generates and sends a probe request. Ex. 1008, [0014], [0019], [0026]-[0027]. Based on this description in Won, a POSITA would have understood that Won teaches that probe requests may originate at a user terminal 10 downstream from a service AP 20. From this teaching, a POSITA would have found it obvious to use a user terminal 10 to generate a Ranging Request message (similar to Won's probe request) and upload the Ranging Request message to the SS in IEEE Std 802.16-2004 for transmission upstream. In other words, it would have been obvious to combine the user terminal 10 of Won (which has the ability to initiate probing procedures) with the system of IEEE Std 802.16-2004, such that the user terminal 10 (the claimed "network operator") generates the Ranging Request message of IEEE Std 802.16-2004 and uploads it to the SS in IEEE Std 802.16-2004.

322. Because Won teaches a user terminal 10 for causing a service AP to send a probe request, a POSITA would have been motivated to use a user terminal 10 for generating and uploading (to a SS) a Ranging Request message that is similar to the probe request. Further, a POSITA would have been motivated to use a separate user terminal 10 to generate and upload the Ranging Request message to the SS because doing so would reduce the processing burden on the SS. The processing burden of having to generate the Ranging Request message (in certain cases) would have been on the user terminal 10. That is, instead of the SS having to always generate the Ranging Request, a POSITA would have found it desirable to configure the SS to receive the Ranging Request from a separate computer (the claimed "network operator") when a network administrator desired to trigger the ranging procedure (e.g., when the SS was having difficulty maintaining the RF link). Ex. 1013, 199. By having the user terminal 10 perform the generation of the Ranging Request message, the processing that goes into this generation is shifted away from the MAC layer of the SS thereby enabling the MAC layer to use its processing power to do other functions, like packaging messages into MAC PDUs. Moreover, a POSITA would have been motivated to use the user terminal 10 to generate the Ranging Request because it gives a user at the location of the SS the ability to initiate the network entry process of IEEE Std 802.16-2004 in a case where the SS was having difficulty synchronizing to a downlink from the BS

and/or difficulty obtaining downlink or uplink parameters. A POSITA would have been motivated to implement this functionality because it would have been a useful tool for troubleshooting network entry problems (e.g., low power or interference). For example, a POSITA would have understood that configuring the SS to receive the Ranging Request from the user terminal and beginning the ranging process in response would have given a network administrator or other user of the SS a tool for testing the SS's ability to maintain the RF link and adjust its power or timing based on Ranging Response messages. A POSITA would have been wanted to have this ability because it gives network administrators the ability to force the ranging process from the SS-side. This gives network administrators more control over the SS, and a POSITA would have been motivated to give network administrators (or other users of the SS) this control (i.e., a semi-manual way of starting the ranging process). A POSITA would have understood these benefits of enabling a network administrator to use a user terminal (like Won's user terminal 10) to generate the Ranging Request message. Similar to how Won describes that the scanning process is initiated by using the user terminal (e.g., Ex. 1008, ¶¶ [0006]-[0007]) to send the probe request so that probing is performed when a network operator deems it appropriate to do so (e.g., when network connectivity is an issue), a POSITA would have likewise been motivated to use the user terminal to initiate ranging. Accordingly, it would have been obvious to the POSITA to

configure the system so that the user terminal would have generated the Ranging Request message (like Won's probe request) at a timing that an administrator determines it to be appropriate, and/or so as to configure the Ranging Request to include suitable parameters. Therefore, in the obvious combination of IEEE Std 802.16-2004 with Won, the Ranging Request message would have been generated at Won's user terminal (the claimed "network operator") and uploaded to the SS (the claimed "second node") in IEEE Std 802.16-2004 to initiate the ranging process.

323. It is also my opinion that other rationales additionally support this combination. First, the combination of IEEE Std 802.16-2004 and Won merely combines known prior art elements according to known methods to yield predictable results. See Section IV (referring to obviousness rationale (A)). The known prior art elements are IEEE Std 802.16-2004's system having the SS sending Ranging Request message to the BS and Won's system including a user terminal for causing an AP to transmit a Probe Request message. Ex. 1013, 49-50, 199-213; Ex. 1008, [0014], [0019], [0026]. These known elements would have been combined according to known methods, such as Won's method of implementing user terminal 10 to communicate with service AP 20. Finally, the combination yields predictable results, specifically it yields a user terminal 10 for

generating the Ranging Request message and uploading it to the SS in IEEE Std 802.16-2004.

324. It is also my opinion that the combination of IEEE Std 802.16-2004 and Won merely uses a known technique to improve similar devices in the same way. See Section IV (referring to obviousness rationale (C)). The known technique is Won's technique of using a user terminal 10 to control an AP to send the probe request thereby initiating the probing procedure. Ex. 1008, [0014], [0019], [0026]. Won uses this technique on its service AP 20, which is similar to the SS of IEEE Std 802.16-2004. Further, a POSITA would have understood that the probe request in Won is similar to the Ranging Request message in IEEE Std 802.16-2004. Won's technique would have improved IEEE Std 802.16-2004's system by enabling a network operator (or network administrator) to initiate the ranging procedure in the same way Won's technique enables a user of user terminal 10 to initiate Won's similar probing procedure.

325. Finally, a POSITA would have had a reasonable expectation of success in achieving the above described combination of IEEE Std 802.16-2004 and Won. This is because the combination merely involves a routine method of configuring a user terminal to upload a message to the SS. A POSITA would have had the skills, including programming and network design skills, to interface the user terminal 10 with the SS of IEEE Std 802.16-2004 so that the user terminal 10

would have uploaded a generated Ranging Request message to the SS. The process of generating the Ranging Request message is already known from IEEE Std 802.16-2004 and it would have been straightforward to move that process to another device (e.g., user terminal 10) or configure another device (e.g., user terminal 10) to perform that process.

326. In conclusion, the combination of IEEE Std 802.16-2004 and Won teaches that the Ranging Request message is generated by a user terminal 10 and uploaded to the SS. This teaches the claimed "wherein the probe request is generated by a network operator and uploaded to the second node" in claim 8. Thus, the combination of IEEE Std 802.16-2004 and Won teaches claim 8.

2. Dependent Claim 16: "The method of claim 15, wherein the probe request is generated by a network operator and uploaded to the first node."

327. Claim 16 of the '690 patent depends from claim 15, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 16 further requires that "the probe request is generated by a network operator and uploaded to the first node." Ex. 1001, claim 16. Although IEEE Std 802.16-2004 does not expressly disclose this feature, in my opinion the combination of IEEE Std 802.16-2004 and Won teaches this feature. Claim 16 is the same as claim 8, but the "second node" is referred to as the "first node" because independent claim 9 is written from the perspective of the node that sends the probe request and receives the probe

response. As such, the first node in claims 9 and 16 corresponds to the second node in claims 1 and 8, while the second node in claims 9 and 16 corresponds to the first node in claims 1 and 8. Thus, the combination of IEEE Std 802.16-2004 and Won teaches claim 16 for the same reasons it teaches claim 8, except that the SS of IEEE Std 802.16-2004 corresponds to the "first node" of claim 16.

3. Dependent Claim 24: "The system of claim 23, wherein the probe request is generated by a network operator and uploaded to the first node."

328. Claim 24 of the '690 patent depends from claim 23, which is taught by IEEE Std 802.16-2004, as discussed above. Claim 24 further requires that "probe request is generated by a network operator and uploaded to the first node." Ex. 1001, claim 24. Although IEEE Std 802.16-2004 does not expressly disclose this feature, in my opinion the combination of IEEE Std 802.16-2004 and Won teaches this feature. Claim 24 is the same as claim 16 (and similar to claim 8), except for its dependency. Thus, the combination of IEEE Std 802.16-2004 and Won teaches claim 24 for the same reasons it teaches claim 16.

D. Waxman Anticipates or Renders Obvious Claims 1-11, 14-19, and 22-24

329. Like the '690 patent, Waxman relates to data transmission (e.g., wireless transmission of a plurality of data packets) in a communication network. Ex. 1007, Abstract, ¶¶ [0001]-[0002], [0012]-[0013].

330. Waxman describes sending probe request packets over a wireless network in order to ascertain transmission parameters of the receiver. Ex. 1007, ¶ [0030], Abstract, FIG. 3. As part of extending the connectivity range in a wireless network, Waxman describes probes requesting transmission format parameters. Ex. 1007, ¶¶ [0001]-[0002].

331. For example, Waxman's stations, e.g., as part of an active scanning process, transmit probe requests to APs specifying transmissions to the station be in a particular format. Ex. 1007, ¶¶ [0030], [0035]. The probe requests include, among other fields, a Requested Transmission Scheme (RTS) field indicating a required transmission scheme. Ex. 1007, ¶ [0030]. Alternatively, the AP may ascertain a station's required transmission format directly from the request probe. Ex. 1007, ¶ [0030]. After receiving the probe request, the AP transmits a probe response to the requesting station, based on a requested transmission scheme. Ex. 1007, ¶ [0037]. In this way, the AP sends communications in different transmission formats, based on various settings or requirements. Ex. 1007, ¶ [0041].

1. Independent Claim 1

a) [1PRE]: "A method comprising:"

332. This preamble is disclosed by Waxman. Waxman describes a method for extended range wireless communication. Ex. 1007, Title, Abstract, ¶¶ [0006], [0052]-[0057], [0060], FIG. 3.

b) [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;"

333. Waxman describes techniques to extend connectivity range between a wireless Access Point (AP) and a wireless communication station. Ex. 1007, ¶ [0001]. Waxman provides an example system that includes "one or more wireless communication stations, for example, stations 101, 102 and 103" and "one or more wireless devices, for example, a wireless Access Point (AP) 105." Ex. 1007, ¶ [0012].

334. Waxman describes that the **AP 105** includes "a processor 111, a memory unit 112, and one or more wireless transceivers, e.g., **a transceiver 120, a STBC transceiver 130, and a BF transceiver 140**" as well as "other suitable hardware components and/or software components." Ex. 1007, ¶¶ [0017]-[0019] (emphasis and color coding added), FIG. 1 (annotated below).

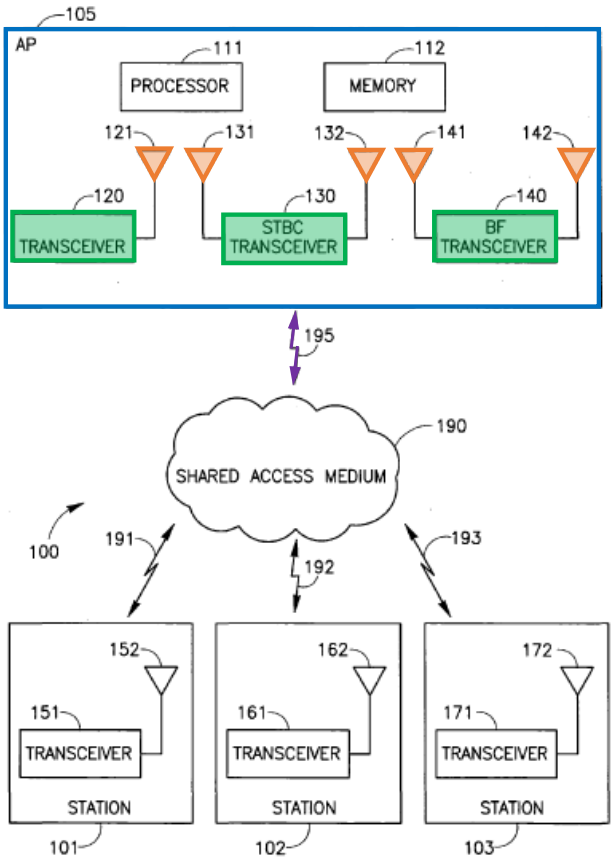


FIG.1

The AP 105 may include one or more antennas, such as **antennas 121, 131, 132, 141, 142**, to communicate with a wireless communication station, and the AP 105 may communicate using a shared access medium 190, for example, through **wireless communication link 195**. Ex. 1007, ¶¶ [0012], [0020]-[0021], [0024] (emphasis and color coding added). Specific to the AP 105, the processor 111 processes signals and/or data transmitted and/or received by the AP 105. Ex. 1007, ¶ [0018]. The transceiver 120 communicates with a respective transceiver of a wireless communication station, e.g., the transceiver 151 of the station 101. Ex. 1007, ¶ [0020]. The STBC transceiver 130 communicates with a respective

transceiver of a wireless communication station, e.g., the transceiver 161 of the station 102. Ex. 1007, ¶¶ [0021]-[0023]. The BF transceiver 140 communicates with a respective transceiver of a wireless communication station, e.g., transceiver the 171 of the station 103. Ex. 1007, ¶¶ [0024]-[0028].

335. As the '690 patent describes a node as being "associated with a variety of devices" including a network communication module associated with a computer or a module configured to interface with a network, Waxman's AP 105 constitutes "a first node." Ex. 1001, 4:10-24.

336. As to the wireless communication stations, Waxman provides that "**[s]tation 101, station 102, station 103**, and AP 105 may communicate using a shared access medium 190, for example, through **wireless communication links 191, 192, 193**, and 195, respectively." Ex. 1007, ¶ [0012] (emphasis and color coding added). Each of **stations 101, 102, and 103** includes respective wireless RF transceivers (e.g., **transceiver 151, transceiver 161, and transceiver 171**, respectively) "to transmit and receive wireless communication signals, e.g., utilizing an antenna" (e.g., **antenna 152, antenna 162, antenna 172**). Ex. 1007, ¶¶ [0014]-[0017] (emphasis and color coding added), FIG. 1 (annotated and copied below, to show each **station** has a respective **transceiver**, **antenna**, and **wireless communication link**).

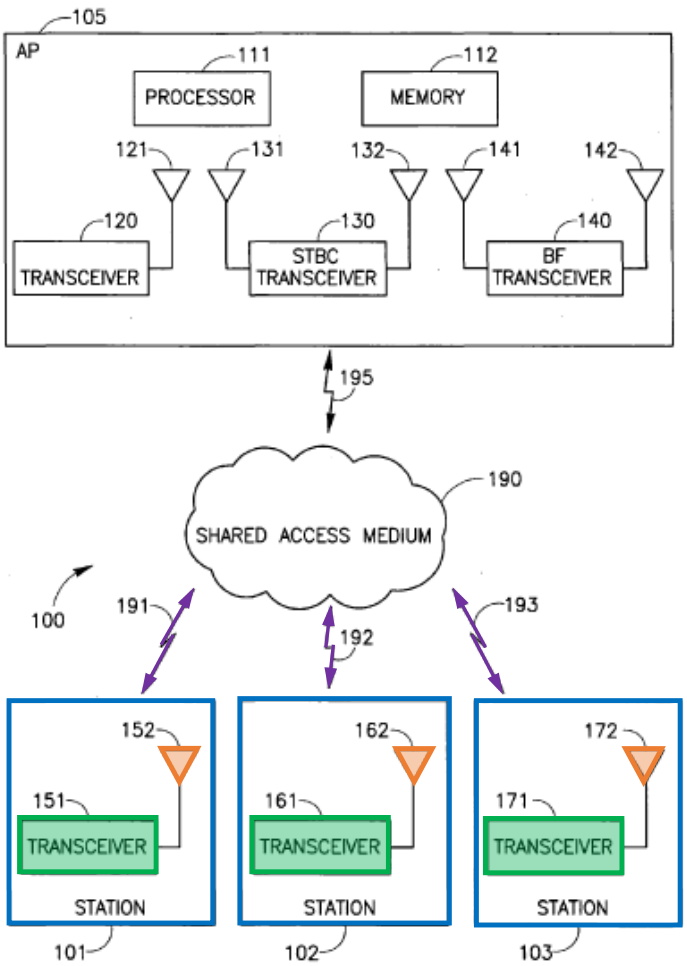


FIG.1

Ex. 1007, FIG. 1 (annotated)

337. Transceivers of wireless stations may additionally be configured "to operate in accordance with IEEE 802.11 standard, e.g., IEEE 802.11n standard," "to utilize a first Transmission Antenna Diversity Scheme (TADS), for example, Space-Time Block Codes (STBC) communication scheme, e.g., using a STBC equalizer which may be included in transceiver [] or may be operatively associated with transceiver," and/or "to utilize a second TADS, for example, Beam Forming

(BF) communication scheme, e.g., using signal targeting or signal focusing techniques." Ex. 1007, ¶¶ [0014]-[0016]. Stations 101, 102, 103 also include "other suitable hardware components and/or software components." Ex. 1007, ¶¶ [0014]-[0016]. While paragraph [0015] of Waxman describes a specific example in which station 102 uses an STBC communication scheme, and paragraph [0016] of Waxman describes a specific example in which station 103 uses a BF communication scheme, a POSITA would have understood that each the stations would have been configured to use any combination of suitable communication schemes and would have switched from among the various communications schemes as appropriate. *See*, *e.g.*, Ex. 1007 ¶¶ [0015]-[0016], [0045] (describing station 102 switching communication schemes based on a proximity to a respective AP). In other words, depending on various settings (e.g., proximity to an AP), each station would have been configured to use a variety of communication schemes to communicate with respective APs. Ex. 1007, ¶¶ [0014]-[0017], [0045].

338. As the '690 patent describes a node as being "associated with a variety of devices" including a network communication module associated with a computer or a module configured to interface with a network, any one of Waxman's stations 101, 102, 103 constitutes the claimed "second node," that is specified in a probe request, as described in more detail below. Ex. 1001, 4:10-24.

339. Waxman's method "includes receiving a probe request including an indication of a requested transmission scheme." Ex. 1007, Abstract. For example, "[s]tations 101, 102 and/or 103 may perform an active scanning, e.g., may transmit a probe request" to access points, such as the AP 105. Ex. 1007, ¶ [0030]. In FIG. 2, Waxman schematically illustrates a timing diagram of wireless communication signals, in which a horizontal axis 210 indicates the timing of wireless communication signals transmitted by a wireless AP, e.g., by the AP 105 of FIG. 1; whereas a horizontal axis 220 indicates the timing of wireless communication signals transmitted by a wireless communication station, e.g., by the station 102 of FIG. 1. Ex. 1007, ¶ [0046], FIGs. 1-2. As shown in FIG. 2 (copied and annotated below), block 221 shows a probe request transmitted by the station to the AP. Ex. 1007, ¶ [0048], FIG. 2.

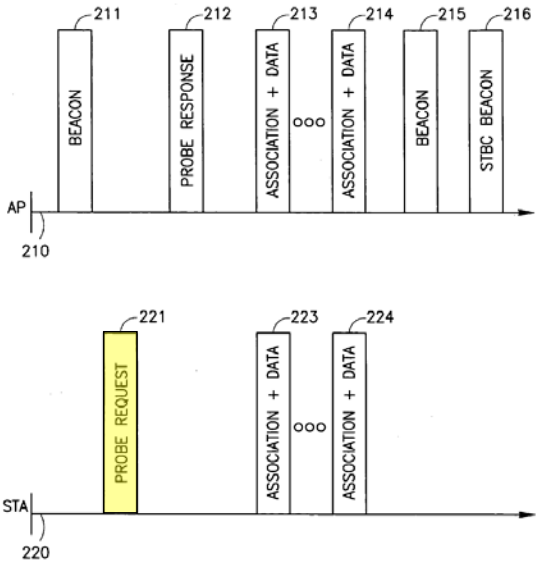


FIG. 2

Ex. 1007, FIG. 2 (annotated)

340. Still further, Waxman's FIG. 3, which illustrates a schematic flow-chart of a method similar to that of the timing diagram of FIG. 2, shows, at box 320, "receiving by the AP a probe request transmitted by a station." Ex. 1007, ¶¶ [0052], [0054], FIG. 3 (copied and annotated below). Waxman explains that the method of FIG. 3 may be implemented using any of stations 101, 102, 103 and/or AP 105. Ex. 1007, ¶ [0052].

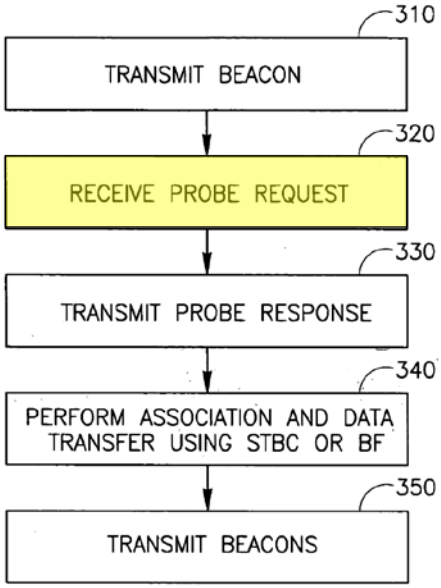


FIG.3

Ex. 1007, FIG. 3 (annotated)

341. Thus, Waxman describes an AP (e.g., AP 105) receiving a probe request. This teaches "receiving in a first node, a probe request" as claimed.

342. Waxman describes that the probe request includes a number of parameters for transmitting a probe response. For example, "[t]he probe request may include a Requested Transmission Scheme (RTS) field, which may include a value of a RTS parameter or other indication . . . [that] indicate[s] to AP 105 a transmission scheme (e.g., a TADS [Transmission Antenna Diversity Scheme]) requested by stations 101, 102 and/or 103." Ex. 1007, ¶ [0030]. The probe request "indicate[s] (e.g., using a value of a parameter in a field of the probe request) a requested transmission scheme, a requested number of transmission antennas to be used, and/or other attributes of a requested transmission scheme." Ex. 1007, ¶ [0035]. The Requested Transmission Scheme (RTS) parameters included in the probe request may include parameters that specify a type of communication scheme, a number of antennas, that the AP use Cyclic Delay Diversity (CDD), STBC communication, BF communication, or other transmission schemes in subsequent communications, among other parameters. Ex. 1007, ¶¶ [0031]-[0034].

343. A probe response (which is generated based on the parameters of the probe request) includes a packet having a preamble portion and a data portion. Ex. 1007, ¶¶ [0042]-[0043], [0056]. The '690 patent explains that physical layer (PHY) packets or probes "comprise preambles and payloads" in which the PHY preamble "is typically inserted at the beginning of each packet to assist receivers in detecting and acquiring the physical layer parameters to properly receive and

decode the packet" and the PHY payload "is used to transmit the data content of the packet." Ex. 1001, 3:42-58, 7:64-8:58. Thus, a POSITA would have understood that Waxman's probe response constitutes a physical layer probe that includes a preamble portion and a content payload/data portion. A POSITA also would have understood that probe request parameters would have specified content for the probe payload, e.g., identifying the probe request, indicating a station from which the probe request originated, providing confirmation of a requested transmission scheme, SSID of the requesting device (e.g., in the case of 802.11 which is one of the protocols used in Waxman (see Ex. 1007, [0009], [0013]-[0020]; IEEE Std 802.11-2007 (Ex. 1012, 84-85) showing SSID in probe request and probe response)) or other transmission parameter specified in the probe request (see IEEE Std 802.11-2007 (Ex. 1012, 84-85) showing Request information in both probe request and probe response), and the like. A POSITA would have understood that including content from the probe request in the payload of the probe response enables Waxman's station to tell that a particular probe response is responsive to a particular probe request. And in view of the above, Waxman teaches the probe request defining a number of parameters (e.g., number of transmission antennas, communication scheme, and/or other attributes of a requested transmission) for transmitting a probe response and that specify at least the data portion of the probe response. Therefore, Waxman teaches "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" as claimed.

344. Waxman explains that the "AP 105 may transmit a probe response if AP 105 is able to transmit using the requested transmission scheme." Ex. 1007, ¶ [0037]. The block 212 of Waxman shows a probe response transmitted by the AP to the station that sent the probe request. Ex. 1007, ¶ [0049], FIG. 2 (copied and annotated below).

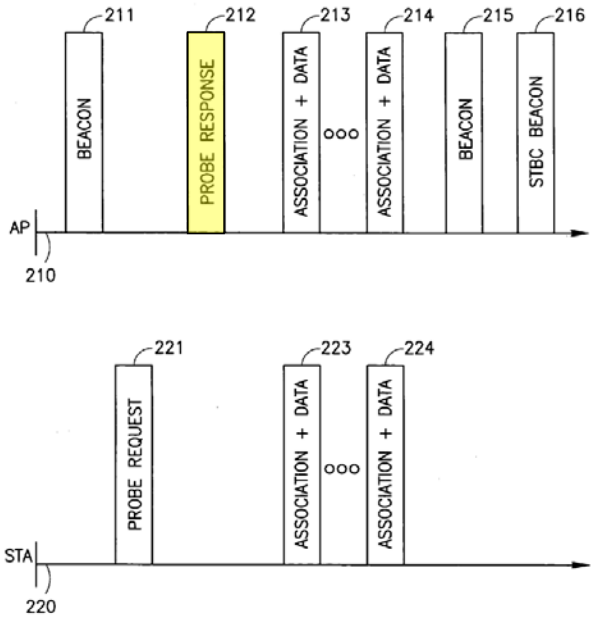


FIG.2

Ex. 1007, FIG. 2 (annotated)

345. Thus, Waxman describes that the AP (e.g., AP 105) generates a probe response for the station (e.g., station 101, 102, or 103) from which the probe

request was sent. This teaches "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 … a second node" as claimed.

346. In conclusion, Waxman teaches an AP (e.g., AP 105) receiving a probe request from a station (e.g., stations 101, 102, or 103), the probe request specifying a plurality of parameters for the probe response including a parameter specifying content for the payload of the probe response (e.g., in accordance with a specified transmission communication scheme) to the station that sent the probe request. This teaches the claimed "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" in limitation [1A]. Thus, Waxman teaches limitation [1A].

c) [1B]: "b) determining a second plurality of parameters associated with generation and transmission of the probe;"

347. Waxman teaches limitation [1B]. As I explained for limitation [1A] above, Waxman teaches the probe request defining a number of parameters (e.g., number of transmission antennas, communication schemes, and/or other attributes of a requested transmission) for transmitting a probe response. The probe response

is subsequently generated in accordance with these parameters. Ex. 1007, ¶¶ [0037]-[0039], [0049], [0055].

348. Also as part of generating the probe response, the AP 105 "may determine, e.g., based on a received probe request and/or other information, that AP 105 is requested or required to transmit data to a certain station using a certain extended-range transmission scheme, for example, TADS, STBC, BF, or the like; and may transmit data (e.g., subsequent data packets, including header portions and data portions) to that station using the requested or required scheme." Ex. 1007, ¶ [0030]. As explained with regard to box 320 of FIG. 3, "[t]he received probe request, and/or other information, may be used by the AP to determine that the AP is requested or required to transmit subsequent data packets using that extended-range transmission scheme (e.g., TADS, STBC, BF, or the like)." Ex. 1007, ¶ [0054].

349. Waxman explains that various transmission schemes make use of different parameters in transmitting data to a station. As an example, for an STBC scheme, "[t]he data stream to be transmitted may be encoded in blocks, which may be distributed among spaced antennas and across time." Ex. 1007, ¶ [0023]. "Characteristics of the STBC scheme may be represented using a matrix, for example, such that a row may represent a time slot, and a column may represent transmissions of an antenna over time." Ex. 1007, ¶ [0023]. A POSITA would

have understood that, if the AP were to send the probe response using an STBC scheme, the AP would have had to determine parameters for this matrix, e.g., based on a number of antennas and time slots for blocks of data.

350. As another example, for a BF scheme, "the information signal may be multiplied by a set of complex weights, wherein the number of weights may equal to the number of antennas used, and then may be transmitted by the antenna array" so that "[t]he signals emitted from different antennas in the array may differ in phase, e.g., based on the distance between antenna elements; and may further differ in amplitude, e.g., based on the various weights associated with various antennas." Ex. 1007, ¶ [0025]. Still further, for BF schemes, "[t]he direction of the beam may be set or modified, for example, by setting or modifying the values of the complex weights used in for multiplying, and/or by steering the direction of the antenna array." Ex. 1007, ¶ [0025]. Waxman further provides that various known methods may be used for setting or modifying beam direction, including but not limited to a switched BF scheme, an adaptive BF scheme, a BF scheme including Direction Of Arrival (DOA) estimation, a BF scheme utilizing an Estimation of Signal Parameters via Rotational Invariance Techniques (ESPRIT) algorithm, a BF scheme utilizing a Multiple Signal Classification (MUSIC) algorithm, a BF scheme utilizing a Min-Norm algorithm, a BF scheme utilizing a root-MUSIC algorithm, a BF scheme utilizing a sequential MUSIC algorithm, a BF scheme utilizing a Capon

beamformer, or a BF scheme utilizing a Rank Reduction Estimator (RARE) algorithm. Ex. 1007, ¶ [0026]. A POSITA would have understood that each of these specific BF schemes or algorithms involves setting a number of parameters. In some of the examples identified by Waxman, complex weights are selected from a "library" of weights that form beams in specific, predetermined directions for a switched BF scheme, which weights may be computed and adaptively updated in substantially real time when using an adaptive BF scheme. Ex. 1007, ¶¶ [0027]-[0028]. A POSITA would have understood that, if the AP were to send the probe response using a BF scheme, the AP would have had to determine parameters for setting or modifying beam direction, including setting values of complex weights and/or selecting a specific BF scheme or algorithm and values for that specific scheme or algorithm.

351. As another example, the AP may determine that Cyclic Delay Diversity (CDD) is specified. *See* Ex. 1007, ¶ [0031]. In such scenarios, a POSITA would have understood that the AP would have determined a number of duplications and path delays for sending communications.

352. Still further, Waxman describes that the AP's transceiver may operate in accordance with the IEEE 802.11 standard. Ex. 1007, ¶ [0020]. The IEEE 802.11 standard explains that "[t]he frame body of a management frame of subtype

Probe Response contains the information shown in Table 7-15 [copied below]." Ex. 1012, 84.

Table 7-15—Probe Response frame body

Order	Information	Notes
1	Timestamp	
2	Beacon interval	
3	Capability	
4	SSID	
5	Supported rates	
6	FH Parameter Set	The FH Parameter Set information element is present within Probe Response frames generated by STAs using FH PHYs.
7	DS Parameter Set	The DS Parameter Set information element is present within Probe Response frames generated by STAs using Clause 15, Clause 18, and Clause 19 PHYs.
8	CF Parameter Set	The CF Parameter Set information element is present only within Probe Response frames generated by APs supporting a PCF.
9	IBSS Parameter Set	The IBSS Parameter Set information element is present only within Probe Response frames generated by STAs in an IBSS.
10	Country	Included if dot11MultiDomainCapabilityEnabled or dot11SpectrumManagementRequired is true.
11	FH Parameters	FH Parameters, as specified in 7.3.2.10, may be included if dot11MultiDomainCapabilityEnabled is true.
12	FH Pattern Table	FH Pattern Table information, as specified in 7.3.2.11, may be included if dot11MultiDomainCapabilityEnabled is true.
13	Power Constraint	Shall be included if dot11SpectrumManagementRequired is true.
14	Channel Switch Announcement	May be included if dot11SpectrumManagementRequired is true.
15	Quiet	May be included if dot11SpectrumManagementRequired is true.
16	IBSS DFS	Shall be included if dot11SpectrumManagementRequired is true in an IBSS.
17	TPC Report	Shall be included if dot11SpectrumManagementRequired is true.
18	ERP Information	The ERP Information element is present within Probe Response frames generated by STAs using ERPs and is optionally present in other cases.
19	Extended Supported Rates	The Extended Supported Rates element is present whenever there are more than eight supported rates, and it is optional otherwise.
20	RSN	The RSN information element is only present within Probe Response frames generated by STAs that have dot11RSNA-Enabled set to TRUE.
21	BSS Load	The BSS Load element is present when dot11QosOption-Implemented and dot11QBSSLoadImplemented are both true.
22	EDCA Parameter Set	The EDCA Parameter Set element is present when dot11QosOptionImplemented is true.
Last–*l*	Vendor Specific	One or more vendor-specific information elements may appear in this frame. This information element follows all other information elements, except the Requested Information elements.
Last–*n*	Requested information elements	Elements requested by the Request information element of the Probe Request frame.

Table 7-15 sets forth a series of parameters for a probe response, which may include a frequency hopping parameter set, a distribution system (DS) parameter set, a contention free (CF) parameter set, among others, which each include a plurality of parameters. Ex. 1012, 84-85, 102-103. A POSITA would have understood that, if the AP were to send the probe response in accordance with the IEEE 802.11 standard, the AP would have had to determine parameters as set forth in the above table.

353. Waxman also explains that substantially entire packets, preamble portions, header portions, and/or data portions of data packets may be transmitted using various communication schemes. Ex. 1007, ¶¶ [0043]-[0044]. Thus, the AP would also have determined another set of parameters associated with which portions of packets are to be sent using specified transmission schemes. In other words, Waxman's AP additionally determines parameters for a type of transmission scheme, e.g., based on the type of scheme identified in the probe response and/or based on settings of the AP (such as antenna settings), for generating the probe response ("determining a second plurality of parameters associated with generation and transmission of the probe").

354. Waxman also explains that substantially entire packets, preamble portions, header portions, and/or data portions of data packets may be transmitted using various communication schemes. Ex. 1007, ¶¶ [0043]-[0044]. Thus, the AP

would also have determined another set of parameters associated with which portions of packets are to be sent using specified transmission schemes. In other words, Waxman's AP additionally determines parameters for a type of transmission scheme, e.g., based on the type of scheme identified in the probe response and/or based on settings of the AP (such as antenna settings), for generating the probe response ("determining a second plurality of parameters associated with generation and transmission of the probe").

355. To the extent that Waxman does not explicitly disclose the claimed "determining a second plurality of parameters," a POSITA would have found it obvious for the AP to determine a plurality of parameters for sending the probe response in order to generate a probe response in accordance with the requested transmission scheme and other settings associated with the AP and/or requesting stations. This would have been the mere use of a known technique (e.g., selection of algorithms and other parameters in a particular transmission scheme, and sets of parameters for entire packets, preamble portions, header portions, and/or data portions of data packets) to improve similar methods (Waxman's method for generating a probe response for a requesting station) in the same way. Indeed, as Waxman discusses both that the AP (claimed "first node") determines, based on the probe request, how to transmit a probe response and that various parameters that would have applied based on specified communication schemes that are

disclosed as specified in the probe request, a POSITA would have understood that such parameters would have been used as part of the AP generating an appropriate probe response.

356. In conclusion, Waxman teaches parameters determined by the AP (e.g., setting values of complex weights and/or selecting a specific BF algorithm and values for that algorithm when using BF communication or determining parameters for a matrix of time slots and antenna transmissions over time when using STBC communication) associated with the generation and transmission of the probe response. This teaches the claimed "determining a second plurality of parameters associated with generation and transmission of the probe" in limitation [1B]. Thus, Waxman teaches limitation [1B].

d) [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"

357. Waxman teaches limitation [1C]. Waxman explains that the "AP 105 may transmit a probe response if AP 105 is able to transmit using the requested transmission scheme." Ex. 1007, ¶ [0037]. The block 212 of Waxman shows a probe response transmitted by the AP to the station that sent the probe request. Ex. 1007, ¶ [0049], FIG. 2 (copied and annotated below).

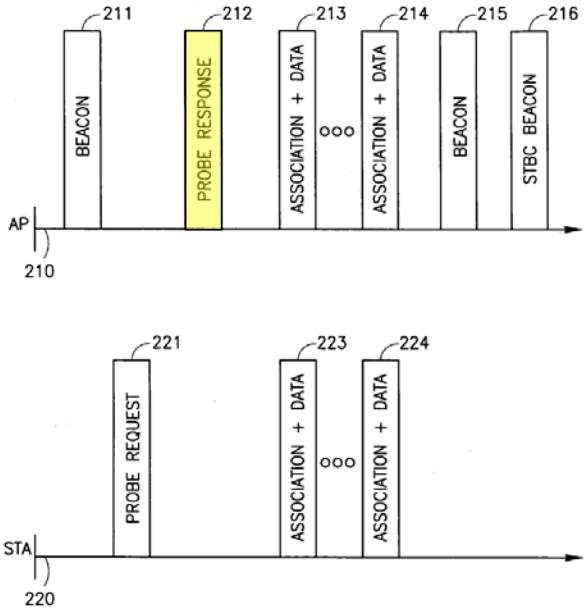


FIG.2

Ex. 1007, FIG. 2 (annotated)

358. And box 330 of Waxman's FIG. 3 shows a step of transmitting a probe response by the AP to the station. Ex. 1007, ¶ [0055], FIG. 3 (copied and annotated below).

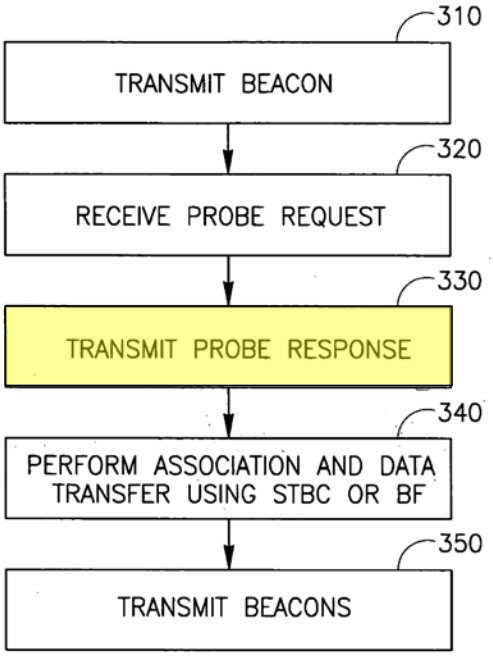


FIG. 3

Ex. 1007, FIG. 3 (annotated)

359. Thus, Waxman describes the AP (e.g., AP 105) generating the probe response for the station (e.g., station 101, 102, or 103) from which the probe request was sent. This teaches "generating the probe" as claimed.

360. As I explained for limitations [1A] and [1B] above, Waxman teaches the probe request defining a number of parameters (e.g., number of transmission antennas, communication schemes, and/or other attributes of a requested transmission) for transmitting a probe response and that the AP determines a number of parameters associated with the generation and transmission of the probe response. The probe response is subsequently generated in accordance with these

parameters (the claimed "generating the probe in accordance with the first plurality of parameters and the second plurality of parameters"). Ex. 1007, ¶¶ [0037]-[0039], [0049], [0055].

361. As I explained for limitation [1A], a POSITA would have understood that the various communications schemes specified in the probe request also specify a form for the probe response (which is the claimed "probe" as I explained above). Waxman therefore teaches parameters of the probe request including a transmission scheme that entails specifying a form for the probe response. This teaches "wherein the probe has a form dictated by the first plurality of parameters" as claimed.

362. In conclusion, Waxman teaches an AP (e.g., AP 105) generating the probe response based on parameters in the probe request for the transmission scheme that specifies a form for the probe response and parameters determined by the AP for transmitting the probe response. This teaches the claimed "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" in limitation [1C]. Thus, Waxman teaches limitation [1C].

e) [1D]: "d) transmitting the probe from the first node to the second node."

363. Waxman teaches limitation [1D]. Waxman explains that the "AP 105 may transmit a probe response if AP 105 is able to transmit using the requested

transmission scheme." Ex. 1007, ¶ [0037]. The block 212 of Waxman shows a probe response transmitted by the AP to the station that sent the probe request. Ex. 1007, ¶ [0049], FIG. 2 (copied and annotated below).

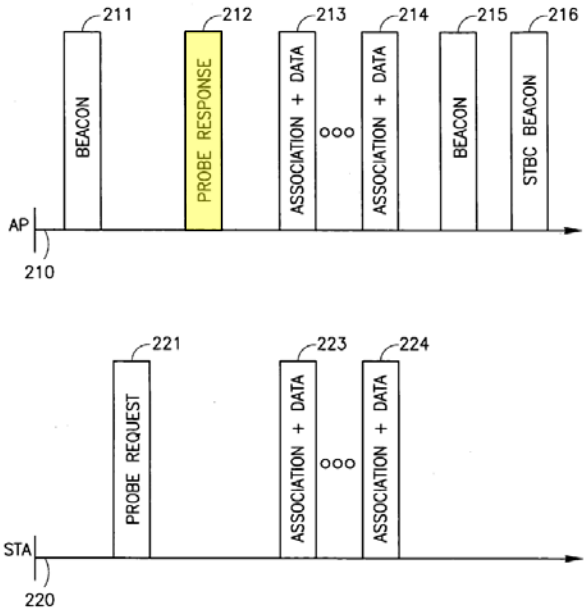


FIG.2

Ex. 1007, FIG. 2 (annotated)

364. And box 330 of Waxman's FIG. 3 shows a step of transmitting a probe response by the AP to the station. Ex. 1007, ¶ [0055], FIG. 3 (copied and annotated below).

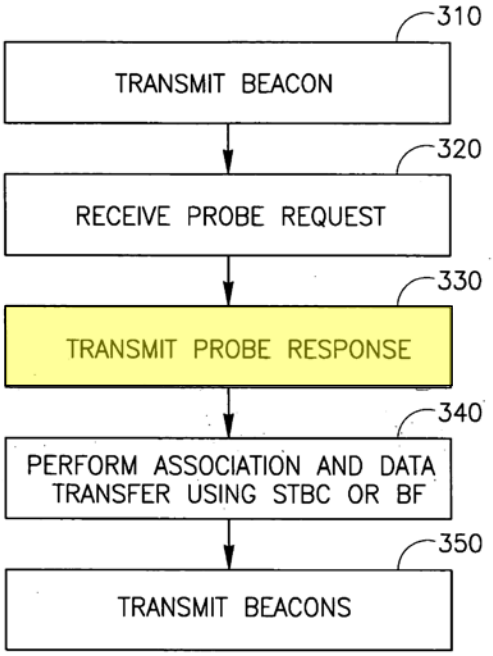


FIG. 3

Ex. 1007, FIG. 3 (annotated)

365. Thus, Waxman describes the station (e.g., station 101, 102, or 103) from which the probe request was sent receiving a probe response from the AP (e.g., AP 105). This teaches "transmitting the probe from the first node to the second node" as claimed. Thus, Waxman teaches limitation [1D].

366. For at least the above reasons, Waxman anticipates or renders obvious claim 1.

2. Dependent Claim 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."

367. Claim 2 of the '690 patent depends from claim 1, which is taught by Waxman, as discussed above. Claim 2 further requires that "using within the first node, at least one of the probe parameters to determine a modulation profile for the probe." Ex. 1001, claim 2. Waxman also teaches this feature as explained below.

368. As discussed above for limitation [1A], Waxman describes that the probe request includes a number of parameters, e.g., RTS parameters, for transmitting a probe response. Waxman provides, as examples of RTS parameters, that a probe request specifies a value of an RTS parameter that instructs the AP send subsequent transmissions to station using STBC communication or BF communication. Ex. 1007, ¶¶ [0032]-[0033]. Waxman explains that a STBC scheme "transmit[s] multiple copies of a data stream across multiple antennas, utilizing the various received versions of the data in order to improve the reliability of data transfer." Ex. 1007, ¶ [0022]. Because "[t]he transmitted data may traverse an environment which may cause scattering, reflection, corruption, or the like, such that some of the received copies of the data may be better than others," "[t]he redundancy may increase the ability of the remote receiver to use one or more of the received copies of the data to correctly decode the received signal." Ex. 1007, ¶ [0022]. Waxman further explains that:

> The STBC scheme may include transmission of multiple redundant copies of data to compensate for fading and thermal noise. The data stream to be transmitted may be encoded in blocks, which may be distributed among spaced antennas and across time. The receiving station may have, but is not required to have, multiple receive antennas, and may utilize diversity reception. Characteristics of the STBC scheme may be represented using a matrix, for example, such that a row may represent a time slot, and a column may represent transmissions of an antenna over time.

Ex. 1007, ¶ [0023]. The STBC scheme thus specifies transmitting a data stream encoded in a block distributed among antennas and over time. Thus, a POSITA would have understood that the STBC scheme specified in the probe request includes a modulation profile for the probe response (which is the claimed "probe" as I explained above).

369. For a BF scheme, Waxman explains that multiple antennas are used to transmit a symbol at a certain time slot. Ex. 1007, ¶ [0024]. Waxman provides additional examples of BF communications:

> In some embodiments, for example, BF transceiver 140 may focus a narrow beam targeted towards a single receiving station, e.g., utilizing a "smart" antenna array. For example, a linearly arranged and equally

> spaced array of antennas may be used by BF transceiver 140 to transmit data. In order to form a "beam", the information signal may be multiplied by a set of complex weights, wherein the number of weights may equal to the number of antennas used, and then may be transmitted by the antenna array. The signals emitted from different antennas in the array may differ in phase, e.g., based on the distance between antenna elements; and may further differ in amplitude, e.g., based on the various weights associated with various antennas. The direction of the beam may be set or modified, for example, by setting or modifying the values of the complex weights used in for multiplying, and/or by steering the direction of the antenna array. BF transmission may take advantage of interference to change the directionality of the antenna array; for example, when transmitting, the BF transceiver may controls [sic] the amplitude and phase of the signal at each antenna, in order to create a pattern of constructive and destructive interference in the wavefront.

Ex. 1007, ¶ [0025]. Waxman goes on to provide a number of known example schemes or algorithms for setting or modifying the direction of the beam. Ex. 1007, ¶¶ [0026]-[0028]. As one example, for a switched BF scheme, "the complex weights used may be selected from a 'library' of weights that form beams in

specific, predetermined directions." Ex. 1007, ¶ [0027]. As another example, for an adaptive BF scheme, "the weights may be computed and adaptively updated in substantially real time." Ex. 1007, ¶ [0028]. The BF scheme thus specifies weights for multiplying and/or steering the direction of an antenna array to control the amplitude and phase of the signal. Thus, a POSITA would have understood that the BF scheme specified in the probe request also includes a modulation profile for the probe response (which is the claimed "probe" as I explained above).

