

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. 8,223,775
Filing Date: September 30, 2003
Issue Date: July 17, 2012
TITLE: ARCHITECTURE FOR A FLEXIBLE AND HIGH-PERFORMANCE
GATEWAY CABLE MODEM

Inter Partes Review No.: IPR2024-00446

DECLARATION OF SAYFE KIAEI

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

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I, Sayfe Kiaei, 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 regarding certain matters pertaining to U.S. Patent No. 8,223,775 (“the ’775 Patent”) (Ex. 1001) and the unpatentability grounds set forth in the Petition for this proceeding. My experience with networking and communication systems, cable modems, and content delivery systems provides me with an understanding of the subject matter described and claimed in the ’775 Patent.

3. I am being compensated at my usual consulting rate or testimony rate of \$685 per hour. 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 party or in the outcome of this proceeding.

II. PROFESSIONAL BACKGROUND AND QUALIFICATIONS

A. Qualifications

4. A full description of my educational background, professional achievements, qualifications, and publications in the past 30+ years are set forth

more fully in my curriculum vitae, which is attached to this Declaration as Exhibit (Ex. 1003). Here, I provide a brief summary of my background and qualifications.

5. I received my Ph.D. in Electrical and Computer Engineering from Washington State University in 1987. My dissertation research areas were in signal processing, communication system and networks. I have several patents and over 200 journal and international conference publications. I have graduated over 100 MS and PhD students working under my supervision on their thesis, and many of them are professors in academia or have senior positions in industry. My research is funded by various sources, including industry and federal agencies, such as NSF, USAID, DARPA, JPL, and NASA.

6. Since 2001, I have held the position of Motorola¹ Endowed Chair Professor in communication and RF systems at the School of Electrical, Computer, and Energy Engineering at Arizona State University (“Arizona State”) in Tempe, Arizona.

¹ This position refers to a historical endowment established in 1998 for supporting communication, manufacturing, and supply chain programs at Arizona State. The objective of this endowment was to strengthen Arizona State’s capabilities in these technologies. Three other Arizona State professors have this endowment title in manufacturing, communication, and supply management. I do not receive any funding from Motorola and have not since I joined Arizona State.

7. I am also the Director of the National Science Foundation Center, Connection One. Connection One is a research center focused on developing wireless communication system and networking technologies.

8. I have been involved in research, teaching, and developing products in the areas of communications, networking, wireless systems, satellite systems, analog and digital circuits, linear and switching power management integrated circuits (PMIC), sensors, electronics, and related areas for the last 30 years.

9. From 1987 to 1993, I was an assistant and tenured associate professor at Oregon State University (“Oregon State”).

10. From 1997 to 2002, I was also an adjunct professor at the University of Texas at Austin.

11. At Oregon State, the University of Texas, and Arizona State, I taught courses in the areas of communication systems; wireline systems, wireless systems; networks; systems and circuits; digital integrated circuits, including HDL, Verilog, and VHDL; digital signal processing; and related areas.

12. At Arizona State, I also developed a new course on wireless transceiver systems. I have been doing research in the wireline and wireless communication and transceiver design. I joined Arizona State in 2001. My research has been funded by the National Science Foundation, DOD, DARPA, and industry in the wireless communication system.

13. In industry and academia, I worked on wireline communication including DSL, MODEMS, CABLE MODEM, DOCIS, and other wireline system. I have also been working on wireless communications since 1990 on 1G, 2G-5G, SATCOM, Networking, WiFi, and wireless sensors since

14. I have been involved in research, teaching, and developing products in the areas of communication system, DSL, Cable MODEM, T1/E1, LAN, WAN, 2-way radios, Land-Mobile radio systems, cellular systems, GPS, location, RF Integrated circuits, Analog and Digital Integrated Circuits, HDL, Verilog, VHD, communications, digital signal processing, and related areas for the last 30 years starting with the first generation of mobile phones.

15. I have also worked on second generation (2G) and third generation (3G) mobile phone technologies including GSM, EDGE, IS-95, 1X CDMA, UMTS, Wide band CDMA, GPS, Bluetooth, and related areas. These terms all refer to leading mobile phone standards and technologies, which enjoyed widespread use in mobile telephone networks throughout the world. I have also worked on other wireless data communication technologies including Bluetooth, the global positioning system (GPS), Wireless local area networks (LAN) (often known as WiFi), and related areas.

16. I have written and reviewed software code in HDL, Assembly, C, C++, DSP code, and MATLAB for processors. I have written, debugged, and reviewed

software code for DSL, embedded microprocessors, and processors used for both wireline and wireless transceivers at Motorola, ASU, and as an expert witness.

17. From 1993-2002, I worked at Motorola and worked at the Land-mobile products Sector (LMPS), wirelines transceivers, and Wireless integrated Technology Center.

18. At Motorola LMPS, and cellular group, I was responsible for the design and development of system, architecture, DSP, analog, and RF integrated circuits for 1G (AMPS, Digital AMPS), 2-way radios, 2G (GSM, EDGE), and 3G (CDMA, WCDMA / UMTS, CDMA2000) transceiver. The products were Motorola flip phone, Razor, iDEN, etc. At LMPS, I worked in the Land-Mobile Products Sector (LMPS) and cellular group. I have designed and contributed to the design of many communications wireless systems including 2-way radios, trucking systems, 2-way radios, land-mobile products, satellite communications, cellular systems, GPS and Bluetooth.

19. I also worked on the interaction of the Iridium satellite system with the cellular and LAN system networking.

20. At Motorola Telecomm group, I worked on a single chip DSL transceiver "COPPERGOLD", Cable modem transceiver (DOCIS I and II) and other wireline systems. I represented Motorola and regularly attended many standards

including ITU (International Telecommunication Unit), ETSI (European Telecommunications Standards Institute), and other standards as a technical expert.

21. I have over 200 journal and conference publications, 9 patents (and applications), and standards contributions. Several of these patents and publications are in the areas of communications, networking and radio systems. At Oregon State, UT, and Arizona State, I taught courses and researched in the areas of communication system, cellular system, land-mobile communication system, analog and digital integrated circuits, power management integrated circuits (PMIC), communication systems; radio frequency (“RF”) systems and circuits; (“RFID”); magnetic and electronic sensors; including HDL, Verilog, and VHDL; digital signal processing; and related areas. The list of my publications is included in my resume in Ex. 1003. *See* Ex. 1003, pp. 10-22.

22. I have been an active member of IEEE communication, radio frequency, and networking societies since 1985 and have published, organized sessions, and been on various IEEE committees. I am an IEEE Fellow, which is the highest level of IEEE membership awarded by the IEEE directors to recognize a high level of demonstrated extraordinary accomplishments. The IEEE Fellow Award is a special recognition for members with extraordinary accomplishments in the IEEE technical fields. To ensure that the recognition is extraordinary, the total number of recipients each year cannot exceed 0.1% of the total higher grade

membership. The IEEE is the Institute of Electrical and Electronics Engineers, the world's largest association of technical professionals whose objectives include the educational and technical advancement of electrical and electronic engineering, telecommunications, computer engineering, and related disciplines.

23. I am a member of the IEEE Circuits and Systems Society, IEEE Solid State Circuits Society, IEEE Signal Processing Society, and IEEE Communication Society. I am also a member of the IEEE RF and Microwave committees, IEEE Low Power Symposium Committee, and IEEE Fellow Selection Committee. I was one of the key organizers establishing the IEEE Radio Frequency Integrated Circuits (RFIC) symposium in 1995, and I have been on the executive and technical committees of RFIC for the last 16 years.

24. I have received several awards including the Carter Best Teacher Award, the IEEE Darlington Award (which is given for the best technical paper on circuits and systems in the IEEE Circuits and Systems Society), and the Motorola 10X Rapid Design Cycle Reduction Award.

25. I have a general understanding of the U.S. patent prosecution process and of the novelty and non-obviousness requirements for patentability.

26. I believe that my extensive industry experience and educational background qualify me as an expert in the relevant field of implementation of cable modems within network-based content delivery systems. 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 filing of the '775 Patent, which I (as I discuss below) understand is late 2003.

III. MATERIALS CONSIDERED

27. In formulating my opinion, I reviewed and considered U.S. Pat. No. 8,223,775.

28. In preparing this declaration, I also reviewed and considered the Petition and the file history (Ex. 1004) of the '775 Patent (Ex. 1001) as well as the following references:

- Ex. 1005: U.S. Pub. No. 2002/0006137 (“Rabenko”)
- Ex. 1006: U.S. Pub. No. 2004/0004974 (“Gaspar”)
- Ex. 1007: U.S. Pub. No. 2002/0091861 (“Kim”)
- Ex. 1008: Harry Newton, *Newton’s Telecom Dictionary*, (CMP Books, 18th ed. Feb. 2002)
- Ex. 1009: U.S. Pub. No. 2004/0125754 (“Johnson”)
- Ex. 1010: U.S. Pub. No. 2002/0065935 (“Koperda”)
- Ex. 1011: Entropic Communications, LLC v. Charter Communications, Inc., No. 2:22-cv-00125-JRG (E.D. Tex. June 26, 2023) (Claim Construction Memorandum Opinion and Order)
- Ex. 1012: U.S. Pub. No. 2002/0078249 (“Lu”)

- Ex. 1013: U.S. Pub. No. 2002/0012343 (“Holloway”)
- Ex. 1014: Andrew S. Tanenbaum, *Computer Networks*, (4th ed. 2003).
- Ex. 1015: U.S. Pub. No. 2002/0138678 (“Kim ’678”)
- Ex. 1016: U.S. Pub. No. 2004/0019765 (“Klein”)

IV. UNDERSTANDING OF APPLICABLE LEGAL STANDARDS

29. 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.

30. I understand that, in this *inter partes* review (IPR), Petitioner is challenging the patentability of the claims of the ’775 Patent. I understand that Petitioner has the burden of proving that each challenged claim is unpatentable by a preponderance of the evidence.

31. 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.

32. 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.

33. 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.

34. 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.

35. 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 or method 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.

36. 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.

37. 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.

38. 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.

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

40. In my opinion, the relevant field of art for the '775 Patent is a cable modem system having a functionally partitioned and flexible architecture. Ex. 1001, 1:8-9.

41. 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 September 30, 2003.

42. 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.