370. Waxman therefore teaches parameters of the probe request including a transmission scheme that entails specifying a form for the probe response including a modulation profile. This teaches "using within the first node, at least one of the probe parameters to determine a modulation profile for the probe" as claimed.

3. Dependent Claim 3

a) [3PRE]: "The method of claim 1, wherein at least one of the probe parameters indicates:"

371. Claim 3 of the '690 patent depends from claim 1, which is taught by Waxman, as discussed above. Claim 3 further includes a list of different pieces of data/information that the probe parameters indicate.[11] Ex. 1001, claim 3. In my

[11] I note that the term "probe parameters" is not exactly included in independent claim 1 and therefore it is unclear whether this term refers to "the first plurality of

opinion, the ordinary meaning of claim 3 requires one parameter to indicate all of the listed pieces of data/information. To the extent that claim 3 is considered to require only one of the probe parameters to indicate only one of the listed pieces of data/information, I have shown how Waxman teaches at least limitations [3A], [3B], and [3D] below.

b) [3A]: "a) a modulation profile for the probe;"

372. As discussed above for limitation [1A], Waxman describes that the probe request includes a number of parameters, e.g., RTS parameters, for transmitting a probe response. Waxman provides, as examples of RTS parameters, that a probe request specifies a value of an RTS parameter that instructs the AP send subsequent transmissions to station using STBC communication or BF communication. Ex. 1007, ¶¶ [0032]-[0033]. Waxman explains that a STBC scheme "transmit[s] multiple copies of a data stream across multiple antennas, utilizing the various received versions of the data in order to improve the reliability of data transfer." Ex. 1007, ¶ [0022]. Because "[t]he transmitted data may traverse an environment which may cause scattering, reflection, corruption, or the like, such that some of the received copies of the data may be better than others," "[t]he redundancy may increase the ability of the remote receiver to use one or

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parameters," "the second plurality of parameters" or both. For purposes of my analysis in this declaration, I have assumed "the probe parameters" refers to both.

more of the received copies of the data to correctly decode the received signal." Ex. 1007, ¶ [0022]. Waxman further explains that:

> The STBC scheme may include transmission of multiple redundant copies of data to compensate for fading and thermal noise. The data stream to be transmitted may be encoded in blocks, which may be distributed among spaced antennas and across time. The receiving station may have, but is not required to have, multiple receive antennas, and may utilize diversity reception. Characteristics of the STBC scheme may be represented using a matrix, for example, such that a row may represent a time slot, and a column may represent transmissions of an antenna over time.

Ex. 1007, ¶ [0023]. The STBC scheme thus specifies transmitting a data stream encoded in a block distributed among antennas and over time. Thus, a POSITA would have understood that the STBC scheme specified in the probe request includes a modulation profile for the probe response (which is the claimed "probe" as I explained above).

373. For a BF scheme, Waxman explains that multiple antennas are used to transmit a symbol at a certain time slot. Ex. 1007, ¶ [0024]. Waxman provides additional examples of BF communications:

In some embodiments, for example, BF transceiver 140 may focus a narrow beam targeted towards a single receiving station, e.g., utilizing a “smart” antenna array. For example, a linearly arranged and equally spaced array of antennas may be used by BF transceiver 140 to transmit data. In order to form a “beam”, the information signal may be multiplied by a set of complex weights, wherein the number of weights may equal to the number of antennas used, and then may be transmitted by the antenna array. The signals emitted from different antennas in the array may differ in phase, e.g., based on the distance between antenna elements; and may further differ in amplitude, e.g., based on the various weights associated with various antennas. The direction of the beam may be set or modified, for example, by setting or modifying the values of the complex weights used in for multiplying, and/or by steering the direction of the antenna array. BF transmission may take advantage of interference to change the directionality of the antenna array; for example, when transmitting, the BF transceiver may controls [sic] the amplitude and phase of the signal at each antenna, in order to create a pattern of constructive and destructive interference in the wavefront.

Ex. 1007, ¶ [0025]. Waxman goes on to provide a number of known example schemes or algorithms for setting or modifying the direction of the beam. Ex. 1007, ¶¶ [0026]-[0028]. As one example, for a switched BF scheme, "the complex weights used may be selected from a 'library' of weights that form beams in specific, predetermined directions." Ex. 1007, ¶ [0027]. As another example, for an adaptive BF scheme, "the weights may be computed and adaptively updated in substantially real time." Ex. 1007, ¶ [0028]. The BF scheme thus specifies weights for multiplying and/or steering the direction of an antenna array to control the amplitude and phase of the signal. Thus, a POSITA would have understood that the BF scheme specified in the probe request also includes a modulation profile for the probe response (which is the claimed "probe" as I explained above).

374. Waxman therefore teaches parameters of the probe request including a transmission scheme that entails specifying a form for the probe response including a modulation profile. This teaches "a modulation profile for the probe" as claimed.

c) [3B]: "b) the number of times to transmit the probe;"

375. Waxman teaches including a number of times to transmit a probe response in the parameters of its probe request. In one example, where an STBC scheme is specified by the RTS parameters, a transceiver of the AP "transmit[s] multiple copies of a data stream across multiple antennas." Ex. 1007, ¶ [0022]. "The redundancy [in transmitting multiple copies] may increase the ability of the

remote receiver to use one or more of the received copies of the data to correctly decode the received signal." Ex. 1007, ¶ [0022]. "The STBC scheme may include transmission of multiple redundant copies of data to compensate for fading and thermal noise." Ex. 1007, ¶ [0023]. Thus, a POSITA would have understood that, as part of specifying the various parameters for the STBC scheme that transmits multiple redundant copies of a probe response, that that probe request would have included a parameter specifying a number of redundant copies to transmit (a number of times to transmit the probe response).

376. Additionally, Waxman explains that, in response to a probe request, the AP 105 transmits signals "repeatedly or periodically" using the specified "transmission scheme." Ex. 1007, ¶¶ [0036], [0054], [0057]. For a signal to be generated and transmitted in accordance with the probe request "repeatedly," a POSITA would have understood that this would have entailed an indication of a number of times to transmit the probe, as the transmission must be repeated some finite number of times in accordance with system parameters and other details. Ex. 1007, ¶ [0036].

377. As such, Waxman teaches probe parameters specifying "the number of times to transmit the probe."

d) [3D]: "d) a preamble type for the probe;"

378. Waxman teaches including a preamble type for a probe in the parameters for generating a probe response. In particular, Waxman discusses that, based on parameters in a probe request, a transmission scheme for a preamble portion of the probe is specified. Ex. 1007, ¶¶ [0042]-[0043]. A POSITA would have understood that specifying a transmission scheme for the preamble portion of the probe includes specifying a preamble type for the probe.

379. As such, Waxman teaches probe parameters specifying "a preamble type for the probe."

4. Dependent Claim 4: "The method of claim 3, wherein the probe request identifies a hidden node."

380. Claim 4 of the '690 patent depends from claim 3, which is taught by Waxman, as discussed above. Claim 4 further requires that "the probe request identifies a hidden node," but says nothing about what a hidden node is. Ex. 1001, claim 4. Waxman also teaches this feature as explained below.

381. The '690 patent describes that "different settings available for different transmission types may be exploited to generate particular probes," which are used "in order to reach or identify a distant or hidden node." Ex. 1001, 8:59-9:6. For example, certain parameters of a probe request may be set to reach or identify distant or hidden nodes. Ex. 1001, 9:7-54.

382. Waxman describes a method for improving extended connectivity range in wireless communications. Ex. 1007, ¶ [0002]. Waxman describes that the AP 105 may periodically or repeatedly transmit a beacon signal, and that "stations 101-103 may be located remotely from AP 105, and may not receive the beacon signal, or may not properly receive the beacon signal, or may have a low or relatively low reliability of reception." Ex. 1007, ¶ [0029]. Subsequently, a station may perform an active scanning that includes transmitting a probe request. Ex. 1007, ¶ [0030]. "[T]he AP 105 may determine, e.g., based on a received probe request and/or other information, that AP 105 is requested or required to transmit data to a certain station using a certain extended-range transmission scheme, for example, TADS, STBC, BF, or the like; and may transmit data (e.g., subsequent data packets, including header portions and data portions) to that station using the requested or required scheme." Ex. 1007, ¶ [0030]. A POSITA would have understood that in a situation where a station has not received a beacon signal or that there is a low reliability of reception, that the probe request would have specified a transmission scheme more suitable for extended range communications, such as STBC or BF schemes. As such, upon specifying such a transmission scheme and receiving a probe response from that station, the AP would have identified a hidden probe (e.g., from an AP that the station did not reliable receive a reliable beacon signal from and that was previously hidden from the station).

383. This teaches the "the probe request identifies a hidden node" as claimed.

5. Dependent Claim 5: "The method of claim 3, wherein the modulation profile for the probe emulates an orthogonal frequency division multiple access (OFDMA) transmission."

384. Claim 5 of the '690 patent depends from claim 3, which is taught by Waxman, as discussed above. Claim 5 further requires that "the modulation profile for the probe emulates an orthogonal frequency division multiple access (OFDMA) transmission." Ex. 1001, claim 5. Waxman also teaches this feature as explained below.

385. As discussed for limitation [3A], Waxman teaches parameters of the probe request including a transmission scheme that entails specifying a form for the probe response including a modulation profile. Waxman also teaches that the probe request is configured to cause the probe response to emulate an OFDMA transmission. Waxman explains that "the invention may be used in conjunction with one or more types of wireless communication signals and/or systems, for example, … Orthogonal FDM (OFDM)." Ex. 1007, ¶ [0009]. An OFDMA scheme (an extension of OFDM) is an OFDM-based multiple access scheme that allows for multiple users. In particular, in OFDM, all subcarriers of the symbol are used for providing data for a specific user, whereas in OFDMA the subcarriers of each symbol may be divided between multiple users. The '690 patent explains

communications using OFDM and OFDMA, and that OFDMA makes use of OFDM symbols to allow multiple nodes simultaneous access to a channel. Ex. 1001, 4:39-5:13, 5:57-6:8.

386. In addition to OFDM, Waxman further suggests communications using OFDMA/OFDM. And in providing particular examples of probe requests, Waxman provides an example in which an RTS parameter indicates that the AP use Cyclic Delay Diversity in subsequent transmissions to the station. Ex. 1007, ¶ [0031]. CDD is a variant of standard delay diversity techniques that is usually implemented at the transmitter side (e.g., the AP) of an OFDM based system. Ex. 1017, Abstract; Ex. 1018, 1:7-33 (describing CDD in OFDM systems). POSITA would have understood the benefits of using OFDMA in a system with multiple users using OFDM. A POSITA also would have understood that the various examples of probe requests in Waxman are configured to dictate the modulation of the probe response, and in particular dictate that the probe response is transmitted using OFDMA.

387. In conclusion, Waxman teaches that the probe request is configured such that the probe response emulates an OFDMA transmission. This teaches that "the modulation profile for the probe emulates an orthogonal frequency division multiple access (OFDMA) transmission," as claimed. Thus, Waxman teaches claim 5.

6. Dependent Claim 6: "The method of claim 1, wherein the probe request is generated by the second node."

388. Claim 6 of the '690 patent depends from claim 1, which is taught by Waxman, as discussed above. Claim 6 further requires that "the probe request is generated by the second node." Ex. 1001, claim 6. Waxman also teaches this feature as explained below.

389. As explained for limitation [1A], any one of Waxman's stations 101, 102, 103 constitutes the claimed "second node." Waxman discloses an AP (e.g., AP 105) receiving a probe request from a station (e.g., any one of stations 101, 102, 103). For example, "[s]tations 101, 102 and/or 103 may perform an active scanning, e.g., may transmit a probe request" to access points, such as the AP 105. Ex. 1007, ¶ [0030]. A POSITA would have understood that as part of performing the active scanning process and transmitting the probe request, that the station generates the probe request. Thus, Waxman teaches claim 6.

7. Dependent Claim 7: "The method of claim 1, wherein the probe request requests a probe that assists in diagnosing a network problem."

390. Claim 7 of the '690 patent depends from claim 1, which is taught by Waxman, as discussed above. Claim 7 further requires that "the probe request requests a probe that assists in diagnosing a network problem," but says nothing about what the network problem is. Ex. 1001, claim 7. Waxman also teaches this feature as explained below.

391. Waxman's method is described as addressing issues in wireless communications in which "an extended connectivity range may not be achieved." Ex. 1007, ¶¶ [0001]-[0009]. In some examples, "stations 101-103 may be located remotely from AP 105, and may not receive the beacon signal, or may not properly receive the beacon signal, or may have a low or relatively low reliability of reception." Ex. 1007, ¶ [0029]. "For example, station 102 and/or station 103 may determine that they may not reliably receive signals from AP 105, e.g., based on a low Signal to Noise Ratio (SNR), based on a marginal detection, based on a reliability parameter, based on poor reception of the beacon signal, based on no reception of the beacon signal, or the like." Ex. 1007, ¶ [0029]. Waxman addresses these issues by providing a system in which each station sets a transmission scheme by which the AP transmits subsequent communications to that station in accordance with settings in the probe request. *See*, *e.g.*, Ex. 1007, ¶¶ [0040]-[0045], [0054]-[0056]. As such, Waxman's probe requests are configured to diagnose network problems associated with limited connectivity range or unreliable reception (a network problem) by use of a transmission scheme that reliably reaches a respective station. Accordingly, Waxman teaches that "the probe request requests a probe that assists in diagnosing a network problem" as claimed. Thus, Waxman teaches claim 7.

8. Dependent Claim 8: "The method of claim 7, wherein the probe request is generated by a network operator and uploaded to the second node."

392. Claim 8 of the '690 patent depends from claim 7, which is taught by Waxman, as discussed above. Claim 8 further requires that "the probe request is generated by a network operator and uploaded to the second node." Ex. 1001, claim 8. A POSITA would have understood that the claimed "network operator" could be a person or a computer, a processor, a microcontroller, a circuit (e.g., an integrated circuit (IC)), a program, or a software module (e.g., a portion of code) tasked with automatically operating a node. With this understanding, Waxman also teaches the features of claim 8 as explained below.

393. As discussed for limitation [1A] and for claim 6, Waxman describes generating and transmitting the probe request as part of a station performing an active scanning process. Ex. 1007, ¶¶ [0030], [0035]. A POSITA would have understood that such an active scanning process would have been initiated by a network operator and then uploaded to a station ("the second node"), e.g., as part of specifying conditions to initiate the active scanning process. Accordingly, Waxman teaches that "the probe request is generated by a network operator and uploaded to the second node."

394. Thus, Waxman teaches claim 8.

9. Independent Claim 9

a) [9PRE]: "A method comprising:"

395. This preamble is disclosed by Waxman for the same reasons provided above for limitation [1PRE]. Independent claim 9 is similar to independent claim 1, but is written from the perspective of the node that sends the probe request and receives the probe response. As such, the first node in claim 9 corresponds to the second node in claim 1, while the second node in claim 9 corresponds to the first node in claim 1. As I will explain below, Waxman's method includes limitations [9A]-[9B]. See Sections XII.D.9.b-c, below. Thus, Waxman teaches limitation [9PRE].

b) [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;"

396. Waxman describes techniques to extend connectivity range between a wireless Access Point (AP) and a wireless communication station. Ex. 1007, ¶ [0001]. Waxman provides an example system includes "one or more wireless communication stations, for example, stations 101, 102 and 103" and "one or more wireless devices, for example, a wireless Access Point (AP) 105." Ex. 1007, ¶ [0012]. "**Station 101, station 102, station 103**, and AP 105 may communicate using a shared access medium 190, for example, through **wireless communication**

links 191, 192, 193, and 195, respectively." Ex. 1007, ¶ [0012] (emphasis and color coding added). Each of **stations 101, 102, and 103** includes respective wireless RF transceivers (e.g., **transceiver 151, transceiver 161, and transceiver 171**, respectively) "to transmit and receive wireless communication signals, e.g., utilizing an antenna" (e.g., **antenna 152, antenna 162, antenna 172**). Ex. 1007, ¶¶ [0014]-[0017] (emphasis and color coding added), FIG. 1 (annotated and copied below, to show each **station** has a respective **transceiver**, **antenna**, and **wireless communication link**).

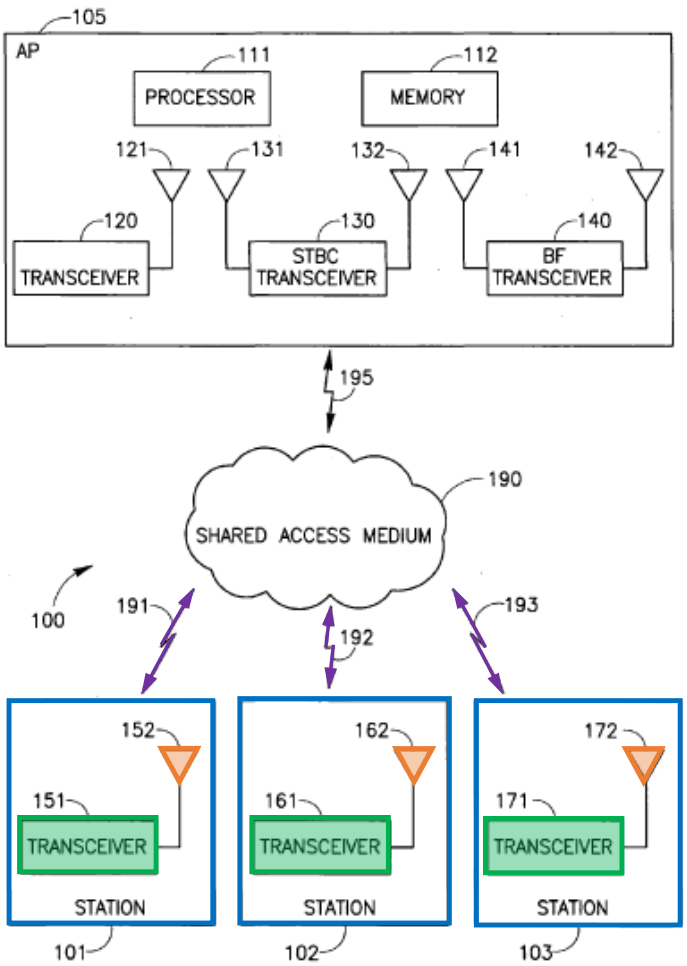


FIG.1

Ex. 1007, FIG. 1 (annotated).

397. Transceivers of wireless stations may additionally be configured "to operate in accordance with IEEE 802.11 standard, e.g., IEEE 802.11n standard," "to utilize a first Transmission Antenna Diversity Scheme (TADS), for example, Space-Time Block Codes (STBC) communication scheme, e.g., using a STBC equalizer which may be included in transceiver [] or may be operatively associated with transceiver," and/or "to utilize a second TADS, for example, Beam Forming

(BF) communication scheme, e.g., using signal targeting or signal focusing techniques." Ex. 1007, ¶¶ [0014]-[0016]. Stations 101, 102, 103 also include "other suitable hardware components and/or software components." Ex. 1007, ¶¶ [0014]-[0016]. While paragraph [0015] of Waxman describes a specific example in which station 102 uses an STBC communication scheme, and paragraph [0016] of Waxman describes a specific example in which station 103 uses a BF communication scheme, a POSITA would have understood that each the stations would have been configured to use any combination of suitable communication schemes and would have switched from among the various communications schemes as appropriate. *See*, *e.g.*, Ex. 1007, ¶¶ [0015]-[0016], [0045] (describing station 102 switching communication schemes based on a proximity to a respective AP). In other words, depending on various settings (e.g., proximity to an AP), each station would have been configured to use a variety of communication schemes to communicate with respective APs. Ex. 1007, ¶¶ [0014]-[0017], [0045].

398. As the '690 patent describes a node as being "associated with a variety of devices" including a network communication module associated with a computer or a module configured to interface with a network, any one of Waxman's stations 101, 102, 103 constitutes the claimed "first node." Ex. 1001, 4:10-24.

399. Waxman also describes that the AP 105 includes "a processor 111, a memory unit 112, and one or more wireless transceivers, e.g., a transceiver 120, a STBC transceiver 130, and a BF transceiver 140" as well as "other suitable hardware components and/or software components." Ex. 1007, ¶¶ [0017]-[0019]. Specific to the AP 105, the processor 111 processes signals and/or data transmitted and/or received by the AP 105. Ex. 1007, ¶ [0018]. The transceiver 120 communicates with a respective transceiver of a wireless communication station, e.g., the transceiver 151 of the station 101. Ex. 1007, ¶ [0020]. The STBC transceiver 130 communicates with a respective transceiver of a wireless communication station, e.g., the transceiver 161 of the station 102. Ex. 1007, ¶¶ [0021]-[0023]. The BF transceiver 140 communicates with a respective transceiver of a wireless communication station, e.g., transceiver the 171 of the station 103. Ex. 1007, ¶¶ [0024]-[0028]. As the '690 patent describes a node as being "associated with a variety of devices" including a network communication module associated with a computer or a module configured to interface with a network, Waxman's AP 105 constitutes "a second node." Ex. 1001, 4:10-24.

400. Waxman's method "includes receiving a probe request including an indication of a requested transmission scheme." Ex. 1007, Abstract. For example, "[s]tations 101, 102 and/or 103 may perform an active scanning, e.g., may transmit a probe request" to access points, such as the AP 105. Ex. 1007, ¶ [0030]. In FIG.

2, Waxman schematically illustrates a timing diagram of wireless communication signals, in which a horizontal axis 210 indicates the timing of wireless communication signals transmitted by a wireless AP, e.g., by the AP 105 of FIG. 1; whereas a horizontal axis 220 indicates the timing of wireless communication signals transmitted by a wireless communication station, e.g., by the station 102 of FIG. 1. Ex. 1007, ¶ [0046], FIGs. 1-2. As shown in FIG. 2 (copied and annotated below), block 221 shows a probe request transmitted by the station to the AP. Ex. 1007, ¶ [0048], FIG. 2.

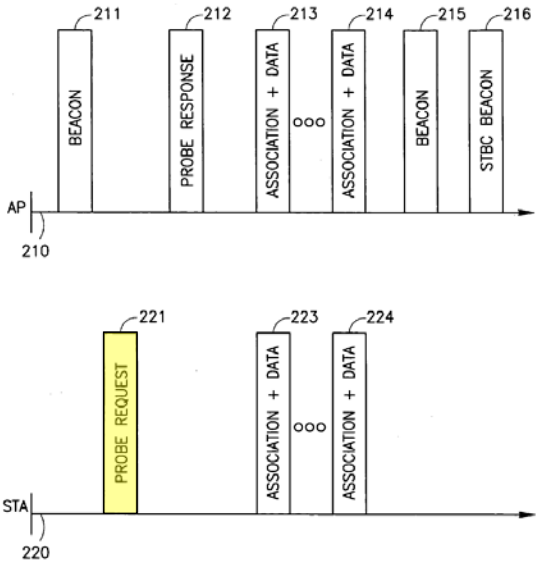


FIG.2

Ex. 1007, FIG. 2 (annotated)

401. Still further, Waxman's FIG. 3, which illustrates a schematic flow-chart of a method similar to that of the timing diagram of FIG. 2, shows, at box 320, "receiving by the AP a probe request transmitted by a station." Ex. 1007, ¶¶

[0052], [0054], FIG. 3 (copied and annotated below). Waxman explains that the method of FIG. 3 may be implemented using any of stations 101, 102, 103 and/or AP 105. Ex. 1007, ¶ [0052].

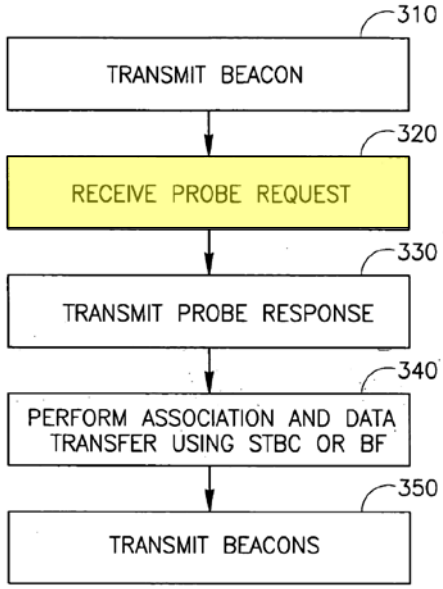


FIG.3

402. Thus, Waxman describes a station (e.g., station 101, station 102, or station 103) sending a probe request to an AP (e.g., AP 105). This teaches "a first node transmitting a probe request to a second node" as claimed.

403. Waxman describes that the probe request includes a number of parameters for transmitting a probe response. For example, "[t]he probe request may include a Requested Transmission Scheme (RTS) field, which may include a value of a RTS parameter or other indication . . . [that] indicate[s] to AP 105 a transmission scheme (e.g., a TADS [Transmission Antenna Diversity Scheme])

requested by stations 101, 102 and/or 103." Ex. 1007, ¶ [0030]. The probe request "indicate[s] (e.g., using a value of a parameter in a field of the probe request) a requested transmission scheme, a requested number of transmission antennas to be used, and/or other attributes of a requested transmission scheme." Ex. 1007, ¶ [0035]. The Requested Transmission Scheme (RTS) parameters included in the probe request may include parameters that specify a type of communication scheme, a number of antennas, that the AP use Cyclic Delay Diversity (CDD), STBC communication, BF communication, or other transmission schemes in subsequent communications, among other parameters. Ex. 1007, ¶¶ [0031]-[0034].

404. A probe response (which is generated based on the parameters of the probe request) includes a packet having a preamble portion and a data portion. Ex. 1007, ¶¶ [0042]-[0043], [0056]. The '690 patent explains that physical layer (PHY) packets or probes "comprise preambles and payloads" in which the PHY preamble "is typically inserted at the beginning of each packet to assist receivers in detecting and acquiring the physical layer parameters to properly receive and decode the packet" and the PHY payload "is used to transmit the data content of the packet." Ex. 1001, 3:42-58, 7:64-8:58. Thus, a POSITA would have understood that Waxman's probe response constitutes a physical layer probe. And in view of the above, Waxman teaches the probe request defining a number of parameters (e.g., number of transmission antennas, communication scheme, and/or

other attributes of a requested transmission) for transmitting a probe response. Therefore, Waxman teaches "the probe request specifying a first plurality of probe parameters for a physical layer probe" as claimed.

405. Waxman provides, as examples of RTS parameters, that a probe request specifies a value of an RTS parameter that instructs the AP send subsequent transmissions to station using STBC communication or BF communication. Ex. 1007, ¶¶ [0032]-[0033]. Waxman explains that a STBC scheme "transmit[s] multiple copies of a data stream across multiple antennas, utilizing the various received versions of the data in order to improve the reliability of data transfer." Ex. 1007, ¶ [0022]. Because "[t]he transmitted data may traverse an environment which may cause scattering, reflection, corruption, or the like, such that some of the received copies of the data may be better than others," "[t]he redundancy may increase the ability of the remote receiver to use one or more of the received copies of the data to correctly decode the received signal." Ex. 1007, ¶ [0022]. Waxman further explains that:

> The STBC scheme may include transmission of multiple redundant copies of data to compensate for fading and thermal noise. The data stream to be transmitted may be encoded in blocks, which may be distributed among spaced antennas and across time. The receiving station may have, but is not required to have, multiple receive

> antennas, and may utilize diversity reception. Characteristics of the STBC scheme may be represented using a matrix, for example, such that a row may represent a time slot, and a column may represent transmissions of an antenna over time.

Ex. 1007, ¶ [0023]. The STBC scheme thus specifies transmitting a data stream encoded in a block distributed among antennas and over time. Thus, a POSITA would have understood that the STBC scheme specified in the probe request includes a modulation profile for the probe response (which is the claimed "probe" as I explained above).

406. For a BF scheme, Waxman explains that multiple antennas are used to transmit a symbol at a certain time slot. Ex. 1007, ¶ [0024]. Waxman provides additional examples of BF communications:

> In some embodiments, for example, BF transceiver 140 may focus a narrow beam targeted towards a single receiving station, e.g., utilizing a "smart" antenna array. For example, a linearly arranged and equally spaced array of antennas may be used by BF transceiver 140 to transmit data. In order to form a "beam", the information signal may be multiplied by a set of complex weights, wherein the number of weights may equal to the number of antennas used, and then may be transmitted by the antenna array. The signals emitted from different

> antennas in the array may differ in phase, e.g., based on the distance between antenna elements; and may further differ in amplitude, e.g., based on the various weights associated with various antennas. The direction of the beam may be set or modified, for example, by setting or modifying the values of the complex weights used in for multiplying, and/or by steering the direction of the antenna array. BF transmission may take advantage of interference to change the directionality of the antenna array; for example, when transmitting, the BF transceiver may controls [sic] the amplitude and phase of the signal at each antenna, in order to create a pattern of constructive and destructive interference in the wavefront.

Ex. 1007, ¶ [0025]. Waxman goes on to provide a number of known example schemes or algorithms for setting or modifying the direction of the beam. Ex. 1007, ¶¶ [0026]-[0028]. As one example, for a switched BF scheme, "the complex weights used may be selected from a 'library' of weights that form beams in specific, predetermined directions." Ex. 1007, ¶ [0027]. As another example, for an adaptive BF scheme, "the weights may be computed and adaptively updated in substantially real time." Ex. 1007, ¶ [0028]. The BF scheme thus specifies weights for multiplying and/or steering the direction of an antenna array to control the amplitude and phase of the signal. Thus, a POSITA would have understood

that the BF scheme specified in the probe request also includes a modulation profile for the probe response (which is the claimed "probe" as I explained above).

407. Waxman therefore teaches parameters of the probe request including a transmission scheme that entails specifying a form for the probe response including a modulation profile. This teaches "the first plurality of probe parameters comprising a form for the probe including a modulation profile for the probe" as claimed.

408. In conclusion, Waxman teaches a station (e.g., stations 101, 102, or 103) transmitting a probe request to an AP (e.g., AP 105), the probe request specifying a plurality of parameters for the probe response including a parameter for the transmission scheme that specifies a form (in particular, it specifies a modulation profile) for the probe response. This teaches the claimed "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" in limitation [9A]. Thus, Waxman teaches limitation [9A].

c) [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."

409. Waxman teaches limitation [9B]. Waxman explains that the "AP 105 may transmit a probe response if AP 105 is able to transmit using the requested transmission scheme." Ex. 1007, ¶ [0037]. The block 212 of Waxman shows a probe response transmitted by the AP to the station that sent the probe request. Ex. 1007, ¶ [0049], FIG. 2 (copied and annotated below).

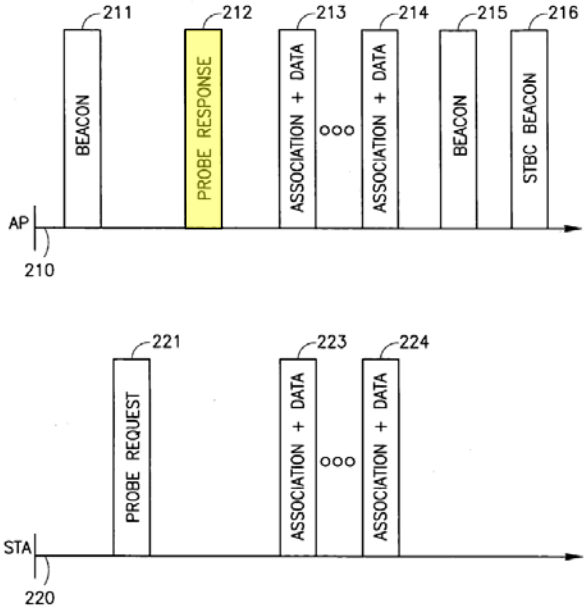


FIG.2

Ex. 1007, FIG. 2 (annotated).

410. And box 330 of Waxman's FIG. 3 shows a step of transmitting a probe response by the AP to the station. Ex. 1007, ¶ [0055], FIG. 3 (copied and annotated below).

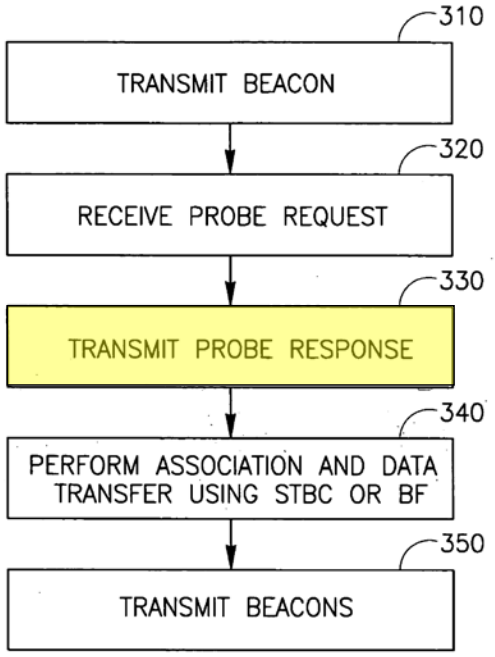


FIG.3

Ex. 1007, FIG. 3 (annotated).

411. Thus, Waxman describes the station (e.g., station 101, 102, or 103) from which the probe request was sent receiving a probe response from the AP (e.g., AP 105). This teaches "the first node receiving the probe from the second node" as claimed.

412. As I explained for limitation [9A] above, Waxman teaches the probe request defining a number of parameters (e.g., number of transmission antennas,

communication schemes, and/or other attributes of a requested transmission) for transmitting a probe response. The probe response is subsequently generated in accordance with these parameters (the claimed "wherein the probe is generated in accordance with the first plurality of parameters…"). Ex. 1007, ¶¶ [0037]-[0039], [0049], [0055].

413. Also as part of generating the probe response, the AP 105 "may determine, e.g., based on a received probe request and/or other information, that AP 105 is requested or required to transmit data to a certain station using a certain extended-range transmission scheme, for example, TADS, STBC, BF, or the like; and may transmit data (e.g., subsequent data packets, including header portions and data portions) to that station using the requested or required scheme." Ex. 1007, ¶ [0030]. As explained with regard to box 320 of FIG. 3, "[t]he received probe request, and/or other information, may be used by the AP to determine that the AP is requested or required to transmit subsequent data packets using that extended-range transmission scheme (e.g., TADS, STBC, BF, or the like)." Ex. 1007, ¶ [0054].

414. Waxman explain that various transmission schemes make use of different parameters in transmitting data from a station. As an example, for an STBC scheme, "[t]he data stream to be transmitted may be encoded in blocks, which may be distributed among spaced antennas and across time." Ex. 1007, ¶

[0023]. "Characteristics of the STBC scheme may be represented using a matrix, for example, such that a row may represent a time slot, and a column may represent transmissions of an antenna over time." Ex. 1007, ¶ [0023]. A POSITA would have understood that, if the AP were to send the probe response using an STBC scheme, the AP would have had to determine parameters for this matrix, based on a number of antennas and time slots for blocks of data.

415. As another example, for a BF scheme, "the information signal may be multiplied by a set of complex weights, wherein the number of weights may equal to the number of antennas used, and then may be transmitted by the antenna array" so that "[t]he signals emitted from different antennas in the array may differ in phase, e.g., based on the distance between antenna elements; and may further differ in amplitude, e.g., based on the various weights associated with various antennas." Ex. 1007, ¶ [0025]. Still further, for BF schemes, "[t]he direction of the beam may be set or modified, for example, by setting or modifying the values of the complex weights used in for multiplying, and/or by steering the direction of the antenna array." Ex. 1007, ¶ [0025]. Waxman further provides that various known methods may be used for setting or modifying beam direction, including but not limited to a switched BF scheme, an adaptive BF scheme, a BF scheme including Direction Of Arrival (DOA) estimation, a BF scheme utilizing an Estimation of Signal Parameters via Rotational Invariance Techniques (ESPRIT) algorithm, a BF

scheme utilizing a Multiple Signal Classification (MUSIC) algorithm, a BF scheme utilizing a Min-Norm algorithm, a BF scheme utilizing a root-MUSIC algorithm, a BF scheme utilizing a sequential MUSIC algorithm, a BF scheme utilizing a Capon beamformer, or a BF scheme utilizing a Rank Reduction Estimator (RARE) algorithm. Ex. 1007, ¶ [0026]. Each of these specific BF schemes or algorithm involves setting a number of parameters. In some of the examples identified by Waxman, complex weights are selected from a "library" of weights that form beams in specific, predetermined directions for a switched BF scheme, which weights may be computed and adaptively updated in substantially real time when using an adaptive BF scheme. Ex. 1007, ¶¶ [0027]-[0028]. A POSITA would have understood that, if the AP were to send the probe response using a BF scheme, the AP would have had to determine parameters for setting or modifying beam direction, including setting values of complex weights and/or selecting a specific BF scheme or algorithm and values for that specific scheme or algorithm.

416. As another example, the AP may determine that Cyclic Delay Diversity (CDD) is specified. See Ex. 1007, ¶ [0031]. In such scenarios, a POSITA would have understood that the AP would have determined a number of duplications and path delays for sending communications.

417. Still further, Waxman describes that the AP's transceiver may operate in accordance with the IEEE 802.11 standard. Ex. 1007, ¶ [0020]. The IEEE

802.11 standard explains that "[t]he frame body of a management frame of subtype Probe Response contains the information shown in Table 7-15 [copied below]." Ex. 1012, 84.

Table 7-15—Probe Response frame body

Order	Information	Notes
1	Timestamp	
2	Beacon interval	
3	Capability	
4	SSID	
5	Supported rates	
6	FH Parameter Set	The FH Parameter Set information element is present within Probe Response frames generated by STAs using FH PHYs.
7	DS Parameter Set	The DS Parameter Set information element is present within Probe Response frames generated by STAs using Clause 15, Clause 18, and Clause 19 PHYs.
8	CF Parameter Set	The CF Parameter Set information element is present only within Probe Response frames generated by APs supporting a PCF.
9	IBSS Parameter Set	The IBSS Parameter Set information element is present only within Probe Response frames generated by STAs in an IBSS.
10	Country	Included if dot11MultiDomainCapabilityEnabled or dot11SpectrumManagementRequired is true.
11	FH Parameters	FH Parameters, as specified in 7.3.2.10, may be included if dot11MultiDomainCapabilityEnabled is true.
12	FH Pattern Table	FH Pattern Table information, as specified in 7.3.2.11, may be included if dot11MultiDomainCapabilityEnabled is true.
13	Power Constraint	Shall be included if dot11SpectrumManagementRequired is true.
14	Channel Switch Announcement	May be included if dot11SpectrumManagementRequired is true.
15	Quiet	May be included if dot11SpectrumManagementRequired is true.
16	IBSS DFS	Shall be included if dot11SpectrumManagementRequired is true in an IBSS.
17	TPC Report	Shall be included if dot11SpectrumManagementRequired is true.
18	ERP Information	The ERP Information element is present within Probe Response frames generated by STAs using ERPs and is optionally present in other cases.
19	Extended Supported Rates	The Extended Supported Rates element is present whenever there are more than eight supported rates, and it is optional otherwise.
20	RSN	The RSN information element is only present within Probe Response frames generated by STAs that have dot11RSNA-Enabled set to TRUE.
21	BSS Load	The BSS Load element is present when dot11QosOption-Implemented and dot11QBSSLoadImplemented are both true.
22	EDCA Parameter Set	The EDCA Parameter Set element is present when dot11QosOptionImplemented is true.
Last–*l*	Vendor Specific	One or more vendor-specific information elements may appear in this frame. This information element follows all other information elements, except the Requested Information elements.
Last–*n*	Requested information elements	Elements requested by the Request information element of the Probe Request frame.

Table 7-15 sets forth a series of parameters for a probe response, which may include a frequency hopping parameter set, a distribution system (DS) parameter

set, a contention free (CF) parameter set, among others, which each include a plurality of parameters. Ex. 1012, 84-85, 102-103. A POSITA would have understood that, if the AP were to send the probe response in accordance with the IEEE 802.11 standard, the AP would have had to determine parameters as set forth in the above table.

418. Waxman also explains that substantially entire packets, preamble portions, header portions, and/or data portions of data packets may be transmitted using various communication schemes. Ex. 1007, ¶¶ [0043]-[0044]. Thus, the AP would also have determined another set of parameters associated with which portions of packets are to be sent using specified transmission schemes. In other words, Waxman's AP additionally determines parameters for a type of transmission scheme, e.g., based on the type of scheme identified in the probe response and/or based on settings of the AP (such as antenna settings), for generating the probe response ("wherein the probe is generated … in accordance with a second plurality of parameters determined by the second node").

419. To the extent that Waxman does not explicitly disclose the claimed "second plurality of parameters determined by the second node," a POSITA would have found it obvious for the AP to determine a plurality of parameters for sending the probe response in order to generate a probe response in accordance with the requested transmission scheme and other settings associated with the AP and/or

requesting stations. This would have been the mere use of a known technique (e.g., selection of algorithms and other parameters in a particular transmission scheme, and sets of parameters for entire packets, preamble portions, header portions, and/or data portions of data packets) to improve similar methods (Waxman's method for generating a probe response for a requesting station) in the same way. Indeed, as Waxman discusses both that the AP (claimed "second node") determines, based on the probe request, how to transmit a probe response and that various parameters that would have applied based on specified communication schemes that are disclosed as specified in the probe request, a POSITA would have understood that such parameters would have been used as part of the AP generating an appropriate probe response.

420. In conclusion, Waxman teaches the station (e.g., stations 101, 102, or 103) receiving the probe response from the AP (e.g., AP 105), wherein the probe response is generated in accordance with the parameters in the probe request (e.g., number of transmission antennas, communication scheme, and/or other attributes of a requested transmission) and parameters determined by the AP (e.g., setting values of complex weights and/or selecting a specific BF algorithm and values for that algorithm when using BF communication or determining parameters for a matrix of time slots and antenna transmissions over time when using STBC communication). This teaches the claimed "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" in limitation [9B]. Thus, Waxman teaches limitation [9B].

421. For at least the above reasons, Waxman anticipates or renders obvious claim 9.

10. Dependent Claim 10: "The method of claim 9, wherein the probe request is configured such that the probe emulates an OFDMA transmission."

422. Claim 10 of the '690 patent depends from claim 9, which is taught by Waxman, as discussed above. Claim 10 further requires that "the probe request is configured such that the probe emulates an OFDMA transmission." Ex. 1001, claim 10. Waxman also teaches this feature as explained below. Claim 10 is similar to claim 5 and thus the reasons below are similar to the reasons given above for claim 5.

423. Waxman also teaches that the probe request is configured to cause the probe response to emulate an OFDMA transmission. Waxman explains that "the invention may be used in conjunction with one or more types of wireless communication signals and/or systems, for example, … Orthogonal FDM (OFDM)." Ex. 1007, ¶ [0009]. An OFDMA scheme (an extension of OFDM) is an OFDM-based multiple access scheme that allows for multiple users. In

particular, in OFDM, all subcarriers of the symbol are used for providing data for a specific user, whereas in OFDMA the subcarriers of each symbol may be divided between multiple users. The ’690 patent explains communications using OFDM and OFDMA, and that OFDMA makes use of OFDM symbols to allow multiple nodes simultaneous access to a channel. Ex. 1001, 4:39-5:13, 5:57-6:8.

424. In addition to OFDM, Waxman further suggests communications using OFDMA/OFDM. And in providing particular examples of probe requests, Waxman provides an example in which an RTS parameter indicates that the AP use Cyclic Delay Diversity in subsequent transmissions to the station. Ex. 1007, ¶ [0031]. CDD is a variant of standard delay diversity techniques that is usually implemented at the transmitter side (e.g., the AP) of an OFDM based system. Ex. 1017, Abstract; Ex. 1018, 1:7-33 (describing CDD in OFDM systems). A POSITA would have understood the benefits of using OFDMA in a system with multiple users using OFDM. A POSITA also would have understood that the various examples of probe requests in Waxman are configured to dictate the modulation of the probe response, and in particular dictate that the probe response is transmitted using OFDMA.

425. In conclusion, Waxman teaches that the probe request is configured such that the probe response emulates an OFDMA transmission. This teaches “the

probe request is configured such that the probe emulates an OFDMA transmission" as claimed. Thus, Waxman teaches claim 10.

11. Dependent Claim 11

d) [11PRE]: "The method of claim 9, further comprising:"

426. Claim 11 of the '690 patent depends from claim 9, which is taught by Waxman, as discussed above. Claim 11 essentially adds a second instance of sending a probe request and receiving a probe to the first instance in independent claim 9 and the feature of using OFDMA that was in claim 10. It also adds the concept of transmitting two probes "simultaneously." Although Waxman does not expressly disclose this "simultaneously" feature, in my opinion a POSITA would have understood that it teaches all features of claim 11 as explained below, and therefore teaches limitation [11PRE].

e) [11A]: "a) the first node transmitting a second probe request to a third node;"

427. This step in limitation [11A] is essentially another instance of the step in limitation [9A] and therefore is taught by Waxman for the same reasons as explained above. While Waxman's FIG. 1 illustrates a single AP 105, Waxman explains that "[o]perations of the method may be implemented, for example, by system 100 of FIG. 1, by stations 102 and/or 103 of FIG. 1, by AP 105 of FIG. 1, ***and***/or by other suitable stations, ***APs,*** transceivers, units, devices, and/or

systems." Ex. 1007, ¶ [0052] (emphasis added). A POSITA would have understood that Waxman's system would have operated with many different APs. And, for at least the same reasons that I explain above for limitation [9A], Waxman teaches a station (e.g., one of stations 101, 102, or 103, any of which is the "first node" in limitation [9A] as explained above and would also be "the first node" in limitation [11A]) transmitting another probe request ("a second probe request" in limitation [11A]) to an additional AP ("a third node" in limitation [11A]). Ex. 1007, ¶¶ [0030], [0045], [0048], [0052], [0054], FIGs. 2-3. Thus, Waxman teaches limitation [11A].

f) [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"

428. This step in limitation [11B] is essentially another instance of the step in limitation [9B] and therefore is taught by Waxman for the same reasons as explained above. Waxman teaches the station ("the first node" in limitation [11B]) receiving another probe response ("a second probe" in limitation [11B] in addition to the probe response that is the "probe" in limitation [9B]) from the additional AP ("the third node") based on parameters specified in the probe request that is sent to the additional AP ("wherein the second probe is generated according to the second probe request"). *See*, *e.g.*, Ex. 1007, ¶¶ [0030], [0037]-[0039], [0049], [0054]-[0055]. Thus, Waxman teaches limitation [11B].

g) [11C]: "wherein the first probe and second probe are transmitted simultaneously using OFDMA."

429. As I explained for claim 10, Waxman teaches transmitting probe responses using OFDMA. Section XII.D.10; Ex. 1007, ¶¶ [0009], [0031]. As OFDMA is beneficial to allocate bandwidth to allow for simultaneous transmission, a POSITA would have understood and found it obvious that the stations configured to employ OFDMA would have received probe responses simultaneously. Stations using OFDMA would not have controlled when the AP sends a probe response, so those stations would have been configured to receive probe responses that were simultaneously transmitted by different APs. Thus, Waxman teaches simultaneous communication between a station and multiple APs. And a POSITA would have understood that the benefits of using OFDMA includes more efficient simultaneous communications.

430. In view of the above, Waxman therefore teaches that "the first probe and second probe are transmitted simultaneously using OFDMA." Thus, Waxman teaches limitation [11C].

12. Dependent Claim 14: "The method of claim 9, wherein the probe request is transmitted at a specific time."

431. Claim 14 of the '690 patent depends from claim 9, which is taught by Waxman, as discussed above. Claim 14 further requires that "the probe request is transmitted at a specific time," but says nothing about what the specific time is or

how it is determined. Ex. 1001, claim 14. Waxman also teaches this feature as explained below.

432. Waxman describes parameters that specify "a certain time slot" for transmission. Ex. 1007, ¶¶ [0024], [0021], [0023]. Waxman also describes that the probe request is transmitted as part of an active scanning process by a station. Ex. 1007, ¶¶ [0030], [0035]. A POSITA would have understood that an active scanning process would have been initiated at a designated time such that the probe request is transmitted at a specific time as part of performing the active scanning process at the designated time. Accordingly, Waxman teaches that "the probe request is transmitted at a specific time" as claimed. Thus, Waxman teaches claim 14.

13. Dependent Claim 15: "The method of claim 9, wherein the probe request is configured to diagnose a network problem."

433. Claim 15 of the '690 patent depends from claim 9, which is taught by Waxman, as discussed above. Claim 15 further requires that "the probe request is configured to diagnose a network problem," but says nothing about what the network problem is. Ex. 1001, claim 15. Waxman also teaches this feature as explained below. Claim 15 is similar to claim 7 and thus the reasons below are similar to the reasons given above for claim 7.

434. Waxman's method is described as addressing issues in wireless communication s in which "an extended connectivity range may not be achieved."

Ex. 1007, ¶¶ [0001]-[0009]. In some examples, "stations 101-103 may be located remotely from AP 105, and may not receive the beacon signal, or may not properly receive the beacon signal, or may have a low or relatively low reliability of reception." Ex. 1007, ¶ [0029]. "For example, station 102 and/or station 103 may determine that they may not reliably receive signals from AP 105, e.g., based on a low Signal to Noise Ratio (SNR), based on a marginal detection, based on a reliability parameter, based on poor reception of the beacon signal, based on no reception of the beacon signal, or the like." Ex. 1007, ¶ [0029]. Waxman addresses these issues by providing a system in which each station sets a transmission scheme by which the AP transmits subsequent communications to that station in accordance with settings in the probe request. See, e.g., Ex. 1007, ¶¶ [0040]-[0045], [0054]-[0056]. As such, Waxman's probe requests are configured to diagnose network problems associated with limited connectivity range or unreliable reception by use of a transmission scheme that reliably reaches a respective station. Accordingly, Waxman teaches that "the probe request is configured to diagnose a network problem" as claimed. Thus, Waxman teaches claim 15.

14. Dependent Claim 16: "The method of claim 15, wherein the probe request is generated by a network operator and uploaded to the first node."

435. Claim 16 of the '690 patent depends from claim 15, which is taught by Waxman, as discussed above. Claim 16 further requires that "the probe request is generated by a network operator and uploaded to the first node." Ex. 1001, claim 16. Claim 16 is the same as claim 8, but the "second node" is referred to as the "first node" because independent claim 9 is written from the perspective of the node that sends the probe request and receives the probe response. As such, the first node in claims 9 and 16 corresponds to the second node in claims 1 and 8, while the second node in claims 9 and 16 corresponds to the first node in claims 1 and 8. Thus, Waxman teaches claim 16 for the same reasons it teaches claim 8, except that the station of Waxman corresponds to the "first node" of claim 16.

436. A POSITA would have understood that the claimed "network operator" could be a person or a computer, a processor, a microcontroller, a circuit (e.g., an integrated circuit (IC)), a program, or a software module (e.g., a portion of code) tasked with automatically operating a node. With this understanding, Waxman also teaches the features of claim 16 as explained below.

437. As discussed for limitation [9A] and for claim 14, Waxman describes transmitting the probe request as part of a station performing an active scanning process. Ex. 1007, ¶¶ [0030], [0035]. A POSITA would have understood that

such an active scanning process would have been initiated by a network operator and then uploaded to a station ("the first node"), e.g., as part of specifying conditions to initiate the active scanning process. Accordingly, Waxman teaches that "the probe request is generated by a network operator and uploaded to the first node."

438. Thus, Waxman teaches claim 16.

15. Independent Claim 17

a) [17PRE]: "A system, comprising:"

439. This preamble is disclosed by Waxman. Waxman describes systems for extended range wireless communication. Ex. 1007, Title, Abstract, ¶¶ [0004], [0009], [0012]-[0014], [0052], [0060], FIG. 1.

440. I note that independent claim 17 is similar to independent claims 1 and 9, but is a system claim as opposed to a method claim. The first and second nodes in independent claim 17 correspond to the first and second nodes in independent claim 9, respectively. As I will explain below, Waxman's system includes the first and second nodes as defined below in limitations [17A]-[17F]. See Sections XII.D.15.b-g, below. Thus, Waxman teaches limitation [17PRE].

b) [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"

441. Waxman describes techniques to extend connectivity range between a wireless Access Point (AP) and a wireless communication station. Ex. 1007, ¶ [0001]. Waxman provides an example system includes "one or more wireless communication stations, for example, stations 101, 102 and 103" and "one or more wireless devices, for example, a wireless Access Point (AP) 105." Ex. 1007, ¶ [0012]. "**Station 101, station 102, station 103**, and AP 105 may communicate using a shared access medium 190, for example, through **wireless communication links 191, 192, 193**, and 195, respectively." Ex. 1007, ¶ [0012] (emphasis and color coding added). Each of **stations 101, 102, and 103** includes respective wireless RF transceivers (e.g., **transceiver 151, transceiver 161, and transceiver 171**, respectively) "to transmit and receive wireless communication signals, e.g., utilizing an antenna" (e.g., **antenna 152, antenna 162, antenna 172**). Ex. 1007, ¶ [0014]-[0017] (emphasis and color coding added), FIG. 1 (annotated and copied

below, to show each **station** has a respective **transceiver**, **antenna**, and **wireless communication link**).

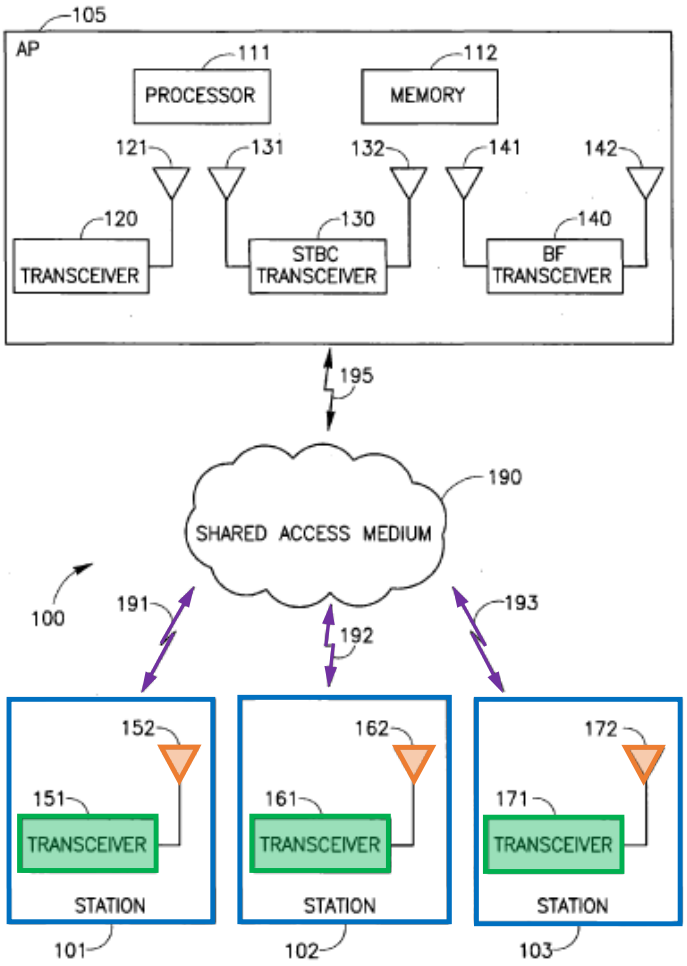


FIG.1

Ex. 1007, FIG. 1 (annotated).

442. Transceivers of wireless stations may additionally be configured "to operate in accordance with IEEE 802.11 standard, e.g., IEEE 802.11n standard," "to utilize a first Transmission Antenna Diversity Scheme (TADS), for example, Space-Time Block Codes (STBC) communication scheme, e.g., using a STBC

equalizer which may be included in transceiver [] or may be operatively associated with transceiver," and/or "to utilize a second TADS, for example, Beam Forming (BF) communication scheme, e.g., using signal targeting or signal focusing techniques." Ex. 1007, ¶ [0014]-[0016]. Stations 101, 102, 103 also include "other suitable hardware components and/or software components." Ex. 1007, ¶¶ [0014]-[0016]. While paragraph [0015] of Waxman describes a specific example in which station 102 uses an STBC communication scheme, and paragraph [0016] of Waxman describes a specific example in which station 103 uses a BF communication scheme, a POSITA would have understood that each the stations would have been configured to use any combination of suitable communication schemes and would have switched from among the various communications schemes as appropriate. *See*, *e.g.*, Ex. 1007, ¶¶ [0015]-[0016], [0045] (describing station 102 switching communication schemes based on a proximity to a respective AP). In other words, depending on various settings (e.g., proximity to an AP), each station would have been configured to use a variety of communication schemes to communicate with respective APs. Ex. 1007, ¶¶ [0014]-[0017], [0045]. Waxman also provides that "[s]ome embodiments of the invention may be implemented, for example, using a machine-readable medium or article which may store an instruction or a set of instructions that, if executed by a machine, for example, by system 100 of FIG. 1, by AP 105 of FIG. 1, by processor 111 of FIG.

1, or by other suitable machines, cause the machine to perform a method and/or operations in accordance with embodiments of the invention." Ex. 1007, ¶ [0060]. As such, and in order to generate and transmit such probe requests and perform such active scanning processes, a POSITA would have understood that each of the communication stations include a respective processors and computer readable code embodied on a computer readable medium.

443. Any one of Waxman's stations 101, 102, 103 constitutes the claimed "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."

444. Waxman also describes that the AP 105 includes "a processor 111, a memory unit 112, and one or more wireless transceivers, e.g., a transceiver 120, a STBC transceiver 130, and a BF transceiver 140" as well as "other suitable hardware components and/or software components." Ex. 1007, ¶¶ [0017]-[0019]. Specific to the AP 105, the processor 111 processes signals and/or data transmitted and/or received by the AP 105. Ex. 1007, ¶ [0018]. The transceiver 120 communicates with a respective transceiver of a wireless communication station, e.g., the transceiver 151 of the station 101. Ex. 1007, ¶ [0020]. The STBC transceiver 130 communicates with a respective transceiver of a wireless communication station, e.g., the transceiver 161 of the station 102. Ex. 1007, ¶¶

[0021]-[0023]. The BF transceiver 140 communicates with a respective transceiver of a wireless communication station, e.g., transceiver the 171 of the station 103. Ex. 1007, ¶¶ [0024]-[0028]. Accordingly, Waxman's AP 105 constitutes "a second node." Ex. 1001, 4:10-24.

445. Waxman's method "includes receiving a probe request including an indication of a requested transmission scheme." Ex. 1007, Abstract. For example, "[s]tations 101, 102 and/or 103 may perform an active scanning, e.g., may transmit a probe request" to access points, such as the AP 105. Ex. 1007, ¶ [0030]. In FIG. 2, Waxman schematically illustrates a timing diagram of wireless communication signals, in which a horizontal axis 210 indicates the timing of wireless communication signals transmitted by a wireless AP, e.g., by the AP 105 of FIG. 1; whereas a horizontal axis 220 indicates the timing of wireless communication signals transmitted by a wireless communication station, e.g., by the station 102 of FIG. 1. Ex. 1007, ¶ [0046]. As shown in FIG. 2 (copied and annotated below), block 221 shows a probe request transmitted by the station to the AP. Ex. 1007, ¶ [0048], FIG. 2.

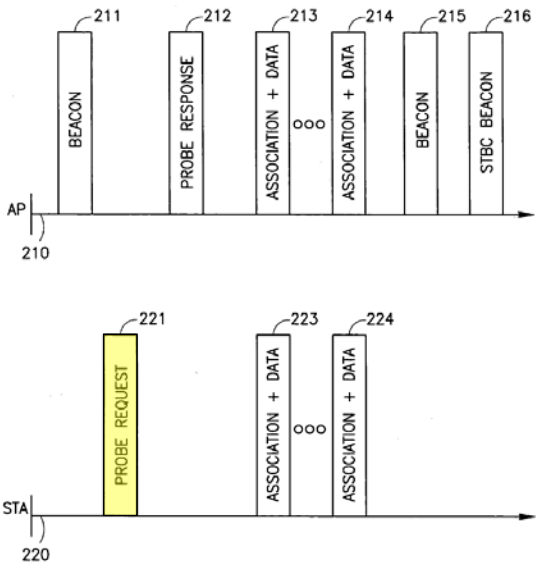


FIG.2

Ex. 1007, FIG. 2 (annotated)

446. Still further, Waxman's FIG. 3, which illustrates a schematic flow-chart of a method similar to that of the timing diagram of FIG. 2, shows, at box 320, "receiving by the AP a probe request transmitted by a station." Ex. 1007, ¶¶ [0052], [0054], FIG. 3 (copied and annotated below). Waxman explains that the method of FIG. 3 may be implemented using any of stations 101, 102, 103 and/or AP 105. Ex. 1007, ¶ [0052].

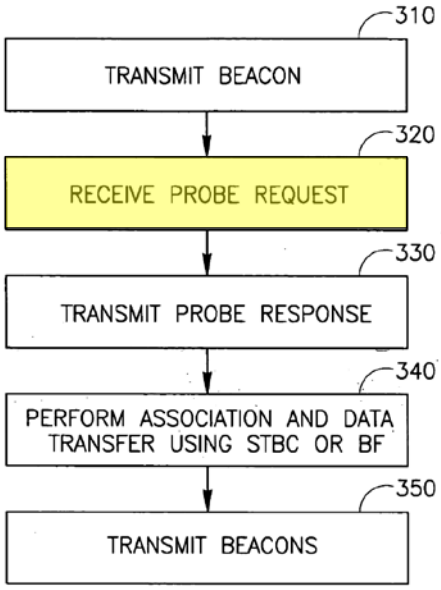


FIG.3

447. Thus, Waxman describes a station (e.g., station 101, station 102, or station 103) sending a probe request to an AP (e.g., AP 105). This teaches "the first computer executable program code [of the first node] configured to transmit a probe request to a second node, on the communications network," as claimed.

448. Waxman describes that the probe request includes a number of parameters for transmitting a probe response. For example, "[t]he probe request may include a Requested Transmission Scheme (RTS) field, which may include a value of a RTS parameter or other indication . . . [that] indicate[s] to AP 105 a transmission scheme (e.g., a TADS [Transmission Antenna Diversity Scheme]) requested by stations 101, 102 and/or 103." Ex. 1007, ¶ [0030]. The probe request "indicate[s] (e.g., using a value of a parameter in a field of the probe request) a

requested transmission scheme, a requested number of transmission antennas to be used, and/or other attributes of a requested transmission scheme." Ex. 1007, ¶ [0035]. The Requested Transmission Scheme (RTS) parameters included in the probe request may include parameters that specify a type of communication scheme, a number of antennas, that the AP use Cyclic Delay Diversity (CDD), STBC communication, BF communication, or other transmission schemes in subsequent communications, among other parameters. Ex. 1007, ¶¶ [0031]-[0034].

449. A probe response (which is generated based on the parameters of the probe request) includes a packet having a preamble portion and a data portion. Ex. 1007, ¶¶ [0042]-[0043], [0056]. The '690 patent explains that physical layer (PHY) packets or probes "comprise preambles and payloads" in which the PHY preamble "is typically inserted at the beginning of each packet to assist receivers in detecting and acquiring the physical layer parameters to properly receive and decode the packet" and the PHY payload "is used to transmit the data content of the packet." Ex. 1001, 3:42-58, 7:64-8:58. Thus, a POSITA would have understood that Waxman's probe response constitutes a physical layer probe that includes a preamble portion and a content payload/data portion. A POSITA also would have understood that probe request parameters would have specified content for the probe payload, e.g., identifying the probe request, indicating a station from which the probe request originated, providing confirmation of a requested

transmission scheme, SSID of the requesting device (e.g., in the case of 802.11 which is one of the protocols used in Waxman (see Ex. 1007, [0009], [0013]-[0020]; IEEE Std 802.11-2007 (Ex. 1012, 84-85) showing SSID in probe request and probe response)) or other transmission parameter specified in the probe request (see IEEE Std 802.11-2007 (Ex. 1012, 84-85) showing Request information in both probe request and probe response), and the like. A POSITA would have understood that including content from the probe request in the payload of the probe response enables Waxman's station to tell that a particular probe response is responsive to a particular probe request. And in view of the above, Waxman teaches the probe request defining a number of parameters (e.g., number of transmission antennas, communication scheme, and/or other attributes of a requested transmission) for transmitting a probe response. Therefore, Waxman teaches "the probe request specifying a first plurality of probe parameters for a physical layer probe" as claimed.

450. Waxman provides, as examples of RTS parameters, that a probe request specifies a value of an RTS parameter that instructs the AP send subsequent transmissions to station using STBC communication or BF communication. Ex. 1007, ¶¶ [0032]-[0033]. Waxman explains that a STBC scheme "transmit[s] multiple copies of a data stream across multiple antennas, utilizing the various received versions of the data in order to improve the reliability

of data transfer." Ex. 1007, ¶ [0022]. Because "[t]he transmitted data may traverse an environment which may cause scattering, reflection, corruption, or the like, such that some of the received copies of the data may be better than others," "[t]he redundancy may increase the ability of the remote receiver to use one or more of the received copies of the data to correctly decode the received signal." Ex. 1007, ¶ [0022]. Waxman further explains that:

> The STBC scheme may include transmission of multiple redundant copies of data to compensate for fading and thermal noise. The data stream to be transmitted may be encoded in blocks, which may be distributed among spaced antennas and across time. The receiving station may have, but is not required to have, multiple receive antennas, and may utilize diversity reception. Characteristics of the STBC scheme may be represented using a matrix, for example, such that a row may represent a time slot, and a column may represent transmissions of an antenna over time.

Ex. 1007, ¶ [0023]. The STBC scheme thus specifies transmitting a data stream encoded in a block distributed among antennas and over time. Thus, a POSITA would have understood that the STBC scheme specified in the probe request includes a modulation profile for the probe response (which is the claimed "probe" as I explained above).

451. For a BF scheme, Waxman explains that multiple antennas are used to transmit a symbol at a certain time slot. Ex. 1007, ¶ [0024]. Waxman provides additional examples of BF communications:

> In some embodiments, for example, BF transceiver 140 may focus a narrow beam targeted towards a single receiving station, e.g., utilizing a "smart" antenna array. For example, a linearly arranged and equally spaced array of antennas may be used by BF transceiver 140 to transmit data. In order to form a "beam", the information signal may be multiplied by a set of complex weights, wherein the number of weights may equal to the number of antennas used, and then may be transmitted by the antenna array. The signals emitted from different antennas in the array may differ in phase, e.g., based on the distance between antenna elements; and may further differ in amplitude, e.g., based on the various weights associated with various antennas. The direction of the beam may be set or modified, for example, by setting or modifying the values of the complex weights used in for multiplying, and/or by steering the direction of the antenna array. BF transmission may take advantage of interference to change the directionality of the antenna array; for example, when transmitting, the BF transceiver may controls [sic] the amplitude and phase of the

signal at each antenna, in order to create a pattern of constructive and destructive interference in the wavefront.

Ex. 1007, ¶ [0025]. Waxman goes on to provide a number of known example schemes or algorithms for setting or modifying the direction of the beam. Ex. 1007, ¶¶ [0026]-[0028]. As one example, for a switched BF scheme, "the complex weights used may be selected from a 'library' of weights that form beams in specific, predetermined directions." Ex. 1007, ¶ [0027]. As another example, for an adaptive BF scheme, "the weights may be computed and adaptively updated in substantially real time." Ex. 1007, ¶ [0028]. The BF scheme thus specifies weights for multiplying and/or steering the direction of an antenna array to control the amplitude and phase of the signal. Thus, a POSITA would have understood that the BF scheme specified in the probe request also includes a modulation profile for the probe response (which is the claimed "probe" as I explained above).

452. Waxman therefore teaches parameters of the probe request including a transmission scheme that entails specifying a form for the probe response including a modulation profile. This teaches "the first plurality of probe parameters comprising at least a payload content for the probe and a modulation profile for the probe" as claimed.

453. In conclusion, Waxman teaches a station (e.g., stations 101, 102, or 103) transmitting a probe request to an AP (e.g., AP 105), the probe request

specifying a plurality of parameters for the probe response including a parameter for the transmission scheme that specifies a form (in particular, it specifies a modulation profile) for the probe response. This teaches the claimed "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" in limitation [17A]. Thus, Waxman teaches limitation [17A].

c) [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 computer readable medium, the second executable program code configured to:"

454. As discussed above for limitation [17B], Waxman's AP 105 constitutes "the second node." And Waxman describes the AP 105 includes "a processor 111, a memory unit 112, and one or more wireless transceivers, e.g., a transceiver 120, a STBC transceiver 130, and a BF transceiver 140" as well as "other suitable hardware components and/or software components." Ex. 1007, ¶¶ [0017]-[0019]. Waxman also provides that "[s]ome embodiments of the invention

may be implemented, for example, using a machine-readable medium or article which may store an instruction or a set of instructions that, if executed by a machine, for example, by system 100 of FIG. 1, by AP 105 of FIG. 1, by processor 111 of FIG. 1, or by other suitable machines, cause the machine to perform a method and/or operations in accordance with embodiments of the invention." Ex. 1007, ¶ [0060].

455. Therefore, Waxman teaches "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 computer readable medium" as claimed in limitation [17B]. And the second computer readable medium of the second node is configured to perform the steps recited in limitations [17C]-[17F], as I will explain below.

d) [17C]: "receive the probe request;"

456. As I explained above with respect to independent claims 1 and 9, Waxman describes an AP (e.g., AP 105) receiving a probe request. Ex. 1007, Abstract, ¶¶ [0030], [0046], [0048], [0052], [0054], FIGs. 1-3. This teaches the second computer readable medium of the second node "receiv[ing] the probe request" as claimed.

e) [17D]: "determine a second plurality of parameters associated with generation and transmission of the probe;"

457. As I explained above with respect to independent claims 1 and 9, Waxman teaches parameters determined by the AP (e.g., setting values of complex weights and/or selecting a specific BF algorithm and values for that algorithm when using BF communication or determining parameters for a matrix of time slots and antenna transmissions over time when using STBC communication) associated with the generation and transmission of the probe response. Ex. 1007, ¶¶ [0019], [0023], [0025], [0027]-[0028], [0030]-[0031], [0043]-[0044], [0054]. This teaches the second computer readable medium of the second node "determin[ing] a second plurality of parameters associated with generation and transmission of the probe" as claimed.

f) [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"

458. As I explained above with respect to independent claims 1 and 9, Waxman teaches an AP (e.g., AP 105) generating the probe response based on parameters in the probe request for the transmission scheme that specifies a form for the probe response and parameters determined by the AP for transmitting the probe response. Ex. 1007, ¶¶ [0037]-[0039], [0049], [0055], FIGs. 2-3. This teaches the second computer readable medium of the second node "generat[ing]

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" as claimed.

g) [17F]: "transmit the probe to the first node."

459. As I explained above with respect to independent claims 1 and 9, Waxman describes the station (e.g., station 101, 102, or 103) from which the probe request was sent receiving a probe response from the AP (e.g., AP 105). Ex. 1007, ¶¶ [0037], [0049], [0055], FIGs. 2-3. This teaches the second computer readable medium of the second node "transmit[ting] the probe to the first node" as claimed. For at least the above reasons, Waxman anticipates or renders obvious claim 17.

16. Dependent Claim 18: "The system of claim 17, wherein the probe request is configured such that the probe emulates an OFDMA transmission."

460. Claim 18 of the '690 patent depends from claim 17, which is taught by Waxman, as discussed above. Claim 18 further requires that "the probe request is configured such that the probe emulates an OFDMA transmission." Ex. 1001, claim 18. Waxman also teaches this feature. Claim 18 is the same as claim 10, except for its dependency. Thus, Waxman teaches claim 18 for the same reasons it teaches claim 10.

17. Dependent Claim 19

a) **[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,"**

461. Claim 19 of the '690 patent depends from claim 17, which is taught by Waxman, as discussed above. Claim 19 is similar to claim 11 in that it adds a second instance of sending a probe request and receiving a probe to the first instance in independent claim 9 and the feature of using OFDMA. It also adds the concept of transmitting two probes "simultaneously." Although Waxman does not expressly disclose this "simultaneously" feature, in my opinion a POSITA would have understood that it teaches all features of claim 19 as explained below.

462. While Waxman's FIG. 1 illustrates a single AP 105, Waxman explains that "[o]perations of the method may be implemented, for example, by system 100 of FIG. 1, by stations 102 and/or 103 of FIG. 1, by AP 105 of FIG. 1, ***and***/or by other suitable stations, ***APs,*** transceivers, units, devices, and/or systems." Ex. 1007, ¶ [0052] (emphasis added). A POSITA would have understood that Waxman's system would have operated with many different APs. And, for at least the same reasons that I explain above for limitation [17A], Waxman teaches a station (e.g., one of stations 101, 102, or 103, any of which is the "first node" in limitation [17A] as explained above and would also be "the first

executable program code" in limitation [19A]) transmitting another probe request ("a second probe request" in limitation [19A]) to an additional AP ("a third node" in limitation [19A]). Ex. 1007, ¶¶ [0030], [0045], [0048], [0052], [0054], FIGs. 2-3. Also, for the same reasons as discussed for limitation [17A], the other probe request specifies probe parameters for a physical layer probe ("a third first plurality of probe parameters for a second physical layer probe") of limitations [19A]. Ex. 1007, ¶¶ [0022]-[0028], [0030]-[0034], [0042]-[0043], [0046], [0048], [0052], [0054], [0056]. Thus, Waxman teaches limitation [19A].

b) [19B]: "the third plurality of probe parameters comprising a second payload content for the second probe and a second modulation profile for the probe, the second probe request further specifying a different second plurality of parameters associated with the generation and transmission of the second probe; and"

463. Limitation [19B] is directed to a similar concept that is in the remaining part of limitation [17A], but relates to the second probe request and second probe. Limitation [19B] is taught for the same reasons given above with respect to limitation [17A]. Specifically, the plurality of parameters in the additional probe request comprises a payload content for the additional probe response to be sent back from the additional AP. This teaches "the third plurality of probe parameters comprising a second payload content for the second probe and

a second modulation profile for the probe" in limitation [19B]. Thus, Waxman teaches limitation [19B].

c) [19C]: "the second probe request further specifying a different second plurality of parameters associated with the generation and transmission of the second probe; and"

464. First, this claim limitation does not specify how "a different second plurality of parameters" differs from the "third first plurality of probe parameters" in limitation [19A]. But, as explained above, Waxman provides numerous parameters for generating a probe response, so any two groups of those parameters teach the "different second plurality of parameters" and "third first plurality of probe parameters" required in claim 19.

465. With respect to the rest of limitation [19C], Waxman teaches limitation [19C] for similar reasons that it teaches limitations [1A], [9A], [17A], and [19A]. Specifically, the additional probe request further specifies a different plurality of parameters associated with the generation and transmission of the probe response to be sent back from the additional AP. This teaches "the second probe request further specifying a different second plurality of parameters associated with the generation and transmission of the second probe" in limitation [19C]. Thus, Waxman teaches limitation [19C].

d) [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"

466. Limitation [19D] is similar to limitations [17B]-[17G], except that is with respect to the third node instead of the second node. Waxman teaches limitation [19D] for the similar reasons it teaches limitations [17B]-[17G], because the additional AP would perform the same steps that the other AP performed to generate an additional probe response that is transmitted back to the requesting station. Thus, Waxman teaches limitation [19D].

e) [19E]: "wherein the first probe and second probe are transmitted simultaneously using OFDMA."

467. Limitation [19E] is the same as limitation [11C]. Thus, Waxman teaches limitation [19E] for the same reasons it teaches limitation [11C].

18. Dependent Claim 22: "The system of claim 17, wherein the probe request is generated by the first node."

468. Claim 22 of the '690 patent depends from claim 17, which is taught by Waxman, as discussed above. Claim 22 further requires that "the probe request is generated by the first node." Ex. 1001, claim 22. Waxman also teaches this feature. Claim 22 is the same as claim 6, but the "second node" is referred to as

the "first node" because independent claim 17 is written from the perspective of the node that sends the probe request and receives the probe response. As such, the first node in claims 17 and 22 corresponds to the second node in claims 1 and 6, while the second node in claims 17 and 22 corresponds to the first node in claims 1 and 6. Thus, Waxman teaches claim 22 for the same reasons it teaches claim 6, except that the station of Waxman corresponds to the "first node" of claim 22.

19. Dependent Claim 23: "The system of claim 17, wherein the probe request is configured to diagnose a network problem."

469. Claim 23 of the '690 patent depends from claim 17, which is taught by Waxman, as discussed above. Claim 23 further requires that "probe request is configured to diagnose a network problem." Ex. 1001, claim 23. Waxman also teaches this feature. Claim 23 is the same as claim 15, except for its dependency. Thus, Waxman teaches claim 23 for the same reasons it teaches claim 15.

20. Dependent Claim 24: "The system of claim 23, wherein the probe request is generated by a network operator and uploaded to the first node."

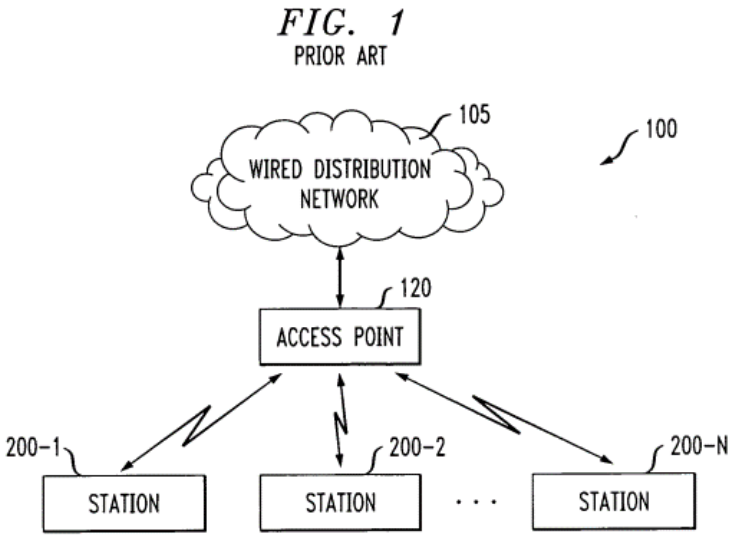
470. Claim 24 of the '690 patent depends from claim 23, which is taught by Waxman, as discussed above. Claim 24 further requires that the "probe request is generated by a network operator and uploaded to the first node." Ex. 1001, claim 24. Waxman also teaches this feature. Claim 24 is the same as claim 16,

except for its dependency. Thus, Waxman teaches claim 24 for the same reasons it teaches claim 16.

E. Waxman In View Of Giesberts Renders Obvious Claims 3-5, 12-13, and 20-21

471. Giesberts, like Waxman, relates to a wireless communication system, and describes methods for access point selection in a wireless network. Ex. 1009, Abstract, ¶¶ [0005]-[0006].

472. Giesberts provides an example wireless network environment 100 that, like Waxman, includes a number of stations (e.g., stations 200-1 through 200-N), that communicate over wireless channels in the wireless network environment 100. Ex. 1009, ¶ [0016]. Also included in Giesberts' wireless network environment 100 of FIG. 1 is an access point 120 along with "other access points (not shown)." Ex. 1009, ¶ [0016]. Also like Waxman, Giesberts' wireless network environment 100 may be implemented with the IEEE 802.11 standard, including "the various extensions to the 802.11 standard, such as 802.11a, b and g, or the HIPERLAN/2 standard." Ex. 1009, ¶ [0016].



Ex. 1009, FIG. 1. I note that while Giesberts' FIG.1 includes an annotation as "prior art," Giesberts describes this figure as an environment "in which the present invention can operate." Ex. 1009, ¶ [0016], FIG. 1. Giesberts specifically describes "a roaming process 700" in which an AP is selected for a given station using correlation information between the station and AP. Ex. 1009, ¶¶ [0023]-[0024]. Giesberts provides multiple measures for the correlation, including estimating the signal-to-noise-ratio (SNR) from the preamble of a probe packet or from previously received probe packets, as well as the percentage of probe packets that are transmitted and received by their destinations without or without errors (e.g., based on the number of missed or received acknowledgements). Ex. 1009, ¶ [0024]. The station is described as a "roaming" station, that has a transmitter and receiver and may be embodied "for example, as personal computer devices, or any device having a wireless communication capability, such as a cellular telephone,

personal digital assistant or pager, as modified herein to provide the features and functions of the present invention." Ex. 1009, ¶¶ [0024]-[0026], FIG. 4.

473. Giesberts provides example frame formats to transmit probe request and probe responses. Ex. 1009, ¶¶ [0014]-[0015], [0044]-[0047], FIGs. 8-9. In particular, the example frame format for the probe request of FIG. 8 includes a preamble with an indication of short training (ST) and long training (LT) symbols, the signal field (SIG) and a probe request payload (REQUEST). Ex. 1009, FIG. 8, ¶¶ [0044]-[0046]. For example, "[i]n an exemplary IEEE 802.11 implementation, the short training (ST) symbol contains 160 samples and is repeated ten times; the long training (LT) symbol contains 160 samples and is repeated 2.5 times; and the signal field (SIG) contains 80 samples." Ex. 1009, ¶ [0044]. In other examples, the probe request frame includes "a field that identifies the MIMO modes that the station supports, e.g., the number of transmit and receive antennas with an independent receive path." Ex. 1009, ¶ [0046]. The probe request frame "can either be sent on a MIMO data rate with high range (robustness) or on a legacy non-MIMO data rate. The prior option may have an improved range-performance compared to the legacy rate, but the latter has the benefit that legacy APs will respond as well." Ex. 1009, ¶ [0046].

474. In the example frame format for the probe response of FIG. 9, "[t]he first part of the preamble consists of the 802.11a/g preamble" and "[t]hereafter, an

extra signal field and the maximum number of training symbols (corresponding to the maximum number of transmitter antennas of the access point) is transmitted, followed by the information about the access point, e.g., fields of the response frame, transmitted in either a legacy or MIMO mode that is optimized for range and not for throughput." Ex. 1009, ¶ [0047]. Regardless of the communication mode, the AP "should send training symbols on all of its antennas, so that the receiver can calculate the correlation." Ex. 1009, ¶ [0047].

1. Dependent Claim 3

a) [3PRE]: "The method of claim 1, wherein at least one of the probe parameters indicates:"

475. Claim 3 of the '690 patent depends from claim 1, which is taught by Waxman, as discussed above. Claim 3 further includes a list of different pieces of data/information that the probe parameters indicate.[12] Ex. 1001, claim 3. As explained above in Section XII.D.3, Waxman teaches these features. To the extent that that the claim is considered to require that a probe parameter to indicate each of the respective probe parameters specified (rather than only one of the probe

[12] I note that the term "probe parameters" is not exactly included in independent claim 1 and therefore it is unclear whether this term refers to "the first plurality of parameters," "the second plurality of parameters" or both. For purposes of my analysis in this declaration, I have assumed "the probe parameters" refers to both.

parameters to indicate only one of the listed pieces of data/information), and that Waxman does not teach all the probe parameters recited in claim 3, Giesberts does. Namely, as I explain for each of the claim 3 limitations below, Giesberts' parameters used as part of its probe requests and probe responses teach the parameters recited. Ex. 1009, ¶¶ [0014]-[0015], [0041]-[0043], FIGs. 8-9, claim 25.

476. In my opinion, a POSITA would have found it obvious to combine Giesberts with Waxman, such that the parameters indicated in Waxman's probe requests also include the probe parameters taught by Giesberts (which similarly teaches probe requests/responses for wireless communications between APs and stations). For example, a POSITA would have found it obvious in view of Giesberts (particularly, Giesberts' frames for probe requests/responses) to program Waxman's system to include indication of those parameters in its probe requests. Thus, Waxman with Giesberts teaches claim 3.

477. A POSITA would have been motivated to make this combination with Giesberts because a POSITA would have wanted to build a wireless communication system that sets multiple parameters to more efficiently leverage available capabilities in communicating with various APs and stations. Ex. 1009, ¶¶ [0025]-[0026], [0041]-[0047]. Further, where multiple communications schemes are contemplated, as in both Waxman and Giesberts, a POSITA would

have been motivated to specify parameters that optimize applicable settings. Thus, a POSITA would have recognized that it is desirable to indicate probe parameters in a probe request in order to improve communications in a wireless communication network.

478. It is also my opinion that other rationales support my finding that the combination of Waxman and Giesberts would have been obvious. For example, the combination of Waxman and Giesberts involves use of a known technique to improve similar devices in the same way. The known techniques are Giesberts' techniques for AP selection using a roaming process and indicating probe parameters to transmit probe requests to APs. Ex. 1009, ¶¶ [0026], [0044]-[0047]. These techniques would have been used to improve Waxman's extended-range wireless communication, which is similar to the roaming process for Giesberts' stations, in the same way Giesberts' probe parameters improve Giesberts' method by specifying parameters to specific scenarios.

479. Lastly, a POSITA would have had an expectation of success in combining Waxman and Giesberts given a POSITA's skills (e.g., communication networks and assessment probes), given extant network communications technology (see Section VIII.B), and given that Waxman already teaches various parameters for its probes. Ex. 1007, ¶¶ [0022]-[0028], [0032]-[0033]. In addition, a POSITA would have expected Waxman's communication system implementing

Giesberts' roaming process that indicates probe parameters to successfully include additional parameters in its probe requests/responses. Ex. 1009, ¶¶ [0026], [0044]-[0047].

b) [3A]: "a) a modulation profile for the probe;"

480. As discussed above for limitation [1A] in Section XII.D.1.b, Waxman describes that the probe request includes a number of parameters, e.g., RTS parameters, for transmitting a probe response. In doing so, Waxman teaches parameters of the probe request including a transmission scheme that entails specifying a form for the probe response including a modulation profile. This teaches "a modulation profile for the probe" as claimed.

481. Giesberts also teaches parameters that indicate a modulation profile for the probe. For example, Giesberts describes specifying probe responses that use MIMO-based OFDM or QAM modulation. Ex. 1009, ¶ [0027]. Giesberts also provides that different data rates "are achieved by varying the coding rate and modulation." Ex. 1009, ¶ [0029]. As part of specifying probe response to use such techniques, Giesberts' teaches probe parameters that indicate a modulation profile for the profile

482. Both the descriptions in Waxman and in Giesberts teach "a modulation profile for the probe" as claimed.

c) [3B]: "b) the number of times to transmit the probe;"

483. Waxman teaches including a number of times to transmit a probe response in the parameters of its probe request. In one example, where an STBC scheme is specified by the RTS parameters, a transceiver of the AP "transmit[s] multiple copies of a data stream across multiple antennas." Ex. 1007, ¶ [0022]. "The redundancy [in transmitting multiple copies] may increase the ability of the remote receiver to use one or more of the received copies of the data to correctly decode the received signal." Ex. 1007, ¶ [0022]. "The STBC scheme may include transmission of multiple redundant copies of data to compensate for fading and thermal noise." Ex. 1007, ¶ [0023]. Thus, a POSITA would have understood that, as part of specifying the various parameters for the STBC scheme that transmits multiple redundant copies of a probe response, that that probe request would have included a parameter specifying a number of copies to transmit (a number of times to transmit the probe response).

484. Additionally, Waxman explains that, in response to a probe request, the AP 105 transmits signals "repeatedly or periodically" using the specified "transmission scheme." Ex. 1007, ¶¶ [0036], [0054], [0057]. For a signal to be generated and transmitted in accordance with the probe request "repeatedly," a POSITA would have understood that this would have entailed an indication of a number of times to transmit the probe, as the transmission must be repeated some

finite number of times in accordance with system parameters and other details. Ex. 1007, ¶ [0036].

485. Giesberts also describes probe parameters that specify a number of times to transmit the probe. For example, Giesberts tracks "the percentage of packets that are transmitted and received by their destinations with or without errors" to determine "the number of missed or received acknowledgements." Ex. 1009, ¶¶ [0024], [0035]. The number of received and missed acknowledgements are considered based on the number of probe response packets transmitted. Ex. 1009, ¶ [0035]. A POSITA would have understood that as part of tracking received/missed probes, the probe response and information used for generating the probe response would have specified a number of probes to send. As such, Giesberts also teaches specifying the number of times to transmit the probe.

486. Both descriptions in Waxman and in Giesberts teach probe parameters specifying "the number of times to transmit the probe."

d) [3C]: "c) a number of symbols for the payload of the probe;"

487. Giesberts teaches including a number of symbols for the payload of a probe response in the parameters of its probe request. Giesberts' probe response "includes a training symbol for each transmitter antenna of said corresponding access point." Ex. 1009, claim 29. Giesberts also explains that after the preamble "an extra signal field and the maximum number of training symbols

(corresponding to the maximum number of transmitter antennas of the access point) is transmitted, followed by the information about the access point, e.g., fields of the response frame, transmitted in either a legacy or MIMO mode that is optimized for range and not for throughput." Ex. 1009, ¶ [0047]. Thus, the number of training symbols specified after the preamble provide a number of symbols for the payload of the probe.

488. As such, Waxman teaches probe parameters specifying "a number of symbols for the payload of the probe."

e) [3D]: "d) a preamble type for the probe;"

489. Waxman teaches including a preamble type for a probe in the parameters for generating a probe response. In particular, Waxman discusses that, based on parameters in a probe request, a transmission scheme for a preamble portion of the probe is specified. Ex. 1007, ¶¶ [0042]-[0043]. A POSITA would have understood that specifying a transmission scheme for the preamble portion of the probe includes specifying a preamble type for the probe.

490. Giesberts also teaches including a preamble type for a probe in the parameters for generating a probe response. For example, for Giesberts' probe response, "[t]he first part of the preamble consists of the 802.11a/g preamble." Ex. 1009, ¶ [0047]. In the example implementation with IEEE 802.11, "the short training (ST) symbol contains 160 samples and is repeated ten times; the long

training (LT) symbol contains 160 samples and is repeated 2.5 times; and the signal field (SIG) contains 80 samples." Ex. 1009, ¶ [0044]. These teachings indicate that Giesberts' probe request specifies a preamble type, e.g., the 802.11a/g preamble, for the probe.

491. As such, both Waxman and Giesberts teach the probe parameters specifying "a preamble type for the probe."

f) [3E]: "e) a cyclic-prefix length for the payload of the probe;"

492. Giesberts teaches including a cyclic-prefix length for the payload of the probe. Giesberts explains that long training symbols, as used when implemented with IEEE 802.11 "are a repetition of a symbol and a cyclic prefix." Ex. 1009, ¶ [0031]. And long training symbols are specified in the payload of the frames for the probe request and probe responses of FIGs. 8-9. Ex. 1009, ¶¶ [0044]-[0047]. These teachings indicate that Giesberts' probe request specifies a cyclic-prefix length for the probe payload.