43. It is my opinion that, for the '775 Patent, a person of ordinary skill in the art (a "POSITA") at the time of the alleged invention would have had at least a degree in computer or electrical engineering, computer science, information systems, or a similar discipline, along with three-to-four years of experience with the design and/or implementation of cable modems within network-based content delivery systems. Additional education may substitute for professional experience, and significant work experience may substitute for formal education.

44. 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 '775 Patent (*i.e.*, September 30, 2003). Therefore, I am familiar with the knowledge and skills that would have been possessed by a hypothetical person of ordinary skill in the art

at the time of the alleged invention. In addition, I believe that my extensive industry experience and educational background qualify me as an expert in the relevant field.

45. In this Declaration, wherever I refer to a POSITA, it should be understood that I am referring to a hypothetical person at the time of the alleged invention of the '775 Patent (*i.e.*, September 30, 2003) meeting the description I have provided in this section.

VI. CLAIM CONSTRUCTION

46. I understand that my analysis requires an understanding of the scope of the claims of the '755 Patent. I understand that claim terms subject to *inter partes* review, absent some other definition provided in the patent, are given their ordinary meaning to a person of ordinary skill in the art in light of the patent specification. Therefore, in my analyses given below, I have assumed that all claim terms are given their ordinary interpretation as would have been understood by a POSITA reading the patent specification as of the priority date.

47. It is my understanding that in a Civil Action in the District Court for the Eastern District of Texas, the U.S. District Judge issued the following constructions of the claims terms of the '775 Patent:

<u>Term</u>	<u>Construction</u>
"the cable modem engine configured to enable upgrades to its software in a	Plain and Ordinary Meaning (Ex. 1011, p. 7)

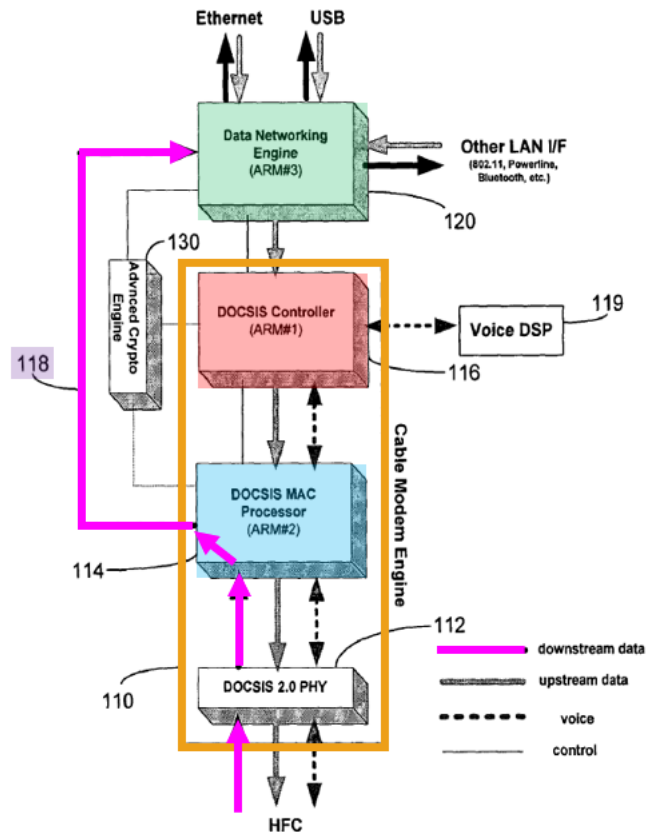
manner that is independent of upgrades to the software of the data networking engine” of Ex. 1001, claim 18	
“downstream PDU packets” of Ex. 1001, claim 18	Plain and Ordinary Meaning (Ex. 1011, p. 7)
“a data networking engine implemented in a first circuit that includes at least one processor” of Ex. 1001, claim 18	“plain meaning” (Ex. 1011, p. 12)
“a cable modem engine implemented in a second circuit that includes at least one processor” of Ex. 1001, claim 18	“plain meaning” (Ex. 1011, p. 12)
“data bus” of Ex. 1001, claim 18	“plain meaning” (Ex. 1011, p. 13)
“wherein the cable modem functions performed by the cable modem engine are completely partitioned from the home networking functions performed by the data networking engine” of Ex. 1001, claim 18	“wherein the cable modem engine and the data networking engine are not necessarily physically separate but are functionally separate such that the cable modem functions are performed only by the cable modem engine and the home networking functions are performed only by the data networking engine.” (Ex. 1011, p. 17)

“DOCSIS functions” of Ex. 1001, claim 19	“plain meaning” (Ex. 1011, p. 20)
“DOCSIS MAC Processor” of Ex. 1001, claim 18	“plain meaning” (Ex. 1011, p. 25)
“DOCSIS controller” of Ex. 1001, claim 18	“plain meaning” (Ex. 1011, p. 25)

VII. OVERVIEW OF THE '775 PATENT

A. '775 Patent

48. The '775 Patent relates to the architecture for gateway cable modem system 100. Ex. 1001, 1:7-9, Fig. 1. Figure 1, reproduced below, is a block diagram of a gateway cable modem architecture. Ex. 1001, 2:42-43. The cable modem system includes a cable modem engine 110 (**orange**) and a data networking engine (**green**). Ex. 1001, Fig. 1. The cable modem engine 110 includes a DOCSIS MAC processor 114 (**blue**) and a DOCSIS controller 116 (**red**). Ex. 1001, Fig. 1. The DOCSIS MAC processor 114 exchanges data and voice data with an external source (not shown) via a DOCSIS PHY layer 112. Ex. 1001, 2:49-3:11, Fig. 1.



Ex. 1001, Fig. 1 (annotated)

49. The DOCSIS controller 116 (**red**) implements VoIP functionality (e.g., PacketCable). Ex. 1001, 3:21-48. The DOCSIS MAC processor 114 (**blue**) implements MAC functions and all processing of downstream PDU (protocol data unit) packets (**light purple** arrows). To increase downstream throughput, processed PDU packets are forwarded directly to data networking engine 120 (**green**) along path 118 (**purple**), bypassing the DOCSIS controller 116 (**red**). Ex. 1001, 3:1-20.

B. Prosecution History

50. The application that issued as the '775 Patent, U.S. Application No. 10/675,566, was filed on September 30, 2003. Ex. 1004, pp. 2-23.

51. In an Office Action dated February 19, 2009, claims 1-15 were rejected under 35 U.S.C. 102 as anticipated by US 2001/0039600 to Brooks et al. ("Brooks") Ex. 1004, pp. 52-58.

52. In response to the Office Action of February 19, 2009, the Applicant amended independent claim 1 as follows:

1. (Currently Amended) A cable modem system comprising:

a data networking engine implemented in a first circuit that includes at least one processor, the data networking engine programmed with software that when executed by the at least one processor of the first circuit causes the data networking engine to perform that performs home data networking functions including interfacing with customer provided equipment; and

a cable modem engine implemented in a second circuit that includes at least one processor, the second circuit being separate from the first circuit, the cable modem engine programmed with software that when executed by the at least one processor of the second circuit causes the cable mode engine to perform that performs all other cable modem functions other than the home networking functions performed by the data networking engine, the cable modem engine configured to enable upgrades to its software in a manner that is independent of upgrades to the software of the data networking engine; and

a data bus that connects the data networking engine to the cable modem engine, wherein the cable modem functions performed by the cable modem engine are being completely partitioned from the home networking functions performed by the data networking engine.

Ex. 1004, p. 67. Further, the Applicant made the following statements:

(*see, e.g.*, claims 5-14). Applicant submits that the '600 reference does not teach a separate data networking engine (as claimed) that implements certain functionality in a manner that is completely partitioned/decoupled from the functionality performed by processors 102 and 104 of cable modem device 100. Specifically, the '600 reference teaches that the home-networking functionality is implemented by the same processors that implement the DOCSIS and VoIP functionality, instead of implementing these functionalities in a partitioned manner in separate engines, as claimed. Thus, the cited portions of the '600 reference do not correspond to the claimed invention.

Ex. 1004, p. 71.

53. A requirement for restriction/election was issued on September 3, 2009, restricting the claims as follows:

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-11 and 16, drawn to computer software upgrading, classified in class 717, subclass 168.
- II. Claims 12-15, drawn to network protocol implementation, classified in class 709, subclass 230.

Ex. 1004, p. 78. In response, the Applicant elected Group I, with traverse, and argued that the restriction was improper and should be withdrawn. Ex. 1004, p. 88.

54. A Final Office Action issued on February 5, 2010, withdrawing the restriction requirement and rejecting all of claims 1-16 as anticipated by Brooks. Ex. 1004, pp. 93-102.

55. In response to the Final Office Action, the Applicant amended claim 1 to correct a typographical error and traversed the art rejections. Ex. 1004, pp. 109-

116. In the Response, the Applicant states the following while discussing the applied prior art:

Figure 2 of the '600 reference discloses only two processors, each of which, therefore, must correspond to the claimed data-networking and cable-modem engines. However, the discussion of Figure 2 makes clear that the cable modem functions are performed by CMAC unit 224 (*see, e.g.*, paragraph 0042). Therefore, in order for the cable modem engine to contain a processor and perform the CMAC functions as claimed, the cited cable modem engine must include circuitry to connect the processors with the CMAC unit. Because available connecting circuitry would be shared with the other processor, Applicant is uncertain how the asserted cable modem engine and home networking engine can be completely partitioned as claimed.

Ex. 1004, pp. 114-115.

56. An Advisory Action of May 11, 2010, maintained the anticipation rejection of the Final Office Action. Ex. 1004, pp. 127-129.

57. The Applicant filed a Request for Continued Examination and the following amendments to claim 1:

1. (Currently amended) A cable modem system comprising:

- a data networking engine implemented in a first circuit that includes at least one processor, the data networking engine programmed with software that when executed by the at least one processor of the first circuit causes the data networking engine to perform home networking functions including interfacing with customer provided equipment;
- a cable modem engine implemented in a second circuit that includes at least one processor, the second circuit being separate from the first circuit, the cable modem engine programmed with software that when executed by the at least one processor of the second circuit causes the cable modem engine to perform cable modem functions other than the home networking functions performed by the data networking engine, the cable modem functions including interfacing with cable media, and the cable modem engine configured to enable upgrades to its software in a manner that is independent of upgrades to the software of the data networking engine; and
- a data bus that connects the data networking engine to the cable modem engine,

wherein the cable modem functions performed by the cable modem engine are completely partitioned from the home networking functions performed by the data networking engine.

Ex. 1004, pp. 131-133. The Applicant also made the following statements:

Therefore, from the Examiner's position that "the data networking engine and cable modem engines are represented in figures 1 and 2" . . . , it would follow that one of the two processors corresponded to the networking engine, and the other of the two processors corresponded to the cable modem engine. It was further pointed out that while the discussion concerning Figure 2 in Brooks '600 paragraph 0042 makes clear that cable modem functions are performed by CMAC unit 224, if the cable modem engine is to contain a processor and perform CMAC functions as claimed, the cited cable modem engine must include circuitry to connect one of the processors with the CMAC unit. **It was noted, however, that because available connecting circuitry would be shared by both the one processor and the other processor, the asserted**

**cable modem engine and home networking engine
could not be completely partitioned as claimed.**

Ex. 1004, pp. 137-138 (emphasis added). The Applicant further stated that:

The Examiner's apparent designation of the first processor 102 in Brooks '600 as the "data networking engine," and the second processor 104 and the CMAC/CPHY block (114, 118, 224, and 228) as the "cable modem engine," further does not square with the claim 1 feature that "the cable modem functions performed by the cable modem engine are completely partitioned from the home networking functions performed by the data networking engine," and the claim 15 feature of "partitioning the data networking engine from the cable modem engine so that the data and home networking functionality is completely decoupled from the DOCSIS and VOIP functionality." This is because CMAC/CPHY block (114, 118, 224, and 228) communicates with both the processors 102 and 104 by sharing the same data paths and sharing the same direct memory access controller.

Ex. 1004, p. 139.

58. A Non-Final Office Action issued on September 2, 2011, rejecting claims 1-6 and 8-16 as obvious. Ex. 1004, pp. 149-158. The Office Action indicated that dependent claim would be allowable if rewritten in independent form including all limitations of the base claim and any intervening claims.

59. In response to the Office Action of September 2, 2011, the Applicant amended the claims. Ex. 1004, pp. 171-177. The Applicant canceled claims 1 and 5 and amended claim 7 to be independent and recite:

7. **(Currently Amended)** A cable modem system ~~comprising: as claimed in claim 5,~~
a data networking engine implemented in a first circuit that includes at least one processor, the data networking engine programmed with software that when executed by the at least one processor of the first circuit causes the data networking engine to perform home networking functions including interfacing with customer provided equipment, wherein the at least one processor is a RISC processor;
a cable modem engine implemented in a second circuit that includes at least one processor, the second circuit being separate from the first circuit, the cable modem engine including a DOCSIS PHY layer, a DOCSIS controller, and a DOCSIS controller and programmed with software that when executed by the at least one processor of the second circuit causes the cable modem engine to perform cable modem functions other than the home networking functions performed by the data networking engine, the cable modem functions including interfacing with cable media, the cable modem engine configured to enable upgrades to its software in a manner that is independent of upgrades to the software of the data networking engine; and
a data bus that connects the data networking engine to the cable modem engine, wherein the cable modem functions performed by the cable modem engine are completely partitioned from the home networking functions performed by the data networking engine;
wherein the DOCSIS MAC processor is configured to process downstream PDU packets and forward the processed packets directly to the data networking engine without the involvement of the DOCSIS controller in order to boost downstream throughput.

Ex. 1004, pp. 171-172. The Applicant also filed the following new claims 17 and 20:

17. **(New)** A method of cable modem operation comprising:
executing, via at least one processor of a first circuit that implements a data networking engine, first software that causes the data networking engine to perform home networking functions including interfacing with customer provided equipment, wherein the at least one processor is a RISC processor;
executing, via one or more processors of a second circuit that implements a cable modem engine programmed with second software, the second software to cause the cable modem engine to perform cable modem functions other than the home networking functions performed by the data networking engine, the cable modem

functions including interfacing with cable media, the cable modem engine configured to enable upgrades to its software in a manner that is independent of upgrades to the software of the data networking engine, wherein the second circuit is separate from the first circuit, and wherein the cable modem engine includes a DOCSIS PHY layer, a DOCSIS controller and a DOCSIS controller;

connecting, via a data bus, the data networking engine to the cable modem engine, wherein the cable modem functions performed by the cable modem engine are completely partitioned from the home networking functions performed by the data networking engine;

processing, via the DOCSIS MAC processor, downstream PDU packets and forwarding the processed packets directly to the data networking engine without the involvement of the DOCSIS controller in order to boost downstream throughput.

Ex. 1004, pp. 174-175.

20. **(New)** A cable modem system comprising:

a data networking engine implemented in a first circuit that includes at least one processor, the data networking engine programmed with software that when executed by the at least one processor of the first circuit causes the data networking engine to perform home networking functions including interfacing with customer provided equipment;

a cable modem engine implemented in a second circuit that includes at least one processor, the second circuit being separate from the first circuit, the cable modem engine programmed with software that when executed by the at least one processor of the second circuit causes the cable modem engine to perform cable modem functions other than the home networking functions performed by the data networking engine, the cable modem functions including interfacing with cable media, and the cable modem engine configured to enable upgrades to its software in a manner that is independent of upgrades to the software of the data networking engine, the cable modem engine including a DOCSIS controller and a DOCSIS MAC processor, the DOCSIS MAC processor configured to process downstream PDU packets and forward the processed packets directly to the data networking engine without the involvement of the DOCSIS controller in order to boost downstream throughput; and

a data bus that connects the data networking engine to the cable modem engine, wherein the cable modem functions performed by the cable modem engine are completely partitioned from the home networking functions performed by the data networking engine.

Ex. 1004, p. 176.

60. A Notice of Allowance issued on June 19, 2012, allowing claims 2-4 and 6-22. Ex. 1004, pp. 185-189. The '775 Patent issued on July 17, 2012. Ex. 1004, p. 207.

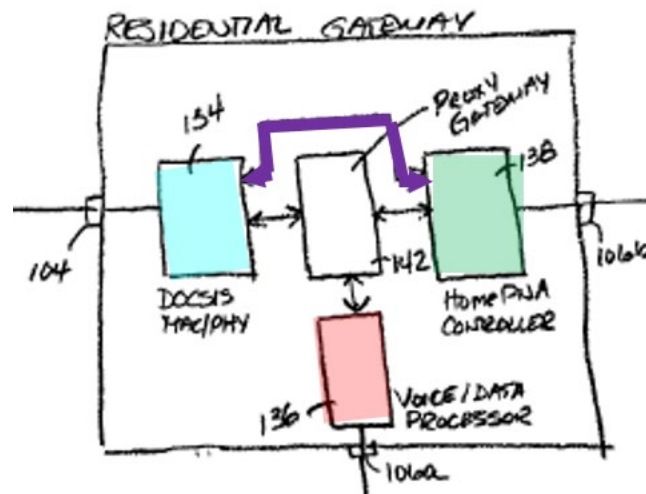
VIII. OVERVIEW OF THE PRIOR ART

A. Rabenko

61. Rabenko (Ex. 1005), U.S. Published Application 2002/0006137, published on January 17, 2002 and claims priority to and incorporates by reference U.S. Provisional Applications 60/203,057 and 60/214,932. Ex. 1005, cover, [0001]. It is my understanding that Rabenko is prior art to the '775 Patent under pre-AIA 35 U.S.C. § 102(b) because Rabenko published at least a year before the earliest priority date of the '775 Patent (September 30, 2003). Rabenko was not considered during prosecution of the '775 Patent. Ex. 1001, cover.

62. Rabenko describes a communication system with a gateway configured to exchange voice and data packets over a telephone line. Ex. 1005, Abstract, [0004]-[0006]. The gateway includes a DOCSIS MAC/PHY 134 (blue), a proxy gateway 142 and voice/data processor 136 (red), and a HomePNA controller 138 (green). DOCSIS MAC/PHY 134 translates the format for all arriving packets from DOCSIS to an internal format. *Id.*, [0044]. If the packet payload is data, DOCSIS MAC/PHY 134 routes, shown by purple, a packet directly to HomePNA controller 138, bypassing both proxy gateway 142 and voice/data processor 136 (similar to the

bypassing of DOCSIS controller in the '775 Patent). *Id.*, [0045]. HomePNA controller 138, like the data networking engine 120 of the '775 Patent, performs home networking functions. *Id.* If the packet payload is voice, DOCSIS MAC/PHY 134 routes the packet to proxy gateway 142. Proxy gateway 142 and voice/data processor 136 process voice packets. *Id.*, [0044]-[0045], [0074], [0082]-[0087], [0139], Fig. 1b.



Ex. 1005, Fig. 1b (excerpted and annotated)

63. Rabenko expands a gateway cable modem by adding HomePNA functions that support HomePNA LAN. The cable modem is used as described by the CableLabs DOCSIS specification and functions as a proxy for voice over IP. Ex. 1005, [0034]-[0035].

64. As described in further detail below, the home networking functions performed by the HomePNA controller 138 are completely partitioned from the cable modem functions performed by the cable modem in the gateway (orange).

Any packet destined for a HomePNA device connected to HomePNA LAN is sent to HomePNA controller 138 which processes and transmits the packet to a media terminal adapter (MTA) 140. Ex. 1005, [0045], Fig. 1b.

B. Gaspar

65. Gaspar (Ex. 1006), U.S. Published Application 2004/0004974, published from U.S. Application No. 10/190,088 which was filed on July 2, 2002. I have been informed that Gaspar is prior art to the '775 Patent under pre-AIA 35 U.S.C. § 102(e) because it published from an application that was filed prior to the earliest priority date of the '775 Patent (September 30, 2003). Gaspar was not considered during prosecution of the '775 Patent. Ex. 1001, cover.

66. Gaspar describes a design for a network controller. Ex. 1006, Abstract. Gaspar's system includes a first controller that includes a physical layer (PHY) configured to be coupled to a data line and a media access control (MAC) configured to be coupled to the PHY. Ex. 1006, [0007].