493. As such, Giesberts teaches probe parameters specifying "a cyclic-prefix length for the payload of the probe," as claimed.

g) [3F]: "f) a transmit power for the probe; and"

494. Giesberts teaches including a transmit power for the probe. Giesberts explains that the APs and stations exchange frames for probes "containing information on the transmit power level limits." Ex. 1009, ¶ [0018]. Giesberts

provides as an example the frame format for exchanging transmit power levels for probes as described "in IEEE, 'Supplement to Standard for Telecommunications and Information Exchange Between Systems—LAN/MAN Specific Requirements—Part 11: Wireless MAC and PHY Specifications: Spectrum and Transmit Power Management Extensions in the 5 GHz band in Europe,' P802.11h/D2.0 (March 2002)." Ex. 1009, ¶ [0018]. These teachings indicate that Giesberts' probe request specifies a transmit power for the probe.

495. As such, Giesberts teaches probe parameters specifying "a transmit power for the probe," as claimed.

h) [3G]: "g) a transmit power scaling factor for the payload of the probe."

496. Giesberts teaches including a transmit power scaling factor for the payload of the probe. The '690 patent explains that a transmit power scaling factor specifies a transmit power for the payload relative to the preamble, and that "probe payloads can be transmitted with different power characteristics than the probe preambles." Ex. 1001, 9:7-42. As described above for limitation [3G], Giesberts explains that the APs and stations exchange frames for probes "containing information on the transmit power level limits," and provides as an example the frame format for exchanging transmit power levels for probes as described "in IEEE, 'Supplement to Standard for Telecommunications and Information Exchange Between Systems—LAN/MAN Specific Requirements—Part 11:

Wireless MAC and PHY Specifications: Spectrum and Transmit Power Management Extensions in the 5 GHz band in Europe,' P802.11h/D2.0 (March 2002)." Ex. 1009, ¶ [0018]. Giesberts also explains that frames may specify probe payloads specifies information of the AP including whether transmission to the AP is to be "optimized for range and not for throughput." Ex. 1009, ¶ [0047]. A POSITA would have understood that Giesberts teaches specifying a transmit power scaling factor for the payload as part of providing information for such a transmission.

497. Waxman also explains that substantially entire packets, preamble portions, header portions, and/or data portions of data packets may be transmitted using various communication schemes. Ex. 1007, ¶¶ [0043]-[0044]. Thus, where the payload or data portion is sent with a specified transmission scheme (and a specified transmit power in view of Giesberts) and the preamble portion is sent with a specified transmission scheme (and a specified transmit power in view of Giesberts), a POSITA would have understood that the probe request would have included a transmit power scaling factor of the probe in order for the probe response to be transmitted as specified. As such, Waxman in view of Giesberts teaches probe parameters specifying "a transmit power scaling factor for the payload of the probe," as claimed.

498. Accordingly, as shown above, the combination of Waxman and Giesberts teaches the additional limitations included in dependent claim 3, and renders claim 3 obvious.

2. Dependent Claim 4: "The method of claim 3, wherein the probe request identifies a hidden node."

499. Claim 4 of the '690 patent depends from claim 3, which is taught by Waxman and Giesberts, as discussed above. Claim 4 further requires that "the probe request identifies a hidden node," but says nothing about what a hidden node is. Ex. 1001, claim 4. As I explained in Section XII.D.4, Waxman teaches this feature.

500. Accordingly. the combination of Waxman and Giesberts renders claim 4 obvious.

3. Dependent Claim 5: "The method of claim 3, wherein the modulation profile for the probe emulates an orthogonal frequency division multiple access (OFDMA) transmission."

501. Claim 5 of the '690 patent depends from claim 3, which is taught by Waxman and Giesberts, as discussed above. Claim 5 further requires that "the modulation profile for the probe emulates an orthogonal frequency division multiple access (OFDMA) transmission." Ex. 1001, claim 5. As I explained in Section XII.D.5, Waxman teaches this feature.

502. Accordingly. the combination of Waxman and Giesberts renders claim 5 obvious.

4. Dependent Claim 12

a) [12PRE]: "The method of claim 9, wherein the probe parameters further comprises:"

503. Claim 12 of the '690 patent depends from claim 9, which is taught by Waxman, as discussed above. Claim 12 further includes a list of different pieces of data/information that the probe parameters comprise. Ex. 1001, claim 12. I note that the list in claim 12 is similar to the list in claim 3. Below I have shown how Waxman in view of Giesberts teaches each of limitations [12A]-[12D], and thus Waxman in view of Giesberts teaches [12PRE].

b) [12A]: "a) an indication of the number of times to transmit the probe;"

504. Limitation [12A] is nearly identical to limitation [3B], as it simply adds "an indication of" in limitation [12A]. Thus, Waxman in view of Giesberts teaches limitation [12A] for the same reasons as it teaches limitation [3B]. See Section XII.E.1.c.

c) [12B]: "b) a number of symbols for the payload of the probe; a preamble type for the probe;"

505. Limitation [12B] includes both limitations [3C] and [3D]. Thus, Waxman in view of Giesberts teaches limitation [12B] for the same reasons as it teaches limitations [3C] and [3D]. See Sections XII.E.1.d-e.

d) [12C]: "c) a cyclic-prefix length for the payload of the probe; a transmit power for the probe; and"

506. Limitation [12C] includes both limitations [3E] and [3F]. Thus, Waxman in view of Giesberts teaches limitation [12C] for the same reasons as it teaches limitations [3E] and [3F]. See Sections XII.E.1.f-g.

e) [12D]: "d) a transmit power scaling factor for the payload of the probe."

507. Limitation [12D] is identical to limitation [3G]. Thus, Waxman in view of Giesberts teaches limitation [12D] for the same reasons as it teaches limitation [3G]. See Section XII.E.1.h.

5. Dependent Claim 13: "The method of claim 12, wherein the probe request is configured such that the probe identifies a hidden node."

508. Claim 13 of the '690 patent depends from claim 12, which is taught by Waxman in view of Giesberts, as discussed above. Claim 13 further requires that "the probe request is configured such that the probe identifies a hidden node." Ex. 1001, claim 13. Waxman teaches this feature as explained above in Section XII.E.4. Claim 13 is similar to claim 4 and thus is rendered obvious by Waxman in view of Giesberts for at least similar given above for claim 4. See Sections XII.E.2, XII.D.4.

6. Dependent Claim 20

a) [20PRE]: "The system of claim 17, wherein the probe parameters further comprises:"

509. Claim 20 of the '690 patent depends from claim 17, which is taught by Waxman, as discussed above. Claim 20 further includes a list of different pieces of data/information that the probe parameters comprise. Ex. 1001, claim 20. I note that the list in claim 20 is similar to the list in claim 3. Below I have shown how Waxman in view of Giesberts teaches each of limitations [20A]-[20F], and thus Waxman in view of Giesberts teaches [20PRE].

b) [20A]: "a) an indication of the number of times to transmit the probe;"

510. Limitation [20A] is nearly identical to limitation [3B], as it simply adds "an indication of" in limitation [20A]. Thus, Waxman in view of Giesberts teaches limitation [20A] for the same reasons as it teaches limitation [3B]. See Section XII.E.1.c.

c) [20B]: "b) a number of symbols for the payload of the probe;"

511. Limitation [20B] is identical to limitation [3C]. Thus, Waxman in view of Giesberts teaches limitation [20B] for the same reasons as it teaches limitation [3C]. See Section XII.E.1.d.

d) [20C]: "c) a preamble type for the probe;"

512. Limitation [20C] is identical to limitation [3D]. Thus, Waxman in view of Giesberts teaches limitation [20C] for the same reasons as it teaches limitation [3D]. See Section XII.E.1.e.

e) [20D]: "d) a cyclic-prefix length for the payload of the probe;"

513. Limitation [20D] is identical to limitation [3E]. Thus, Waxman in view of Giesberts teaches limitation [20D] for the same reasons as it teaches limitation [3E]. See Section XII.E.1.f.

f) [20E]: "e) a transmit power for the probe; and"

514. Limitation [20E] is identical to limitation [3F]. Thus, Waxman in view of Giesberts teaches limitation [20E] for the same reasons as it teaches limitation [3F]. See Section XII.E.1.g.

g) [20F]: "f) a transmit power scaling factor for the payload of the probe."

515. Limitation [20F] is identical to limitation [3G]. Thus, Waxman in view of Giesberts teaches limitation [20F] for the same reasons as it teaches limitation [3G]. See Section XII.E.1.h.

7. Dependent Claim 21: "The system of claim 20, wherein the probe request is configured such that the probe identifies a hidden node."

516. Claim 21 of the '690 patent depends from claim 20, which is taught by Waxman in view of Giesberts, as discussed above. Claim 21 further requires that "the probe request is configured such that the probe identifies a hidden node." Ex. 1001, claim 21. Claim 21 is nearly the same as claim 4, except for its dependency and that it recites that the probe request "is configured such that the probe identifies a hidden node" rather than the "probe request identifies a hidden node" as recited in claim 4. Thus, Waxman in view of Giesberts teaches claim 21 for the same reasons it teaches claim 4.

F. Waxman In View Of Zuckerman Renders Obvious Claims 5, 10-11, and 18-19 and Waxman In View of Giesberts and Zuckerman Renders Obvious Claim 5

517. To the extent that claims 5, 10-11, and 18-19 are not found to be taught based on Waxman alone (or Waxman in view of Giesberts for claim 5 which depends from claim 3 that I rely on Giesberts for), it is my opinion that Waxman in view of Zuckerman (or Waxman in view of Giesberts and Zuckerman for claim 5) renders these claims obvious as I explain below.

1. Dependent Claim 5: "The method of claim 3, wherein the modulation profile for the probe emulates an orthogonal frequency division multiple access (OFDMA) transmission."

518. Claim 5 of the '690 patent depends from claim 3, which is taught by Waxman alone or Waxman in view of Giesberts, as discussed above. Claim 5 further requires that "the modulation profile for the probe emulates an orthogonal frequency division multiple access (OFDMA) transmission." Ex. 1001, claim 5. Waxman also teaches this feature as explained below.

519. As discussed above in the grounds in view of Waxman alone, Waxman teaches parameters of the probe request including a transmission scheme that entails specifying a form for the probe response including a modulation profile, and that its system may be used with OFDM. Section XII.D.5. To the extent that Waxman's OFDM systems do not teach "modulation profile for the probe emulates an orthogonal frequency division multiple access (OFDMA) transmission," Zuckerman does.

520. Similar to Waxman, Zuckerman describes a system for wireless (and wired) communications. Ex. 1016, Abstract, ¶¶ [0002]-[0006], [0015], [0064], [0066]-[0068]. In Zuckerman's wireless communication system a centralized synchronizing communication controller 7 (which may take the form of an AP, similar to Waxman) communicates with a plurality of wireless clients, such as subscriber devices 4, 50, 51 (similar to Waxman's stations) Ex. 1016, ¶¶ [0041],

[0064]-[0065], FIG. 1G. Zuckerman describes OFDM (orthogonal frequency division modulation/multiplexing) and OFDM (orthogonal frequency division multiple access) interchangeably as available types of multi-carrier modulation in its communication system. Ex. 1016, ¶¶ [0006]-[0007], claims 6, 15. Zuckerman explains that "OFDMA is the 'multi-user' version of OFDM" in which "[e]ach OFDMA user transmits symbols using subcarriers that remain orthogonal to those of other users" and that an OFDMA system is "a multiple access system designed for simultaneous access by multiple users, is applied to OFDM." Ex. 1016, ¶¶ [0007]-[0008]. While Zuckerman expressly defines OFDM as "refer[ring] to any orthogonal multi-carrier modulation" and OFDMA as "refer[ring] to any orthogonal multi-carrier modulation with frequency sub-channelization capabilities," Zuckerman goes on to describe its systems and methods that use multi-carrier modulations as interchangeably using OFDM or OFDMA modulations. Ex. 1016, ¶¶ [0035]-[0036], [0047]-[0051] (discussing "inherent characteristics" common to both OFDM and OFDMA), [0134], [0145]-[0146], [0237].

521. A POSITA would have found it obvious to combine Waxman and Zuckerman, or Waxman, Giesberts, and Zuckerman, such that Waxman's probe requests techniques for specifying modulation profiles that use OFDM are also configured to configure a probe to emulate an OFDMA transmission as taught by

Zuckerman. Zuckerman's centralized synchronizing communication controller 7 (e.g., an AP) performs similar functions to that of Waxman's AP 105 in generating transmission in accordance with specified transmission schemes, and can modulate a downlink transmission using multi-carrier modulation such as a OFDM or OFDMA modulation scheme. Ex. 1016, ¶¶ [0064]-[0066]. Waxman describes use of OFDM communication systems, but does not expressly include OFDMA transmission. A POSITA would have found it obvious to also use Zuckerman's modulation techniques that use OFDM or OFDMA modulation as part of Waxman's wireless communication system, as I explain below.

522. 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]. For example, a POSITA would have found it obvious to configure a probe request as described in Waxman such that a subsequent probe response emulates an OFDMA, as taught by Zuckerman. Ex. 1016, ¶¶ [0047]-[0051] [0134], [0145]-[0146], [0237]. As such, Waxman in view of Zuckerman teaches the modulation profile for the probe "emulate[ing] an orthogonal frequency division multiple access (OFDMA) transmission," as claimed.

523. Accordingly, as shown above, the combination of Waxman and Zuckerman or the combination of Waxman, Giesberts, and Zuckerman renders claim 5 obvious.

2. Dependent Claim 10: "The method of claim 9, wherein the probe request is configured such that the probe emulates an OFDMA transmission."

524. Claim 10 of the '690 patent depends from claim 9, which is taught by Waxman, as discussed above. Claim 10 further requires that "the probe request is configured such that the probe emulates an OFDMA transmission." Ex. 1001, claim 10. Claim 10 is nearly the same as claim 5, except for its dependency and that it recites that "the probe request is configured such that the probe emulates an OFDMA transmission," rather than that "the modulation profile for the probe emulates an orthogonal frequency division multiple access (OFDMA) transmission," as recited in claim 5. Thus, Waxman in view of Zuckerman teaches claim 10 for the same reasons it teaches claim 5.

3. Dependent Claim 11

525. Claim 11 of the '690 patent depends from claim 9, which is taught by Waxman, as discussed above. Claim 11 essentially adds a second instance of sending a probe request and receiving a probe to the first instance in independent claim 9 and the feature of using OFDMA that was in claim 10. It also adds the concept of transmitting two probes "simultaneously." As I explain above for claim

5, to the extent that Waxman's OFDM systems do not teach OFDMA transmission, Zuckerman does. For similar reasons as claim 5, Waxman in view of Zuckerman teaches transmission of the first probe and the second probe using OFDMA.

526. Additionally, as I explained above for the ground in view of Waxman alone, although Waxman does not expressly disclose this "simultaneously" feature, in my opinion a POSITA would have understood that it teaches all features of claim 11. Section XII.D.11. Zuckerman also teaches simultaneous transmission of probe using OFDMA.

527. Zuckerman explains that "OFDMA divides an allocated frequency band into N subcarriers and allocates them to groups, for simultaneous use by multiple links" in which "[o]n the forward link from a base station to a plurality of users, the subcarrier groups, allocated to the respective mobile stations, are transferred simultaneously, while at the same time synchronizing with one another, and thereby guaranteeing mutual orthogonality of the subcarriers." Ex. 1016, ¶ [0008]. Accordingly, OFDMA allows multiple users to simultaneously transmit on the same uplink channel. Ex. 1016, ¶¶ [0176], [0211]-[0212], [0215]-[0216].

528. As OFDMA is beneficial to allocate bandwidth to allow for simultaneous transmission, a POSITA would have understood and found it obvious that Waxman's stations would have been configured to employ OFDMA, as taught by Zuckerman, and would have received probe responses simultaneously. Stations

would not have controlled when APs send probe responses, so those stations would have been configured to receive probe responses that were simultaneously transmitted by different APs. Thus, it would have been obvious to combine Waxman and Zuckerman to transmit probes simultaneously using OFDMA because a POSITA would have understood that the benefits of using OFDMA include more efficient simultaneous communications.

529. A POSITA would have found it obvious to combine Waxman and Zuckerman, such that Waxman's probe request/response techniques that use OFDM are also configured to simultaneously transmit probe responses using OFDMA as taught by Zuckerman. Waxman describes use of OFDM communication systems, but does not expressly include OFDMA transmission. A POSITA would have found it obvious to also use Zuckerman's modulation techniques that use OFDM or OFDMA modulation as part of Waxman's wireless communication system, because doing so more efficiently allocates bandwidth for multiple user communications.

530. 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]. For example, a POSITA would have found it obvious to configure Waxman's first probe and

second probe to be transmitted simultaneously using OFDMA, as taught by Zuckerman. Ex. 1016, ¶¶ [0047]-[0051], [0134], [0145]-[0146], [0176], [0211]-[0212], [0215]-[0216], [0237].

531. In view of the above, Waxman in view of Zuckerman teaches that "the first probe and second probe are transmitted simultaneously using OFDMA," as recited in limitation [11C]. And, for at least the reasons discussed above in the grounds in view of Waxman alone, Waxman teaches limitations [11PRE]-[11B]. Section XII.D.11.

532. Accordingly, as shown above, the combination of Waxman and Zuckerman teaches the additional limitations included in dependent claim 11, and renders claim 11 obvious.

4. Dependent Claim 18: "The system of claim 17, wherein the probe request is configured such that the probe emulates an OFDMA transmission."

533. Claim 18 of the '690 patent depends from claim 17, which is taught by Waxman, as discussed above. Claim 18 further requires that "the probe request is configured such that the probe emulates an OFDMA transmission." Ex. 1001, claim 18. Claim 18 is nearly the same as claim 5, except for its dependency and that it recites that "the probe request is configured such that the probe emulates an OFDMA transmission," rather than that "the modulation profile for the probe emulates an orthogonal frequency division multiple access (OFDMA)

transmission," as recited in claim 5. Thus, Waxman in view of Zuckerman teaches claim 18 for the same reasons it teaches claim 5.

5. Dependent Claim 19

534. Claim 19 of the '690 patent depends from claim 17, which is taught by Waxman, as discussed above. Claim 19 is similar to claim 11 in that it adds a second instance of sending a probe request and receiving a probe to the first instance in independent claim 9 and the feature of using OFDMA. It also adds the concept of transmitting two probes "simultaneously." For similar reasons as claim 11, Waxman in view of Zuckerman teaches simultaneous transmission of the first probe and the second probe using OFDMA.

535. Thus, Waxman in view of Zuckerman teaches claim 19 for the same reasons it teaches claim 11.

G. Waxman In View Of Won Renders Obvious Claims 7-8, 15-16, and 23-24

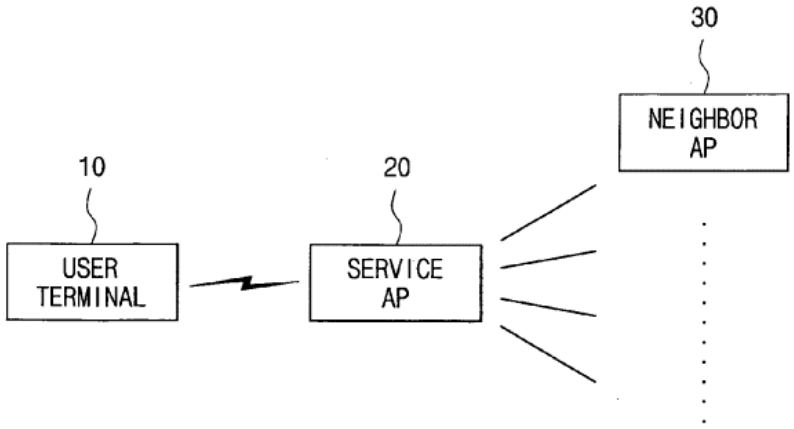
536. Won relates to detecting duplicate service set identifiers (SSIDs) in a wireless network. Ex. 1008, Abstract, ¶¶ [0012]-[0015]. Like Waxman, Won discusses systems in which APs and stations/clients wirelessly communicate. Ex. 1008, Abstract, ¶¶ [0012]-[0015]. Won describes that an AP establishes a network using a SSID, and a client then accesses the AP via the SSID. Ex. 1008, ¶¶ [0005]-[0006]. For example, a client terminal transmits a probe request packet and then waits for a probe response packet in order to access an AP or to scan neighbor APs.

Ex. 1008, ¶ [0006]. Also like Waxman, Won also describes an "active scanning" process in which the client transmits a probe request packet to neighbor APs and then collects AP information based on probe response packets received from the neighbor APs. Ex. 1008, ¶ [0007]. Won addresses "in the case that a user attempts to use a purchased AP without changing the SSID setting thereof, the SSID of the purchased AP may be the same as that of a neighbor AP" and this may result in "abnormal data services" where the client accesses an incorrect AP (based on use of a duplicate SSID) and data services failure based on failure to authenticate. Ex. 1008, ¶ [0009]. "The client may repeat connection between two APs having the same SSID, thereby risking the stability of the service. It is also possible that another client accesses the user AP to be freely provided with a data service." Ex. 1008, ¶ [0009]. Won addresses such problems with a system for detecting an AP having a duplicate SSID in which an active scanning process identifies whether a duplicate SSID is present by collecting neighbor AP information. Ex. 1008, ¶¶ [0010]-[0011]. Namely, duplicate SSIDs are identified by receiving a scan request from a user or client, generating a probe request with an SSID of a service AP, transmitting the probe request to neighbor APs, receiving probe responses from the neighbor APs, detecting SSIDs in the probe responses, and identifying any instances of a neighbor AP having the same SSID as the service AP. Ex. 1008, ¶¶

[0013]-[0014]. The service AP is coupled to a user terminal, and the scan request is given by the user terminal. Ex. 1008, ¶¶ [0014], [0019].

537. Won's system includes a user terminal 10, a service AP 20 for providing a data service to the user terminal 10, and a plurality of neighbor APs 30 for transmitting/receiving packets to/from the service AP 20. Ex. 1008, ¶ [0026], FIG. 2.

FIG. 2



"In response to the scan request from the user terminal 10, the service AP 20 generates a probe request packet by inserting the SSID of the AP 20 thereinto, sends the probe request packet to the neighbor APs 30, and then collects probe response packets, sent in response to the probe request packet from the neighbor APs 30." Ex. 1008, ¶ [0026]. Won further provides: "at first, a client sends a user scan request to an AP in a service set (S10). The scan request can also be checked directly by a user in the AP, in place of the client. In response to the scan request

from the client, the AP in the service set generates a probe request packet by inserting its own SSID thereinto (S20), and transmits the generated probe request packet to neighbor APs (S30). The AP in the service set collects probe response packets, in response to the probe request packet, from the neighbor APs for about 500 ms (S40)." Ex. 1008, ¶ [0035], FIG. 4. While Won describes its process as including a service AP that generates a probe request based on receiving a scan request from a user or client terminal, Won also describes known processes in which the client terminal generates the probe request to be sent to an AP. Ex. 1008, ¶ [0006] ("the client transmits a probe request packet"), [0007] ("the client transmits a probe request packet to the neighbor APs").

538. A POSITA would have found it obvious to combine Waxman and Won, such that Waxman's probe requests techniques for extending connectivity range are also configured to identify duplicate SSIDs in a wireless communication system. Won's service AP 20 performs similar functions to those of Waxman's stations 101, 102, 103, in generating probe requests and receiving probe responses from other APs (e.g., Won's neighbor AP 30, Waxman's AP 105). Waxman refers to an active scanning process but does not provide details for initiating the active scanning process. And Won describes an active scanning process that is initiated by a client or user terminal. A POSITA would have found it obvious to also use Won's system for identifying duplicate SSIDs as part of sending/receiving probe

requests/responses in Waxman's wireless communication system, as I explain below.

539. A POSITA also would have found it obvious to include Won's user terminal 10 to initiate an active scanning process in Waxman's system. For example, a POSITA would have found it obvious to, as part of initiating a scan request, receive a probe request and/or other related parameters from a user terminal to set up an appropriate scan request, as taught by Won. Ex. 1008, ¶¶ [0012], [0014], [0026]-[0035], [0040]-[0041]. Thus, a user terminal would have generated and uploaded a probe request to a station (e.g., Waxman's stations 101, 102, 103). Ex. 1008, ¶¶ [0006]-[0007], [0013], [0015], [0026].

1. Dependent Claim 7: "The method of claim 1, wherein the probe request requests a probe that assists in diagnosing a network problem."

540. Claim 7 of the '690 patent depends from claim 1, which is taught by Waxman, as discussed above. Claim 7 further requires that "the probe request requests a probe that assists in diagnosing a network problem," but says nothing about what the network problem is. Ex. 1001, claim 7. To the extent that Waxman does not disclose such features, Won does.

541. Won's method provides a specific scanning function for a client AP "in order to quickly find and monitor a problem." Ex. 1008, ¶ [0012]. The problems described in Won includes the "unintended presence of the same SSID"

or "a hidden SSID, which cannot be detected using conventional scanning schemes." Ex. 1008, ¶ [0012]. Won's process diagnoses such a problem in that "the service AP 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, ¶ [0039]. Won also explains that its scanning function prevent unstable network service that takes place when a neighbor AP uses the same SSID, as well as bandwidth or service costs issues that may result from other's using the user's network via the same SSID. Ex. 1008, ¶¶ [0040]-[0041]. Won's scanning function also detects an AP using a hidden SSID, and therefore addresses network problems that might result from an AP using a hidden SSID. Ex. 1008, ¶ [0042].

542. In the combination of Waxman and Won, Waxman's station would have performed an active scanning process that also employs techniques of Won's scanning process to identify duplicate/hidden SSIDs. As such, a POSITA would have desired to utilize Won's scan function to identify duplicate/hidden SSIDs that may cause network problems. Ex. 1008, ¶¶ [0026]-[0027], [0035]-[0042]. 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.

543. It is also my opinion that other rationales also support my finding that the combination of Waxman and Won would have been obvious. The known elements from Waxman include Waxman's stations (e.g., stations 101, 102, 103) that use an active scanning process to optimize communication with neighbor APs, and the known elements from Won include Won's scanning process for detecting APs using duplicate/hidden SSIDs. Ex. 1007, ¶¶ [0030], [0035]; Ex. 1008, ¶¶ [0026]-[0027], [0035]-[0042]. This combination of Waxman and Won would have the predictable result of adding, to Waxman active scanning process, a technique for detecting APs using duplicate/hidden SSIDs (which would have identified APs that would have caused network issues if left undetected).

544. The combination of Waxman and Won also amounts to applying a known technique taught by Won to a known device described by Waxman that is ready for improvement to yield predictable results. Specifically, the combination applies an active scanning process to identify potential network problems taught by Won for Won's wireless network system to Waxman's similar wireless communication system that is ready for improvement by Won's technique. Waxman's wireless communication is particularly ready for improvement because it, like Won, uses an active scanning process to provide (e.g., based on received

information from neighboring APs) improved wireless communications, but Waxman does not explicitly include a process to identify neighbor APs that may pose potential network problems. Ex. 1007, ¶¶ [0030], [0035]; Ex. 1008, ¶¶ [0007]-[0010], [0035]-[0038]. Waxman's wireless communication system already uses an active scanning process that includes sending probe requests to neighboring APs and receiving probe responses from those APs and the predictable result is a modification of Waxman's scanning process to further include an indication of SSIDs in the probe request and probe response and using that information in diagnosing a network problem.

545. Lastly, 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]. In addition, a POSITA would have expected Waxman's stations implementing Won's scanning process to operate similar to Waxman's scanning process, but simply with the added SSID in the probe request for use in identifying duplicate SSIDs and diagnosing a potential network problem.

546. Accordingly, as shown above, the combination of Waxman and Won teaches the additional limitations included in dependent claim 7, and renders claim 7 obvious to a POSITA.

2. Dependent Claim 8: "The method of claim 7, wherein the probe request is generated by a network operator and uploaded to the second node."

547. Claim 8 of the '690 patent depends from claim 7, which is taught by Waxman alone, or Waxman and Won, as discussed above. Claim 8 further requires that "the probe request is generated by a network operator and uploaded to the second node." Ex. 1001, claim 8. To the extent that Waxman does not disclose such features, Won does.

548. As discussed for the grounds in view of Waxman alone (e.g., for limitation [1B] and claim 6), Waxman describes generating and transmitting the probe request as part of a station performing an active scanning process. Sections XII.D.1.c, XII.D.6; 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 it initiated, Won does.

549. Won's active scanning process can identify whether a duplicate SSID is present by collecting neighbor AP information as part of identifying potential network issues. Ex. 1008, ¶¶ [0010]-[0011]. 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], FIG. 2. Won provides as an example: "at first, a client sends a user scan request to an AP in a service set (S10). … In response to the scan request from the client, the AP in the service set generates a probe request packet by inserting its own SSID thereinto (S20), and transmits the generated probe request packet to neighbor APs (S30)." Ex. 1008, ¶ [0035], FIG. 4. While Won's FIG. 4 example process includes the service AP generating a probe request based on a scan request from a user terminal, Won also describes processes in which the user terminal (the claimed "network operator") generates the probe request to be sent to the AP. Ex. 1008, ¶¶ [0006] ("the client transmits a probe request packet"), [0007] ("the client transmits a probe request packet to the neighbor APs").

550. A POSITA would have understood the benefits of a probe request generated by a network operator operating via a user terminal. For example, as Won describes, the scanning process is initiated by a the request (e.g., Ex. 1008, ¶¶ [0006]-[0007]) and therefore the system can perform such a scan upon a network operator deeming it appropriate to do so (e.g., when network connectivity is an issue, or a network issue indicates a potential hidden AP). Ex. 1008, ¶¶ [0039]-[0042]. Accordingly, it would have been obvious to the POSITA that the network

operator at the user terminal would generate the probe request, e.g., at a timing that the network operator determines it to be appropriate, and/or so as to configure the probe request to include suitable parameters. Therefore, in at least one obvious combination of Waxman with Won the probe request would have been generated at Won's user terminal (the claimed "network operator") and uploaded to Waxman's station (the claimed "second node") to initiate Waxman's active scanning process.

551. Accordingly, as shown above, the combination of Waxman and Won teaches the additional limitations included in dependent claim 8, and renders claim 8 obvious.

552. Thus, Waxman and Won render obvious claim 8.

3. Dependent Claim 15: "The method of claim 9, wherein the probe request is configured to diagnose a network problem."

553. Claim 15 of the '690 patent depends from claim 9, which is taught by Waxman, as discussed above. Claim 15 further requires that "the probe request is configured to diagnose a network problem," but says nothing about what the network problem is. Ex. 1001, claim 15. Claim 15 is similar to claim 7 and thus is rendered obvious by Waxman in view of Won for at least the same reasons given above for claim 7.

554. Accordingly, the combination of Waxman and Won teaches the additional limitations included in dependent claim 15, and renders claim 15 obvious to a POSITA.

4. Dependent Claim 16: "The method of claim 15, wherein the probe request is generated by a network operator and uploaded to the first node."

555. Claim 16 of the '690 patent depends from claim 15, which is taught by Waxman alone or Waxman in view of Won, as discussed above. Claim 16 further requires that "the probe request is generated by a network operator and uploaded to the first node." Ex. 1001, claim 16. Claim 16 is the same as claim 8, but the "second node" is referred to as the "first node" because independent claim 9 is written from the perspective of the node that sends the probe request and receives the probe response. As such, the first node in claims 9 and 16 corresponds to the second node in claims 1 and 8, while the second node in claims 9 and 16 corresponds to the first node in claims 1 and 8. Thus, Waxman in view of Won teaches claim 16 for the same reasons it teaches claim 8, except that the station of Waxman and Won corresponds to the "first node" of claim 16.

5. Dependent Claim 23: "The system of claim 17, wherein the probe request is configured to diagnose a network problem."

556. Claim 23 of the '690 patent depends from claim 17, which is taught by Waxman, as discussed above. Claim 23 further requires that "probe request is

configured to diagnose a network problem." Ex. 1001, claim 23. Claim 23 is the same as claim 15, except for its dependency. Thus, Waxman in view of Won teaches claim 23 for the same reasons it teaches claim 15.

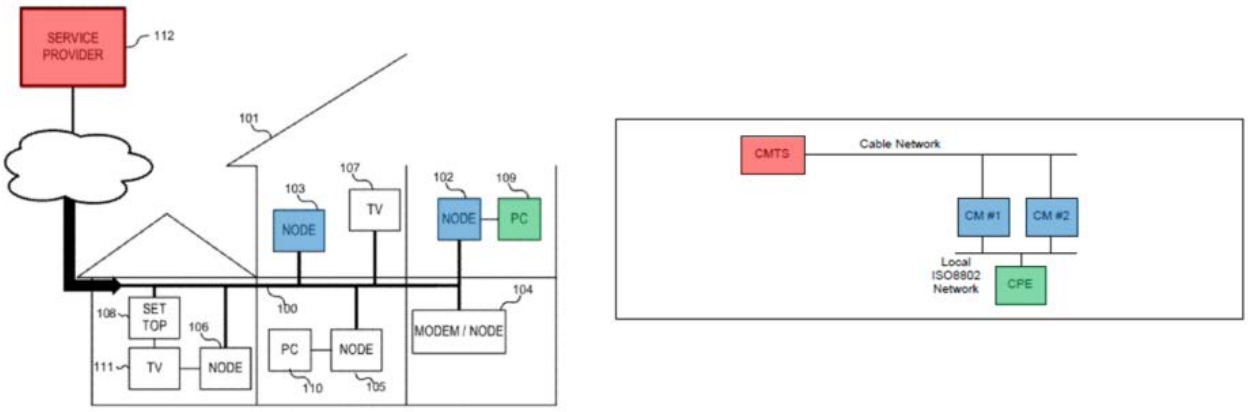
6. Dependent Claim 24: "The system of claim 23, wherein the probe request is generated by a network operator and uploaded to the first node."

557. Claim 24 of the '690 patent depends from claim 23, which is taught by Waxman alone or Waxman in view of Won, as discussed above. Claim 24 further requires that the "probe request is generated by a network operator and uploaded to the first node." Ex. 1001, claim 24. Claim 24 is the same as claim 16, except for its dependency. Thus, Waxman in view of Won teaches claim 24 for the same reasons it teaches claim 16.

H. DOCSIS 2.0 (Ranging Procedure) Anticipates Claims 1-2, 6-7, 9, and 14-15 and DOCSIS 2.0 (Test Procedure) In View Of ISO8802-2 Renders Obvious Claims 1-2, 6-7, 9, and 14-15

558. As shown below by the side-by-side comparison of Figure 1 of the '690 patent and Figure 5-3 of DOCSIS 2.0, the systems of the '690 patent and DOCSIS 2.0 are generally the same. Ex. 1001, 3:24-4:24, FIG. 1; Ex. 1010, 1-5, 23-37, FIGs. 1-1, 1-2, 5-1, 5-2, 5-3, 5-4. The cable modem termination system (CMTS) (**red**) in DOCSIS 2.0 corresponds to the service provider 112 (**red**) of the '690 patent. Ex. 1001, 4:20-24; Ex. 1010, 12. Just as the service provider 112 is connected to a plurality of nodes (e.g., nodes 102 and 103) (**blue**) via a

communications medium 100 in the ’690 patent, the CMTS is connected to a plurality of cable modems (e.g., CM #1 and CM #2) (**blue**) via the cable network in DOCSIS 2.0. Ex. 1001, 3:27-38, FIG. 1; Ex. 1010, 11, 28-29. And, just as the nodes may be connected to a variety of devices (e.g., PC 109) (**green**) in the ’690 patent, the cable modems may be connected to a variety of customer premises equipment (CPE) (**green**) in DOCSIS 2.0. Ex. 1001, 4:10-20; Ex. 1010, 13, 29-31.



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

559. The claims simply refer to first and second nodes and are not otherwise limited to any particular system architecture. Likewise, the claims simply refer to two messages (a probe request and a probe), and are not otherwise limited to any particular protocol. Thus, a POSITA would have understood that the DOCSIS 2.0 specification describes a relevant system and protocol. DOCSIS 2.0 describes a number of messages that are communicated between two of its nodes (e.g., between the CMTS and CMs). Ex. 1010, 23-37. The messages are used for providing various procedures or operations having various purposes (e.g.,

initialization, bandwidth allocation, etc.). Ex. 1010, 187, 239-267. Some of the messages are used in one procedure while some of the other messages are used in another procedure for another purpose. Ex.1010, 239-267. Also, some messages are used in multiple different procedures. Ex.1010, 239-267. Depending on the scope of the claims (e.g., depending on how a probe is defined), DOCSIS 2.0 may have multiple procedures using different messages that can be applied to the claims.

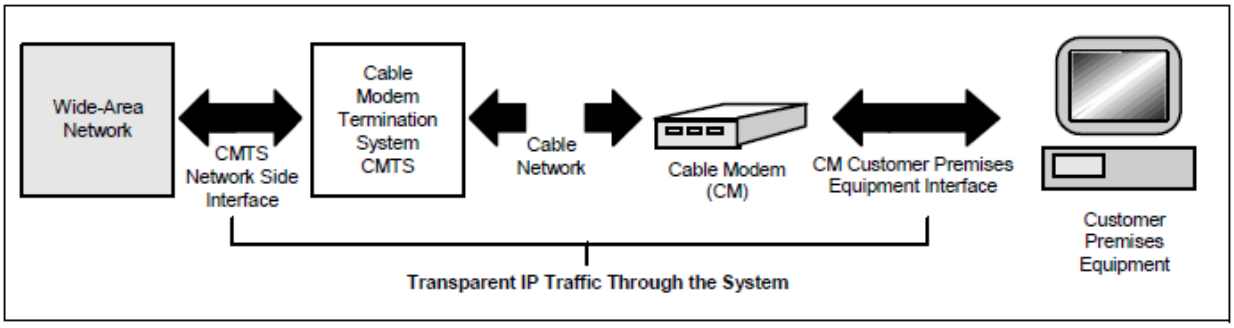
560. In any event, my analysis below focuses on two procedures described in DOCSIS 2.0 and how they apply to the claims. For ease of explanation, I will refer to these two procedures as a "ranging procedure" and a "test procedure." As explained on a limitation-by-limitation basis below, the system and the method for operating it (and in particular the ranging procedure and test procedure) anticipate or render obvious many of the '690 patent's claims. More specifically, DOCSIS 2.0's ranging procedure anticipates claims 1-2, 6-9, 14-17, and 22-24, while DOCSIS 2.0's test procedure in view of ISO8802-2 renders obvious claims 1-2, 6-9, 14-17, and 22-24. I note that a POSITA would have found it obvious to combine DOCSIS 2.0's test procedure and ISO8802-2 test procedure because DOCSIS 2.0 expressly tells the reader to do so. Ex. 1010, 28, 132. It is also listed as a reference in DOCSIS 2.0, so a POSITA would have looked to it for ways to improve or implement the processes described in DOCSIS 2.0. Ex. 1010, 8. A

POSITA would have also adopted the test procedure from ISO8802-2 because that is a well-known standard and the test procedures are compatible. Finally, a POSITA would have had the skills to implement DOCSIS 2.0's test procedure according to ISO8802-2's test procedure and would have expected to achieve success in doing so.

1. Independent Claim 1

a) [1PRE]: "A method comprising:"

561. This preamble is disclosed by DOCSIS 2.0. DOCSIS 2.0 describes a data-over-cable system and a method for operating the system. Ex. 1010, 1, 23 ("operating a data-over-cable system"). The method for operating the system includes numerous procedures or operations intended to provide "transparent bi-directional transfer of Internet Protocol (IP) traffic, between the cable system head-end and customer locations, over an all-coaxial or hybrid-fiber/coax (HFC) cable network." Ex. 1010, 2. The system with this service goal is illustrated in Figure 1-1 below. Ex. 1010, 2.

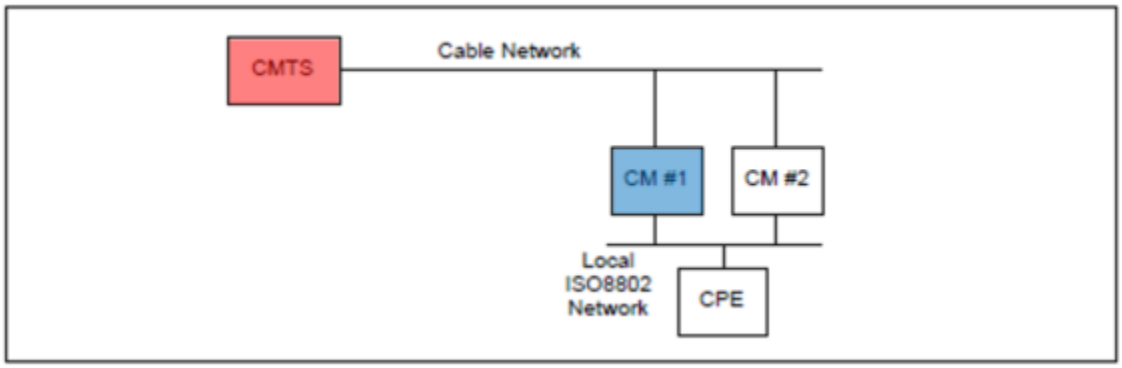


Ex. 1010, FIG. 1-1

562. The method for operating the system at large is described by describing various procedures or operations of the components of the system and by defining interfaces, protocols, and messages. That is, the various procedures and definitions in DOCSIS 2.0 taken together teach a method for operating the data-over-cable system. For example, DOCSIS 2.0 describes a ranging procedure by describing an Upstream Channel Descriptor (UCD) message that causes Ranging Request (RNG-REQ) and Ranging Response (RNG-RSP) messages to be transmitted. Ex. 1010, 135-152, 197-200. As another example, DOCSIS 2.0 describes a test procedure by describing a Test Request (TST-REQ) message. Ex. 1010, 184-186. It is the collection of such procedures/operations that forms the method which meets the claimed "method." Alternatively, each of the ranging procedure or test procedure alone meets the claimed "method." Lastly, as discussed below, DOCSIS 2.0's method (either the collection of its various procedures/operations, or the ranging procedure or test procedure individually) comprises limitations [1A]-[1D]. See Sections XII.H.1.b-e, below. Thus, DOCSIS 2.0 teaches limitation [1PRE].

b) [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;"

563. As shown below in Figure 5-3 of DOCSIS 2.0, the system of DOCSIS includes a cable mode termination system (CMTS) communicating with a cable modem (e.g., CM #1). Ex. 1010, 29, FIG. 5-3. The CM (e.g., CM #1) (**blue**) in DOCSIS 2.0 corresponds to the claimed "first node" and the CMTS (**red**) in DOCSIS 2.0 corresponds to the claimed "second node."



564. Both the ranging procedure and test procedure include the step of receiving in limitation [1A]. Thus, I will address both below.

565. **Ranging Procedure:** With respect to the ranging procedure, DOCSIS 2.0 states that "[r]anging is the process of acquiring the correct timing offset such that the cable modem's transmissions are aligned to the correct mini-slot boundary." Ex. 1010, 197. DOCSIS 2.0 explains that "a cable modem MUST synchronize to the downstream and learn the upstream channel characteristics

through the Upstream Channel Descriptor MAC management message" and "MUST put together either an Initial Ranging Request message or a Ranging Request message." Ex. 1010, 197. DOCSIS 2.0 also describes that the Upstream Channel Descriptor (UCD) message "MUST be transmitted by the CMTS at a periodic interval to define the characteristics of an logical upstream channel (Figure 8-16)." Ex. 1010, 135, 22 (definition of UCD). DOCSIS 2.0 further describes that the UCD is received by at least one CM (e.g., CM #1, which corresponds to the claimed "first node"). Ex. 1010, 243-246. The format of the UCD message is shown in Figure 8-16 (reproduced below). Ex. 1010, 136. This UCD message corresponds to the claimed "probe request."

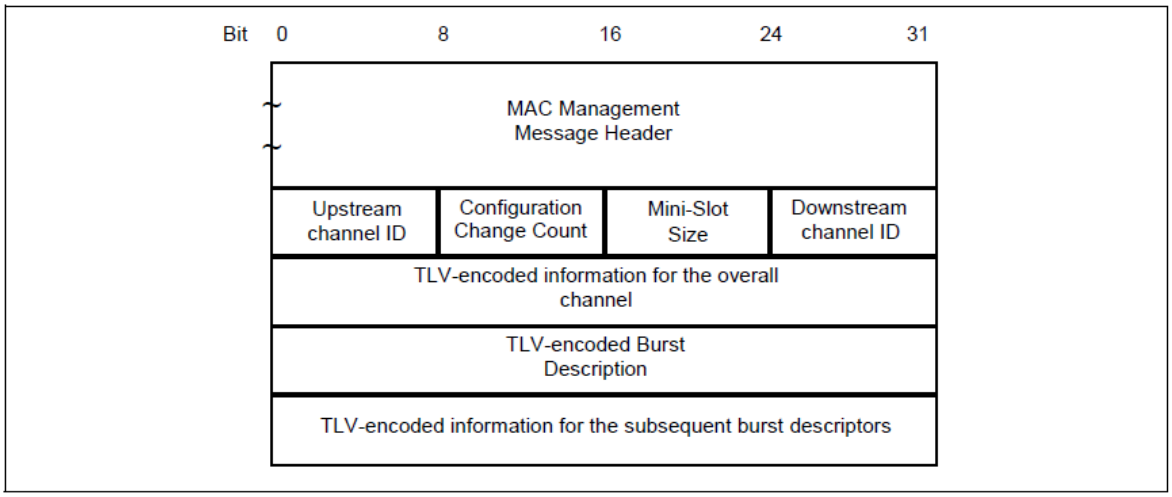


Figure 8-16 Upstream Channel Descriptor

566. As shown above, the UCD message includes eight portions: a MAC Management Message Header, Upstream Channel ID, Configuration Change Count, Mini-Slot Size, Downstream Channel ID, TLV-Encoded Information for

the Overall Channel, TLV-Encoded Burst Description, and TLV-Encoded Information for the Subsequent Burst Descriptors. Ex. 1010, 136.[13] The parameters in the TLV-Encoded Information for the Overall Channel are defined in Table 8-18 (portions of which are reproduced below) and an example of UCD encoded TLV data is given in Figure 8-18 (not shown below) of DOCSIS 2.0. Ex. 1010, 137-143.