67. Gaspar describes that its PHY circuit is "partitioned" from its MAC circuit. Ex. 1006, [0007], [0014], [0017], [0022]. In this manner, the MAC can be debugged and/or upgraded independently from the other circuits. Ex. 1006, [0014], [0024]. Gaspar further describes a home telecommunication systems that include a HomePNA controller compliant with the HomePNA specification, and provides background knowledge of well-known features of HomePNA controllers. Ex. 1006,

[0001]-[0008]. Specifically, Gaspar states it was already known in the prior art for a HomePNA controller to “include[] a physical layer (PHY) and a media access control (MAC).” Ex. 1006, [0003]. Gaspar teaches that the MAC 120 of its HomePNA controller “is implemented with a field programmable gate array (FPGA)...[or] with other programmable devices such as a programmable logic device.” Ex. 1006, [0021]. Gaspar’s PHY 122 of the HomePNA controller is “designed with an ASIC” to perform “standard functions,” including “a signal processing function such as a digital signal processor (DSP) function.” Ex. 1006, [0023].

C. Kim

68. Kim (Ex. 1007) is a U.S. Published Application filed May 31, 2001, which published on July 11, 2002. Ex. 1007, cover. I have been informed that Kim is prior art to the ’775 Patent under pre-AIA 35 U.S.C. § 102(b) because it published at least a year before the earliest priority date of the ’775 Patent (September 30, 2003). Kim was not considered during prosecution of the ’775 Patent. Ex. 1001, cover.

69. Kim describes a home-based telecommunications system that includes a residential gateway. Ex. 1007, Abstract, [0001]-[0016]. Kim’s residential gateway includes a HomePNA controller. Ex. 1007, [0026], [0032]-[0042], Fig. 3. Kim teaches that its residential gateway is “modular-type” such that the HomePNA

controller and an ADSL controller are partitioned and can be independently upgraded. Ex. 1007, [0026].

D. Johnson

70. Johnson (Ex. 1009) is a U.S. Published Application filed August 1, 2003, which published on July 1, 2004. Ex. 1009, cover. I have been informed that Johnson is prior art to the '775 Patent under pre-AIA 35 U.S.C. § 102(e) because Johnson published from an application that was filed before the earliest priority date of the '775 Patent. Johnson was not considered during prosecution of the '775 Patent. Ex. 1001, cover.

71. Johnson describes designing and managing a home network that distributes data such as voice and video. Ex. 1009, Abstract, [0002], [0020], [0048]. Johnson teaches a networking device that includes a networking management capability (as defined in the CableHome Specification) and data interfaces that are also CableHome compliant. Ex. 1009, [0032]-[0035], [0062]-[0067], Figs. 10-13.

E. Koperda

72. Koperda (Ex. 1010) is a U.S. Published Application filed February 26, 2001, which published on May 30, 2002. Ex. 1010, cover. I have been informed that Koperda is prior art to the '775 Patent under pre-AIA 35 U.S.C. § 102(e) because it published from an application filed before the earliest priority date of the '775

Patent (September 30, 2003). Koperda was not considered during prosecution of the '775 Patent. Ex. 1001, cover.

73. Koperda describes a home-based telecommunications system that includes a residential gateway that may be configured to perform any of a number of different functions. Ex. 1010, Abstract, [0003]-[0007], [0023]-[0024]. Koperda's residential gateway is a modular design that allows for any of a variety of different network access technologies, home network technologies, and network services to be implemented in one or more modules. Ex. 1010, [0023]-[0025]. In particular, Koperda provides a non-exhaustive list "of the network technologies categories that could be provided by modules in the gateway system." 1010, [0025], Table 1.

TABLE 1

Network interfaces	Home interfaces	Wireless modules	Misc. modules
DOCSIS	Ethernet	IEEE 802.11a	power
ADSL	HomePNA	IEEE 802.11b	Security
ADSLite	Bluetooth	HomeRF	Firewall/ Router
T1	Homepower	HiperLAN II	VPN
T3	2-Line POTs	900 MHz cordless phone	Standby power
SDSL	4-Line POTs	2.4 GHz cordless phone	NAT/DHCP
ISDN	Security Panel Monitoring		Softswitch PBX functions
V.90 (56K) modem	Utility Monitoring		
HDTV Tuner	Multi-port Ethernet Hub		
VDSL	Cordless Telephony		
FDDI	Camcorder Video (HAVI - IEEE 1394)		

Ex. 1010, Table 1 (annotated)

F. Lu

74. Lu (Ex. 1012) published on June 20, 2002, from a U.S. Application filed on December 15, 2000. Ex. 1012, cover. It is my understanding that Lu is prior art to the '775 Patent under pre-AIA 35 U.S.C. § 102(b) because it published at least a year prior to the earliest priority date of the '775 Patent (September 30, 2003). Lu was not considered during prosecution of the '775 Patent. Ex. 1001, cover.

75. Lu describes methods, systems, and apparatuses for managing data flow over an OSI type layered network including PHY and MAC layers. Ex. 1012, Abstract, [0005], [0006], [0037], [0038], [0044], [0048], [0050], [0124], [0125]. Particularly, Lu describes a MAC layer in communication with a PHY layer. Ex. 1012, [0037], [0038]. Lu explicitly describes using its architecture for HomePNA (HPNA) 1.0 and 2.0. Ex. 1012, [0035], [0044], [0050], [0051], [0078], [0081], [0082], [0129], [0130]. Lu describes four example implementations of its MAC architecture configurations. Ex. 1012, [0124]-[0128]. In one such example, Lu describes that its soft MAC is implemented in a dedicated RISC machine 2602. Ex. 1012, [0125], Fig. 23.

G. Kim '678

76. Kim '678 (Ex. 1015) is a U.S. Published Application filed January 31, 2001, which published on September 26, 2002. Ex. 1015, cover. It is my understanding that Kim '678 is prior art to the '775 Patent under pre-AIA 35 U.S.C.

§ 102(b) because it published at least a year before the earliest priority date of the '775 Patent (September 30, 2003). Kim '678 was not considered during prosecution of the '775 Patent. Ex. 1001, cover.

77. Kim '678 describes that an ARM940-based RISC processor was a commonly known processor for offering high probability that a functional block having bus ownership can perform its operation compared to conventional exclusive bus arbitration schemes. Ex. 1015, [0193].

H. Klein

78. Klein (Ex. 1016) is a U.S. Published Application filed July 23, 2003, which published on January 29, 2004. Ex. 1016, cover. It is my understanding that Klein is prior art to the '775 Patent under 35 U.S.C. § 102(e) because it published from a patent application filed before the earliest priority date of the '775 Patent (September 30, 2003). Klein was not considered during prosecution of the '775 Patent. Ex. 1001, cover.

79. Klein describes that an ARM9TDMI-based RISC processor was a commonly known processor for accommodating digital logic processing functions, such as in Rabenko's DOCSIS MAC, in products that demand the highest levels of performance with small size, low cost, and low power consumption. Ex. 1016, [0008].

IX. OPINIONS WITH RESPECT TO THE '775 PATENT

80. It is my opinion that claims 1-20 of the '775 Patent are invalid at least on the following grounds:

Ground	References	Basis	Claims Challenged
A	Rabenko	§103	1-7, 10, 12, 14-15, 18-20
B	Rabenko in view of Gaspar	§103	1-7, 10, 12, 14-15, 18-20
C	Rabenko in view of Kim	§103	1-7, 10, 12, 14-15, 18-20
D	Rabenko in view of Gaspar and Kim	§103	1-7, 10, 12, 14-15, 18-20
E-H	Each of Grounds A-D + Lu	§103	1-7, 10, 12, 14-15
I-P	Each of Grounds A-H + Klein and Kim '678	§103	12
Q-X	Each of Grounds A-H + Koperda	§103	8
Y-FF	Each of Grounds Q-X + Johnson	§103	9
GG-NN	Each of Grounds A-H + Johnson	§103	11, 13, 16-17

A. Grounds A-P: Claims 1-7, 10, 12, 14-15, and 18-20 are Rendered Obvious

81. As I set forth below, it is my opinion that each of the proposed combinations renders obvious claims 1-7, 10, 12, 14-15, and 18-20².

82. Claims 1 and 18 are both independent system claims. Since claim 18 is broader in scope than claim 1, I will address claims 18-20 before addressing claims 1-7, 10, 12, and 14-15.

1. Independent Claim 18:

a. Limitation [18A]: “A cable modem system comprising:”

83. It is my opinion that, to the extent preamble limitation [18A] is limiting, Rabenko teaches it. As discussed above in Section VIII.A, Rabenko discloses a communication system including a gateway with a cable modem (“a cable modem system”). Ex. 1005, Abstract, [0034]-[0035], Figs. 1b, 2.

84. Therefore, it is my opinion that Rabenko discloses “a cable modem system.”

² The limitations of the claims appear and are labelled in the Claims Listing Appendix.

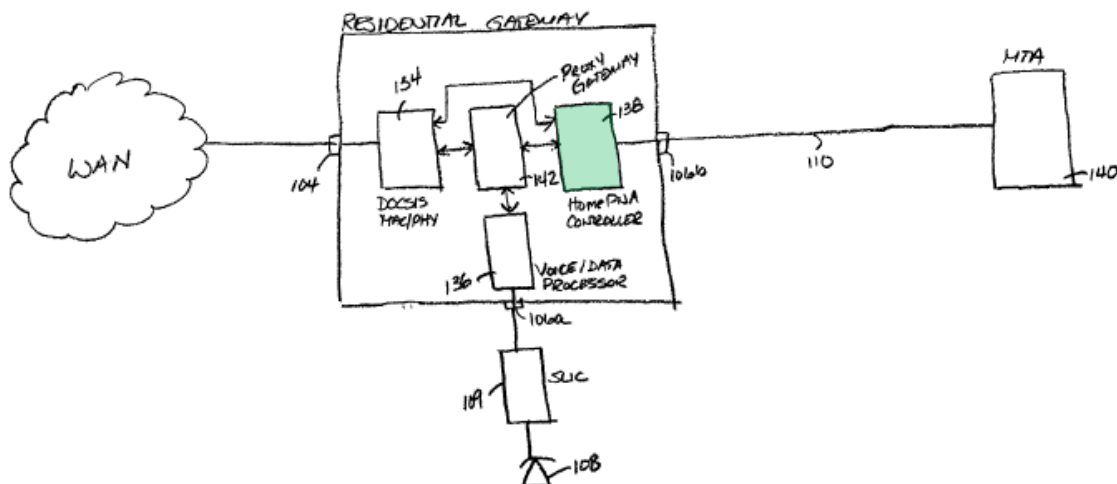
- b. Limitation [18B]: “a data networking engine implemented in a first circuit that includes at least one processor, the data networking engine programmed with software that when executed by the at least one processor of the first circuit causes the data networking engine to perform home networking functions including interfacing with customer provided equipment;”**

85. It is my opinion that the each of the proposed combinations teaches limitation [18B].

86. Rabenko describes that the DOCSIS MAC/PHY 134 can provide an interface with a wide area network (WAN). Ex. 1005, [0044]. Further, all packets are routed through the DOCSIS MAC/PHY 134. Ex. 1005, [0044]. For packets in a downstream direction, the DOCSIS MAC/PHY 134 determines whether a packet is voice or data, and if it is data, the packet is routed directly to the HomePNA controller 138 (part of the claimed “data networking engine”). Ex. 1005, [0045], Fig. 1b.

87. Rabenko describes the HomePNA controller 138 (**green**), which, as I describe more fully below, along with the AFE 226, functions as the claimed “data networking engine.” Ex. 1005, Fig. 1b. Rabenko describes that the HomePNA controller 138 (**green**) can be a fully integrated MAC/PHY device. Ex. 1005, [0080]. Further, the HomePNA controller 138 provides bi-directional communication with (claimed “home networking functions including interfacing with”) customer equipment/devices such as, for example, HomePNA phone 126, computer 128, etc.

(“customer provided equipment”) (e.g., via subscriber port 106b), operating on a HomePNA local area network (LAN) 110. Ex. 1005, [0080]. A POSITA would have understood that providing bi-directional communications between the WAN and HomePNA phone 126 is providing a first “home networking function[] including interfacing with customer provided equipment.” A POSITA would have further understood that providing bi-directional communications between the WAN and computer 128 is a second “home networking function[] including interfacing with customer provided equipment.” Accordingly, it is my opinion that Rabenko describes that the HomePNA controller 138 “perform[s] home networking functions including interfacing with customer provided equipment” as claimed.



Ex. 1005, Fig. 1b (annotated)

88. I note that, outside of the claims, the '775 Patent does not mention “circuits.” Rabenko describes, referring to Figure 2, that HomePNA controller 138

is coupled to an analog front end (AFE) 226. Ex. 1005, [0080], Fig. 2. Further, Rabenko describes, concerning Fig. 11a, that AFE 226 couples the HomePNA controller 138 to the HomePNA LAN 110. Ex. 1005, [0223], [0239], [0253], Fig. 11a. It is my opinion that a POSITA would understand that Rabenko's HomePNA controller 138 and AFE 226 comprise a circuit (claimed "first circuit").

89. It is my opinion that a POSITA would have understood Rabenko's HomePNA controller 138, which can be "a fully integrated MAC/PHY device," to include a processor. Ex. 1005, [0080]. For example, a POSITA would have understood a "processor" as a type of "controller": a component that coordinates, controls, and/or synchronizes operation of one or more devices. Ex. 1008, p. 5. Indeed, the HomePNA controller 138, comprises the hardware and software necessary to execute its processing functions. Ex. 1005, [0268]. For example, Rabenko describes processing functionality performed by HomePNA controller 138 as including "translat[ing] the data packet to a HomePNA packet" in the downstream direction, and further "convert[ing] the HomePNA packet to a[n] internal format," "determin[ing] whether [the] packet payload contains voice or data," and routing the packets accordingly, in the upstream direction. Ex. 1005, [0045]-[0046]. Thus, it is my opinion that a POSITA would have understood Rabenko's HomePNA *controller* 138 would be the same as a "processor" based upon the design choice of a particular implementation ("software") and/or design constraints imposed on an overall

system. Ex. 1005, [0268]. Accordingly, Rabenko describes or renders obvious a HomePNA controller implemented as a processor utilizing software and hardware to perform its functions. Ex. 1005, [0268].

90. Rabenko describes that its components/blocks/modules etc. can be implemented via electronic hardware, computer software, or combinations of both. Ex. 1005, [0268]. Additionally, considering Rabenko's description that HomePNA controller 138 can be "a fully integrated MAC/PHY device," a POSITA would have understood that HomePNA controller 138 would include a processor. Ex. 1005, [0080].

91. Further still, Rabenko teaches that its system implements the HomePNA protocol, which "is described in the HomePNA Specification Version 2.0, the contents of which is expressly incorporated herein by reference as though set forth in full." Ex. 1005, [0034]. It is my opinion that a POSITA would have understood that the HomePNA controller 138, which is compliant with HomePNA Specification Version 2.0, would include a processor to perform functions specified in Rabenko and the incorporated specification.

92. For example, Rabenko states:

A HomePNA controller 138 enables a 4-32 Mbits/sec LAN using existing in home telephone wiring. The HomePNA controller 138 can be a fully integrated MAC/PHY device that provides bi-directional communication with devices such as for example a HomePNA phone, computer etc., operating on a HomPNA[sic] LAN via the

subscriber port 106b of the residential gateway. The HomePNA controller 138 may include DMA channels which are used for fast data communication of processed data to the system memory 214 via the ISB 218. In the described exemplary embodiment, the HomePNA controller 138 includes a digital PHY having a FDQAM/QAM transmitter and receiver coupled to an analog front end (AFE) 226.

Ex. 1005, [0080]. A POSITA would have understood that a standards-compliant HomePNA controller performed standardized functions such as digital signal processing functions, QAM/FDQAM modulation functions, and DAC (Digital Analog Conversion) functions, and that performance of these functions require a processor. *See, e.g.,* Ex. 1007, [0002], [0042] (collectively teaching that a “HomePNA controller with 10 Mbps HomePNA 2.0 function” “receives HomePNA receiving signal from a home network, and performs ADC (Analog Digital Conversion) function, QAM (Quadrature Amplitude Modulation)/FDQAM (Frequency Diverse QAM) demodulation function, IEEE 802.3 CSMA/CD (Carrier Sense Multiple Access with Collision Detection) MAC (Medium Access Control) function, and PCMCIA signal conversion function”). In this way also, Rabenko teaches that the HomePNA controller 138 includes a processor that executes software.

93. Accordingly, it is my opinion that a POSITA would have understood that Rabenko’s HomePNA controller 138 would be implemented in a circuit that

includes a processor and would be programmed with software that, when executed, causes the HomePNA control 138 to perform the functions described above.

94. This understanding of Rabenko is further evidenced by Holloway. Rabenko identifies “[a]n exemplary HomePNA system is disclosed [in] U.S. patent application Ser. No. 09/826,239 (the “’239 Application”). Ex. 1005, 0227. The ’239 Application published as Holloway on January 31, 2002. Ex. 1013, cover. Holloway describes “nodes” which are “[a]ny device that can send and/or receive frames of data with other devices via a communication medium. Ex. 1013, [0105]. Holloway further describes that:

Each node in either type of network has within it a device that permits the node to send and receive data frames in the form of electrical, electromagnetic, or optical signals. The device is conventionally a semiconductor device implementing the PHYSICAL layer of the network connectivity, and the medium access control (MAC) portion of the DATA layer of network connectivity.

Ex. 1013, [0111]. Accordingly, a POSTIA would have understood that Rabenko’s HomePNA controller 138, which can be a fully integrated MAC/PHY device, Ex. 1005, [0080], [0217], could be an example of one of Holloway’s node. Further, Holloway states that these two layers (PHY and MAC):

are typically implemented as a combination of logic and memory storage that is configured to carry out the task of the layer. The logic can be in the form of hardware, software, firmware, or a combination of those. **Each layer may also be implemented using programmable gate array (PGA) technology, such as system programmable gate arrays (SPGA) and field programmable gate arrays (FPGA). Also, each layer,**

or a combination of the layers, may be implemented as an integrated circuit or software program.

Ex. 1013, [0115] (emphasis added). Holloway further describes that its nodes may have within them a “semiconductor device,” such as the Broadcom 4210 controller, to implement the PHY and MAC layer. Ex. 1013, [0116].

95. Therefore, it is my opinion that a POSITA reading Rabenko would have been directed to Holloway, which is explicitly identified in Rabenko. Further, a POSITA would have understood that Rabenko’s HomePNA controller 138 could be an example of one of Holloway’s nodes, and Holloway teaches that its nodes are implemented in circuits that include processors. Therefore, it would have been obvious to a POSITA that Rabenko’s HomePNA controller 138 can be implemented in a circuit that includes at least one processor.

96. Further, it was generally known before the earliest priority date of the ‘775 Patent that standard-compliant HomePNA controllers included a processor, as shown by Gaspar. Like Rabenko, Gaspar is directed to the design of home telecommunication systems that include a HomePNA controller that is compliant with the HomePNA standards. Ex. 1005, Figs. 1a-2, [0003], [0031]-[0047]; Ex. 1006, [0001]-[0008]. Again, like Rabenko (which describes HomePNA controller that can be “a fully integrated MAC/PHY device”), Gaspar describes that a HomePNA controller is known to “include[] a physical layer (PHY) and a media access control (MAC).” Ex. 1006, [0003]; Ex. 1005, [0080].

97. Gaspar teaches that the MAC 120 of its HomePNA controller “is implemented with a field programmable gate array (FPGA)...[or] with other programmable devices such as a programmable logic device.” Ex. 1006, [0021]. Gaspar’s PHY 122 of the HomePNA controller is “designed with an ASIC” (Application Specific Integrated Circuit) to perform “standard functions,” including “a signal processing function such as a digital signal processor (DSP) function.” Ex. 1006, [0023]. Thus, it is my opinion that a POSITA would understand that the PHY 122 of Gaspar’s HomePNA controller is at least a digital signal processor.

98. It is my opinion that it would have been obvious for a POSITA to implement the HomePNA controller functions of Rabenko using a processor, as taught by the HomePNA controller structure of Gaspar, since the use of a processor would enable Rabenko’s HomePNA controller to execute the functions specified in the HomePNA Specification. Ex. 1005, [0034]; Ex. 1006, [0023]. First, a POSITA would have recognized that such a combination would be a simple substitution of one known element for another to obtain predictable results. As explained above, both Rabenko and Gaspar teach home telecommunication systems that includes HomePNA controller with both a MAC and a PHY and that implements functions of the related specification. Ex. 1005, Figs. 1a-2, [0003], [0031]-[0047], [0180]; Ex. 1006, [0003], [0007], [0014]. Since Rabenko already provides a HomePNA controller with home networking functionality, a POSITA would have been

motivated to apply Gaspar's teaching of constructing the controller using programmable hardware (*i.e.*, a processor), including, for example, ASICs, to help comply with the HomePNA Specification 2.0. Ex. 1006, [0021]-[0023]; Ex. 1005, [0034]. A POSITA would have sought such a combination to ensure that the HomePNA controller included the necessary architecture (*i.e.*, processor(s)) to perform the functions set out in the HomePNA Specification Version 2.0.