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.

[13] I note that TLV stands for "Type/Length/Value." Ex. 1010, 21.

567. As shown from the above table, the parameters of the UCD message include a modulation rate parameter, frequency parameter, maintain power spectral density parameter, and ranging required parameter. Ex. 1010, 137-139. The modulation rate parameter is a 1 byte long value that provides a multiple of a base rate of 160 kHz that is to be used for modulating subsequent signals on the upstream channel identified by the Upstream Channel ID of the same UCD message. Ex. 1010, 137, 54 (see section 6.2.10 Modulation Rates). The frequency parameter is a 4 byte long value that provides the upstream center frequency that is to be used for subsequent signals on the upstream channel identified by the Upstream Channel ID of the same UCD message. Ex. 1010, 137. The maintain power spectral density parameter is a 1 byte long value that controls the transmit power level to be used for subsequent signals on the upstream channel identified by the Upstream Channel ID of the same UCD message. Ex. 1010, 139. The ranging required parameter is a 1 byte long value that indicates whether ranging is required to be performed on the upstream channel identified by the Upstream Channel ID of the same UCD message. Ex. 1010, 139.

568. Further, as I explained above, the UCD message includes TLV-Encoded Burst Description and TLV-Encoded Information for the Subsequent Burst Descriptors, which include further parameters. As DOCSIS 2.0 explains, "[w]ithin each Burst Descriptor is an unordered list of Physical-layer attributes,

encoded as TLV values." Ex. 1010, 140. "These attributes are shown in Table 8-19" which is reproduced below in part. Ex. 1010, 140-142.

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)

569. As shown in this table, the attributes/parameters include a modulation type for specifying a type of modulation (e.g., QPSK, 16QAM, 8QAM, etc.) to be used for a subsequent burst on the upstream channel identified by the Upstream Channel ID that is in the same UCD message. Ex. 1010, 141.

570. In addition to these parameters, there are further parameters in the MAC Management Message Header of the UCD message. As shown in Figure 8-14 (below), the MAC Management Message Header includes numerous parameters (referred to as "fields"), such as a destination address (DA), source address (SA), etc. Ex. 1010, 132-135.

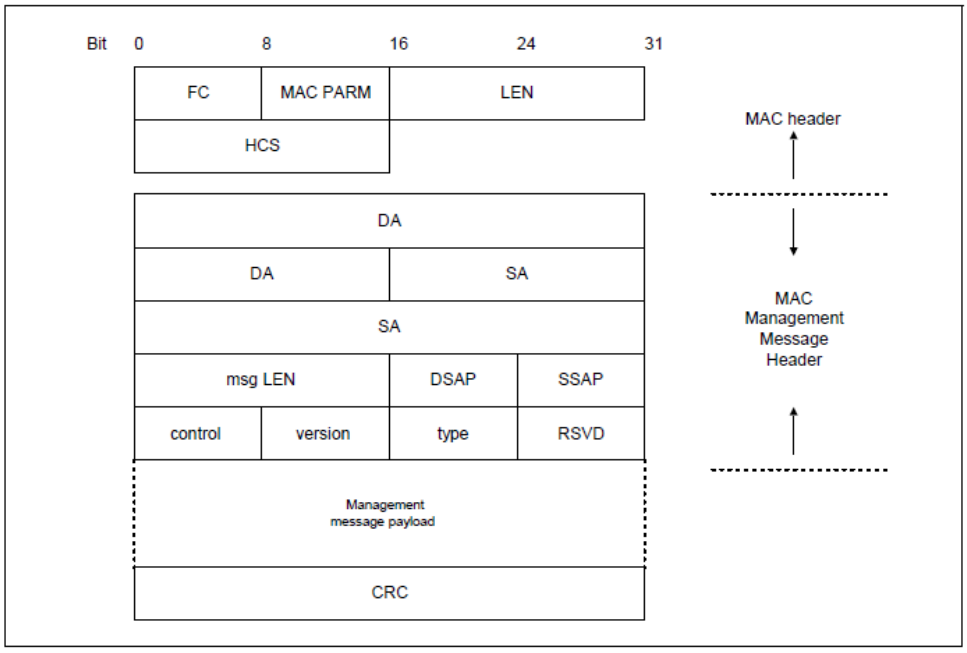


Figure 8-14 MAC Header and MAC Management Message Header Fields

571. Thus, the UCD message, collectively from its eight different portions (i.e., MAC Management Message Header, Upstream Channel ID, Configuration Change Count, Mini-Slot Size, Downstream Channel ID, TLV-Encoded Information for the Overall Channel, TLV-Encoded Burst Description, and TLV-Encoded Information for the Subsequent Burst Descriptors), specifies a plurality of parameters that meets the claimed "first plurality of parameters." Moreover, the plurality of parameters (in particular, the modulation rate for the channel and the modulation type for the burst) of the UCD message are used for forming a Ranging Request (RNG-REQ) message (the claimed "probe"), which is generated when the ranging required parameter of the UCD message has a value of 1 or 2. Ex. 1010, 139, 146-147, 197-198. Therefore, the plurality of parameters of the UCD

message are "associated with the generation and transmission of a probe," as claimed.

572. In addition, and as I explained above, one of the parameters of the UCD message is the Downstream Channel ID. Ex. 1010, 136-137. This Downstream Channel ID is then included in the payload of the Ranging Request message, as shown in Figure 8-21 (reproduced below). Ex. 1010, 146-147.

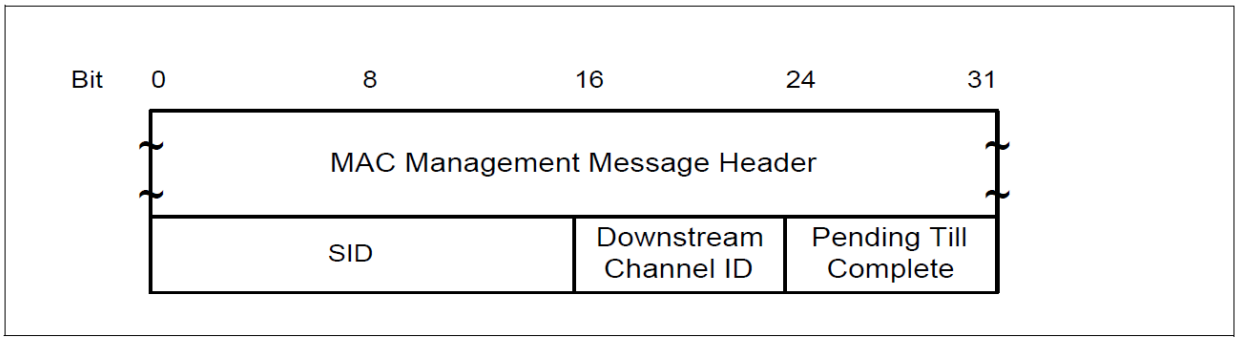


Figure 8-21 Packet PDU Following the Timing Header

573. DOCSIS 2.0 explains that the Downstream Channel ID is "[t]he identifier of the downstream channel on which the CM received the UCD which described this upstream." Ex. 1010, 147. As shown above, the Downstream Channel ID is part of the packet PDU that follows the Timing Header and also follows the MAC Management Message Header. Because of this location outside of the headers, a POSITA would have understood that the Downstream Channel ID is part of the payload of the Ranging Request message (the claimed "probe"). Therefore, the Downstream Channel ID parameter in the UCD message specifies content (the identifier) of the payload for the Ranging Request message (the

claimed "wherein the first plurality of parameters at least specify content payload of the probe"). Ex. 1010, 136-137, 146-147.

574. The plurality of parameters of the UCD message also includes the source address (SA) parameter (which is within the MAC Management Message Header of the UCD message). Ex. 1010, 133, 136. The SA parameter specifies the CMTS (the claimed "wherein the first plurality of parameters at least specify…a second node"), which is the node that transmits the UCD message to the CM and will receive the Ranging Request message. Ex. 1010, 133, 146-147.

575. In conclusion, DOCSIS 2.0 teaches receiving in a CM, a UCD message specifying a plurality of parameters associated with the generation and transmission of a Ranging Request message, wherein the plurality of parameters specify a payload of the Ranging Request message and the CMTS. This teaches the claimed "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" in limitation [1A]. Thus, DOCSIS 2.0's ranging procedure teaches limitation [1A].

576. **Test Procedure:** With respect to the test procedure, DOCSIS 2.0 states that "[t]he CM MUST provide a test mode." Ex. 1010, 96, 98. DOCSIS 2.0 also states that "the CM and CMTS MUST respond appropriately to TEST and

XID requests per [ISO8802-2]." Ex. 1010, 28. More specifically, DOCSIS 2.0 describes the CM receiving a Test Request message (TST-REQ), which corresponds to the claimed "probe request." Ex. 1010, 184-185 ("CM receives a TST-REQ message (either unicast to the CM itself, or broadcast)"). The Test Request message is a type of MAC Management Message. Ex. 1010, 133-134. "The Test Request is used to force a CM to enter or leave one of two test modes." Ex. 1010, 184. The Test Request message is shown in Figure 8-45 (reproduced below). Ex. 1010, 185.

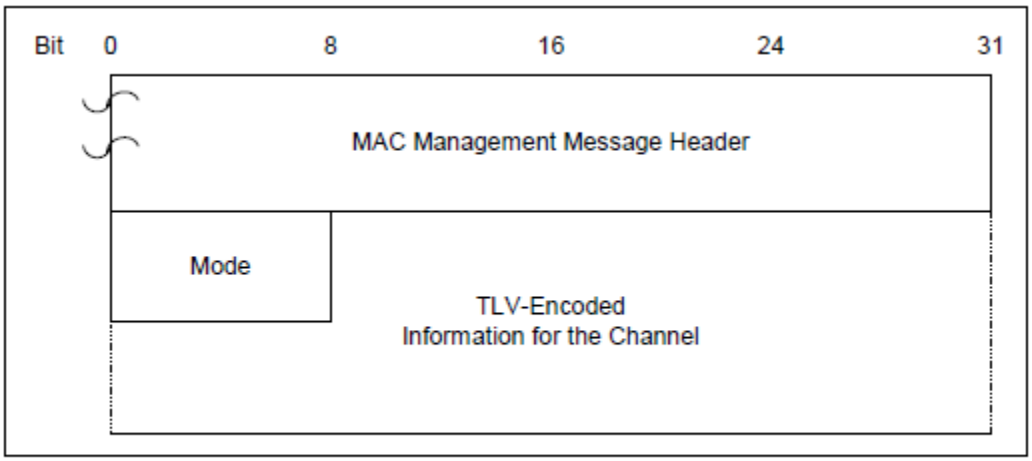


Figure 8-45 Test Request

577. As shown above, the Test Request message includes three portions: a MAC Management Message Header, Mode, and TLV-Encoded Information for the Channel. Ex. 1010, 185. The Mode has one of three values: 0, 1, or 2. Ex. 1010, 185. If the Mode is 0, the CM (which receives the Test Request Message) disables all test modes and reboots. Ex. 1010, 185. If the Mode is not 0, "the CM MUST

begin the test mode indicated in the Mode parameter, using the channel parameters included in the TST-REQ message." Ex. 1010, 185 (DOCSIS uses the notation "!=0" to indicate "not equal to 0"). More specifically, if the Mode is 1, the CM transmits "a continuous (non-bursted) upstream signal at the commanded modulation rate, carrier frequency, and power level." Ex. 1010, 185, 98 (which also describes the transmission of this continuous signal in the test mode). And, if the mode is 2, the CM transmits "a continuous (non-bursted), unmodulated (CW) upstream signal at the commanded carrier frequency, modulation rate and power level." Ex. 1010, 185, 96 (which also describes the transmission of this continuous signal in the test mode). The channel parameters (e.g., carrier frequency, modulation rate, and power level) are obtained from the TLV-Encoded Information for the Channel in the TST-REQ message and are defined in Table 8-22 (reproduced below). Ex. 1010, 185-186.

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.

578. As shown from the above table, each of the above parameters must be included in the Test Request message having a Mode equal to 1. Ex. 1010, 185-186. In addition to these parameters, there are further parameters in the MAC Management Message Header of the Test Request message. As shown in Figure 8-14 (below), the MAC Management Message Header includes numerous parameters (referred to as "fields"), such as a destination address (DA), source address (SA), etc. Ex. 1010, 132-135.

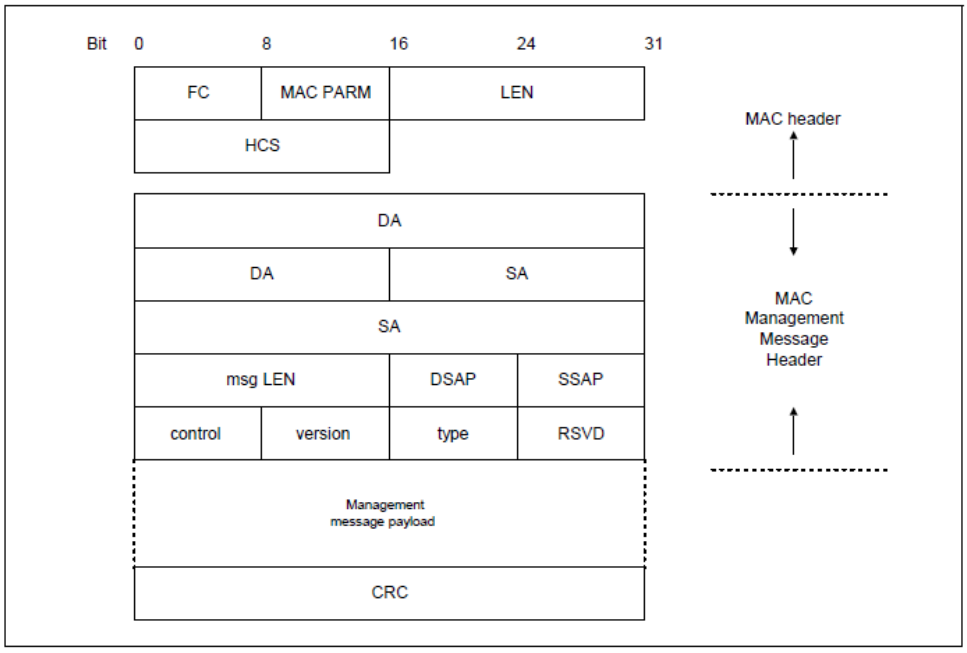


Figure 8-14 MAC Header and MAC Management Message Header Fields

579. Thus, the Test Request message, collectively from its three different portions (i.e., MAC Management Message Header, Mode, and TLV-Encoded Information for the Channel), specifies a plurality of parameters that meets the claimed "first plurality of parameters." Moreover, the plurality of parameters (in particular, the carrier frequency, modulation rate, and power level) of the Test Request message are used for forming the continuous (non-bursted) upstream signal (the claimed "probe"). Ex. 1010, 185 ("CM MUST begin the test mode indicated in the Mode parameter, using the channel parameters included in the TST-REQ message"). Therefore, the plurality of parameters of the Test Request message are "associated with the generation and transmission of a probe," as claimed.

580. In addition, the plurality of parameters of the Test Request message includes the Mode parameter which specifies the continuous (non-bursted) upstream signal that is to be sent and therefore specifies a payload for the continuous (non-bursted) upstream signal (the claimed "wherein the first plurality of parameters at least specify content payload of the probe"). Ex. 1010, 185. The content payload is also specified because the upstream signal sent as the test response signal would include the information field that was included in the Test Request message which would include the non-header parameters (i.e., Mode and channel parameters). See Section XII.H.1.c (next section regarding limitation [1B] which discusses the test response message from ISO8802-2). The plurality of parameters of the Test Request message also includes the source address (SA) parameter that specifies the CMTS (the claimed "wherein the first plurality of parameters at least specify…a second node"), which is the node that transmits the Test Request message to the CM and will receive the continuous (non-bursted) upstream signal. Ex. 1010, 133.

581. In conclusion, DOCSIS 2.0 teaches receiving in a CM, a Test Request message specifying a plurality of parameters associated with the generation and transmission of a continuous (non-bursted) upstream signal, wherein the plurality of parameters specify a payload of the continuous (non-bursted) upstream signal and the CMTS. This teaches the claimed "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" in limitation [1A]. Thus, DOCSIS 2.0's test procedure teaches limitation [1A].

c) [1B]: "b) determining a second plurality of parameters associated with generation and transmission of the probe;"

582. **Ranging Procedure:** As I explained above, the UCD message includes a ranging required parameter that will cause the CM to generate and transmit the Ranging Request message (the claimed "probe"). Ex. 1010, 139, 146-147. As shown in Figure 8-21 (reproduced below), the Ranging Request message includes a plurality of parameters (the claimed "second plurality of parameters"), such as the parameters for the MAC Management Message Header (which includes numerous parameters as explained above), the SID parameter, the Downstream Channel ID, and the Pending Till Complete parameter. Ex. 1010, 146-147.

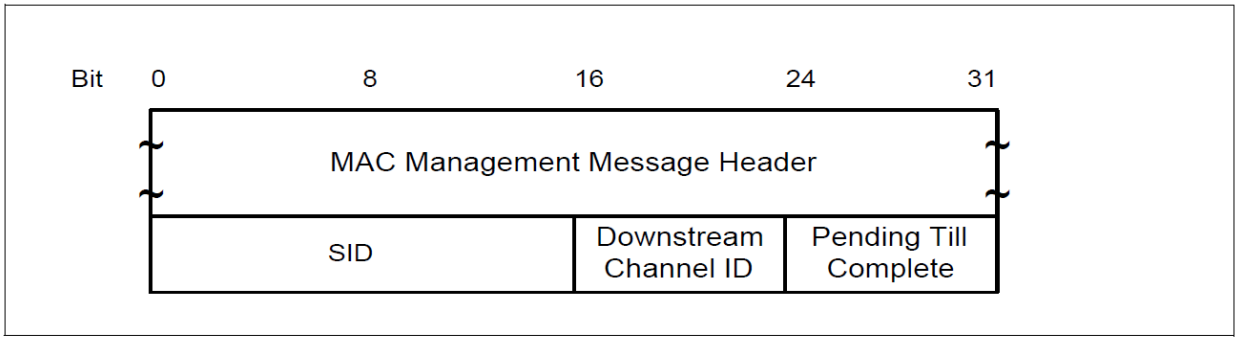
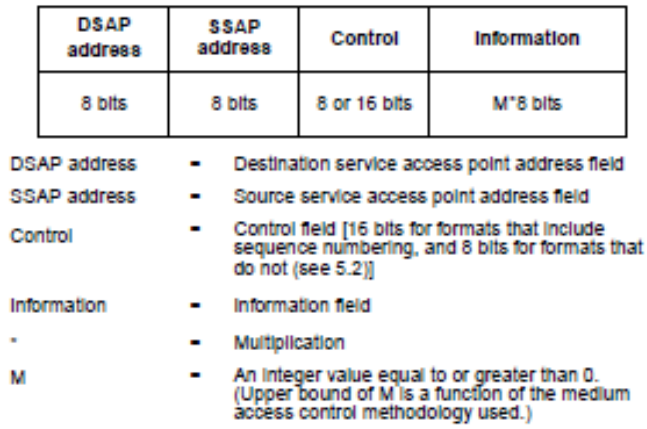


Figure 8-21 Packet PDU Following the Timing Header

583. A POSITA would have understood that these parameters must be determined in order to generate and transmit the Ranging Request message. Therefore, the plurality of parameters of the Ranging Request message are "associated with the generation and transmission of a probe," as claimed.

584. In conclusion, DOCSIS 2.0 teaches the CM determining a plurality of parameters associated with the generation and transmission of the Ranging Request message. This teaches the claimed "determining a second plurality of parameters associated with generation and transmission of the probe" in limitation [1B]. Thus, DOCSIS 2.0' ranging procedure teaches limitation [1B].

585. **Test Procedure:** As I explained above, the CM upon receiving a Test Request message with a Mode equal to 1 or 2 will generate and transmit a continuous (non-bursted) upstream signal (the claimed "probe") based on the parameters in the Test Request message. Ex. 1010, 185. Also, this upstream signal in response to the Test Request message must be generated per ISO8802-2. Ex. 1010, 28. A POSITA would have understood that this upstream signal is a Test response message in ISO8802-2. Ex. 1011, 53. Per ISO8802-2, the Test response includes a PDU with the following format, which means the upstream signal includes a PDU with the following format. Ex. 1011, 39, 53, FIG. 4.



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

586. As shown, this PDU format includes multiple parameters, such as a destination service access point (DSAP) address, source service access point (SSAP) address, control, and information. Ex. 1011, 39. Therefore, to send the upstream signal (or Test response) with this PDU, a POSITA would have understood that the CM must determine these PDU parameters (the claimed "second plurality of parameters"). Moreover, these PDU parameters (i.e., DSAP, SSAP, control, and information parameters) of the upstream signal are used for forming the upstream signal (the claimed "probe"). Ex. 1011, 39. Therefore, the plurality of PDU parameters of the upstream signal are "associated with generation and transmission of the probe," as claimed.

587. In conclusion, DOCSIS 2.0 and ISO8802-2 teach the CM determining a plurality of PDU parameters (i.e., DSAP, SSAP, control, and information parameters) associated with the generation and transmission of the continuous (non-bursted) upstream signal. This teaches the claimed "determining a second

plurality of parameters associated with generation and transmission of the probe" in limitation [1B]. Thus, DOCSIS 2.0's test procedure along with ISO8802-2 teaches limitation [1B].

d) [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"

588. **Ranging Procedure:** As I explained above, the plurality of parameters in the UCD message (the claimed "first plurality of parameters") and the plurality of parameters for the Ranging Request message (the claimed "second plurality of parameters") are used to generate the Ranging Request message (the claimed "probe"). Specifically, the ranging required parameter in the UCD message causes the CM to generate the Ranging Request message, which is generated from the plurality of parameters in Figure 8-21, like the SID parameter, Downstream Channel ID, etc. Ex. 1010, 139, 147.

589. Further, because the modulation rate and frequency parameters from the UCD message are used for the modulation rate and center frequency of the Ranging Request message (the claimed "probe"), at least those parameters dictate the form of the Ranging Request message. Ex. 1010, 137. A POSITA would have understood that the modulation rate and/or center frequency are characteristics of the form of the Ranging Request message because they dictate how the Ranging Request message is formatted and transmitted.

590. In conclusion, DOCSIS 2.0 teaches the CM generating the Ranging Request message in accordance with the plurality of parameters in the UCD message and the plurality of parameters for the Ranging Request message, wherein the Ranging Request message has a form (e.g., modulation rate and center frequency) dictated by the plurality of parameters in the UCD message. This teaches the claimed "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" in limitation [1C]. Thus, DOCSIS 2.0's ranging procedure teaches limitation [1C].

591. **Test Procedure:** As I explained above, the plurality of parameters in the Test Request message (the claimed "first plurality of parameters") and the PDU parameters for the upstream signal (the claimed "second plurality of parameters") are used to generate the upstream signal. Specifically, the parameters in the Test Request message are used for generating the upstream signal with the modulation rate, carrier frequency, and power level indicated by the parameters. Ex. 1010, 185-186. Also, the PDU parameters are used to populate the data for generating the upstream signal. Ex. 1010, 28; Ex. 1011, 39, 53.

592. Further, because the parameters from the Test Request message are used for the modulation rate, carrier frequency, and power level of the upstream signal (the claimed "probe"), those parameters dictate the form of the upstream

signal. Ex. 1010, 185-186. A POSITA would have understood that the modulation rate, carrier frequency, and/or power level are characteristics of the form of the upstream signal because they dictate how the upstream signal is formatted and transmitted.

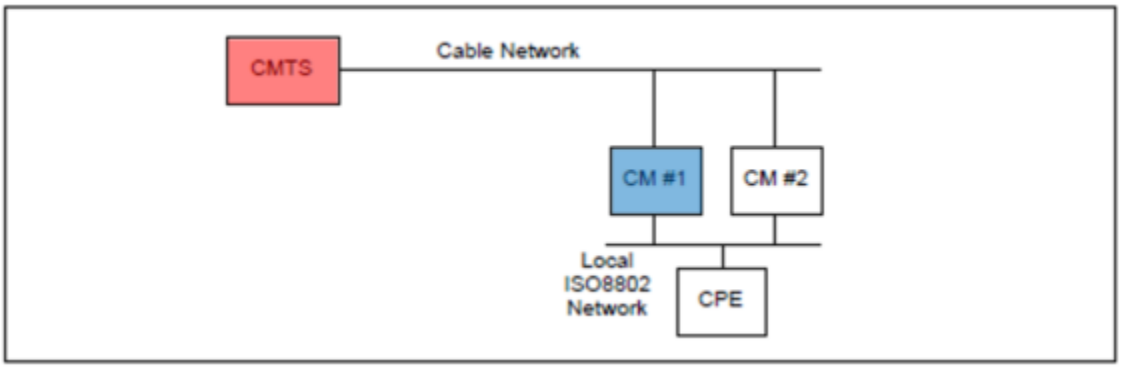
593. In conclusion, DOCSIS 2.0 and ISO8802-2 teach the CM generating the upstream signal in accordance with the plurality of parameters in the Test Request message and the plurality of PDU parameters, wherein the continuous (non-bursted) upstream signal has a form (e.g., modulation rate, carrier frequency, and power level) dictated by the plurality of parameters in the Test Request message. This teaches the claimed "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" in limitation [1C]. Thus, DOCSIS 2.0's test procedure along with ISO8802-2 teaches limitation [1C].

e) [1D]: "d) transmitting the probe from the first node to the second node."

594. **Ranging Procedure:** As I explained above, DOCSIS 2.0 teaches that the CM (the claimed "first node") transmits the Ranging Request message (the claimed "probe") to the CMTS (the claimed "second node") on the upstream channel identified by the UCD message in response to receiving the UCD message that requires ranging. Ex. 1010, 146-147, 197-198, 246-247. In conclusion, DOCSIS 2.0 teaches transmitting the Ranging Request message from the CM to

the CMTS. This teaches the claimed "transmitting the probe from the first node to the second node" in limitation [1D]. Thus, DOCSIS 2.0's ranging procedure teaches limitation [1D].

595. **Test Procedure:** As I explained above, DOCSIS 2.0 teaches that the CM (the claimed "first node") transmits the continuous (non-bursted) upstream signal (the claimed "probe"). Ex. 1010, 185. A POSITA would have understood that the CMTS (the claimed "second node") is upstream from the CM as shown in Figure 5-3 of DOCSIS 2.0 (below) and would receive this upstream signal. Ex. 1010, 29, FIG. 5-3. Therefore, the upstream signal is transmitted to the CMTS.



596. Further, ISO8802-2 states that "[t]he LLC sends a TEST response PDU, using the SSAP address of the TEST command PDU as the DSAP address of the TEST response PDU, and with an individual or null SSAP address selected by the DSAP address of the TEST command PDU." Ex. 1011, 53. This means that the CM (which has the LLC component being mentioned) will take the source address from the Test Request message it receives and use it as the destination

address for the upstream signal. And, because the source address of the Test Request message is the address of the CMTS that sent the Test Request message, the upstream signal will be sent to the CMTS.

597. In conclusion, DOCSIS 2.0 and ISO8802-2 teach transmitting the continuous (non-bursted) upstream signal from the CM to the CMTS. This teaches the claimed "transmitting the probe from the first node to the second node" in limitation [1D]. Thus, DOCSIS 2.0's test procedure along with ISO8802-2 teaches limitation [1D].

2. Dependent Claim 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."

598. Claim 2 of the '690 patent depends from claim 1, which is taught by DOCSIS 2.0's ranging procedure and the combination of DOCSIS 2.0's test procedure with ISO8802-2, as discussed above. Claim 2 further requires "using within the first node, at least one of the probe parameters to determine a modulation profile for the probe."[14] Ex. 1001, claim 2. DOCSIS 2.0's ranging

[14] I note that the term "probe parameters" is not exactly included in independent claim 1 and therefore it is unclear whether this term refers to "the first plurality of parameters," "the second plurality of parameters" or both. For purposes of my analysis in this declaration, I have assumed "the probe parameters" refers to both "first plurality of parameters" and "second plurality of parameters."

procedure and the combination of DOCSIS 2.0's test procedure with ISO8802-2 also teach this feature, which was actually shown above but will be specifically addressed below.

599. **Ranging Procedure:** As discussed above with respect to claim 1, the CM (the claimed "first node") receives the UCD message, which includes the modulation rate parameter and modulation type parameter (for a burst). Ex. 1010, 137, 141; see Section XII.H.1. Either one of these parameters (or both) is used within the CM to determine a modulation profile for the Ranging Request message (the claimed "probe") that is sent on the upstream channel identified by the UCD message. Ex. 1010, 17 (definition of modulation rate), 146-147, 197-198. A POSITA would have understood that each of the modulation rate parameter and the modulation type parameter corresponds to the "at least one of the probe parameters to determine a modulation profile for the probe" because they each dictate how the Ranging Request message is to be modulated for transmission on the upstream channel. In other words, they each provide a characteristic of the modulation for the Ranging Request message that is transmitted on the upstream channel.

600. In conclusion, DOCSIS 2.0 teaches using within the CM, the modulation rate parameter and/or modulation type parameter (among the plurality of parameters of the UCD message) to determine a modulation profile for the

Ranging Request message. This teaches the claimed "using within the first node, at least one of the probe parameters to determine a modulation profile for the probe" in claim 2. Thus, DOCSIS 2.0's ranging procedure teaches claim 2.

601. **Test Procedure:** As discussed above with respect to claim 1, the CM (the claimed "first node") receives the Test Request message, which includes the modulation rate parameter. Ex. 1010, 17 (definition of modulation rate), 137, 141. This parameter is used within the CM to determine a modulation profile for the continuous (non-bursted), unmodulated (CW) upstream signal (the claimed "probe") that is sent as a test response. Ex. 1010, 185. A POSITA would have understood that the modulation rate parameter corresponds to the "at least one of the probe parameters to determine a modulation profile for the probe" because it dictates how the upstream signal is to be modulated. In other words, it provides a characteristic of the modulation for the upstream signal.

602. In conclusion, DOCSIS 2.0 teaches using within the CM, the modulation rate parameter (among the plurality of parameters of the Test Request message) to determine a modulation profile for the upstream signal (test response). This teaches the claimed "using within the first node, at least one of the probe parameters to determine a modulation profile for the probe" in claim 2. Thus, DOCSIS 2.0's test procedure teaches claim 2.

3. Dependent Claim 6: "The method of claim 1, wherein the probe request is generated by the second node."

603. Claim 6 of the '690 patent depends from claim 1, which is taught by DOCSIS 2.0's ranging procedure and the combination of DOCSIS 2.0's test procedure with ISO8802-2, as discussed above. Claim 6 further requires that "the probe request is generated by the second node." Ex. 1001, claim 6. DOCSIS 2.0's ranging procedure and the combination of DOCSIS 2.0's test procedure with ISO8802-2 also teach this feature, which was actually shown above but will be specifically addressed below.

604. **Ranging Procedure:** As I explained above with respect to claim 1, the UCD message (the claimed "probe request") is generated and transmitted by the CMTS (the claimed "second node"). Ex. 1010, 135-137 ("A CMTS MUST generate UCDs in the format shown in Figure 8-16"), FIG. 8-16. This teaches the claimed "wherein the probe request is generated by the second node" in claim 6. Thus, DOCSIS 2.0's ranging procedure teaches claim 6.

605. **Test Procedure:** DOCSIS 2.0 states that "[t]he TST-REQ message with Mode!= 0 MUST NOT be sent by the CMTS except in response to an explicit command from the operator." Ex. 1010, 184. From this statement, a POSITA would have understood that the CMTS (the claimed "second node") generates the Test Request message (the claimed "probe request") in at least some cases where the operator provides the explicit command. This teaches the claimed "wherein the

probe request is generated by the second node" in claim 6. Thus, DOCSIS 2.0's test procedure teaches claim 6.

4. Dependent Claim 7: "The method of claim 1, wherein the probe request requests a probe that assists in diagnosing a network problem."

606. Claim 7 of the '690 patent depends from claim 1, which is taught by DOCSIS 2.0's ranging procedure and the combination of DOCSIS 2.0's test procedure with ISO8802-2, as discussed above. Claim 7 further requires that "the probe request requests a probe that assists in diagnosing a network problem." Ex. 1001, claim 7. DOCSIS 2.0's ranging procedure and the combination of DOCSIS 2.0's test procedure with ISO8802-2 also teach this feature as explained below.

607. **Ranging Procedure:** As I explained above with respect to claim 1, the UCD message (the claimed "probe request") includes a ranging required parameter to request a CM to send the Ranging Request message (the claimed "probe"). Ex. 1010, 135-139. Further, the Ranging Request message assists in diagnosing a problem with the CM connecting to the CMTS on the upstream channel identified by the UCD. Ex. 1010, 146-150, 197-198. More specifically, the Ranging Request message assists in diagnosing a problem with the timing of the CM's communications on the upstream channel. Ex. 1010, 197-198. If the Ranging Request is not successful, the CMTS will send a Ranging Response message with a ranging status parameter that commands the CM to continue

ranging to attempt to connect via the upstream channel or to abort trying to connect via the upstream channel. Ex. 1010, 150, 198.

608. In conclusion, DOCSIS 2.0 teaches that the UCD message requests the Ranging Request message that assists in diagnosing a network problem. This teaches the claimed "wherein the probe request requests a probe that assists in diagnosing a network problem" in claim 7. Thus, DOCSIS 2.0's ranging procedure teaches claim 7.

609. **Test Procedure:** As I explained above with respect to claim 1, the Test Request message (the claimed "probe request") includes a Mode parameter that causes a CM to send the upstream signal (the claimed "probe"). Ex. 1010, 185. Further, the upstream signal sent in response to the Test Request message assists in diagnosing a problem with the CM. Ex. 1010, 184-185. More specifically, a POSITA would have understood that the upstream signal in response to the Test Request assists in diagnosing a problem with upstream signal timing or upstream required power level. Ex. 1010, 241-242 (describing need to scan to acquire a valid downstream signal and need to re-acquire upstream timing after interruption and after other attempts at recovering such as unsuccessful ranging), 489 (describing testing of SNR), 492-493 (testing adjacent channel interference), 625, 628.

610. In conclusion, DOCSIS 2.0 teaches that the Test Request message requests the upstream signal (test response) that assists in diagnosing a problem with the upstream signal timing or power. This teaches the claimed "wherein the probe request requests a probe that assists in diagnosing a network problem" in claim 7. Thus, DOCSIS 2.0's test procedure teaches claim 7.

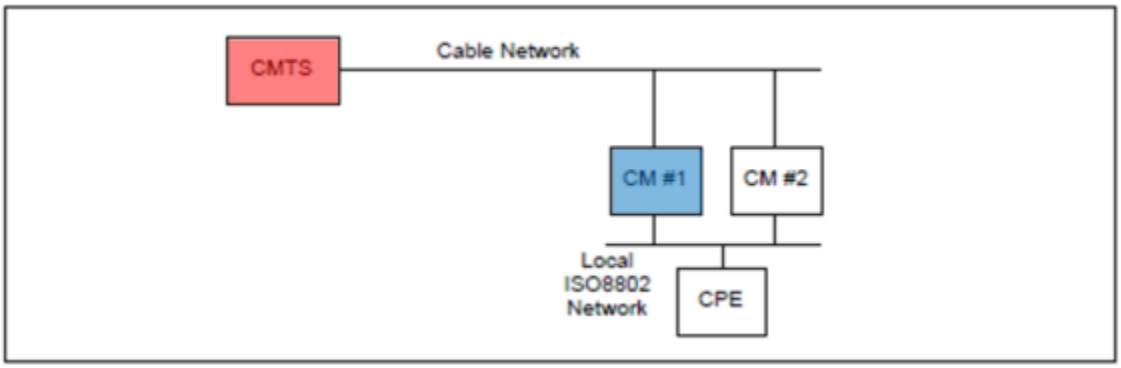
5. Independent Claim 9

a) [9PRE]: "A method comprising:"

611. This preamble is disclosed by DOCSIS 2.0 for the same reasons provided above for limitation [1PRE]. Independent claim 9 is similar to independent claim 1, but is written from the perspective of the node that sends the probe request and receives the probe response. As such, the first node in claim 9 corresponds to the second node in claim 1, while the second node in claim 9 corresponds to the first node in claim 1. As I will explain below, DOCSIS 2.0's method (either the collection of its various procedures/operations, or the ranging procedure or test procedure individually) comprises limitations [9A]-[9B]. See Sections XII.H.5.b-c, below. Thus, DOCSIS 2.0 teaches limitation [9PRE].

b) [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;"

612. As shown below in Figure 5-3 of DOCSIS 2.0, the system of DOCSIS includes a cable mode termination system (CMTS) communicating with a cable modem (e.g., CM #1). Ex. 1010, 29, FIG. 5-3. The CMTS (**red**) in DOCSIS 2.0 corresponds to the claimed "first node" and the CM (e.g., CM #1) (**blue**) in DOCSIS 2.0 corresponds to the claimed "second node."



613. Both the ranging procedure and test procedure include the step of transmitting in limitation [9A]. Thus, I will address both below.

614. **Ranging Procedure:** With respect to the ranging procedure, DOCSIS 2.0 states that "[r]anging is the process of acquiring the correct timing offset such that the cable modem's transmissions are aligned to the correct mini-slot boundary." Ex. 1010, 197. DOCSIS 2.0 explains that "a cable modem MUST synchronize to the downstream and learn the upstream channel characteristics

through the Upstream Channel Descriptor MAC management message" and "MUST put together either an Initial Ranging Request message or a Ranging Request message." Ex. 1010, 197. DOCSIS 2.0 also describes that the Upstream Channel Descriptor (UCD) message "MUST be transmitted by the CMTS at a periodic interval to define the characteristics of an logical upstream channel (Figure 8-16)." Ex. 1010, 135, 22 (definition of UCD). DOCSIS 2.0 further describes that the UCD is transmitted by the CMTS (which corresponds to the claimed "first node") and is received by at least one CM (e.g., CM #1, which corresponds to the claimed "second node"). Ex. 1010, 243-246. The format of the UCD message is shown in Figure 8-16 (reproduced below). Ex. 1010, 136. This UCD message corresponds to the claimed "probe request."

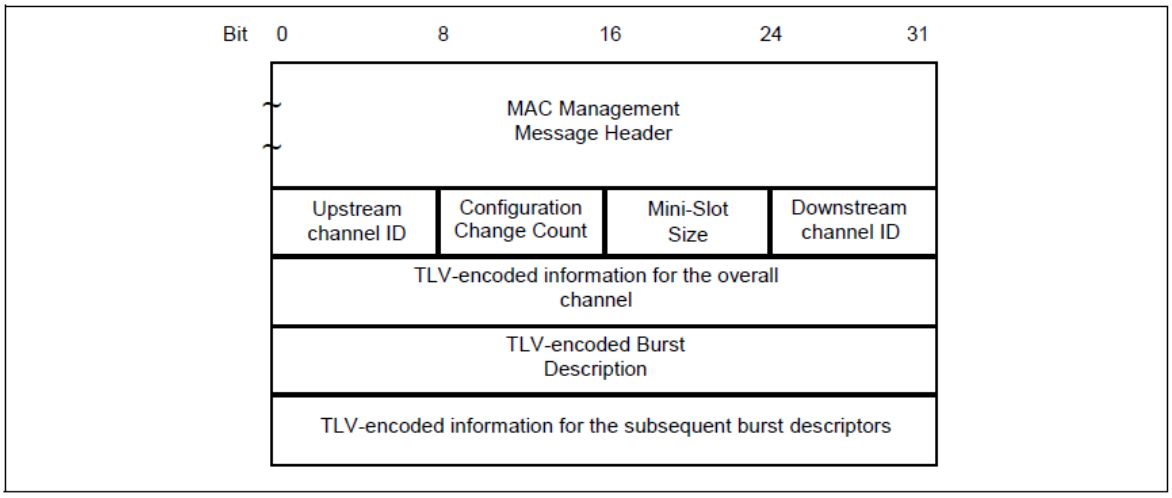


Figure 8-16 Upstream Channel Descriptor

615. As shown above, the UCD message includes eight portions: a MAC Management Message Header, Upstream Channel ID, Configuration Change

Count, Mini-Slot Size, Downstream Channel ID, TLV-Encoded Information for the Overall Channel, TLV-Encoded Burst Description, and TLV-Encoded Information for the Subsequent Burst Descriptors. Ex. 1010, 136. The parameters in the TLV-Encoded Information for the Overall Channel are defined in Table 8-18 (portions of which are reproduced below) and an example of UCD encoded TLV data is given in Figure 8-18 (not shown below) of DOCSIS 2.0. Ex. 1010, 137-143.

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.

616. As shown from the above table, the parameters of the UCD message include a modulation rate parameter, frequency parameter, maintain power spectral density parameter, and ranging required parameter. Ex. 1010, 137-139. The modulation rate parameter is a 1 byte long value that provides a multiple of a base rate of 160 kHz that is to be used for modulating subsequent signals on the upstream channel identified by the Upstream Channel ID of the same UCD message. Ex. 1010, 137, 54 (see section 6.2.10 Modulation Rates). The frequency parameter is a 4 byte long value that provides the upstream center frequency that is to be used for subsequent signals on the upstream channel identified by the Upstream Channel ID of the same UCD message. Ex. 1010, 137. The maintain power spectral density parameter is a 1 byte long value that controls the transmit power level to be used for subsequent signals on the upstream channel identified by the Upstream Channel ID of the same UCD message. Ex. 1010, 139. The ranging required parameter is a 1 byte long value that indicates whether ranging is required to be performed on the upstream channel identified by the Upstream Channel ID of the same UCD message. Ex. 1010, 139.

617. Further, as I explained above, the UCD message includes TLV-Encoded Burst Description and TLV-Encoded Information for the Subsequent Burst Descriptors, which include further parameters. As DOCSIS 2.0 explains, "[w]ithin each Burst Descriptor is an unordered list of Physical-layer attributes,

encoded as TLV values." Ex. 1010, 140. "These attributes are shown in Table 8-19" which is reproduced below in part. Ex. 1010, 140-142.

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)

618. As shown in this table, the attributes/parameters include a modulation type for specifying a type of modulation (e.g., QPSK, 16QAM, 8QAM, etc.) to be used for a subsequent burst on the upstream channel identified by the Upstream Channel ID that is in the same UCD message. Ex. 1010, 141.

619. In addition to these parameters, there are further parameters in the MAC Management Message Header of the UCD message. As shown in Figure 8-14 (below), the MAC Management Message Header includes numerous parameters (referred to as "fields"), such as a destination address (DA), source address (SA), etc.. Ex. 1010, 132-135.

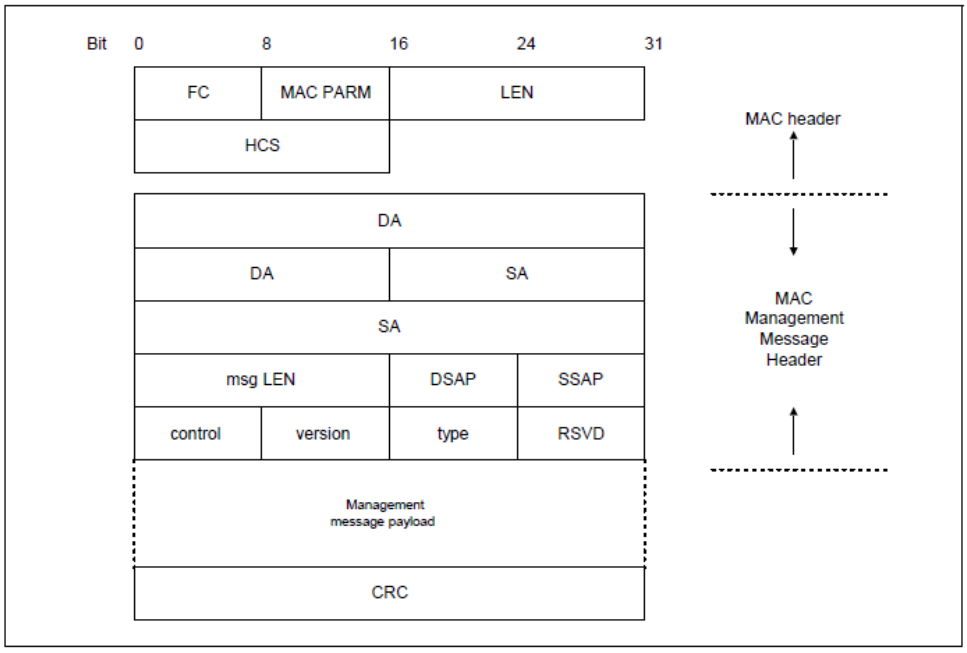


Figure 8-14 MAC Header and MAC Management Message Header Fields

620. Thus, the UCD message, collectively from its eight different portions (i.e., MAC Management Message Header, Upstream Channel ID, Configuration Change Count, Mini-Slot Size, Downstream Channel ID, TLV-Encoded Information for the Overall Channel, TLV-Encoded Burst Description, and TLV-Encoded Information for the Subsequent Burst Descriptors), specifies a plurality of parameters that meets the claimed "first plurality of parameters." Moreover, the plurality of parameters (in particular, the modulation rate for the channel and the modulation type for the burst) of the UCD message are used for forming a Ranging Request (RNG-REQ) message (the claimed "physical layer probe"), which is generated when the ranging required parameter of the UCD message has a value of 1 or 2. Ex. 1010, 139, 146-147, 197-198. Therefore, the plurality of parameters of

the UCD message comprise "a form for the probe including a modulation profile for the probe," as claimed.

621. As I explained above in this section and with respect to limitation [1A], the UCD message includes the modulation rate parameter and modulation type parameter (for a burst). Ex. 1010, 137, 141; see Section XII.H.1.b. Either one of these parameters (or both) indicates a modulation profile for the Ranging Request message (the claimed "probe") that is sent on the upstream channel identified by the UCD message. Ex. 1010, 17 (definition of modulation rate), 146-147, 197-198. A POSITA would have understood that each of the modulation rate parameter and the modulation type parameter indicates "a modulation profile" because they each dictate how the Ranging Request message is to be modulated for transmission on the upstream channel. In other words, they each provide a characteristic of the modulation for the Ranging Request message that is transmitted on the upstream channel.

622. In addition, the Ranging Request (RNG-REQ) message is the claimed "physical layer probe" at least because it is configured using physical layer parameters, such as the modulation rate from the UCD message as explained above. Ex. 1010, 24 ("The data-over-cable system, configured with at least one set of defined physical-layer parameters (e.g., modulation, forward error correction, modulation rate, etc.) from the range of configuration settings described in this

specification…"), 140-142 (upstream physical-layer burst attributes of UCD message). A POSITA would have also understood that the Ranging Request message is a "physical layer probe" because it is transmitted at initialization or to determine network delay and request power adjustment, which are attributes of the physical layer. Ex. 1010, 146 ("A Ranging Request MUST be transmitted by a CM at initialization on an upstream other than a DOCSIS 2.0 Only Upstream, and periodically on request from CMTS to determine network delay and request power adjustment.").

623. In conclusion, DOCSIS 2.0 teaches a CMTS transmitting a UCD message to a CM, the UCD message specifying a plurality of parameters for the physical layer Ranging Request message, the plurality of parameters comprising a form for the Ranging Request message including a modulation rate for the Ranging Request message. This teaches "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" in limitation [9A]. Thus, DOCSIS 2.0's ranging procedure teaches limitation [9A].

624. **Test Procedure:** With respect to the test procedure, DOCSIS 2.0 states that "[t]he CM MUST provide a test mode." Ex. 1010, 96, 98. DOCSIS 2.0 also states that "the CM and CMTS MUST respond appropriately to TEST and

XID requests per [ISO8802-2]." Ex. 1010, 28. More specifically, DOCSIS 2.0 describes the CM receiving a Test Request message (TST-REQ), which corresponds to the claimed "probe request." Ex. 1010, 184-185 ("CM receives a TST-REQ message (either unicast to the CM itself, or broadcast)"). The Test Request message is a type of MAC Management Message. Ex. 1010, 133-134. "The Test Request is used to force a CM to enter or leave one of two test modes." Ex. 1010, 184. The Test Request message is shown in Figure 8-45 (reproduced below). Ex. 1010, 185.

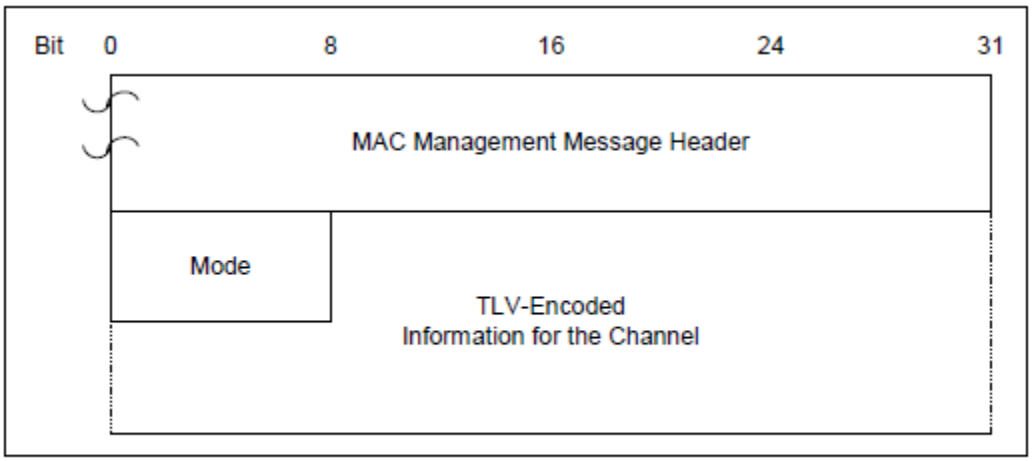


Figure 8-45 Test Request

625. As shown above, the Test Request message includes three portions: a MAC Management Message Header, Mode, and TLV-Encoded Information for the Channel. Ex. 1010, 185. The Mode has one of three values: 0, 1, or 2. Ex. 1010, 185. If the Mode is 0, the CM (which receives the Test Request Message) disables all test modes and reboots. Ex. 1010, 185. If the Mode is not 0, "the CM MUST

begin the test mode indicated in the Mode parameter, using the channel parameters included in the TST-REQ message." Ex. 1010, 185 (DOCSIS uses the notation "!=0" to indicate "not equal to 0"). More specifically, if the Mode is 1, the CM transmits "a continuous (non-bursted) upstream signal at the commanded modulation rate, carrier frequency, and power level." Ex. 1010, 185, 98 (which also describes the transmission of this continuous signal in the test mode). And, if the mode is 2, the CM transmits "a continuous (non-bursted), unmodulated (CW) upstream signal at the commanded carrier frequency, modulation rate and power level." Ex. 1010, 185, 96 (which also describes the transmission of this continuous signal in the test mode). The channel parameters (e.g., carrier frequency, modulation rate, and power level) are obtained from the TLV-Encoded Information for the Channel in the TST-REQ message and are defined in Table 8-22 (reproduced below). Ex. 1010, 185-186.

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.

626. As shown from the above table, each of the above parameters must be included in the Test Request message having a Mode equal to 1. Ex. 1010, 185-186. In addition to these parameters, there are further parameters in the MAC Management Message Header of the Test Request message. As shown in Figure 8-14 (below), the MAC Management Message Header includes numerous parameters (referred to as "fields"), such as a destination address (DA), source address (SA), etc. Ex. 1010, 132-135.

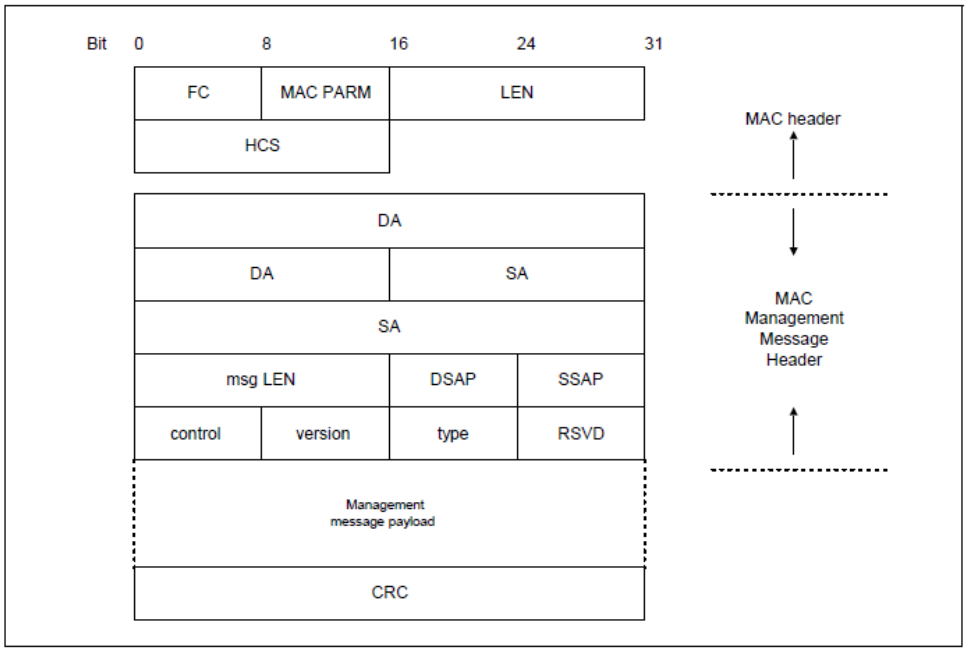


Figure 8-14 MAC Header and MAC Management Message Header Fields

627. Thus, the Test Request message, collectively from its three different portions (i.e., MAC Management Message Header, Mode, and TLV-Encoded Information for the Channel), specifies a plurality of parameters that meets the claimed "first plurality of parameters." Moreover, the plurality of parameters (in particular, the carrier frequency, modulation rate, and power level) of the Test Request message are used for forming the continuous (non-bursted) upstream signal (the claimed "physical layer probe"). Ex. 1010, 185 ("CM MUST begin the test mode indicated in the Mode parameter, using the channel parameters included in the TST-REQ message"). Therefore, the plurality of parameters of the Test Request message comprise "a form for the probe including a modulation profile for the probe," as claimed.

628. As I explained above in this section and with respect to limitation [1A], the Test Request message includes the modulation rate parameter. Ex. 1010, 137, 141. This parameter indicates a modulation profile for the continuous (non-bursted), unmodulated (CW) upstream signal (the claimed "probe") that is sent as a test response. Ex. 1010, 17 (definition of modulation rate), 185. A POSITA would have understood that the modulation rate parameter indicates "a modulation profile" because it dictates how the upstream signal is to be modulated. In other words, it provides a characteristic of the modulation for the upstream signal (test response) transmitted upstream to the CMTS.

629. In addition, the continuous (non-bursted) upstream signal is the claimed "physical layer probe" at least because it is configured using physical layer parameters, such as the modulation rate from the Test Request message as explained above. Ex. 1010, 24 ("The data-over-cable system, configured with at least one set of defined physical-layer parameters (e.g., modulation, forward error correction, modulation rate, etc.) from the range of configuration settings described in this specification…"), 140-142 (upstream physical-layer burst attributes of UCD message). A POSITA would have also understood that the upstream signal is a "physical layer probe" because it is used to test the timing of communications on the physical layer. Ex. 1010, 185 ("The CM tracks the downstream symbol clock

and uses it to generate the upstream symbol clock as in normal synchronous operation."), 186 (parameters for M/N ratio to use for timing determination).

630. In conclusion, DOCSIS 2.0 teaches a CMTS transmitting a Test Request message to a CM, the Test Request message specifying a plurality of parameters for the physical layer upstream signal, the plurality of parameters comprising a form for the upstream signal including a modulation rate for the upstream signal. This teaches the claimed "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" in limitation [9A]. Thus, DOCSIS 2.0's test procedure teaches limitation [9A].

c) [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."

631. **Ranging Procedure:** As I explained above, the UCD message includes a ranging required parameter that will cause the CM to generate and transmit the Ranging Request message (the claimed "probe"). Ex. 1010, 139, 146-147. As shown in Figure 8-21 (reproduced below), the Ranging Request message includes a plurality of parameters (the claimed "second plurality of parameters"), such as the parameters for the MAC Management Message Header (which includes

numerous parameters as explained above), the SID parameter, the Downstream Channel ID, and the Pending Till Complete parameter. Ex. 1010, 146-147.

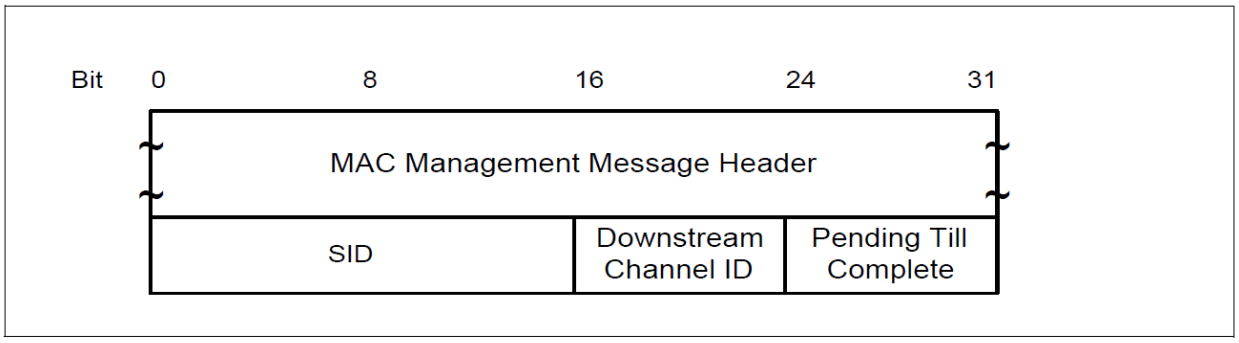


Figure 8-21 Packet PDU Following the Timing Header

632. A POSITA would have understood that these parameters must also be determined by the CM in order to generate and transmit the Ranging Request message. Therefore, the plurality of parameters in the UCD message (the claimed "first plurality of parameters") and the plurality of parameters for the Ranging Request message (the claimed "second plurality of parameters") are used to generate the Ranging Request message (the claimed "probe"). Specifically, the ranging required parameter in the UCD message causes the CM to generate the Ranging Request message, which is generated from the plurality of parameters in Figure 8-21, like the SID parameter, Downstream Channel ID, etc. Ex. 1010, 139, 147.

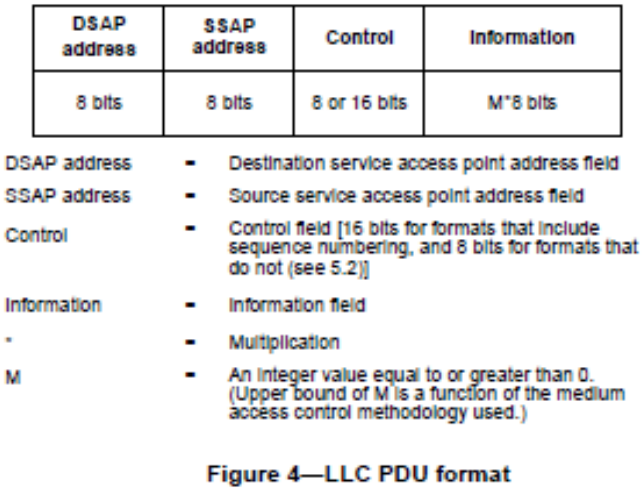
633. Also, the CM transmits the Ranging Request message (the claimed "probe") on the upstream channel identified by the UCD message in response to receiving the UCD message that requires ranging. Ex. 1010, 146-147, 197-198. A

POSITA would have understood that the CMTS (the claimed "first node") is upstream from the CM (the claimed "second node"), and therefore would have received the upstream Ranging Request message from the CM. Ex. 1010, 2, 29, FIGs. 1-1, 5-3.

634. In conclusion, DOCSIS 2.0 teaches the CMTS receiving the Ranging Request message from the CM, wherein the Ranging Request message is generated in accordance with the plurality of parameters in the UCD message and in accordance with the plurality of parameters for the Ranging Request message as determined by the CM. This teaches "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" in limitation [9B]. Thus, DOCSIS 2.0's ranging procedure teaches limitation [9B].

635. **Test Procedure:** As I explained above, the CM upon receiving a Test Request message with a Mode equal to 1 or 2 will generate and transmit a continuous (non-bursted) upstream signal (the claimed "probe") based on the parameters in the Test Request message. Ex. 1010, 185. Also, this upstream signal in response to the Test Request message must be generated per ISO8802-2. Ex. 1010, 28. A POSITA would have understood that this upstream signal is a Test response message in ISO8802-2. Ex. 1011, 53. Per ISO8802-2, the Test

response includes a PDU with the following format, which means the upstream signal includes a PDU with the following format. Ex. 1011, 39, 53, FIG.4.



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

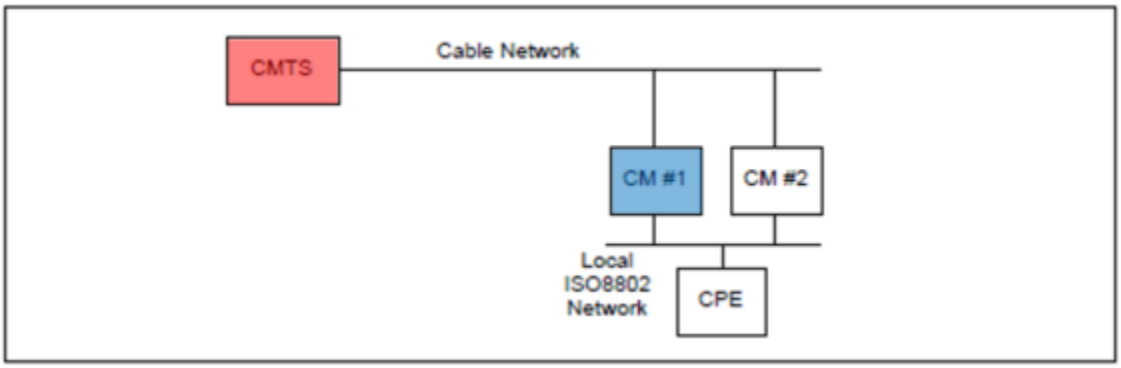
DSAP address - Destination service access point address field
SSAP address - Source service access point address field
Control - Control field [16 bits for formats that include sequence numbering, and 8 bits for formats that do not (see 5.2)]
Information - Information field
* - Multiplication
M - An 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

636. As shown, this PDU format includes multiple parameters, such as a destination service access point (DSAP) address, source service access point (SSAP) address, control, and information. Ex. 1011, 39. Therefore, to send the upstream signal (or Test response) with this PDU, a POSITA would have understood that the CM must determine these PDU parameters (the claimed "second plurality of parameters"). Moreover, these PDU parameters (i.e., DSAP, SSAP, control, and information parameters) of the upstream signal are used for forming the upstream signal (the claimed "probe"). Ex. 1011, 39. Therefore, the plurality of parameters in the Test Request message (the claimed "first plurality of parameters") and the PDU parameters for the upstream signal (the claimed "second plurality of parameters") are used to generate the upstream signal. Specifically, the parameters in the Test Request message are used for generating the upstream

signal with the modulation rate, carrier frequency, and power level indicated by the parameters. Ex. 1010, 185-186. Also, the PDU parameters are used to populate the data for generating the upstream signal. Ex. 1010, 28; Ex. 1011, 39, 53.

637. Also, the CM (the claimed "first node") transmits the continuous (non-bursted) upstream signal (the claimed "probe"). Ex. 1010, 185. A POSITA would have understood that the CMTS (the claimed "second node") is upstream from the CM as shown in Figure 5-3 of DOCSIS 2.0 (below) and would receive this upstream signal. Ex. 1010, 29, FIG. 5-3. Therefore, the upstream signal is transmitted to the CMTS.



638. Further, ISO8802-2 states that "[t]he LLC sends a TEST response PDU using the SSAP address of the TEST command PDU as the DSAP address of the TEST response PDU, and with an individual or null SSAP address selected by the DSAP address of the TEST command PDU." Ex. 1011, 53. This means that the CM (which has the LLC component being mentioned) will take the source address from the Test Request message it receives and use it as the destination

address for the upstream signal. And, because the source address of the Test Request message is the address of the CMTS (the claimed "first node") that sent the Test Request message, the upstream signal will be sent to the CMTS from the CM (the claimed second node").

639. In conclusion, DOCSIS 2.0 with ISO8802-2 teaches the CMTS receiving the upstream signal from the CM, wherein the upstream signal is generated in accordance with the plurality of parameters in the Test Request message and in accordance with the plurality of parameters for the upstream signal as determined by the CM. This teaches "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" in limitation [9B]. Thus, DOCSIS 2.0's test procedure in view of ISO8802-2 teaches limitation [9B].

6. Dependent Claim 14: "The method of claim 9, wherein the probe request is transmitted at a specific time."

640. Claim 14 of the '690 patent depends from claim 9, which is taught by DOCSIS 2.0's ranging procedure and the combination of DOCSIS 2.0's test procedure with ISO8802-2, as discussed above. Claim 14 further requires that "the probe request is transmitted at a specific time," but says nothing about what the specific time is or how it is determined. Ex. 1001, claim 14. DOCSIS 2.0's ranging procedure and the combination of DOCSIS 2.0's test procedure with

ISO8802-2 also teach this feature, which was previously shown above but will be specifically addressed below.

641. **Ranging Procedure:** With respect to the ranging procedure, DOCSIS 2.0 states that "[r]anging is the process of acquiring the correct timing offset such that the cable modem's transmissions are aligned to the correct mini-slot boundary." Ex. 1010, 197. DOCSIS 2.0 explains that "a cable modem MUST synchronize to the downstream and learn the upstream channel characteristics through the Upstream Channel Descriptor MAC management message" and "MUST put together either an Initial Ranging Request message or a Ranging Request message." Ex. 1010, 197. DOCSIS 2.0 also describes that the Upstream Channel Descriptor (UCD) message "MUST be transmitted by the CMTS at a periodic interval to define the characteristics of an logical upstream channel (Figure 8-16)." Ex. 1010, 135, 22 (definition of UCD). A POSITA would have understood that any of the times at the start and/or end of this periodic interval corresponds to the claimed "specific time" that the UCD message (the claimed "probe request") is transmitted. Therefore, DOCSIS 2.0 teaches that the UCD message is transmitted at a specific time. Thus, DOCSIS 2.0's ranging procedure teaches claim 14.

642. **Test Procedure:** DOCSIS 2.0 states that "[t]he TST-REQ message with Mode!= 0 MUST NOT be sent by the CMTS except in response to an explicit

command from the operator." Ex. 1010, 184. From this statement, a POSITA would have understood that the Test Request message (TST-REQ) is transmitted at the specific time that the operator (either human network operator or electronic network operator) determines to send the Test Request message. Therefore, DOCSIS 2.0 teaches that the Test Request message is transmitted at a specific time. Thus, DOCSIS 2.0's test procedure teaches claim 14.

7. Dependent Claim 15: "The method of claim 9, wherein the probe request is configured to diagnose a network problem."

643. Claim 15 of the '690 patent depends from claim 9, which is taught by DOCSIS 2.0's ranging procedure and the combination of DOCSIS 2.0's test procedure with ISO8802-2, as discussed above. Claim 15 further requires that "the probe request is configured to diagnose a network problem," but says nothing about what the network problem is. Ex. 1001, claim 15. DOCSIS 2.0's ranging procedure and the combination of DOCSIS 2.0's test procedure with ISO8802-2 also teach this feature as explained below. Claim 15 is similar to claim 7 and thus the reasons below are similar to the reasons given above for claim 7.

644. **Ranging Procedure:** As I explained above with respect to claim 9, the UCD message (the claimed "probe request") includes a ranging required parameter to request a CM to send the Ranging Request message (the claimed "probe"). Ex. 1010, 135-139. Further, the UCD triggers the Ranging Request message in order to assist in diagnosing a problem with the CM connecting to the

CMTS on the upstream channel identified by the UCD. Ex. 1010, 146-150, 197-198. More specifically, the UCD message is configured with the ranging required parameter so it can trigger the Ranging Request message to be sent so the CMTS is able to diagnose a problem with the timing of the CM's communications on the upstream channel. Ex. 1010, 197-198. If the Ranging Request is not successful, the CMTS will send a Ranging Response message with a ranging status parameter that commands the CM to continue ranging to attempt to connect via the upstream channel or to abort trying to connect via the upstream channel. Ex. 1010, 150, 198.

645. In conclusion, DOCSIS 2.0 teaches that the UCD message is configured to trigger the Ranging Request message to diagnose a network problem. This teaches the claimed "wherein the probe request is configured to diagnose a network problem" in claim 15. Thus, DOCSIS 2.0's ranging procedure teaches claim 15.

646. **Test Procedure:** As I explained above with respect to claim 9, the Test Request message (the claimed "probe request") includes a Mode parameter that causes a CM to send the upstream signal (the claimed "probe"). Ex. 1010, 185. Further, the Test Request message triggers the upstream signal in order to assist in diagnosing a problem with the CM. Ex. 1010, 184-185. More specifically, a POSITA would have understood that the upstream signal in response to the Test Request assists in diagnosing a problem with upstream signal

timing or upstream required power level. Ex. 1010, 241-242 (describing need to scan to acquire a valid downstream signal and need to re-acquire upstream timing after interruption and after other attempts at recovering such as unsuccessful ranging), 489 (describing testing of SNR), 492-493 (testing adjacent channel interference), 625, 628.

647. In conclusion, DOCSIS 2.0 teaches that the Test Request message is configured to trigger the upstream signal (test response) that assists in diagnosing a problem with the upstream signal timing or power. This teaches the claimed "wherein the probe request is configured to diagnose a network problem" in claim 15. Thus, DOCSIS 2.0's test procedure teaches claim 15.

I. DOCSIS 2.0 (Ranging Procedure) In View of Zuckerman Renders Obvious Claims 8, 10-11, 16-19, and 22-24 And DOCSIS 2.0 (Test Procedure) In View Of ISO8802-2 and Zuckerman Renders Obvious Claims 8, 10-11, 16-19, and 22-24

648. It is my opinion that DOCSIS 2.0 (Ranging Procedure) in view of Zuckerman or DOCSIS 2.0 (Test Procedure) in view of ISO8802-2 and Zuckerman renders claims 8, 10-11, 16-19, and 22-24 obvious as I explain below.

1. Dependent Claim 8: "The method of claim 7, wherein the probe request is generated by a network operator and uploaded to the second node."

649. Claim 8 of the '690 patent depends from claim 7, which is taught by DOCSIS 2.0's ranging procedure and the combination of DOCSIS 2.0's test procedure with ISO8802-2, as discussed above. Claim 8 further requires that "the

probe request is generated by a network operator and uploaded to the second node." Ex. 1001, claim 8. DOCSIS 2.0's ranging procedure in view of Zuckerman and DOCSIS 2.0's test procedure in view of ISO8802-2 and Zuckerman also teach this feature as explained below.

650. **Ranging Procedure:** As I explained above with respect to claim 6, DOCSIS 2.0 teaches that the UCD message (the claimed "probe request") is generated and transmitted by the CMTS (the claimed "second node"). Ex. 1010, 135-137 ("A CMTS MUST generate UCDs in the format shown in Figure 8-16"), FIG. 8-16. DOCSIS 2.0 also teaches that the CMTS may be commanded to send messages from an operator. Ex. 1010, 184 (The TST-REQ message may be sent by the CMTS "in response to an explicit command from the operator."), 182 ("The CMTS can transmit UP-DIS messages either as a result of a triggering event detected by the CMTS internally, or in response to a remote management command" and the CMTS "SHOULD be able to send a UP-DIS in response to an external command"). DOCSIS 2.0 also explains that in one implementation such commands are Simple Network Management Protocol (SNMP) commands that are sent to the CMTS. Ex. 1010, 182 ("One of the possible implementations may be SNMP commands sent to the CMTS over the network."), 305 ("CMTS MUST support DCC operations triggered via SNMP"), 326 ("during normal operation, the CMTS is directed (via SNMP or otherwise) to move a CM to a channel…" and

"CMTS MUST support, via SNMP, the override of this initialization technique…"). DOCSIS 2.0 also states that "[a] CMTS SHOULD be capable of being remotely reprogrammed in the field via a software download over the network." Ex. 1010, 333.

651. DOCSIS 2.0 further explains that mechanisms for CMTS Initialization, such as using a local terminal, downloading a file, and SNMP, are described in [DOCSIS5]. Ex. 1010, 239. [DOCSIS5] refers to a reference, called Data-Over-Cable Service Interface Specifications, Operations Support System Interface Specification, CM-SP-OSSIv2.0-I09-050812, that is another specification for the same DOCSIS system and is meant to be read as a companion to DOCSIS 2.0. Ex. 1010, 5, 7. In particular, [DOCSIS 5] specifies the "Operations Support Systems Interfaces" which are the "network element management layer interfaces between the network elements and the high-level OSSs (operations support systems) which support the basic business processes." Ex. 1010, 5. The following Figure 1-2 from DOCSIS 2.0 shows how the Data Over Cable Systems OSS Interface (DOCS-OSSI) provides an interface between the CMTS and an Operations Support System. Ex. 1010, 4.

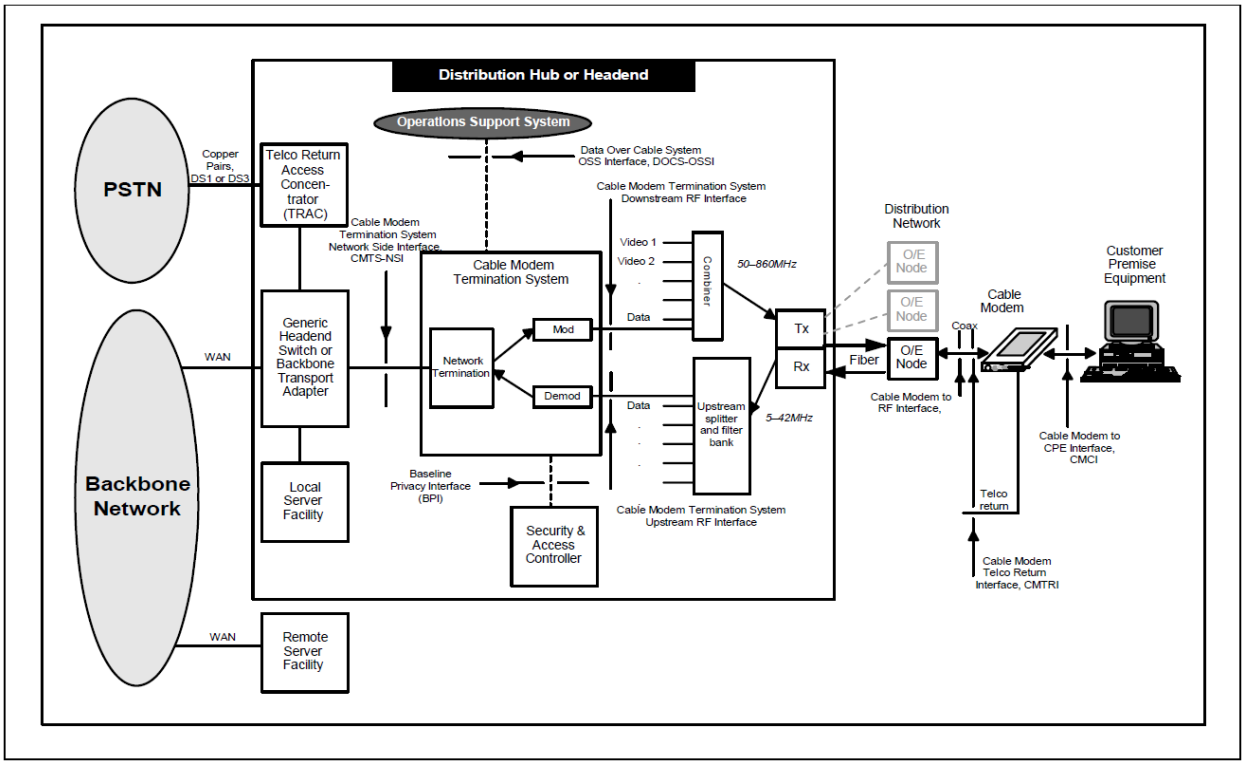


Figure 1-2 Data-Over-Cable Reference Architecture

652. A POSITA would have understood that the Operations Support System assists in operating the CMTS and therefore is or includes a "network operator," as claimed. A POSITA would have also understood that SNMP commands would be provided by the Operations Support System to the CMTS via the DOCS-OSSI interface. Although DOCSIS 2.0 describes the CMTS generating the UCD message (the claimed "probe request"), a POSITA would have understood that this description is not intended to limit the actual generation to the CMTS. Rather, a POSITA would have understood that this description intends to cover performing the generation of the UCD message by whatever is controlling/operating the CMTS; whether it is the CMTS itself (e.g., an internal

processor and/or internal software) or an external processor and/or external software). In practice, the CMTS is generally controlled/operated with a separate computer (which a POSITA would have considered to be a network operator). As an example, see Figure 3 of Min (Ex. 1019), which shows a System CPU 246 with a System Memory 247 operating the Advanced CMTS MAC 206. Ex. 1019, 9:32-34, FIG. 3. Generally, the PHY layer is controlled internally in the CMTS, while the MAC layer is controlled by the software in a computer. The computer would have been mounted and connected in the same standard 19" rack containing the CMTS equipment. In fact, prior to the earliest claimed priority date of the '690 patent (Dec. 15, 2008), I have personally worked with a DOCSIS based system in which a separate computer was used to control/operate the CMTS.

653. To the extent that the Patent Owner attempts to argue (incorrectly) that the UCD message would not have been uploaded to the CMTS via the DOCS-OSSI interface as discussed above, I note that DOCSIS 2.0 also teaches that the CMTS stack includes an Internet Protocol (IP) layer. Ex. 1010, 28. The CMTS stack with the IP layer can be seen in Figure 5-1 (first figure below), Figure 5-2 (second figure below), and Figure 5-4 (third figure below).

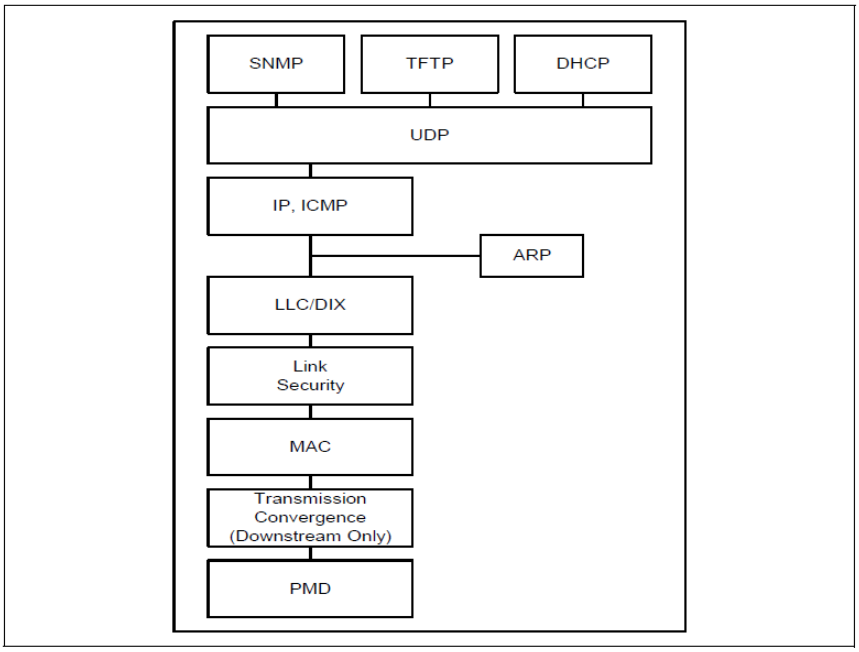


Figure 5-1 Protocol Stack on the RF Interface

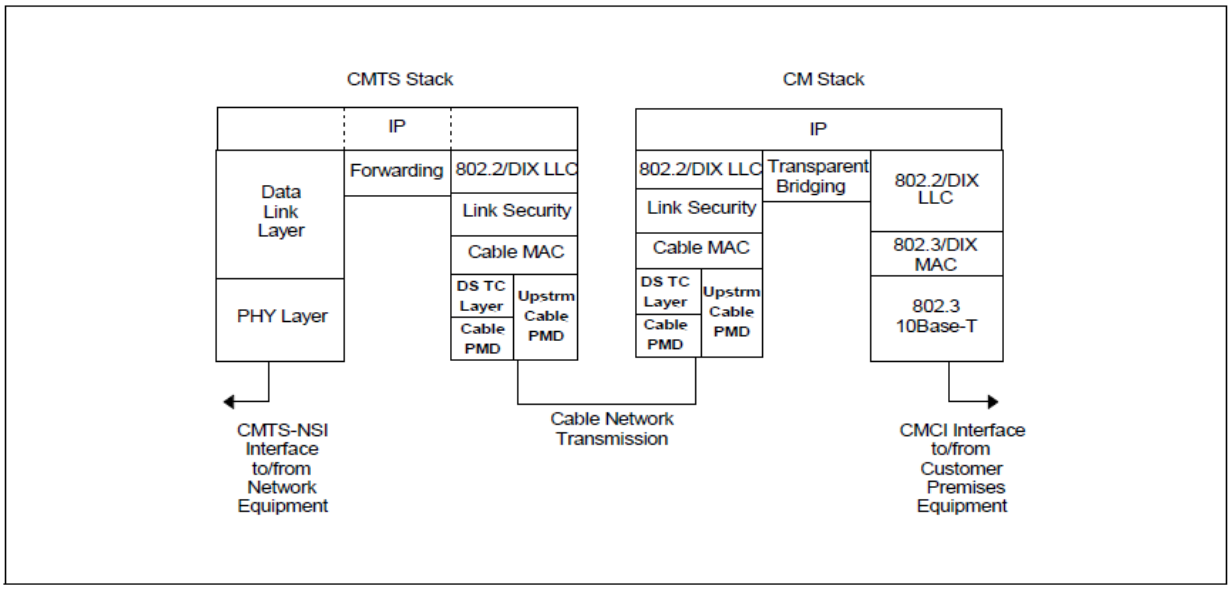


Figure 5-2 Data Forwarding Through the CM and CMTS

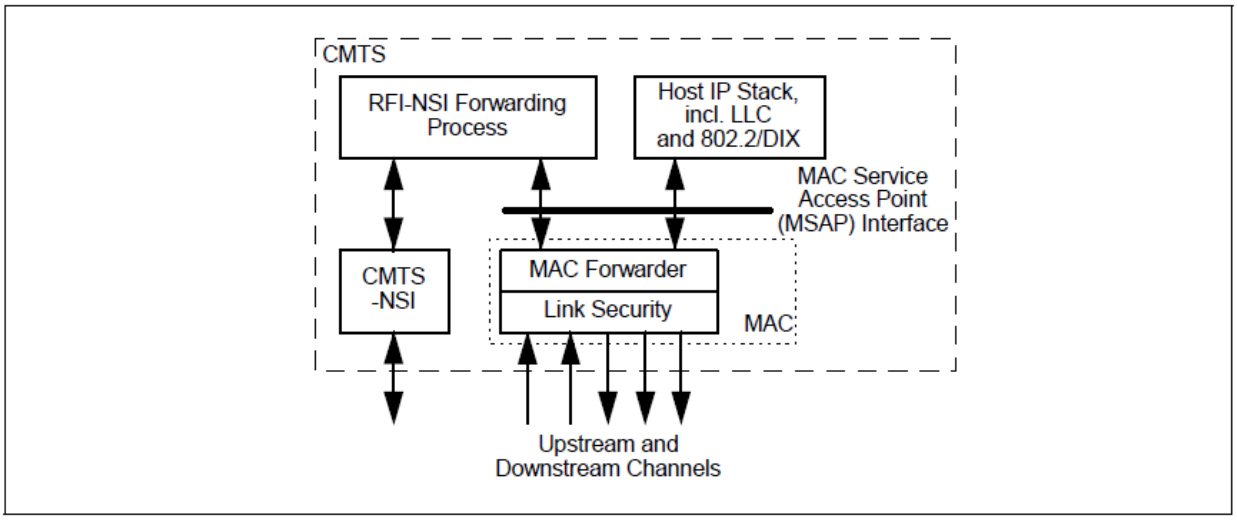
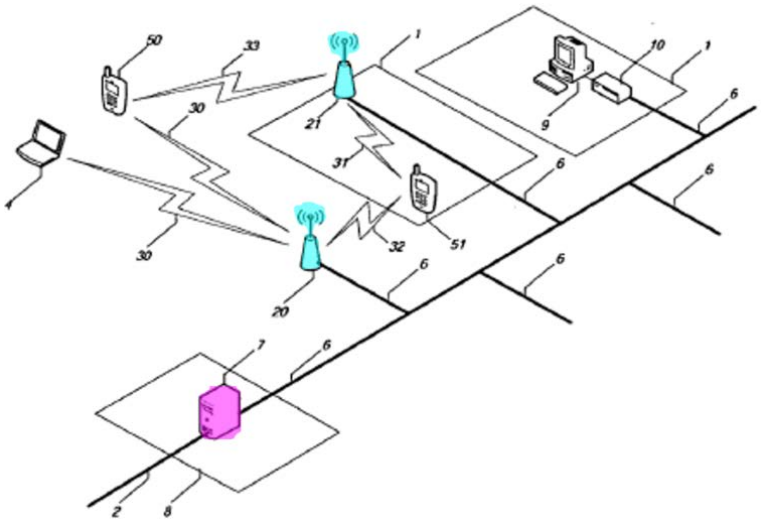


Figure 5-4 MAC Forwarder

654. Because the CMTS has an IP layer, a POSITA would have understood that it may be controlled using IP packets. Ex. 1010, 27 ("Certain management functions also ride on IP, so that the protocol stack on the cable network is as shown in Figure 5-1 (this does not restrict the generality of IP transparency between the head-end and the customer). These management functions include, for example, supporting spectrum management functions and the downloading of software."). A POSITA would have been motivated to use IP packets to control the CMTS (for example, by sending MAC messages such as the UCD message to it) in order to allow the CMTS to be controlled remotely (e.g., from a remote location away from the CMTS). It also would have been desirable to have the MAC layer functionality at a centralized location, as Zuckerman teaches. Ex. 1016, [0041], [0044]-[0045]. A POSITA would have also been familiar with programming a device to issue commands using IP packets. Therefore, a POSITA

would have also expected to achieve success in controlling the CMTS with IP packets. In particular, a POSITA would have expected success in configuring another device (e.g., computer or server) to generate a UCD message and send it in an IP packet to the CMTS for forwarding to the CM.

655. In any event, a POSITA would have found it obvious to use a network operator, like the Operations Support System, to generate the UCD message and send it (or upload it) to a separate node, like the CMTS, for forwarding to the CM. Zuckerman, for example, teaches this concept. With respect to Zuckerman's Figure 1 (reproduced below), Zuckerman teaches a centralized synchronizing communication controller 7 (**magenta**) that implements the MAC layer (i.e., performs MAC layer functions) and is separate from converters 20 and 21 (**aqua**) that transmit the MAC messages. Ex. 1016, [0069]-[0070].



656. In view of Zuckerman, a POSITA would have used a separate computer (the claimed "network operator") to perform at least some of the MAC layer functions of DOCSIS 2.0, such as generating MAC messages like the UCD message, and to send the MAC messages to another node that handles the transmission of the MAC messages. For example, a POSITA would have used a separate computer in the Operations Support System to do this.

657. A POSITA would have been motivated to use a separate network operator because it reduces the processing burden on a single device and shifts some of that burden to a network operator. For example, a POSITA would have wanted to reduce the processing burden on a CMTS by offloading MAC functions to a separate computer (like a computer of the Operations Support System). In particular, a POSITA would have been motivated to shift this burden to the Operations Support System because that system is already in place to support the CMTS. Also, by shifting this burden to the Operations Support System, the CMTS is able to use its processing power to do other functions, like modulation. Another motivation for implementing the MAC functions on a separate computer is to provide a central location for the operations of the MAC layer that is more accessible, while the PHY layer components are kept in a more secure space or placed in a more desirable location for transmissions on the network. Indeed,

Zuckerman teaches the desire to have a centralized MAC layer separate from PHY layer nodes. Ex. 1016, [0041], [0044]-[0045].

658. It is also my opinion that other rationales additionally support that this claim is obvious. First, implementing DOCSIS 2.0's system to use a separate system (the claimed "network operator") to generate and upload MAC messages to the CMTS merely combines known prior art elements according to known methods to yield predictable results. See Section IV (referring to obviousness rationale (A)). The known prior art elements are the CMTS and systems (described in both DOCSIS 2.0 Zuckerman) for operating it. Ex. 1010, 27-28; Ex. 1016, [0041], [0053]. These known elements would have been combined according to known methods, such as DOCSIS 2.0's methods for connecting a CMTS to separate systems through various interfaces. Finally, the combination of the known elements according to the known interfacing methods yields a predictable result, specifically a separate computer for generating the MAC messages (like the UCD message) and uploading them to the CMTS in DOCSIS 2.0.

659. It is also my opinion that implementing DOCSIS 2.0's system to use a separate system (the claimed "network operator") to generate and upload MAC messages to the CMTS is merely the predictable result of applying a known technique to a known device ready for improvement. See Section IV (referring to obviousness rationale (D)). The known technique is a technique of creating a

centralized MAC layer away from the PHY layer. And, the CMTS of DOCSIS 2.0 is the known device ready for improvement because it would benefit from offloading of processes like generating MAC messages and including such processes in a central location where access (e.g., to make updates) is easier.

660. A POSITA would have also expected to achieve success in having another computer (such as one in the Operations Support System) generate the UCD message and send/upload it to the CMTS. A POSITA would have been familiar with SNMP commands and would have understood how to use them to control the CMTS. Ex. 1010, 20 (defining SNMP as a known protocol of the IETF). For example, a POSITA would have been able to program a device in the Operations Support System to generate the UCD message and send an SNMP command to control the CMTS to transmit the UCD message to the CM. SNMP was a well-known protocol for commanding network devices (like servers and CMTSs) and indeed the CMTS in accordance with the DOCSIS 2.0 standard would have already been configured to accept SNMP commands (including commands to transmit MAC messages and the UCD message is a MAC message as described above).

661. In conclusion, DOCSIS 2.0 in view of Zuckerman teaches that the UCD message is generated by a network operator implementing the MAC layer and uploaded to a separate node implementing the PHY of the CMTS. This

teaches the claimed "wherein the probe request is generated by a network operator and uploaded to the second node" in claim 8. Thus, DOCSIS 2.0's ranging procedure in view of Zuckerman teaches claim 8.