99. It also would have been obvious for a POSITA to implement the HomePNA controller functions of Rabenko using a processor, as taught in Gaspar, because Rabenko teaches that its HomePNA controller "may be implemented in any number of way[s] including electronic hardware, computer software, or combinations of both" "depend[ing] upon the particular application and design constraints imposed on the overall system." Ex. 1005, [0268]. Rabenko teaches that "[s]killed artisans recognize the interchangeability of hardware and software under these circumstances, and how best to implement the described functionality for each particular application." Ex. 1005, [0268]. Accordingly, it is my opinion that a POSITA, recognizing that Rabenko allows for interchangeability of hardware and software in its HomePNA controller but does not explicitly designate the specific type of hardware and software to be used, would look to specific architectures for HomePNA controllers, such as those taught in Gaspar, for implementing the hardware and software of Rabenko's HomePNA controller.

100. It is my opinion that it would have been obvious for a POSITA to combine the teachings of Rabenko and Gaspar for multiple reasons. First, a POSITA would have recognized that such a combination would be a simple substitution of one known limitation for another to obtain predictable results. For example, as I describe above, both Rabenko and Gaspar teach home telecommunication systems with a standards-compliant HomePNA controller that includes both a MAC and PHY. Ex. 1005, Figs. 1a-2, [0003], [0031]-[0047], [0180]; Ex. 1006, [0003], [0007], [0014], [0016], [0021]- [0024]. Gaspar explicitly states that its HomePNA controller performs “standard functions,” including at least “a digital signal processor (DSP) function.” Ex. 1006, [0021]-[0023]. Thus, it is my opinion that to the extent Rabenko’s HomePNA controller does not include such architecture, it would have been obvious to a POSITA to substitute Gaspar’s HomePNA controller with a DSP to ensure that the HomePNA controller included the necessary architecture (*i.e.*, processor(s)) to perform the functions set out in the HomePNA Specification Version 2.0, similar to Gaspar.

101. Additionally or alternatively, a POSITA would have recognized that such a combination would have been simply applying a known technique to a known device ready for improvement to yield predictable results. As I describe above, both Rabenko and Gaspar teach home telecommunication systems that include a standards-compliant HomePNA controller that includes both a MAC and a PHY.

Ex. 1005, Figs. 1a-2, [0003], [0031]-[0047], [0180], Ex. 1006, [0003], [0007], [0014], [0016], [0021], [0022], [0023], [0024]. Gaspar further explicitly states that its HomePNA controller performs “standard functions,” including “a digital signal processor (DSP) function.” Ex. 1006, [0021]-[0023]. The inclusion of the processor in Gaspar ensures that its HomePNA controller includes the necessary architecture (*i.e.*, processor(s)) to perform the functions set out in the HomePNA Specification Version 2.0. Thus, it is my opinion that, to the extent Rabenko’s HomePNA controller lacks such architecture, it would have been obvious to a POSITA to use Gaspar’s technique of including a processor in its HomePNA controller in Rabenko’s system to improve Rabenko in a way to yield predictable results: ensuring that Rabenko’s HomePNA controller included the necessary architecture (*i.e.*, processor(s)) to perform the functions set out in the HomePNA Specification Version 2.0.

102. Additionally or alternatively, combining Rabenko and Gaspar would be merely using known techniques to improve similar devices in the same way. For example, it would have been a known technique to implement the HomePNA controller functions of Rabenko by the HomePNA Version 2.0 compliant controller utilizing a processor of Gaspar to improve the similar HomePNA controller taught in Rabenko and Gaspar in the same way—by ensuring that Rabenko’s HomePNA

controller included the necessary architecture (*i.e.*, processor(s)) to perform the functions set out in the HomePNA Specification Version 2.0.

103. Additionally, it is my opinion that a POSITA would have had the skill to implement a processor based HomePNA controller in Rabenko's system, as taught by Gaspar, for example, by programming a processor with software in Redford's HomePNA controller to implement the home networking functionalities to be HomePNA Specification Version 2.0 compliant. Additionally, such a combination requires only minor hardware, software, and/or firmware modifications, leading to an expectation of success. Ex. 1005, [0268]. Additionally, a POSITA would have had the skill to implement a processor-based HomePNA controller in Rabenko's system, as taught by Gaspar, because the POSITA would have been familiar with programming processors used for the signal processing and other processing functions required by the HomePNA Version 2.0 Specification, leading to an expectation of success.

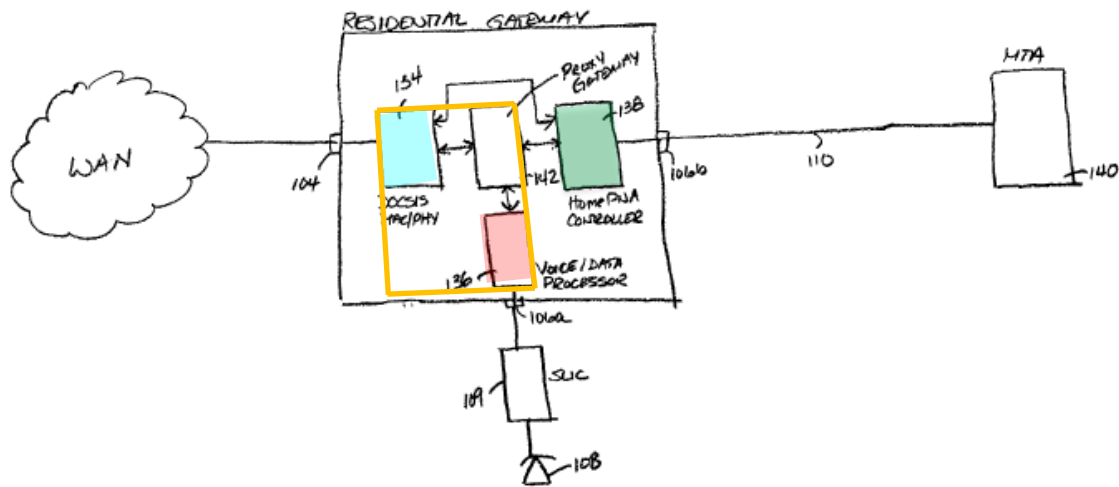
104. Therefore, it is my opinion that each of the proposed combinations, or at least each of the proposed combinations that include Gaspar, teaches "a data networking engine implemented in a first circuit that includes at least one processor, the data networking engine programmed with software that when executed by the at least one processor of the first circuit causes the data networking engine to perform

home networking functions including interfacing with customer provided equipment” as claimed.

- c. **Limitation [18C]: “a cable modem engine implemented in a second circuit that includes at least one processor, the second circuit being separate from the first circuit, the cable modem engine programmed with software that when executed by the at least one processor of the second circuit causes the cable modem engine to perform cable modem functions other than the home networking functions performed by the data networking engine, the cable modem functions including interfacing with cable media, and”**

105. It is my opinion that Rabenko teaches limitation [18C].

106. As I describe in Section VIII.A, Rabenko describes its communication system including DOCSIS MAC/PHY 134/DOCSIS MAC 212 (**blue**), a proxy gateway 142 and voice/data processor 136/213 (**red**) (together, the claimed “cable modem engine” (**orange**)) which are implemented in a second circuit performing cable modem functions according to the CableLabs Data Over Cable Service Interface Specification (DOCSIS). Ex. 1005, [0034], [0044]-[0047], Fig. 1b.



Ex. 1005, Fig. 1b (annotated)

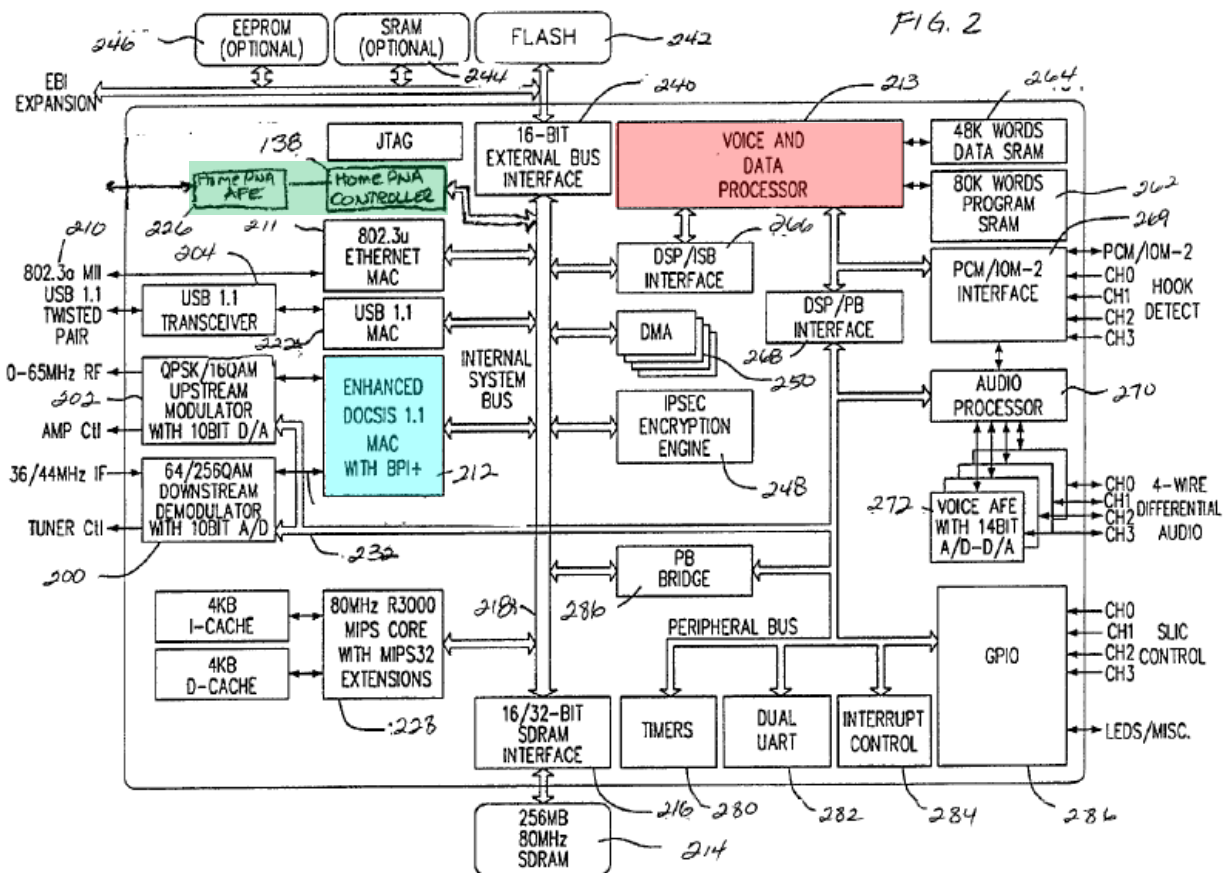
107. Rabenko, Figure 2 (reproduced and annotated below) illustrates an example of its residential gateway. A POSITA would understand that DOCSIS MAC 212 of Figure 2 is an illustrative example of the DOCSIS MAC layer of DOCSIS MAC/PHY 134 of Figure 1b.

108. Further, voice and data processor 213 of Figure 2 is an illustrative example of voice/data processor 136 (and, in some configurations, the proxy gateway 142) of Figure 1b. As Rabenko describes:

the voice and data processor 213 includes the proxy gateway function described in connection with FIG. 1b. Alternatively, the proxy gateway function could be implemented in the MIPS core 228.

Ex. 1005, [0074]. As further described below, it is my opinion that the DOCSIS MAC/PHY 134/DOCSIS MAC 212, the proxy gateway 142, and voice/data processor 136/213 together teach the claimed “cable modem engine.” Similarly, the

'775 Patent describes that its cable modem engine includes a DOCSIS PHY, MAC, and controller implementing voice functionality. Ex. 1001, 2:5-11.



Ex. 1005, Fig. 2 (annotated)

109. Referring to Figure 2, Rabenko describes:

DOCSIS was developed to ensure that cable modem equipment built by a variety of manufacturers is compatible, as is the case with traditional dial-up modems. The described exemplary embodiment can provide integrated functions for communicating with a cable head (not shown) end via the network port 104. By way of example, a QPSK upstream modulator 202 is configured to transmit data to the cable head end, and a QAM downstream demodulator 200 is configured to receive data from the cable

head end, and a QPSK out of band downstream demodulator 206 is configured to receive out of band MPEG-2 encoded messages from the cable head end.

Ex. 1005, [0050].

110. It is my opinion that Rabenko's description of "integrated functions for communicating with a cable head [] end" and/or the configuration "to receive out of band MPEG-2 encoded messages from the cable head end" teach the claimed "cable modem functions including interfacing with cable media." Ex. 1005, [0050], [0052], [0053]. For example, network port 104, shown in Figure 1b reproduced above, may lead to the unshown cable head end in the cloud labeled "WAN" for interfacing with cable media (e.g., MPEG-2 encoded messages). Ex. 1005, [0044], [0050], Fig. 1b. Rabenko also discloses using DOCSIS for connecting to a cable head end "for delivery of broadband services, such as IP services over the IP network (an HFC [(Hybrid Fiber-Coaxial)] network)," which is an example of the claimed "cable media." Ex. 1005, [0033], [0178], [0197]. Indeed, Patent Owner argued as much during prosecution of the '775 Patent as it argues that the claimed "the cable modem functions include interfacing with cable media" is supported by the "illustrated interfaces to the HFC or RF external sources" illustrated in Figures 1 and 2). Ex.

1004, p. 137.³ Further, Rabenko describes that the DOCSIS MAC 212 may include encryption/decryption, frame acquisition, and multiplexing with MPEG2-TS compliant video and audio streams. Ex. 1005, [0053]. A POSITA would understand that a DOCSIS MAC/PHY 134/DOCSIS MAC 212 receiving MPEG-2 encoded messages from a cable head end and including the functionality to encrypt/decrypt MPEG-2 video/audio streams, includes the claimed function “interfacing with cable media.” Similarly, during prosecution Patent Owner argued that a prior art processor “handles many cable modem functions” because it is described as including MPEG decoding and frame synchronization functionalities. Ex. 1004, p. 139.

111. These cable modem functions are “functions other than the home networking functions performed by the data networking engine” described above in Section IX.A.1.b. For example, as described above, Rabenko describes that the HomePNA controller 138 provides bi-directional communication with customer equipment/devices such as a phone, computer, etc., operating on a LAN. Ex. 1005, [0080]. A POSITA would understand that providing such bi-directional communication for customer equipment on a LAN is functionality other than

³ Ex. 1004, p. 137 (“Claim 1 has been amended to recite that the cable modem functions include interfacing with cable media. Support for this amendment is found in the implementation of examples of Figures 1 and 2, and the illustrated interfaces to the HFC or RF external sources.”).

communicating with a cable head end (as performed by Rabenko's DOCSIS MAC/PHY 134/DOCSIS MAC 212 (part of the "cable modem engine")).

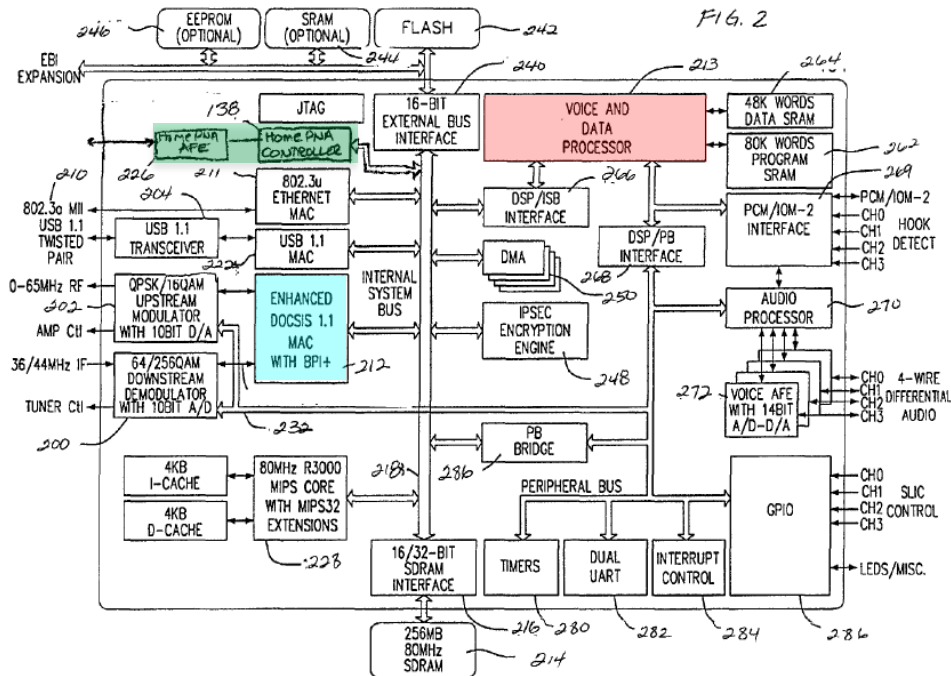
112. Rabenko describes that all packets that arrive to or leave from the residential gateway via the WAN go through DOCSIS MAC/PHY 134/DOCSIS MAC 212. Ex. 1005, [0044]. DOCSIS MAC/PHY 134/DOCSIS MAC 212 translates a packet format from DOCSIS to an internal format. Ex. 1005, [0044]. In the downstream direction, DOCSIS MAC/PHY 134/DOCSIS MAC 212 determines whether a packet payload is voice or data. Ex. 1005, [0045]. If the payload is voice and destined for a Plain Old Telephone Service (POTS) telephone 108, the packet is routed to voice/data processor 136/213 shown in Figure 1b above. Ex. 1005, [0045], Fig. 1b. It is my opinion that a POSITA would understand that the DOCSIS MAC/PHY 134/DOCSIS MAC 212 and voice/data processor 136/213 are part of a circuit ("second circuit").

113. Further, Rabenko describes that voice/data processor 136/213 generates an analog voice signal from the decompressed signal and delivers the analog voice signal to the POTS telephone 108 via the Subscriber Line Interface Circuit (SLIC) 109. Ex. 1005, [0047]. The cable modem functions of generating an analog voice signal from the decompressed signal and delivering the analog voice signal to POTS telephone 108 via SLIC 109 also are "cable modem

functions other than the home networking functions performed by the data networking engine” described above in Section IX.A.1.b.

114. As I describe above in Section IX.A.1.b, Rabenko describes that its HomePNA controller 138 can be a fully integrated MAC/PHY device. Ex. 1005, [0080]. As shown in Figure 1b above, Rabenko discloses that DOCSIS MAC/PHY 134/DOCSIS MAC 212 (**blue**), proxy gateway 142, and voice/data processor 136/213 (**red**) (claimed “second circuit”) are separate from HomePNA controller 138 and AFE 226 (claimed “first circuit”). Ex. 1005, Fig. 1b.

115. Rabenko’s Figure 2 illustrates an example of its residential gateway 102 in Figures 1a and 1b. Ex. 1005, [0050]. It is my opinion that the claimed “second circuit” includes voice and data processor 213 (claimed “at least one processor”) which correlates to the voice/data processor 136 described with respect to Fig. 1b. Ex. 1005, [0057], [0074], [0097]. As described above, A POSITA would understand that DOCSIS MAC 212 corresponds to the MAC layer of DOCSIS MAC/PHY 134 and voice and data processor 213 (claimed “at least one processor”) that implements the proxy gateway functions correlates to voice/data processor 136 and the proxy gateway 142 described with respect to Figure 1b. Ex. 1005, [0057], [0074], [0097]. Rabenko further describes that core 228, a processor that is part of the proxy gateway 142, interfaces with DOCSIS MAC 212, which correlates to DOCSIS MAC/PHY 134 in Fig. 1b. *Id.*



Ex. 1005, Fig. 2 (annotated)

116. Rabenko describes that core 228:

includes a high performance CPU operating at a speed of at least 80 MHz with 32-bit address and data paths. The MIPS core 228 may include two way set associative instruction and data caches on the order of about 4K bytes each. Further, the MIPS core 228 may provide standard EJTAG support with debug mode, run control, single step and software breakpoint instruction as well as additional optional EJTAG features.