662. **Test Procedure:** As I explained above with respect to claim 6, DOCSIS 2.0 teaches that the CMTS (the claimed "second node") generates the Test Request message (the claimed "probe request") in at least some cases. DOCSIS 2.0 states that "[t]he TST-REQ message with Mode!= 0 MUST NOT be sent by the CMTS except in response to an explicit command from the operator." Ex. 1010, 184. This statement expressly discloses the existence of a separate operator for controlling the sending of a Test Request message. Moreover, from this statement, a POSITA would have understood that the Test Request message would have been generated by the operator (the claimed "network operator") and uploaded to the CMTS for transmission in at least some cases.

663. More specifically, a POSITA would have understood that the Test Request message would be generated by a separate computer and sent/uploaded to the CMTS via a SNMP command that commands the CMTS to send the Test Request message. A POSITA would have understood this or this would have at least been obvious for the reasons I explained above with respect to the Ranging Procedure. It also would have been obvious to use IP packets to upload the Test Request message for the reasons I explained above (for example, to allow for

remote control/operation of the CMTS). In this regard, Zuckerman also teaches separation of the MAC and PHY layers, which teaches a POSITA that MAC messages (like the Test Request message) are generated in a separate, remote location and uploaded for further transmission. Zuckerman also provides a motivation for doing so, which is to create a centralized MAC layer.

664. In conclusion, DOCSIS 2.0 in view of Zuckerman teaches that the Test Request message is generated by a network operator and uploaded to the CMTS. This teaches the claimed "wherein the probe request is generated by a network operator and uploaded to the second node" in claim 8. Thus, DOCSIS 2.0's test procedure (with ISO8802-2) in view of Zuckerman teaches claim 8.

2. Dependent Claim 10: "The method of claim 9, wherein the probe request is configured such that the probe emulates an OFDMA transmission."

665. Claim 10 of the '690 patent depends from claim 9, which is taught by DOCSIS 2.0's ranging procedure and the combination of DOCSIS 2.0's test procedure with ISO8802-2, as discussed above. Claim 10 further requires that "the probe request is configured such that the probe emulates an OFDMA transmission." Ex. 1001, claim 10. DOCSIS 2.0 does not teach using OFDMA, so it does not teach claim 10. However, it would have been obvious to use OFDMA in the system taught by DOCSIS 2.0. Indeed, later DOCSIS standards, namely DOCSIS 3.1, did add description of OFDMA. The industry was well aware of

OFDMA well before the earliest claimed priority date of the '690 patent (December 15, 2008) and a POSITA would have known that OFDMA was an available option for implementing a cable network system as described in DOCSIS 2.0. OFDMA was used in xDSL systems long before DOCSIS 3.1 incorporated it. The reason OFDMA was not expressly incorporated into DOCSIS 2.0 is because OFDMA requires greater processing capabilities and therefore was more expensive to implement at that time. However, as processing capabilities improved and costs became lower, OFDMA became more practical. In other words, the market was moving towards use of OFDMA in cable networks long before it was eventually incorporated into DOCSIS 3.1. The market was moving that way because the advantages of OFDMA were well-known, as evidenced by Zuckerman. It is my opinion that the market demand for OFDMA would have led a POSITA to implement or convert DOCSIS 2.0 to use OFDMA (and indeed history shows it did adopt OFDMA).

666. First, Zuckerman acknowledges that "[c]able modems mostly use the DOCSIS standards for transferring data in parallel with dedicated CATV channels, which transfer the video channels over coax cables." Ex. 1016, [0005]. Zuckerman explains that "[v]arious modulations can be used to carry the data over the coax." Ex. 1016, [0005]. Zuckerman then goes on to expound on the advantages of OFDMA. Ex. 1016, [0006]-[0008], [0049], [0134], [0141]. And

Zuckerman describes using OFDMA for both cable and wireless connections. Ex. 1016, [0015], [0041], [0048]-[0051], [0053]-[0054], [0058]-[0065], [0071]-[0072], [0076] ("the combination of OFDMA over coax introduces the unexpected result of solving the problem of thermal noise buildup up to a predefined number of users."), [0110].

667. Based on Zuckerman's teachings, a POSITA would have found it obvious to implement the cable network of DOCSIS 2.0 to use OFDMA. As a result, MAC management messages (such as the UCD message and Ranging Request message) of DOCSIS 2.0 would have been modulated using OFDMA. A POSITA would have been motivated to use OFDMA because it enables simultaneous access to the cable network by multiple users and supports high rate applications. Ex. 1016, [0008]. OFDMA uses subcarriers to provide a high spectral efficiency, while reducing signal impairments from interference. Ex. 1016, [0006]-[0007]. A POSITA would have wanted to leverage these advantages in the cable network of DOCSIS 2.0 in which many users are accessing the network simultaneously and for receiving or sending voice and video data that benefit from high data rates. OFDMA improves network performance by independently modulating subcarriers within frequency bands and as an effective method of overcoming transmission impairments due to signal reflections and interference. See Section VIII.C (which describes how OFDM and OFDMA

improve performance). OFDMA also employs a large degree of error correction which works to an advantage when certain subcarriers are not received. Ex. 1015, 12-13. The error correction allows the receiver to recover the data even if a subcarrier fails to make it to the receiver without degradation. Ex. 1015, 22 (Section 2.1.12 about flat fading), 50 (describing averaging over many subcarriers allows acquisition at very low SNR levels). Because of these improvements in network performance (e.g., an improved bit error rate), a POSITA would have been motivated to use OFDMA in the DOCSIS 2.0 system (which already used other multiple access schemes like TDMA and CDMA). Ex. 1010, 441-442. OFDMA would have been useful in improving performance at the frequency bands used in the DOCSIS 2.0 system (e.g., 5-1000 MHz), although a POSITA would have understood that OFDMA works well for other frequency bands too. Ex. 1010, 15 (Radio Frequency definition). Moreover, a POSITA would have understood that the DOCSIS 2.0 system would have suffered from noise and other interference, spurious power, carrier leakage, reflections, and network congestion problems that the use of OFDMA would have improved upon, so a POSITA would have been motivated to use OFDMA to address those problems. Ex. 1010, 91.

668. It is also my opinion that other rationales additionally support this combination. First, the combination of DOCSIS 2.0 and Zuckerman merely combines known prior art elements according to known methods to yield

predictable results. See Section IV (referring to obviousness rationale (A)). The known prior art elements are DOCSIS 2.0's system having the CMTS send a UCD message or Test Request message to a CM and the CM sending back a Ranging Request message or Test Response (upstream signal) and Zuckerman's devices for using OFDMA on wired and/or wireless networks. Ex. 1010, 135-139; Ex. 1016, [0015], [0041], [0048]-[0051], [0053]-[0054], [0058]-[0065], [0071]-[0072], [0076], [0110]. These known elements would have been combined according to known methods, such as Zuckerman's method of using OFDMA over coax and the well-known techniques for deploying OFDMA (see technical background section). Finally, the combination yields predictable results, specifically it yields a UCD message or Test Request message modulated using OFDMA and configured to cause the Ranging Request message or Test Response (upstream signal) to be modulated with OFDMA.

669. It is also my opinion that the combination of DOCSIS 2.0 and Zuckerman merely uses a known technique to improve similar devices in the same way. See Section IV (referring to obviousness rationale (C)). The known technique is Zuckerman's deploying of OFDMA, which was a well-known type of modulation. Ex. 1016, [0047]-[0049], [0075]-[0076]. Zuckerman uses this technique on a variety of wired and/or wireless networks illustrated in Figures 1A-1G, which include cable modems 10 and a centralized synchronizing

communication controller 7 similar to the CMs and CMTS of DOCSIS 2.0, respectively. Ex. 1016, [0041], [0053]-[0066], [0070]-[0072]. Further, the shared signal wired distribution line 6 comprising coax in Zuckerman is similar to the cable network of DOCSIS 2.0. Ex. 1016, [0058]-[0059]. Zuckerman's technique of using OFDMA would have improved DOCSIS 2.0's system by all the ways in which OFDMA is advantageous over single carrier modulation in DOCSIS. Ex. 1016, [0005].

670. Finally, a POSITA would have had a reasonable expectation of success in achieving the above described combination of DOCSIS 2.0 and Zuckerman. Ex. 1016, [0015]. This is because the combination merely involves changing from one known type of modulation to another known type of modulation (namely OFDMA). A POSITA would have had the skills, including network design skills, to deploy OFDMA modulation, particularly since OFDMA modulators were readily available. See Sections VIII and X above. The process of generating the UCD message and Test Request message to trigger sending of the Ranging Request message and the Test Response (upstream signal), respectively, was already known from DOCSIS 2.0 and it would have been straightforward to change the modulations of those messages to OFDMA. Ex. 1016, [0038]-[0039], [0052], [0065], [0075],

671. In conclusion, the combination of DOCSIS 2.0 (with ISO8802-2 for the test procedure) and Zuckerman teaches that the UCD message and Test Request message are configured such that the Ranging Request message and Test Response (upstream signal) message emulate an OFDMA transmission. This teaches the "wherein the probe request is configured such that the probe emulates an OFDMA transmission" in claim 10. Thus, the combination of DOCSIS 2.0's ranging procedure and Zuckerman and the combination of DOCSIS 2.0's test procedure with ISO8802-2 and Zuckerman teach claim 10.

3. Dependent Claim 11

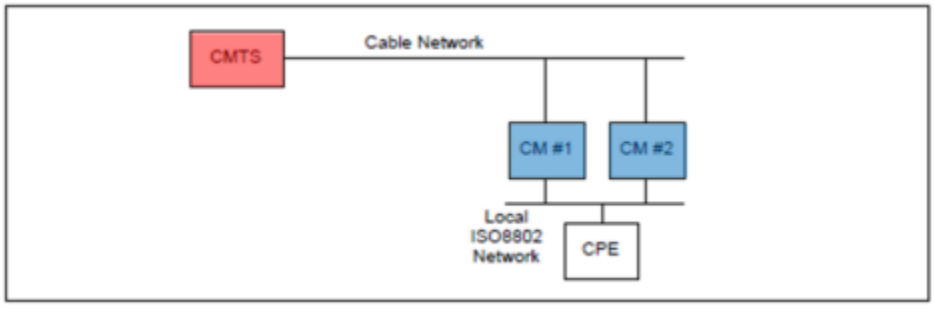
a) [11PRE]: "The method of claim 9, further comprising:"

672. Claim 11 of the '690 patent depends from claim 9, which is taught by DOCSIS 2.0's ranging procedure and the combination of DOCSIS 2.0's test procedure with ISO8802-2, as discussed above. Claim 11 adds a second instance of sending a probe request and receiving a probe to the first instance in independent claim 9 and the feature of using OFDMA that was in claim 10. It also adds the concept of transmitting two probes "simultaneously." Although DOCSIS 2.0 does not use OFDMA and does not expressly disclose this "simultaneously" feature, in my opinion a POSITA would have understood that DOCSIS 2.0's ranging procedure in view of Zuckerman and DOCSIS 2.0's test procedure in view

of ISO8802-2 and Zuckerman teach these features as explained below, and therefore they teach limitation [11PRE].

b) [11A]: "a) the first node transmitting a second probe request to a third node;"

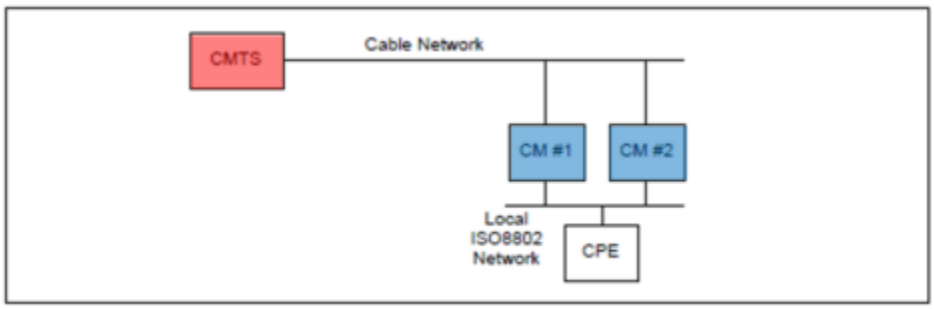
673. **Ranging Procedure:** As I explained above with respect to limitation [9A], DOCSIS 2.0 describes the CMTS (the claimed "first node) transmitting a UCD message (the claimed "probe request") to a CM #1 (the claimed "second node" in limitation [9A]). Ex. 1010, 243-246. With respect to Figure 5-3 of DOCSIS 2.0 (reproduced below), a POSITA would have understood that the same CMTS also transmits another UCD message (the claimed "second probe request") to a CM #2 (the claimed "third node"). Ex. 1010, 135-136 ("A separate [UCD] message MUST be transmitted for each logical upstream that is currently available for use."), 243-246.



674. In conclusion, DOCSIS 2.0 teaches the CMTS transmitting another UCD message (in addition to the UCD message described for limitation [9A]) to CM #2 (different from CM #1). This teaches "the first node transmitting a second

probe request to a third node" in limitation [11A]. Thus, DOCSIS 2.0's ranging procedure teaches limitation [11A].

675. **Test Procedure:** As I explained above with respect to limitation [9A], DOCSIS 2.0 describes the CMTS (the claimed "first node) transmitting a Test Request message (the claimed "probe request") to a CM #1 (the claimed "second node" in limitation [9A]). Ex. 1010, 184-185. With respect to Figure 5-3 of DOCSIS 2.0 (reproduced below), a POSITA would have understood that the same CMTS would have been commanded to transmit another Test Request message (the claimed "second probe request") to a CM #2 (the claimed "third node") in order to test that CM as well. Ex. 1010, 184-185.



676. In conclusion, DOCSIS 2.0 teaches the CMTS transmitting another Test Request message (in addition to the Test Request message described for limitation [9A]) to CM #2 (different from CM #1). This teaches "the first node transmitting a second probe request to a third node" in limitation [11A]. Thus, DOCSIS 2.0's test procedure teaches limitation [11A].

c) [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"

677. **Ranging Procedure:** As I explained above with respect to limitation [9B], DOCSIS 2.0 describes the CMTS (the claimed "first node) receiving a Ranging Request message (the claimed "probe request") from the CM #1 (the claimed "second node" in limitation [9B]), wherein that Ranging Request message is generated in accordance with the parameters in the UCD message that triggered it. Ex. 1010, 139, 146-147, 197-198; Section XII.H.5.C. Similarly, a POSITA would have understood that the same CMTS would have received another Ranging Request message (the claimed "second probe") that was sent from CM #2 and that was generated according to the parameters in the other UCD message sent to the CM #2.

678. In conclusion, DOCSIS 2.0 teaches the CMTS receiving another Ranging Request message (in addition to the Ranging Request message described for limitation [9B]) from CM #2, wherein this other Ranging Request message is generated according to the UCD message sent to the CM #2. This teaches "the first node receiving a second probe from the third node, wherein the second probe is generated according to the second probe request" in limitation [11B]. Thus, DOCSIS 2.0's ranging procedure teaches limitation [11B].

679. **Test Procedure:** As I explained above with respect to limitation [9B], DOCSIS 2.0 and ISO8802-2 teach the CMTS (the claimed "first node) receiving an upstream signal (the claimed "probe request") from the CM #1 (the claimed "second node" in limitation [9B]), wherein that upstream signal is generated in accordance with the parameters in the Test Request message that triggered it. Ex. 1010, 28, 185; Ex. 1011, 39, 53; Section XII.H.5.C. Similarly, a POSITA would have understood that the same CMTS would have received another upstream signal (the claimed "second probe") that was sent from CM #2 and that was generated according to the parameters in the other Test Request message sent to the CM #2.

680. In conclusion, DOCSIS 2.0 teaches the CMTS receiving another upstream signal (in addition to the upstream signal described for limitation [9B]) from CM #2, wherein this other upstream signal is generated according to the Test Request message sent to the CM #2. This teaches "the first node receiving a second probe from the third node, wherein the second probe is generated according to the second probe request" in limitation [11B]. Thus, DOCSIS 2.0's test procedure teaches limitation [11B].

d) [11C]: "wherein the first probe and second probe are transmitted simultaneously using OFDMA."

681. As I explained above for claim 10, DOCSIS 2.0 does not describe using OFDMA. However, it would have been obvious to use OFDMA in view of the POSITA's knowledge of OFDMA and Zuckerman. The reasons that using

OFDMA in DOCSIS 2.0 would have been obvious (including the market trend and known OFDMA advantages like higher spectral density) were given above with respect to claim 10 and thus are not fully repeated here. In the combinations of DOCSIS 2.0 with Zuckerman, OFDMA would have been used for messages in both the ranging procedure and test procedure as I explain below. The concept of transmitting "simultaneously" is simply a result of the use of OFDMA as I also explain below.

682. **Ranging Procedure:** As I explained above with respect to limitations [9A], [9B], [11A], and [11B], CM #1 will transmit one Ranging Request (the claimed "first probe") and CM #2 will transmit another Ranging Request (the claimed "second probe"). *See* Sections XII.H.5.b-c, XII.I.3.b-c. In the combinations with Zuckerman, both Ranging Requests would have been transmitted using OFDMA. As a result of using OFDMA, in at least some cases, both Ranging Requests would have been transmitted simultaneously. This would have happened because the UCD messages that trigger them would have been sent simultaneously or near simultaneously so that the ranging procedure would be performed on multiple channels simultaneously. Ex. 1010, 479-484 (describing multiple channels). Also, the ranging opportunities that the CMs use to transmit the Ranging Requests would have overlapped in at least some cases because they would have been independent from each other (i.e., the ranging opportunity on one

channel for CM #1 would be determined independent of the ranging opportunity on another channel for CM #2).

683. A POSITA would have understood that simultaneous transmissions are desirable because they enable the same transmitter/receiver hardware and network to be used to provide service to multiple users efficiently. Ex. 1016, [0198]. Zuckerman recognizes that simultaneous transmissions will occur on the uplink (i.e., link from cable modems to CMTS). Ex. 1016, [0076], [0174]-[0176], [0198]. This would have been permitted in the modified DOCSIS 2.0 system (i.e., modified to use OFDMA as discussed above) because, as Zuckerman teaches, OFDMA is "designed for simultaneous access by multiple users." Ex. 1016, [0008]. More specifically, OFDMA provides numerous simultaneous sub-channels designed for simultaneous transmissions over the same link. Ex. 1016, [0080], [0210]-[0212]. To the extent the modified DOCSIS 2.0 system (i.e., modified to use OFDMA as discussed above) does not already teach simultaneous transmission of Ranging Request messages, a POSITA would have been motivated to configure the system to transmit these messages simultaneously because it efficiently uses the bandwidth and because ranging is required to ensure correct timing of communications between the CMTS and CMs. Ex. 1010, 197, 484. Given the POSITA's skills, the known ranging procedure, and the known OFDMA technique, a POSITA would have expected to successfully configure the system to

perform the simultaneous transmission of two Ranging Request messages. Ex. 1010, 247-251; Ex. 1016, [0007]-[0008].

684. In conclusion, the combination of DOCSIS 2.0 and Zuckerman teaches the Ranging Request message from the CM #1 and the Ranging Request message from the CM #2 being transmitted simultaneously using a modified DOCSIS system (modified to use OFDMA). This teaches "wherein the first probe and second probe are transmitted simultaneously using OFDMA" in limitation [11C]. Thus, DOCSIS 2.0's ranging procedure in view of Zuckerman teaches limitation [11C].

685. **Test Procedure:** As I explained above with respect to limitations [9A], [9B], [11A], and [11B], CM #1 will transmit one upstream test response signal (the claimed "first probe") and CM #2 will transmit another upstream test response signal (the claimed "second probe"). In the combinations with Zuckerman, both upstream test response signals would have been transmitted using OFDMA. As a result of using OFDMA, in at least some cases, both upstream test response signals would have been transmitted simultaneously. This would have happened because the Test Response messages that trigger them would have been sent simultaneously or near simultaneously so that the testing procedure would be performed on multiple channels simultaneously. Ex. 1010, 479-484 (describing multiple channels).

686. A POSITA would have understood that simultaneous transmissions are desirable because they enable the same transmitter/receiver hardware and network to be used to provide service to multiple users efficiently. Ex. 1016, [0198]. Zuckerman recognizes that simultaneous transmissions will occur on the uplink (i.e., link from cable modems to CMTS). Ex. 1016, [0076], [0174]-[0176], [0198]. This would have been permitted in the modified DOCSIS 2.0 system (i.e., modified to use OFDMA as discussed above) because, as Zuckerman teaches, OFDMA is "designed for simultaneous access by multiple users." Ex. 1016, [0008]. More specifically, OFDMA provides numerous simultaneous sub-channels designed for simultaneous transmissions over the same link. Ex. 1016, [0080], [0210]-[0212]. To the extent the modified DOCSIS 2.0 system (i.e., modified to use OFDMA as discussed above) does not already teach simultaneous transmission of upstream test response signals, a POSITA would have been motivated to configure the system to transmit these signals simultaneously because it efficiently uses the bandwidth and because testing of multiple CMs simultaneously would have been desirable given the number of CMs connected to a CMTS. Ex. 1010, 197, 484. Given the POSITA's skills, the known test procedure, and the known OFDMA technique, a POSITA would have expected to successfully configure the system to perform the simultaneous transmission of two upstream test response signals. Ex. 1010, 184-185; Ex. 1016, [0007]-[0008].

687. In conclusion, the combination of DOCSIS 2.0, ISO8802-2 (which describes the test response), and Zuckerman teaches the upstream test response signal from the CM #1 and the upstream test response signal from the CM #2 being transmitted simultaneously using a modified DOCSIS system (modified to use OFDMA). This teaches "wherein the first probe and second probe are transmitted simultaneously using OFDMA" in limitation [11C]. Thus, DOCSIS 2.0's test procedure in view of Zuckerman teaches limitation [11C].

4. Dependent Claim 16: "The method of claim 15, wherein the probe request is generated by a network operator and uploaded to the first node."

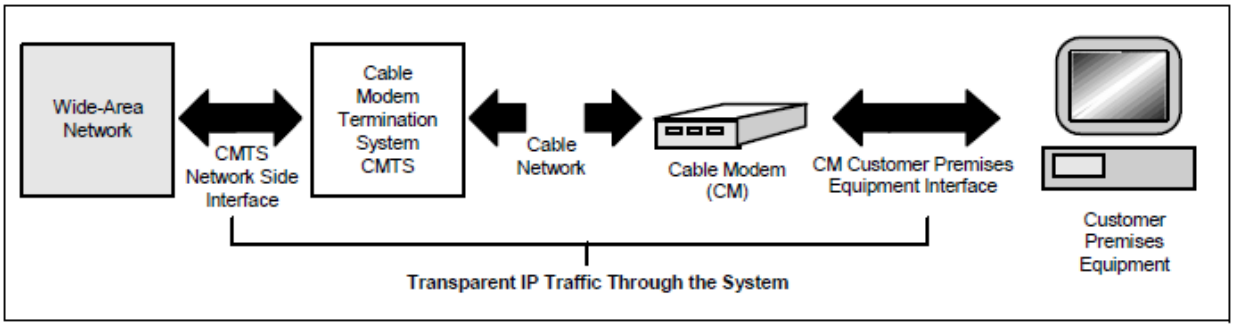
688. Claim 16 of the '690 patent depends from claim 15, which is taught by DOCSIS 2.0's ranging procedure and the combination of DOCSIS 2.0's test procedure with ISO8802-2, as discussed above. Claim 16 further requires that "the probe request is generated by a network operator and uploaded to the first node." Ex. 1001, claim 16. In my opinion, DOCSIS 2.0's ranging procedure in view of Zuckerman and DOCSIS 2.0's test procedure in view of ISO8802-2 and Zuckerman teach this feature. Claim 16 is the same as claim 8, but the "second node" is referred to as the "first node" because independent claim 9 is written from the perspective of the node that sends the probe request and receives the probe response. As such, the first node in claims 9 and 16 corresponds to the second node in claims 1 and 8, while the second node in claims 9 and 16 corresponds to

the first node in claims 1 and 8. Thus, DOCSIS 2.0's ranging procedure in view of Zuckerman and DOCSIS 2.0's test procedure in view of ISO8802-2 and Zuckerman teach claim 16 for the same reasons they teach claim 8, except that the CMTS of DOCSIS 2.0 corresponds to the "first node" of claim 16.

5. Independent Claim 17

a) [17PRE]: "A system, comprising:"

689. This preamble is disclosed by DOCSIS 2.0. DOCSIS 2.0 describes a data-over-cable system and a method for operating the system. Ex. 1010, 1, 23 ("operating a data-over-cable system"). The system is illustrated in Figure 1-1 below. Ex. 1010, 2.



Ex. 1010, FIG. 1-1

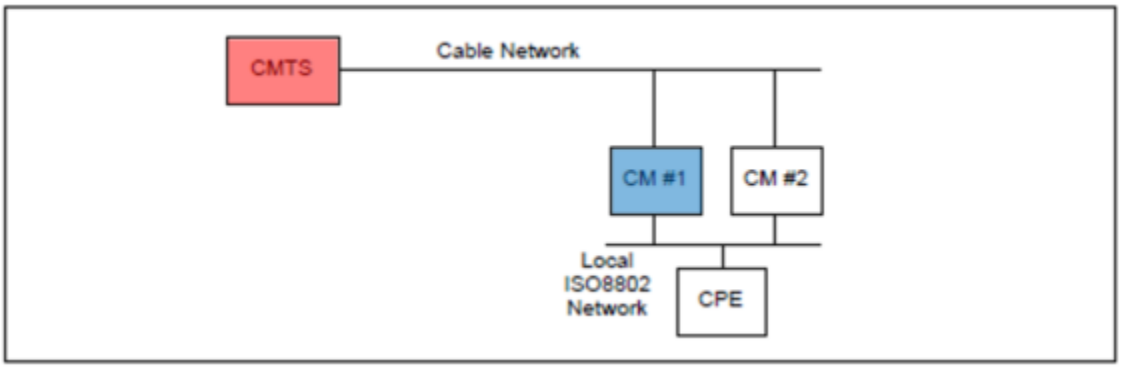
690. As I explained above for claims 1 and 9, DOCSIS 2.0 describes a ranging procedure and test procedure (with reference to ISO8802-2 which would have been obvious to combine with DOCSIS 2.0 for the reasons given above) that are performed by nodes (such as the CMTS and CMs) of this system. Ex. 1010, 135-152, 184-186, 197-200. The CMTS and one of the CMs meet the claimed first

and second nodes on the basis of their performing the ranging procedure or test procedure. Thus, I will address both ways that the CMTS and CM meet the claimed first and second nodes below. Further, I note that independent claim 17 is similar to independent claims 1 and 9, but is a system claim as opposed to a method claim. The first and second nodes in independent claim 17 correspond to the first and second nodes in independent claim 9, respectively. As I will explain below, DOCSIS 2.0's system includes the first and second nodes as defined below in limitations [17A]-[17F]. *See* Sections XII.I.5.b-g, below. Thus, DOCSIS 2.0 teaches limitation [17PRE].

b) [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"

691. As shown below in Figure 5-3 of DOCSIS 2.0, the system of DOCSIS includes a cable mode termination system (CMTS) communicating with a cable modem (e.g., CM #1). Ex. 1010, 29, FIG. 5-3. The CMTS (**red**) in DOCSIS 2.0 corresponds to the claimed "first node" and the CM (e.g., CM #1) (**blue**) in DOCSIS 2.0 corresponds to the claimed "second node." The "Cable Network" in

Figure 5-3 below corresponds to the claimed "communications network." As shown below, the CMTS is on the Cable Network and thus teaches the claimed "first node on a communications network."



692. Further, 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 the well-known implementation for the protocol stack of the CMTS, which is shown in Figure 5-1 (reproduced below). Ex. 1010, 27.

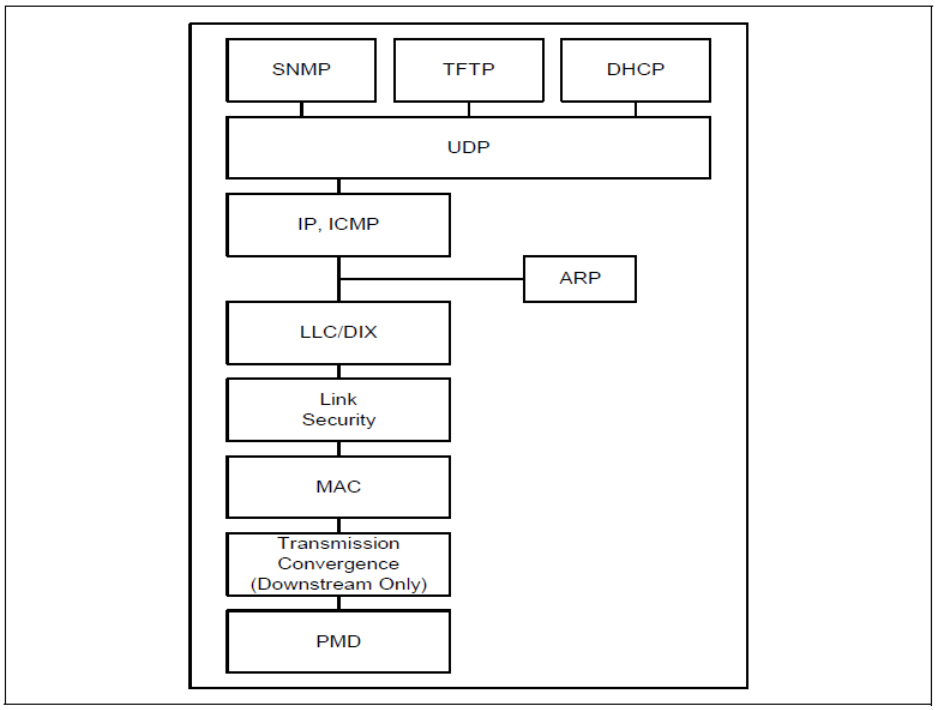


Figure 5-1 Protocol Stack on the RF Interface

693. A POSITA would have understood that the computer executable program code would have been configured to carry out the various procedures/functions (e.g., ranging procedure and test procedure) of the various layers in the stack. A typical implementation of the CMTS would have been to use a processor for executing code stored on internal memory of the CMTS. It would not have been practical to use circuitry alone to implement the CMTS protocol stack. Indeed, DOCSIS 2.0 indicates the existence of the "processor" and "software" in a CMTS when discussing what to do with an Extended Header (EHDR) field. Ex. 1010, 118 ("Initial implementations SHOULD pass this field to the processor. This will allow future software upgrades to take advantage of this capability."), 125 ("A compliant CMTS & CM MUST support extended

headers."). DOCSIS 2.0 also describes that the CMTS stores configuration data in its non-volatile storage, which is a computer readable medium. Ex. 1010, 239 ("The CMTS MUST be able to reboot and operate in a stand-alone mode using configuration data retained in non-volatile storage.").

694. In any event, a POSITA would have found it obvious to implement the CMTS in this manner. A POSITA would have been motivated to implement it this way because processors and memory are readily available and programming such processors would have been within the POSITA's skill set. A POSITA would have also been motivated to carry out this implementation because it is cost effective as it would have been cheaper and less time consuming to write a program and store it on memory for a processor to execute than it would have been to build a system from hardware components alone.

695. **Ranging Procedure:** With respect to the ranging procedure, DOCSIS 2.0 states that "[r]anging is the process of acquiring the correct timing offset such that the cable modem's transmissions are aligned to the correct mini-slot boundary." Ex. 1010, 197. DOCSIS 2.0 explains that "a cable modem MUST synchronize to the downstream and learn the upstream channel characteristics through the Upstream Channel Descriptor MAC management message" and "MUST put together either an Initial Ranging Request message or a Ranging Request message." Ex. 1010, 197. DOCSIS 2.0 also describes that the Upstream

Channel Descriptor (UCD) message "MUST be transmitted by the CMTS at a periodic interval to define the characteristics of an logical upstream channel (Figure 8-16)." Ex. 1010, 135, 22 (definition of UCD). DOCSIS 2.0 further describes that the UCD is transmitted on the cable network by the CMTS (which corresponds to the claimed "first node") and is received by at least one CM (e.g., CM #1, which corresponds to the claimed "second node"). Ex. 1010, 243-246. The format of the UCD message is shown in Figure 8-16 (reproduced below). Ex. 1010, 136. This UCD message corresponds to the claimed "probe request."

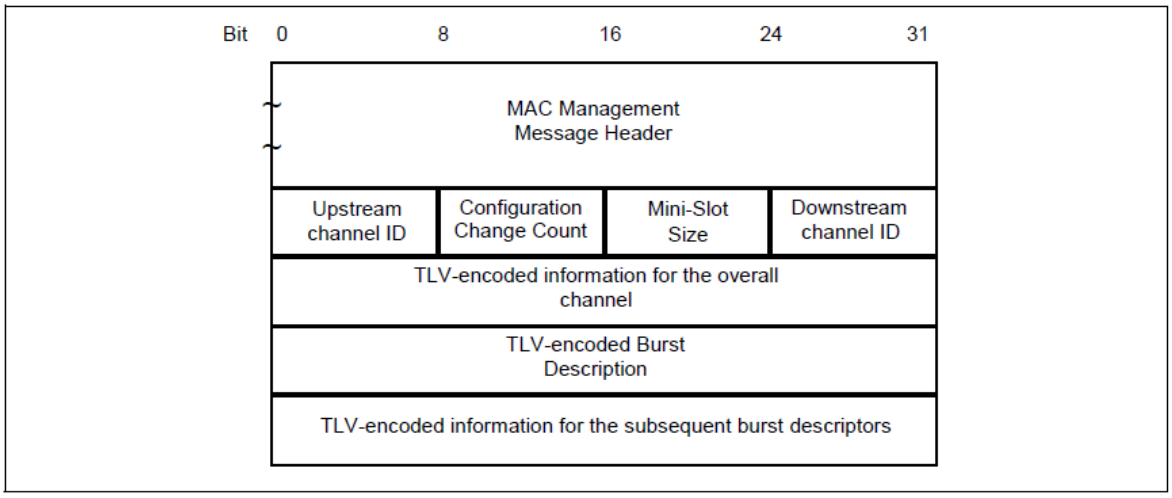


Figure 8-16 Upstream Channel Descriptor

696. As shown above, the UCD message includes eight portions: a MAC Management Message Header, Upstream Channel ID, Configuration Change Count, Mini-Slot Size, Downstream Channel ID, TLV-Encoded Information for the Overall Channel, TLV-Encoded Burst Description, and TLV-Encoded Information for the Subsequent Burst Descriptors. Ex. 1010, 136. The parameters

in the TLV-Encoded Information for the Overall Channel are defined in Table 8-18 (portions of which are reproduced below) and an example of UCD encoded TLV data is given in Figure 8-18 (not shown below) of DOCSIS 2.0. Ex. 1010, 137-143.

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.

697. As shown from the above table, the parameters of the UCD message include a modulation rate parameter, frequency parameter, maintain power spectral density parameter, and ranging required parameter. Ex. 1010, 137-139. The modulation rate parameter is a 1 byte long value that provides a multiple of a base

rate of 160 kHz that is to be used for modulating subsequent signals on the upstream channel identified by the Upstream Channel ID of the same UCD message. Ex. 1010, 137, 54 (see section 6.2.10 Modulation Rates). The frequency parameter is a 4 byte long value that provides the upstream center frequency that is to be used for subsequent signals on the upstream channel identified by the Upstream Channel ID of the same UCD message. Ex. 1010, 137. The maintain power spectral density parameter is a 1 byte long value that controls the transmit power level to be used for subsequent signals on the upstream channel identified by the Upstream Channel ID of the same UCD message. Ex. 1010, 139. The ranging required parameter is a 1 byte long value that indicates whether ranging is required to be performed on the upstream channel identified by the Upstream Channel ID of the same UCD message. Ex. 1010, 139.

698. Further, as I explained above, the UCD message includes TLV-Encoded Burst Description and TLV-Encoded Information for the Subsequent Burst Descriptors, which include further parameters. As DOCSIS 2.0 explains, "[w]ithin each Burst Descriptor is an unordered list of Physical-layer attributes, encoded as TLV values." Ex. 1010, 140. "These attributes are shown in Table 8-19" which is reproduced below in part. Ex. 1010, 140-142.

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)

699. As shown in this table, the attributes/parameters include a modulation type for specifying a type of modulation (e.g., QPSK, 16QAM, 8QAM, etc.) to be used for a subsequent burst on the upstream channel identified by the Upstream Channel ID that is in the same UCD message. Ex. 1010, 141.

700. In addition to these parameters, there are further parameters in the MAC Management Message Header of the UCD message. As shown in Figure 8-14 (below), the MAC Management Message Header includes numerous parameters (referred to as "fields"), such as a destination address (DA), source address (SA), etc. Ex. 1010, 132-135.

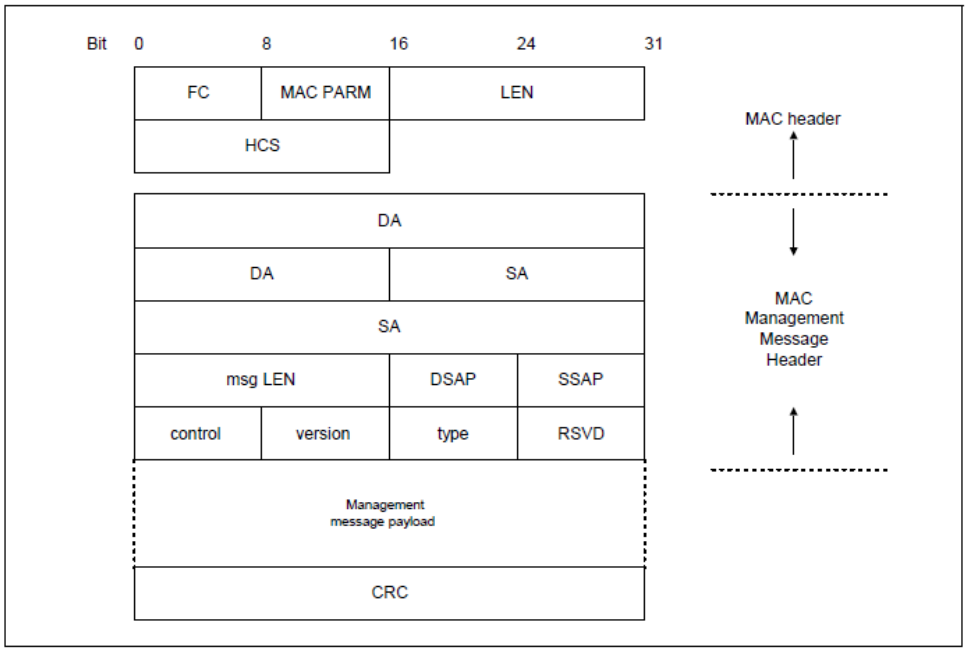


Figure 8-14 MAC Header and MAC Management Message Header Fields

701. Thus, the UCD message, collectively from its eight different portions (i.e., MAC Management Message Header, Upstream Channel ID, Configuration Change Count, Mini-Slot Size, Downstream Channel ID, TLV-Encoded Information for the Overall Channel, TLV-Encoded Burst Description, and TLV-Encoded Information for the Subsequent Burst Descriptors), specifies a plurality of parameters that meets the claimed "first plurality of parameters." Moreover, the plurality of parameters (in particular, the modulation rate for the channel and the modulation type for the burst) of the UCD message are used for forming a Ranging Request (RNG-REQ) message (the claimed "physical layer probe"), which is generated when the ranging required parameter of the UCD message has a value of 1 or 2. Ex. 1010, 139, 146-147, 197-198. Therefore, the UCD message

"specif[ies] a first plurality of probe parameters for a physical layer probe," as claimed.

702. The Ranging Request (RNG-REQ) message is the claimed "physical layer probe" at least because it is configured using physical layer parameters, such as the modulation rate from the UCD message as explained above. Ex. 1010, 24 ("The data-over-cable system, configured with at least one set of defined physical-layer parameters (e.g., modulation, forward error correction, modulation rate, etc.) from the range of configuration settings described in this specification…"), 140-142 (upstream physical-layer burst attributes of UCD message). A POSITA would have also understood that the Ranging Request message is a "physical layer probe" because it is transmitted at initialization or to determine network delay and request power adjustment, which are attributes of the physical layer. Ex. 1010, 146 ("A Ranging Request MUST be transmitted by a CM at initialization on an upstream other than a DOCSIS 2.0 Only Upstream, and periodically on request from CMTS to determine network delay and request power adjustment.").

703. In addition, and as I explained above, one of the parameters of the UCD message is the Downstream Channel ID. Ex. 1010, 136-137. This Downstream Channel ID is then included in the payload of the Ranging Request message, as shown in Figure 8-21 (reproduced below). Ex. 1010, 146-147.

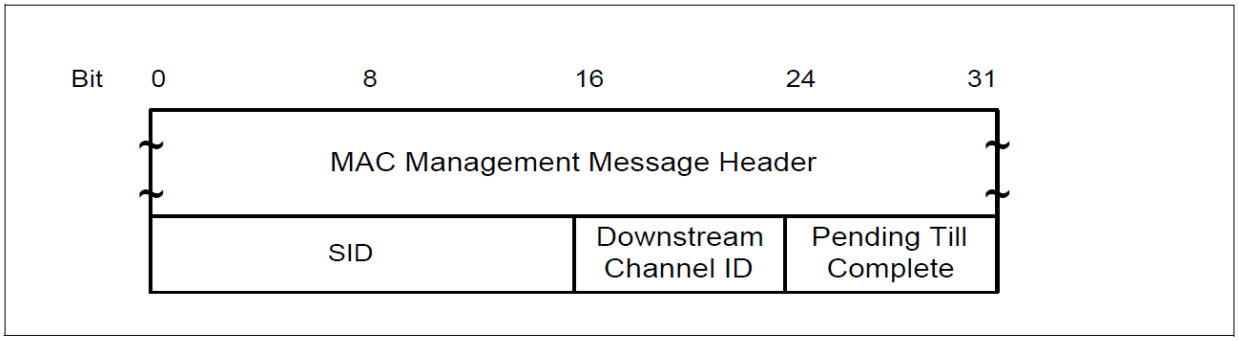


Figure 8-21 Packet PDU Following the Timing Header

704. DOCSIS 2.0 explains that the Downstream Channel ID is "[t]he identifier of the downstream channel on which the CM received the UCD which described this upstream." Ex. 1010, 147. As shown above, the Downstream Channel ID is part of the packet PDU that follows the Timing Header and also follows the MAC Management Message Header. Because of this location outside of the headers, a POSITA would have understood that the Downstream Channel ID is part of the payload of the Ranging Request message (the claimed "probe"). Therefore, the Downstream Channel ID parameter in the UCD message specifies content (the identifier) of the payload for the Ranging Request message (the claimed "wherein the first plurality of parameters comprising at least a payload content for the probe"). Ex. 1010, 136-137, 146-147.

705. As I explained above in this section and with respect to limitation [1A], the UCD message includes the modulation rate parameter and modulation type parameter (for a burst). Ex. 1010, 137, 141; see Section XII.H.1.b. Either one of these parameters (or both) indicates a modulation profile for the Ranging

Request message (the claimed "probe") that is sent on the upstream channel identified by the UCD message. Ex. 1010, 17 (definition of modulation rate), 146-147, 197-198. A POSITA would have understood that each of the modulation rate parameter and the modulation type parameter indicates "a modulation profile" because they each dictate how the Ranging Request message is to be modulated for transmission on the upstream channel. In other words, they each provide a characteristic of the modulation for the Ranging Request message that is transmitted on the upstream channel. Therefore, the UCD message includes a plurality of parameters "comprising…a modulation profile for the probe," as claimed.

706. In conclusion, DOCSIS 2.0 teaches a CMTS on a cable network , the CMTS comprising a processor and computer executable program code embodied on a CMTS's internal memory, the code configured to transmit the UCD message to the CM, on the cable network, the UCD message specifying a plurality of parameters for the physical layer Ranging Request message, wherein the plurality of parameters comprises at least a part of the payload of the Ranging Request message and a modulation rate for the Ranging Request message. This teaches "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[15] computer

[15] I have treated this "a" as an extraneous word.

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" in limitation [17A]. Thus, DOCSIS 2.0's ranging procedure teaches limitation [17A].

707. **Test Procedure:** With respect to the test procedure, DOCSIS 2.0 states that "[t]he CM MUST provide a test mode." Ex. 1010, 96, 98. DOCSIS 2.0 also states that "the CM and CMTS MUST respond appropriately to TEST and XID requests per [ISO8802-2]." Ex. 1010, 28. More specifically, DOCSIS 2.0 describes the CM receiving a Test Request message (TST-REQ), which corresponds to the claimed "probe request." Ex. 1010, 184-185 ("CM receives a TST-REQ message (either unicast to the CM itself, or broadcast)"). The Test Request message is a type of MAC Management Message. Ex. 1010, 133-134. "The Test Request is used to force a CM to enter or leave one of two test modes." Ex. 1010, 184. The Test Request message is shown in Figure 8-45 (reproduced below). Ex. 1010, 185.

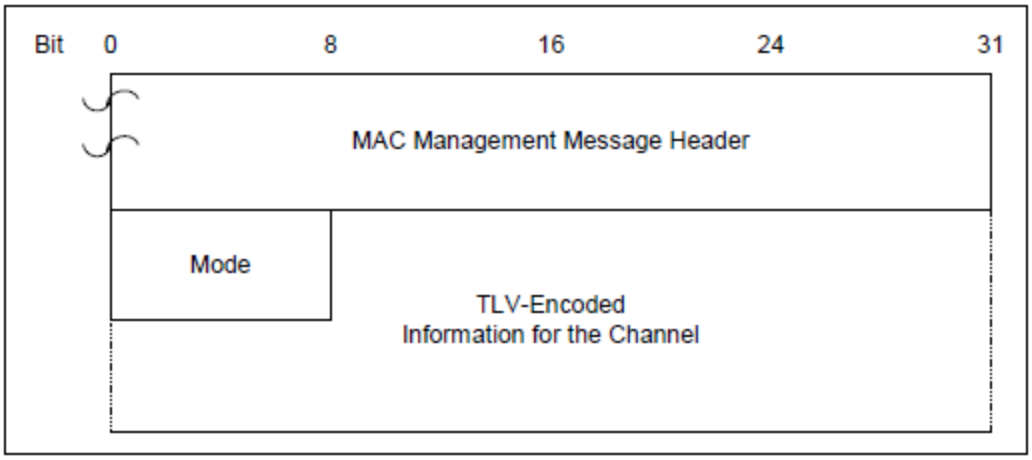


Figure 8-45 Test Request

708. As shown above, the Test Request message includes three portions: a MAC Management Message Header, Mode, and TLV-Encoded Information for the Channel. Ex. 1010, 185. The Mode has one of three values: 0, 1, or 2. Ex. 1010, 185. If the Mode is 0, the CM (which receives the Test Request Message) disables all test modes and reboots. Ex. 1010, 185. If the Mode is not 0, "the CM MUST begin the test mode indicated in the Mode parameter, using the channel parameters included in the TST-REQ message." Ex. 1010, 185 (DOCSIS uses the notation "!=0" to indicate "not equal to 0"). More specifically, if the Mode is 1, the CM transmits "a continuous (non-bursted) upstream signal at the commanded modulation rate, carrier frequency, and power level." Ex. 1010, 185, 98 (which also describes the transmission of this continuous signal in the test mode). And, if the mode is 2, the CM transmits "a continuous (non-bursted), unmodulated (CW) upstream signal at the commanded carrier frequency, modulation rate and power

level." Ex. 1010, 185, 96 (which also describes the transmission of this continuous signal in the test mode). The channel parameters (e.g., carrier frequency, modulation rate, and power level) are obtained from the TLV-Encoded Information for the Channel in the TST-REQ message and are defined in Table 8-22 (reproduced below). Ex. 1010, 185-186.

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.

709. As shown from the above table, each of the above parameters must be included in the Test Request message having a Mode equal to 1. Ex. 1010, 185-186. In addition to these parameters, there are further parameters in the MAC Management Message Header of the Test Request message. As shown in Figure 8-14 (below), the MAC Management Message Header includes numerous

parameters (referred to as “fields”), such as a destination address (DA), source address (SA), etc.. Ex. 1010, 132-135.

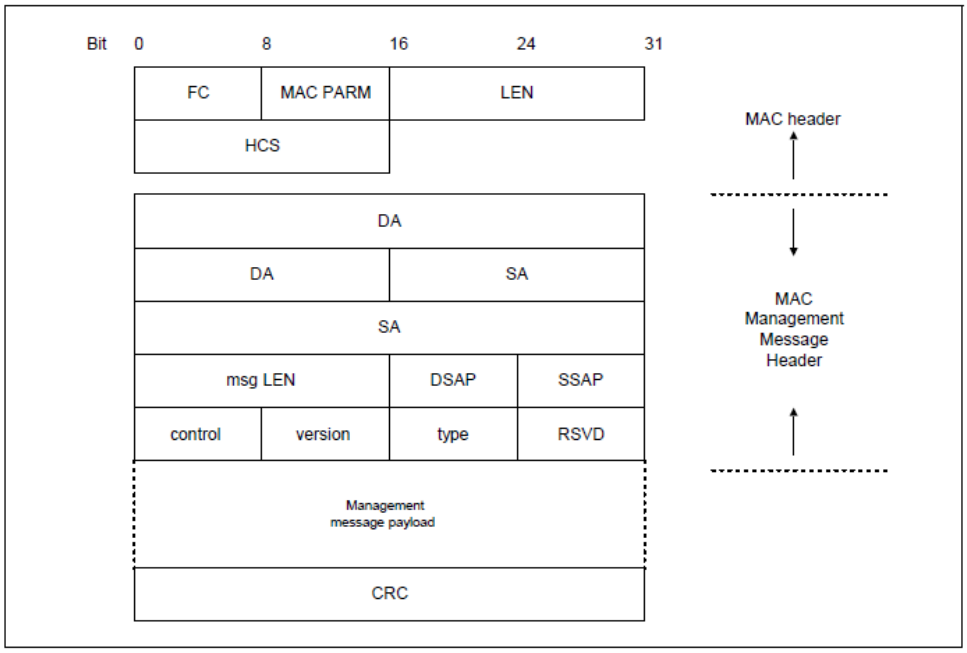


Figure 8-14 MAC Header and MAC Management Message Header Fields

710. Thus, the Test Request message, collectively from its three different portions (i.e., MAC Management Message Header, Mode, and TLV-Encoded Information for the Channel), specifies a plurality of parameters that meets the claimed “first plurality of parameters.” Moreover, the plurality of parameters (in particular, the carrier frequency, modulation rate, and power level) of the Test Request message are used for forming the continuous (non-bursted) upstream signal (the claimed “physical layer probe”). Ex. 1010, 185 (“CM MUST begin the test mode indicated in the Mode parameter, using the channel parameters included in the TST-REQ message”). Therefore, the plurality of parameters of the Test

Request message "specif[ies] a first plurality of probe parameters for a physical layer probe," as claimed.

711. The continuous (non-bursted) upstream signal is the claimed "physical layer probe" at least because it is configured using physical layer parameters, such as the modulation rate from the Test Request message as explained above. Ex. 1010, 24 ("The data-over-cable system, configured with at least one set of defined physical-layer parameters (e.g., modulation, forward error correction, modulation rate, etc.) from the range of configuration settings described in this specification…"), 140-142 (upstream physical-layer burst attributes of UCD message). A POSITA would have also understood that the upstream signal is a "physical layer probe" because it is used to test the timing of communications on the physical layer. Ex. 1010, 185 ("The CM tracks the downstream symbol clock and uses it to generate the upstream symbol clock as in normal synchronous operation."), 186 (parameters for M/N ratio to use for timing determination).

712. In addition, the plurality of parameters of the Test Request message includes the Mode parameter which specifies the continuous (non-bursted) upstream signal that is to be sent and therefore specifies a payload for the continuous (non-bursted) upstream signal (the claimed "wherein the first plurality of parameters comprising at least a payload content for the probe"). Ex. 1010, 185. The content payload is also specified because the upstream signal sent as the test

response signal would include the information field that was included in the Test Request message (this would include the non-header parameters (i.e., Mode and channel parameters). See Section XII.H.1.c (section regarding limitation [1B] which discusses the test response message from ISO8802-2).

713. As I explained above in this section and with respect to limitation [1A], the Test Request message includes the modulation rate parameter. Ex. 1010, 137, 141; see Section XII.H.1.b. This parameter indicates a modulation profile for the continuous (non-bursted), unmodulated (CW) upstream signal (the claimed "probe") that is sent as a test response. Ex. 1010, 17 (definition of modulation rate), 185. A POSITA would have understood that the modulation rate parameter indicates "a modulation profile" because it dictates how the upstream signal is to be modulated. In other words, it provides a characteristic of the modulation for the upstream signal (test response) transmitted upstream to the CMTS. Therefore, the Test Request message includes a plurality of parameters "comprising…a modulation profile for the probe," as claimed.

714. In conclusion, DOCSIS 2.0 teaches a CMTS on a cable network , the CMTS comprising a processor and computer executable program code embodied on a CMTS's internal memory, the code configured to transmit the Test Request message to the CM, on the cable network, the Test Request message specifying a plurality of parameters for the physical layer upstream signal (test response),

wherein the plurality of parameters comprises at least a part of the payload of the upstream signal and a modulation rate for the upstream signal. This teaches "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" in limitation [17A]. Thus, DOCSIS 2.0's test procedure teaches limitation [17A].

c) [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 computer readable medium, the second executable program code configured to:"

715. As I explained above, the CM in DOCSIS corresponds to the claimed "second node." The CM is also on the cable network and therefore teaches the "second node on the communications network," as claimed. Ex. 1010, 29, FIG. 5-3. Further, a POSITA would have understood that the CM 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 CM,

which is the same as the CMTS and is also shown in Figure 5-1 (reproduced below). Ex. 1010, 27.

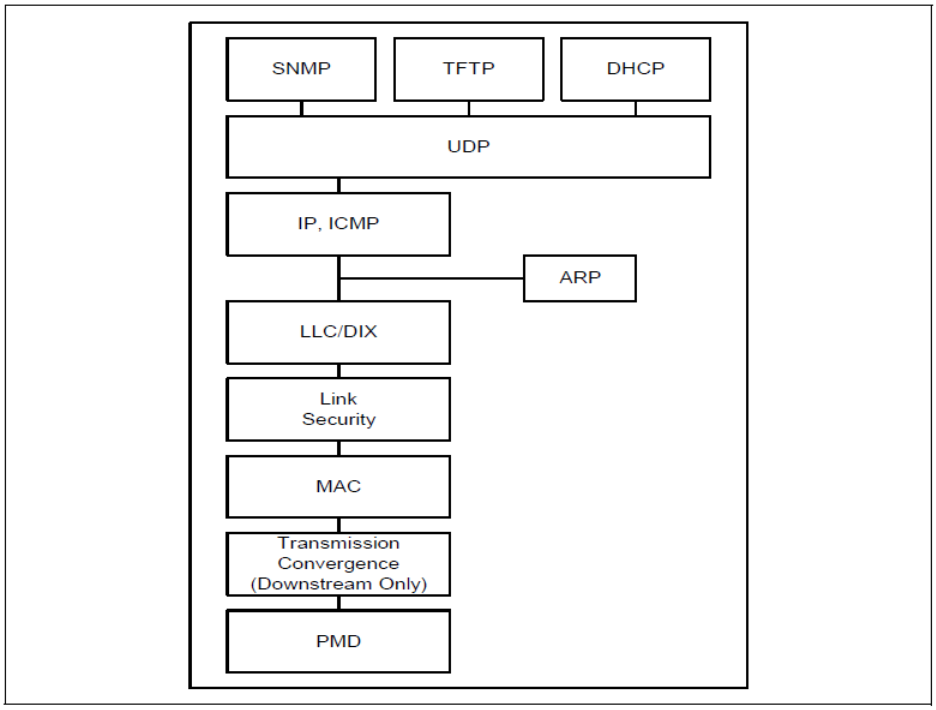


Figure 5-1 Protocol Stack on the RF Interface

716. A POSITA would have understood that the computer executable program code would have been configured to carry out the various procedures/functions (e.g., ranging procedure and test procedure) of the various layers in the stack. A typical implementation of the CM would have been to use a processor for executing code stored on internal memory of the CM. It would not have been practical to use circuitry alone to implement the CM protocol stack. Indeed, DOCSIS 2.0 indicates the existence of the "processor" and "software" in a CM when discussing what to do with an Extended Header (EHDR) field. Ex. 1010, 118 ("Initial implementations SHOULD pass this field to the processor.

This will allow future software upgrades to take advantage of this capability."), 125 ("A compliant CMTS & CM MUST support extended headers.").

717. In any event, a POSITA would have found it obvious to implement the CM in this manner. A POSITA would have been motivated to implement it this way because processors and memory are readily available and programming such processors would have been within the POSITA's skill set. A POSITA would have also been motivated to carry out this implementation because it is cost effective as it would have been cheaper and less time consuming to write a program and store it on memory for a processor to execute than it would have been to build a system from hardware components alone.

718. In conclusion, DOCSIS 2.0 teaches the CM on the cable network, the CM comprising its own processor and computer executable program code embodied on the CM's internal memory, the code configured to cause the CM to carry out the ranging procedure and test procedure, which include the functions described below in limitations [17C]-[17F]. This teaches "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 computer readable medium, the second executable program code configured to: [perform the functions in limitations [17C]-[17F]" in limitation [17B]. Thus, DOCSIS 2.0 teaches limitation [17B].

d) [17C]: "receive the probe request;"

719. **Ranging Procedure:** As I explained above with respect to independent claims 1 and 9, DOCSIS 2.0 teaches that the CM receives the UCD message. Ex. 1010, 135-143, 243-246. The UCD message in DOCSIS 2.0 corresponds to the claimed "probe request" because it includes a ranging required parameter that triggers the Ranging Request message to perform ranging which is performed to establish the correct timing so the CM and CMTS can communicate. Ex. 1010, 136-139, 197. Thus, DOCSIS 2.0's ranging procedure teaches limitation [17C].

720. **Test Procedure:** As I explained above with respect to independent claims 1 and 9, DOCSIS 2.0 teaches that the CM receives the Test Request message (TST-REQ). Ex. 1010, 28, 184-185. The Test Request message in DOCSIS 2.0 corresponds to the claimed "probe request" because it is used to trigger the upstream signal to test the timing of communications on the physical layer. Ex. 1010, 185 ("The CM tracks the downstream symbol clock and uses it to generate the upstream symbol clock as in normal synchronous operation."), 186 (parameters for M/N ratio to use for timing determination). Thus, DOCSIS 2.0's test procedure teaches limitation [17C].

e) [17D]: "determine a second plurality of parameters associated with generation and transmission of the probe;"

721. **Ranging Procedure:** As I explained above with respect to independent claims 1 and 9, DOCSIS 2.0 teaches that the CM determines a plurality of parameters (e.g., MAC Management Message Header parameters, the SID parameter, the Downstream Channel ID parameter, and the Pending Till Complete parameter) associated with generation and transmission of the Ranging Request message. Ex. 1010, 139, 146-147. Thus, DOCSIS 2.0's ranging procedure teaches limitation [17D].

722. **Test Procedure:** As I explained above with respect to independent claims 1 and 9, DOCSIS 2.0 teaches that the CM determines a plurality of PDU parameters (e.g., DSAP, SSAP, control, and information parameters) associated with generation and transmission of the upstream signal. Ex. 1010, 28; Ex. 1011, 39, 53. Thus, DOCSIS 2.0's test procedure teaches limitation [17D].

f) [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"

723. **Ranging Procedure:** As I explained above with respect to independent claims 1 and 9, DOCSIS 2.0 teaches that the CM generates the Ranging Request message (the claimed "probe") in accordance with the parameters in the UCD message (the claimed "first plurality of parameters") and the

parameters determined for the Ranging Request message (the claimed "second plurality of parameters"). Ex. 1010, 139, 147. Further, because the modulation rate and frequency parameters from the UCD message are used for the modulation rate and center frequency of the Ranging Request message (the claimed "probe"), at least those parameters dictate the form of the Ranging Request message. Ex. 1010, 137. Thus, DOCSIS 2.0's ranging procedure teaches limitation [17E].

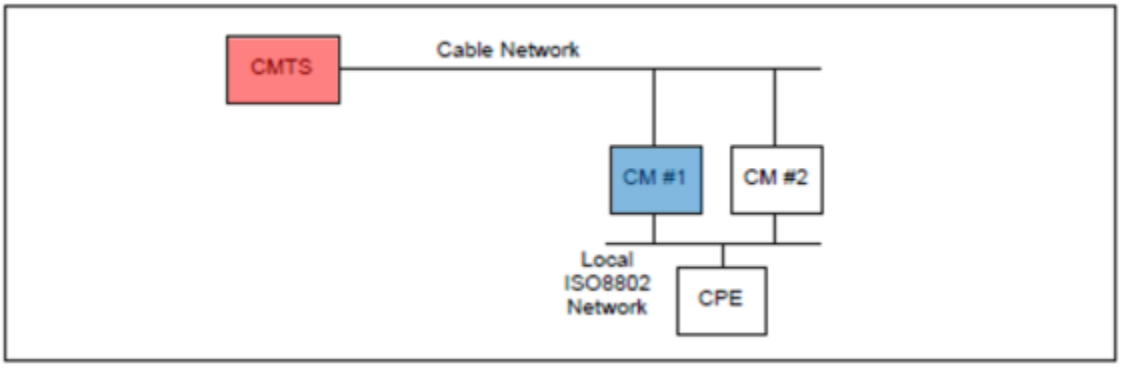
724. **Test Procedure:** As I explained above with respect to independent claims 1 and 9, DOCSIS 2.0 teaches that the CM generates the upstream signal (the claimed "probe") in accordance with the parameters in the Test Request message (the claimed "first plurality of parameters") and the PDU parameters determined for the upstream signal (the claimed "second plurality of parameters"). Ex. 1010, 28, 185-186; Ex. 1011, 39, 53. Further, because the parameters from the Test Request message are used for the modulation rate, carrier frequency, and power level of the upstream signal (the claimed "probe"), those parameters dictate the form of the upstream signal. Ex. 1010, 185-186. Thus, DOCSIS 2.0's test procedure teaches limitation [17E].

g) [17F]: "transmit the probe to the first node."

725. **Ranging Procedure:** As I explained above with respect to independent claims 1 and 9, DOCSIS 2.0 teaches that the CM transmits the Ranging Request message (the claimed "probe") to the CMTS (the claimed "first

node") on the upstream channel identified by the UCD message in response to receiving the UCD message that requires ranging. Ex. 1010, 146-147, 197-198, 246-247. Thus, DOCSIS 2.0's ranging procedure teaches limitation [17F].

726. **Test Procedure:** As I explained above with respect to independent claims 1 and 9, DOCSIS 2.0 teaches that the CM (the claimed "second node") transmits the continuous (non-bursted) upstream signal (the claimed "probe"). Ex. 1010, 185. A POSITA would have understood that the CMTS (the claimed "first node") is upstream from the CM as shown in Figure 5-3 of DOCSIS 2.0 (below) and would receive this upstream signal. Ex. 1010, 29, FIG. 5-3. Therefore, the upstream signal is transmitted to the CMTS.



727. Further, ISO8802-2 states that "[t]he LLC sends a TEST response PDU using the SSAP address of the TEST command PDU as the DSAP address of the TEST response PDU, and with an individual or null SSAP address selected by the DSAP address of the TEST command PDU." Ex. 1011, 53. This means that the CM (which has the LLC component being mentioned) will take the source

address from the Test Request message it receives and use it as the destination address for the upstream signal. And, because the source address of the Test Request message is the address of the CMTS that sent the Test Request message, the upstream signal will be sent to the CMTS.

728. In conclusion, DOCSIS 2.0 and ISO8802-2 teach transmitting the continuous (non-bursted) upstream signal from the CM to the CMTS. This teaches the claimed "transmit the probe to the first node" in limitation [17F]. Thus, DOCSIS 2.0's test procedure along with ISO8802-2 teaches limitation [17F].

6. Dependent Claim 18: "The system of claim 17, wherein the probe request is configured such that the probe emulates an OFDMA transmission."

729. Claim 18 of the '690 patent depends from claim 17, which is taught by the combination of DOCSIS 2.0's ranging procedure and Zuckerman and the combination of DOCSIS 2.0's test procedure with ISO8802-2 and Zuckerman, as discussed above. Claim 18 further requires that "the probe request is configured such that the probe emulates an OFDMA transmission." Ex. 1001, claim 18. DOCSIS 2.0 does not teach using OFDMA, so it does not teach claim 18. However, it would have been obvious to use OFDMA in the system taught by DOCSIS 2.0 at least in view of Zuckerman. Claim 18 is the same as claim 10, except for its dependency. Thus, the combination of DOCSIS 2.0's ranging procedure and Zuckerman and the combination of DOCSIS 2.0's test procedure

with ISO8802-2 and Zuckerman teach claim 18 for the same reasons they teach claim 10.

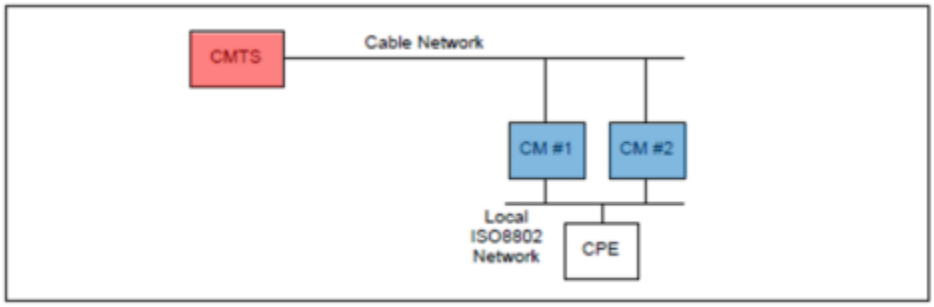
7. Dependent Claim 19

a) [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,"

730. Claim 19 of the '690 patent depends from claim 17, which is taught by the combination of DOCSIS 2.0's ranging procedure and Zuckerman and the combination of DOCSIS 2.0's test procedure with ISO8802-2 and Zuckerman, as discussed above. Claim 19 is similar to claim 11 in that it adds a second instance of sending a probe request and receiving a probe to the first instance in independent claim 9 and the feature of using OFDMA. It also adds the concept of transmitting two probes "simultaneously." Although DOCSIS 2.0 does not use OFDMA and does not expressly disclose this "simultaneously" feature, in my opinion a POSITA would have understood that DOCSIS 2.0's ranging procedure in view of Zuckerman and DOCSIS 2.0's test procedure in view of ISO8802-2 and Zuckerman teach these features as explained below.

731. **Ranging Procedure:** As I explained above with respect to limitation [17A], DOCSIS 2.0 describes the CMTS (the claimed "first node) having program code configured to transmit a UCD message (the claimed "probe request") to a CM

#1 (the claimed "second node" in limitation [9A]) on the cable network. Ex. 1010, 243-246; Section XII.I.5.b. With respect to Figure 5-3 of DOCSIS 2.0 (reproduced below), a POSITA would have understood that the program code of the same CMTS is also configured to transmit another UCD message (the claimed "second probe request") to a CM #2 (the claimed "third node") on the cable network. Ex. 1010, 135-136 ("A separate [UCD] message MUST be transmitted for each logical upstream that is currently available for use."), 243-246.



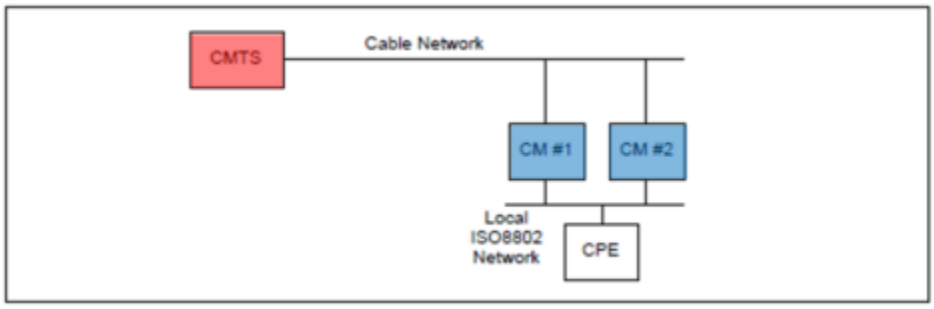
732. This additional UCD message to the CM #2 would have included a plurality of parameters (the claimed "third first plurality of probe parameters"), such as a modulation rate parameter, frequency parameter, etc., similar to how the UCD message sent to the CM #1 included a plurality of parameters. Ex. 1010, 136 (Figure 8-16), 137-143 (Table 8-18). Further, these parameters are for a second physical layer probe at least because they include the Ranging Required parameter to cause another Ranging Request message to be transmitted. Ex. 1010, 137-139. This additional Ranging Request message is the claimed "second physical layer probe" at least because it is configured using physical layer parameters, such as the

modulation rate from the UCD message as explained above. Ex. 1010, 24 ("The data-over-cable system, configured with at least one set of defined physical-layer parameters (e.g., modulation, forward error correction, modulation rate, etc.) from the range of configuration settings described in this specification…"), 140-142 (upstream physical-layer burst attributes of UCD message).

733. In conclusion, DOCSIS 2.0 teaches the code on the CMTS being configured to transmit another UCD message (in addition to the UCD message described for limitation [17A]) to CM #2 (different from CM #1) on the cable network, wherein this additional UCD message specifies its own plurality of parameters for another physical layer Ranging Request message (in addition to the Ranging Request message described for limitation [17A]). This teaches "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" in limitation [19A]. Thus, DOCSIS 2.0's ranging procedure teaches limitation [19A].

734. **Test Procedure:** As I explained above with respect to limitation [17A], DOCSIS 2.0 describes the CMTS (the claimed "first node) having program code configured to transmit a Test Request message (the claimed "probe request") to a CM #1 (the claimed "second node" in limitation [9A]) on the cable network.

Ex. 1010, 184-185; Section XII.I.5.b. With respect to Figure 5-3 of DOCSIS 2.0 (reproduced below), a POSITA would have understood that the same CMTS would have been commanded to transmit another Test Request message (the claimed "second probe request") to a CM #2 (the claimed "third node") on the cable network in order to test that CM as well. Ex. 1010, 184-185.



735. This additional Test Request message to the CM #2 would have included a plurality of parameters (the claimed "third first plurality of probe parameters"), such as a modulation rate parameter, carrier frequency parameter, power level, etc., similar to how the Test Request message sent to the CM #1 included a plurality of parameters. Ex. 1010, 185-186. Further, these parameters are for a second physical layer probe at least because the additional Test Request causes an additional upstream signal to be transmitted according to them. Ex. 1010, 184-185. This additional upstream signal is the claimed "second physical layer probe" at least because it is configured using physical layer parameters, such as the modulation rate from the Test Request message as explained above. Ex. 1010, 24 ("The data-over-cable system, configured with at least one set of defined

physical-layer parameters (e.g., modulation, forward error correction, modulation rate, etc.) from the range of configuration settings described in this specification…"), 140-142 (upstream physical-layer burst attributes of UCD message). A POSITA would have also understood that the upstream signal is a "physical layer probe" because it is used to test the timing of communications on the physical layer. Ex. 1010, 185 ("The CM tracks the downstream symbol clock and uses it to generate the upstream symbol clock as in normal synchronous operation."), 186 (parameters for M/N ratio to use for timing determination).

736. In conclusion, DOCSIS 2.0 teaches the code on the CMTS being configured to transmit another Test Request message (in addition to the Test Request message described for limitation [17A]) to CM #2 (different from CM #1) on the cable network, wherein this additional Test Request message specifies its own plurality of parameters for another physical layer upstream signal (in addition to the upstream signal described for limitation [17A]). This teaches "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" in limitation [19A]. Thus, DOCSIS 2.0's test procedure teaches limitation [19A].

b) [19B]: "the third plurality of probe parameters comprising a second payload content for the second probe and a second modulation profile for the probe, the second probe request further specifying a different second plurality of parameters associated with the generation and transmission of the second probe; and"

737. Limitation [19B] is directed to a similar concept that is in the remaining part of limitation [17A], but relates to the second probe request and second probe. Limitation [19B] is taught for the same reasons given above with respect to limitation [17A]. *See* Section XII.I.5.b.

738. **Ranging Procedure:** Specifically, the plurality of parameters in the additional UCD message to the CM #2 comprises a payload content for the additional Ranging Request message to be sent back from the CM #2 and another modulation rate for the additional Ranging Request message. This teaches "the third plurality of probe parameters comprising a second payload content for the second probe and a second modulation profile for the probe" in limitation [19B]. Thus, DOCSIS 2.0's ranging procedure teaches limitation [19B].

739. **Test Procedure:** Specifically, the plurality of parameters in the additional Test Request message to the CM #2 comprises a payload content for the additional upstream test response signal to be sent back from the CM #2 and another modulation rate for the additional upstream test response signal. This teaches "the third plurality of probe parameters comprising a second payload

content for the second probe and a second modulation profile for the probe" in limitation [19B]. Thus, DOCSIS 2.0's test procedure teaches limitation [19B].

c) [19C]: "the second probe request further specifying a different second plurality of parameters associated with the generation and transmission of the second probe; and"

740. First, this claim limitation does not specify how "a different second plurality of parameters" differs from the "third first plurality of probe parameters" in limitation [19A]. But, as explained above, any one UCD message or Test Request message has numerous parameters for generating a Ranging Request or upstream signal, respectively, so any two groups of those parameters teaches the "different second plurality of parameters" and "third first plurality of probe parameters" required in claim 19.

741. **Ranging Procedure:** With respect to the rest of limitation [19C], DOCSIS 2.0's ranging procedure teaches limitation [19C] for similar reasons that it teaches limitations [1A], [9A], [17A], and [19A]. See Sections XII.H.1.b, XII.H.5.b, XII.I.5.b, XII.I.7.a. Specifically, the additional UCD message sent to the CM #2 further specifies a different plurality of parameters associated with the generation and transmission of the additional Ranging Request message to be sent back from the CM #2. This teaches "the second probe request further specifying a different second plurality of parameters associated with the generation and

transmission of the second probe" in limitation [19C]. Thus, DOCSIS 2.0's ranging procedure teaches limitation [19C].

742. **Test Procedure:** With respect to the rest of limitation [19C], DOCSIS 2.0's test procedure teaches limitation [19C] for similar reasons that it teaches limitations [1A], [9A], [17A], and [19A]. See Sections XII.H.1.b, XII.H.5.b, XII.I.5.b, XII.I.7.a. Specifically, the additional Test Request message sent to the CM #2 further specifies a different plurality of parameters associated with the generation and transmission of the additional upstream test response signal to be sent back from the CM #2. This teaches "the second probe request further specifying a different second plurality of parameters associated with the generation and transmission of the second probe" in limitation [19C]. Thus, DOCSIS 2.0's test procedure teaches limitation [19C].

d) [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"

743. Limitation [19D] is similar to limitations [17B]-[17F], except that it is with respect to the third node instead of the second node. See Sections XII.I.5.c-g.

744. **Ranging Procedure:** DOCSIS 2.0 teaches limitation [19D] for the similar reasons it teaches limitations [17B]-[17F], because the CM #2 would have been configured in the same manner (using a processor and code on a computer readable medium) to perform the same steps that the CM #1 performed to generate an additional Ranging Request message that is transmitted back to the CMTS on the cable network. Thus, DOCSIS 2.0's ranging procedure teaches limitation [19D].

745. **Test Procedure:** DOCSIS 2.0 teaches limitation [19D] for the similar reasons it teaches limitations [17B]-[17F], because the CM #2 would have been configured in the same manner (using a processor and code on a computer readable medium) to perform the same steps that the CM #1 performed to generate an additional upstream test response signal that is transmitted back to the CMTS on the cable network. Thus, DOCSIS 2.0's test procedure teaches limitation [19D].

e) [19E]: "wherein the first probe and second probe are transmitted simultaneously using OFDMA."

746. Limitation [19E] is the same as limitation [11C]. *See* Section XII.I.3.d. Thus, DOCSIS 2.0's ranging procedure in view of Zuckerman and DOCSIS 2.0's test procedure in view of ISO8802-2 and Zuckerman teach limitation 19[E] for the same reasons they teach limitation [11C].

8. Dependent Claim 22: "The system of claim 17, wherein the probe request is generated by the first node."

747. Claim 22 of the '690 patent depends from claim 17, which is taught by the combination of DOCSIS 2.0's ranging procedure and Zuckerman and the combination of DOCSIS 2.0's test procedure with ISO8802-2 and Zuckerman, as discussed above. Claim 22 further requires that "the probe request is generated by the first node." Ex. 1001, claim 22. DOCSIS 2.0's ranging procedure and the combination of DOCSIS 2.0's test procedure with ISO8802-2 also teaches this feature. Claim 22 is the same as claim 6, but the "second node" is referred to as the "first node" because independent claim 17 is written from the perspective of the node that sends the probe request and receives the probe response. As such, the first node in claims 17 and 22 corresponds to the second node in claims 1 and 6, while the second node in claims 17 and 22 corresponds to the first node in claims 1 and 6. Thus, the combination of DOCSIS 2.0's ranging procedure and Zuckerman and the combination of DOCSIS 2.0's test procedure with ISO8802-2 and Zuckerman teach claim 22 for the same reasons they teach claim 6, except that the CMTS of DOCSIS 2.0 corresponds to the "first node" of claim 22.

9. Dependent Claim 23: "The system of claim 17, wherein the probe request is configured to diagnose a network problem."

748. Claim 23 of the '690 patent depends from claim 17, which is taught by the combination of DOCSIS 2.0's ranging procedure and Zuckerman and the

combination of DOCSIS 2.0's test procedure with ISO8802-2 and Zuckerman, as discussed above. Claim 23 further requires that "probe request is configured to diagnose a network problem." Ex. 1001, claim 23. DOCSIS 2.0's ranging procedure and the combination of DOCSIS 2.0's test procedure with ISO8802-2 also teach this feature. Claim 23 is the same as claim 15, except for its dependency. Thus, the combination of DOCSIS 2.0's ranging procedure and Zuckerman and the combination of DOCSIS 2.0's test procedure with ISO8802-2 and Zuckerman teach claim 23 for the same reasons they teach claim 15.

10. Dependent Claim 24: "The system of claim 23, wherein the probe request is generated by a network operator and uploaded to the first node."

749. Claim 24 of the '690 patent depends from claim 23, which is taught by the combination of DOCSIS 2.0's ranging procedure and Zuckerman and the combination of DOCSIS 2.0's test procedure with ISO8802-2 and Zuckerman, as discussed above. Claim 24 further requires that "probe request is generated by a network operator and uploaded to the first node." Ex. 1001, claim 24. In my opinion, DOCSIS 2.0's ranging procedure in view of Zuckerman and DOCSIS 2.0's test procedure in view of ISO8802-2 and Zuckerman teach this feature. Claim 24 is the same as claim 16 (and similar to claim 8), except for its dependency. Thus, DOCSIS 2.0's ranging procedure in view of Zuckerman and

DOCSIS 2.0's test procedure in view of ISO8802-2 and Zuckerman teach claim 24 for the same reasons they teach claim 16.

XIII. EVIDENCE OF NON-OBVIOUSNESS

750. It is my understanding that in order for evidence of non-obviousness or secondary considerations to be relevant, there must be a nexus between the claimed invention and the evidence. I am not aware of any evidence of non-obviousness or secondary considerations.

XIV. CONCLUSION

751. All of the statements made in this declaration of my own knowledge are true. All statements made based on information and belief are believed to be true. Further, these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under § 1001 of Title 18 of the United States Code.

Date: 2-15-2024

James G. Bertonis

Appendix A

PROFESSIONAL EXPERIENCE

2009 to Present — **Azure Communications Inc.**
CEO

Azurecomm designs and develops wireless broadband solutions and advanced radio communications technology. The company has deep technical experience over the vast array of wireless protocols, devices, and systems employed across the RF and microwave frequency spectrum. Participation in the IEEE 802.11, 802.15, and 802.16 standards. Azurecomm has a proven track record having developed and sold broadband wireless equipment in use by major broadband service providers worldwide. The company is currently developing wireless designs and systems for new 5G, and IoT applications.

2003 to 2008 — **Arcwave Inc.**
Chief Technical Officer

Arcwave was created by the merger of Advanced Radio Cells Inc., and CoWave Networks. Managed all technology and product development efforts of the company. Architected and led the design team for the evolution of a DOCSIS based broadband wireless system originally for Wireless ISP's, to address the requirements of cable system operators (MSOs) to provide broadband wireless extension to their cable plants. This product strategy created a new market segment, and enabled Arcwave in one year to become the recognized industry leader in wireless solutions for the cable industry.

2000 to 2003 — **Advanced Radio Cells Incorporated (ARCi)**
CEO and Founder

Lead the company from inception to over $1 million in sales and raised over $7 million in corporate and venture capital investment. Assembled the management team, developed corporate partners and key customer relationships. Performed successfully in a difficult business environment to adapt plans to reflect changing market and financial conditions. Successfully drove the merger of ARCi with CoWave Networks in March 2003.

ARCi developed and brought to market a high performance broadband wireless delivery system operating in the license-free 5.3, and 5.8 GHz frequency bands. ARCi concentrated its development effort on RF system engineering, and adapting the DOCSIS cable modem standard for wireless Internet capability, creating wireless DOCSIS. This leveraged solution enabled ISPs to deliver profitable wireless broadband service to communities, providing affordable high-speed wireless Internet delivery. ARCi has a wireless ISP and Telco installed system customer base, serving both business and residential users.

1986 to 2000 **ADBS CORPORATION**
CEO

Wireless consulting firm specializing in design and engineering of Wireless LAN, WAN, Satellite, Cellular handset design, and base stations. Technology includes 802.16/WiMAX, 802.11/Wi-Fi, CDMA, DOCSIS, DBS, VSATs, OFDM, Spread Spectrum, FSK, MSK, QPSK to 256QAM modulation. Patent analysis, assessment and litigation support including James Bertonis testifying as a wireless technology expert in several litigations.

1981 to 1984 **TELECOM INDUSTRIES CORPORATION**
CEO/Co-founder

Manufacturer of satellite communications products and a pioneer in the home satellite TV industry. Innovative products included the first 4 GHz integrated low noise satellite down-converter, an award winning TVRO receiver design, and a portable collapsible dish antenna. Lead company through product development, manufacturing start-up, sales development, and corporate financing. Company was sold to its largest customer.

1978 to 1980 **NATIONAL SEMICONDUCTOR CORPORATION**
Design Engineer/Project Manager, Module Products Group

Developed specialized analog and RF functional circuit modules for high volume production in consumer, cable television, and industrial product applications. Managed project design, customer engineering, and the release to manufacturing.

1976 to 1978 **BLONDER-TONGUE LABORATORIES, INC.**
RF Design Engineer, Advanced Cable Products Division

On the development team for the world's first broadcast wireless Cable-TV system, deployed from transmitters located on the World Trade Center tower, providing pay television throughout the New York metropolitan area. Responsible for RF and video circuit design for descrambling systems, modulators, and set-top box development.

EXPERT WITNESS AND LITIGATION SUPPORT EXPERIENCE

Case:	**Motorola Solutions v. Hytera Communications**
Matter:	Trade Secret theft
Court:	United States District Court, N. Illinois, Case No. 1:17 CV-1973
Project:	Technical expert - Analysis and report on scope of development for digital two-way radio product engineering, impact of stolen trade secrets on the cost, timeline.
Date:	2019
Client:	Kirkland and Ellis LLP; Justin Singh, Attorney for Motorola

Case:	**Apple Inc. v. Nokia**
Matter:	Patent Litigation (US and EU)
Court:	United States Patent and Trademark Office, and European Patent Office
Project:	Technical expert for Inter Partes Review (IPR) challenging validity of multi-mode cellphone receiver patent. Client reached global settlement before filing of IPR.
Date:	2017
Client:	Ropes and Gray LLP; Carolyn Redding, Attorney for Apple

Case:	**Provident - Pomona Properties v. SolSource**
Matter:	Service Contract Litigation
Court:	California Superior Court, Los Angeles, Case No. KC068239
Project:	Performed on site performance testing of campus Wi-Fi network; Prepared report categorizing wireless system architecture and user upstream/downstream data rate
Date:	2016
Client:	Manly, Stewart & Finaldi, Attorneys for plaintiffs

Case:	**Comcast Cable v. British Telecom**
Matter:	Patent infringement and invalidity
Court:	U.S. District Court, Delaware, Case No. 1:11-cv-00843-SLR
Project:	Expert for DOCSIS, OpenCable standards, related patents and technology
Date:	2012
Client:	Keker & Van Nest, Attorneys for plaintiff

Case:	**Chavarria v. Trabert**
Matter:	Personal injury civil lawsuit
Court:	California Superior Court, Santa Clara County, San Jose, CA
Project:	Testified at jury trial regarding design and maintenance of electrical equipment.
Date:	2010
Client:	Fernando V. Hernandez, Attorney for plaintiff

Case:	**Intel Corp. v. Wi-LAN Inc.**
Matter:	Patent infringement and invalidity
Court:	Federal District Court, Northern California, Case No. 5:08-CV-04555
Project:	Non-testimonial expert for WiMAX patents and broadband wireless technology
Date:	2008 - 2009
Client:	Kirkland & Ellis LLP, Attorneys for Intel

Case: **Malikyar v. Sramek**
Matter: Federal wiretapping statute, civil jury trial
Court: Federal District Court, Northern California District, San Francisco, CA
Project: Expert witness for wireless telephone wiretapping communications equipment. Testified in Federal District Court; provided research for plaintiff's attorney.
Date: 2009

Case: **Rembrandt v. Cox Communications**
Matter: Patent infringement matter
Court: Federal
Project: Non-testimonial expert in DOCSIS broadband technology and patent analysis.
Date: 2008
Client: Kilpatrick Stockton LLP, Atlanta, for defendants

Case: **Huff v. Andrew Corporation**
Matter: Patent and business valuation dispute
Court: California Superior Court, Santa Clara County
Project: Testimonial expert witness regarding broadband and VSAT satellite technology. Testified, provided research, and assisted questioning of opposing experts.
Date: 2005
Client: Bergeson LLP co-w/Gardner, Carton & Douglas for Andrew Corp., defendants.

Case: **CSIRO v. Netgear Inc.**
Matter: Patent infringement matter
Court: United States District Court, Northern District, San Jose, California
Project: Expert consultant regarding 802.11a, 802.11g, 802.11n and OFDM technology
Date: 2005
Client: Wilson, Sonsini, Goodrich & Rosati (Palo Alto) for Netgear, defendants

Case: **Research in Motion v. 3Com/US Robotics Corp.**
Matter: Product defect, product development contract dispute
Court: American Arbitration Association, New York
Project: Testimonial expert witness on wireless modem products and technology; provided technical research, prepared reports, and assisted questioning of opposing experts.
Date: 1998
Client: Barrett, Gravante & Stern, for 3Com

Case: **Network Services Corp. v. Buckner Inc.**
Matter: Product defect, product development contract dispute
Court: American Arbitration Association, San Francisco
Project: Testimonial expert witness on low cost two-way RF pager technology; Provided research, testified at arbitration; assisted questioning opposing experts.
Date: 1998
Client: Kimble MacMichael & Upton, for Buckner, defendants

Case:	**L3 Communications et al v. Titan Comm. et al.**
Matter:	Product defect litigation
Court:	Arbitration, San Diego, CA
Project:	Testimonial expert witness on VSAT satellite technology
Date:	1998
Client:	Popelka Allard, for L3

Case:	**Life Point et al. v. Cargill, Voyager Technologies et al**
Matter:	Patent infringement, trade secret misappropriation
Court:	United States District Court, San Jose
Project:	Testimonial expert witness on security system using 802.11 technology
Date:	1995 - 2000 inclusive
Client:	Cooley Godward, for Voyager Technologies, defendant

EDUCATION

BSEE, Syracuse University, Syracuse, NY, May 1976

MBA, Santa Clara University, Santa Clara, CA, June 1986

PUBLICATIONS

Bertonis, James, and Wilson, Eric "High Speed Wireless Internet over Unlicensed Radio Bands - An Innovative Approach"
Private Wireless & Broadband Magazine, June 2000

Bertonis, James, "Scorecard Tracks PCS Technical Standards"
Electrical Engineering Times, October 21, 1996

Bertonis, James G., "Overview of 3G Personal Communications Technology" *IC Expo Applications Conference on Communications Technology - Proceedings,* October 1996

AFFILIATIONS AND MEDIA

Board of Directors, Momentum for Health, Santa Clara Valley nonprofit provider of health services offering treatment for adults, teens and families in the community with health issues.

Property Tax Advisory Board, Los Gatos-Saratoga Union High School District

Science and Technology Instructor, USA Prepares, nationally syndicated radio show.

PATENTS

Apparatus and Method for High-Speed Wireless Upstream Data Transmission Using CATV Compatible Modems
6,625,222 Issued Sept. 2003

Apparatus and Method for Extending DOCSIS Cable Modem Service Over Wireless Links
7,596,798 Issued Sept. 2009

Apparatus and Method for Extending a Cable Modem Data Service Over Wireless Links
7,840,989 Issued Nov. 2010

Apparatus and Method for Extending a Cable Modem Data Service Over Wireless Links
7,917,931 Issued Mar. 2011

Appendix B

LIST OF EXHIBITS REVIEWED

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")

Appendix C

CLAIM LISTING APPENDIX

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

Designation	Claim Language
Claim 1	
[1PRE]	1. 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	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]	3. 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	4. The method of claim 3, wherein the probe request identifies a hidden node.
Claim 5	

Designation	Claim Language
5	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	6. The method of claim 1, wherein the probe request is generated by the second node.
Claim 7	
7	7. The method of claim 1, wherein the probe request requests a probe that assists in diagnosing a network problem.
Claim 8	
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]	9. 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	10. The method of claim 9, wherein the probe request is configured such that the probe emulates an OFDMA transmission.
Claim 11	
[11PRE]	11. 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]	12. 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	13. The method of claim 12, wherein the probe request is configured such that the probe identifies a hidden node.
Claim 14	
14	14. The method of claim 9, wherein the probe request is transmitted at a specific time.
Claim 15	
15	15. The method of claim 9, wherein the probe request is configured to diagnose a network problem.
Claim 16	
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]	17. 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 computer readable medium, the second executable program code configured to:
[17C]	receive the probe request;

Designation	Claim Language
[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	18. The system of claim 17, wherein the probe request is configured such that the probe emulates an OFDMA transmission.
Claim 19	
[19A]	19. 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	
[20PRE]	20. 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;

Designation	Claim Language
[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	21. The system of claim 20, wherein the probe request is configured such that the probe identifies a hidden node.
Claim 22	
22	22. The system of claim 17, wherein the probe request is generated by the first node.
Claim 23	
23	23. The system of claim 17, wherein the probe request is configured to diagnose a network problem.
Claim 24	
24	24. The system of claim 23, wherein the probe request is generated by a network operator and uploaded to the first node.