Ex. 1005, [0057]. Cable modem functions implemented by the proxy gateway 142 would be implemented by core 228 and/or the voice and data processor using software. Ex. 1005, [0074], [0097], [0102]. In the downstream direction, proxy gateway 142 determines whether a packet with a voice payload is destined for HomePNA LAN or POTS. Ex. 1005, [0045]. If destined for POTS, proxy gateway routes such a packet to voice and data processor 136. Ex. 1005, [0045]. Proxy

gateway 142 is similarly responsible for voice packet routing in the upstream direction. Ex. 1005, [0046]. Such functions are similar to the '775 Patent's description that the DOCSIS processor exchanges voice data in both direction with the DOCSIS controller 116. '775 Patent, 3:9-11. The cable modem functions of determining whether a packet with a voice payload is destined for HomePNA LAN or POTS and routing voice packets in the upstream direction also are "cable modem functions other than the home networking functions performed by the data networking engine." See Section IX.A.1.b; *see also* Ex. 1005, [0102]-[0105] (describing additional cable modem functions of the proxy gateway other than home networking functions).

117. Rabenko also describes that voice and data processor 213 "may be implemented with a variety of technologies including, by way of example, embedded communications software that enables transmission of voice over packet based networks." Ex. 1005, [0074]. See, also, Ex. 1005, [0075], [0089]-[0097], [0139].

118. Further still, Rabenko describes that a person of skill in the art would understand that its components and circuits may be implemented in any of a number of ways, including "software." Ex. 1005, [0268]. It is my opinion that a POSITA would have understood that Rabenko's cable modem engine (DOCSIS MAC/PHY 134/DOCSIS MAC 212, voice/data processor 136/213, and/or MIPS core 228) is

programmed with software that when implemented by the cable modem engine, which is separate from the HomePNA controller 138 and AFE 226 (data networking engine), causes the cable modem engine to perform cable modem functions other than the home networking functions performed by the data networking engine, including interfacing with cable media (e.g., interfacing with the HFC network and/or interfacing with MPEG-2 data).

119. It is, therefore, my opinion that Rabenko (and therefore each proposed combination) discloses “a cable modem engine implemented in a second circuit that includes at least one processor, the second circuit being separate from the first circuit, the cable modem engine programmed with software that when executed by the at least one processor of the second circuit causes the cable modem engine to perform cable modem functions other than the home networking functions performed by the data networking engine, the cable modem functions including interfacing with cable media” as claimed.

d. Limitation [18D]: “the cable modem engine configured to enable upgrades to its software in a manner that is independent of upgrades to the software of the data networking engine,”

120. As described above in Sections IX.A.1.b-c, Rabenko’s DOCSIS MAC/PHY 134+voice/data processor 136/213(“cable modem engine”) and HomePNA controller 138 + AFE 226 (“data networking engine”) are separate,

independent components of separate circuits. As taught by Rabenko, it is my opinion that a POSITA would have understood that each of these independent components “may be implemented in any number of way[s] including electronic hardware, computer software, or combinations of both . . . depend[ing] upon the particular application and design constraints imposed on the overall system.” Ex. 1005, [0268].

121. Although Rabenko does not explicitly teach that its cable modem engine is configured to enable upgrades to its software in a manner that is independent of upgrades to the software of the data networking engine, it is my opinion that it would have been obvious to a POSITA to do so. Indeed, rather than being a result of some unique component, the ’775 Patent describes its “[f]lexibility” or independent software-upgradability as a mere “**result** of the virtual de-coupling” of cable modem engine functionality and data networking engine functionality. *See* Ex. 1001, 3:53-62, 4:25-28. As I describe in more detail below in Section IX.A.1.g, Rabenko’s home networking functions performed by the data networking engine (HomePNA Controller 138+AFE 226) are, similarly, completely partitioned and de-coupled from the cable modem functions performed by the cable modem engine (DOCSIS MAC/PHY 134/DOCSIS MAC 212+voice/data processor 136/213) since the home networking functions, described above in Section IX.A.1.b are performed by HomePNA controller 138 and/or AFE 226 (and not the DOCSIS MAC/PHY

134/DOCSIS MAC 212 or voice/data processor 136/213), while cable modem functions, described above in Section IX.A.1.c, are performed by the DOCSIS MAC/PHY 134/DOCSIS MAC 212 and/or voice/data processor 136/213 and not the HomePNA controller 138. Thus, by virtue of being de-coupled as described, Rabenko's system accomplishes the same result described in the '775 Patent—"the cable modem engine [is] configured to enable upgrades to its software in a manner that is independent of upgrades to the software of the data networking engine." It is my opinion that a POSITA would have recognized that Rabenko's decoupled system is "configured to enable" independent upgrades as claimed.

122. Additionally, when faced with implementing the upgradability of Rabenko's data networking engine and cable modem engine, there are only a few finite options, to configure them to be updated as a package or separately. A POSITA would recognize that these options are equally obvious to try.

123. Further still, Rabenko teaches that "[s]killed artisans recognize the interchangeability of hardware and software under these circumstances, and how best to implement the described functionality for each particular application." Ex. 1005, [0268]. Accordingly, it is my opinion that a POSITA, recognizing these are different, partitioned circuits, would have understood that upgrades to software of DOCSIS MAC/PHY 134/DOCSIS MAC 212, proxy gateway 142, or voice/data processor 136/213 would be independent of upgrades to software of the separate

HomePNA controller 138 or AFE 226. This is especially true considering the different protocols used and the separate functions performed by the two engines. A POSITA would have understood that two different engines performing two different functions and using two different protocols (DOCSIS and PNA) should be separately upgradeable to address protocol changes independently. Thus, Rabenko renders obvious that “the cable modem engine configured to enable upgrades to its software in a manner that is independent of upgrades to the software of the data networking engine.”

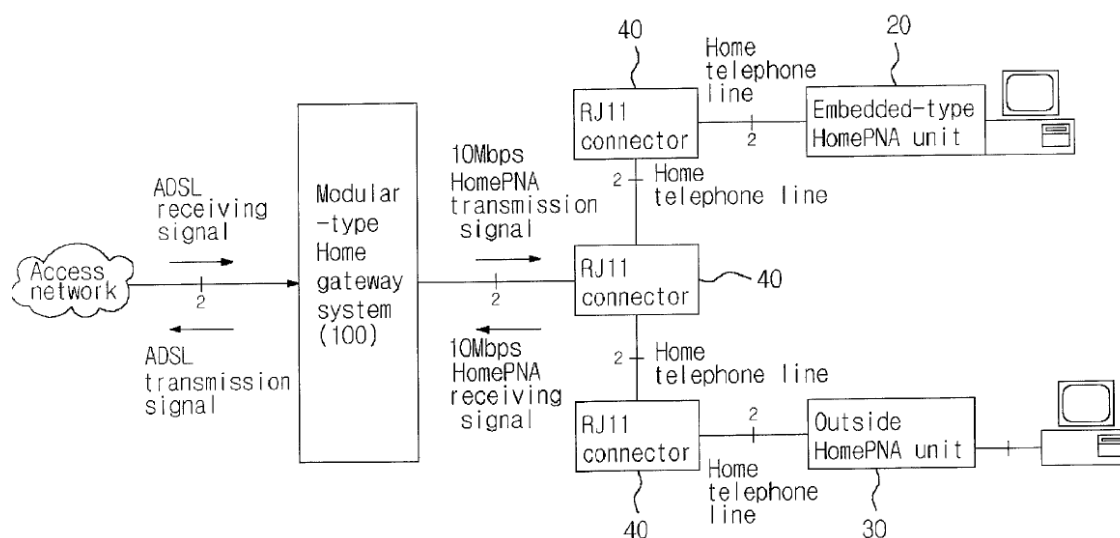
124. Additionally, it was generally known before the priority date of the ’775 Patent that a DOCSIS MAC/PHY 134/DOCSIS MAC 212 (part of the “cable modem engine”) would have been configured to enable upgrades to its software independent of upgrades to the software of HomePNA controller (included in the claimed “data networking engine”). It is, therefore, my opinion that a POSITA would have found such a feature to be obvious.

125. First, Rabenko describes that its HomePNA controller is compliant with the HomePNA protocol, which “is described in the HomePNA Specification Version 2.0, the contents of which is expressly incorporated herein by reference as though set forth in full.” Ex. 1005, [0034]. It is my opinion that a POSITA would have understood that a standard-compliant device would have to be frequently updated or replaced in order to maintain compliance with such evolving standards, for example,

as evidenced by Gaspar. *See, e.g.*, Ex. 1006, [0005] (“as protocols change or standards evolve, the HPNA controller must be upgraded.”). For example, as described above, like Rabenko, Gaspar teaches a home telecommunication system with a standards-compliant HomePNA controller, including a MAC and a PHY. Ex. 1005, Figs. 1a-2, [0003], [0031]-[0047], [0180], Ex. 1006, [0003], [0007], [0014], [0016], [0021]-[0024]. Gaspar describes that “as protocols change or standards evolve, the HPNA controller must be upgraded,” and such upgrades can be “costly and time consuming.” Ex. 1006, [0005]. Therefore, Gaspar identifies that a system including a HomePNA controller should “enable convenient modifications” of the network controller. Ex. 1006, [0006]. To this end, Gaspar describes partitioning the MAC and PHY layers of the HomePNA controller to be separately upgradable. Ex. 1006, [0007], [0014], [0024]. It is my opinion that a POSITA reading Rabenko in view of Gaspar would have recognized the advantages of making the MAC and PHY layers separable. Thus, when designing a system including a HomePNA controller (data networking engine) and separate DOCSIS MAC/PHY+voice/data processor (cable modem engine) having different functions and using different protocols, a POSITA would find it obvious, *a fortiori*, to make them independently upgradable.

126. To the extent such a feature would not be obvious over Rabenko alone or over Rabenko in view of Gaspar, such a feature would be obvious in view of Kim. Like Rabenko, Kim describes a home-based telecommunications system that

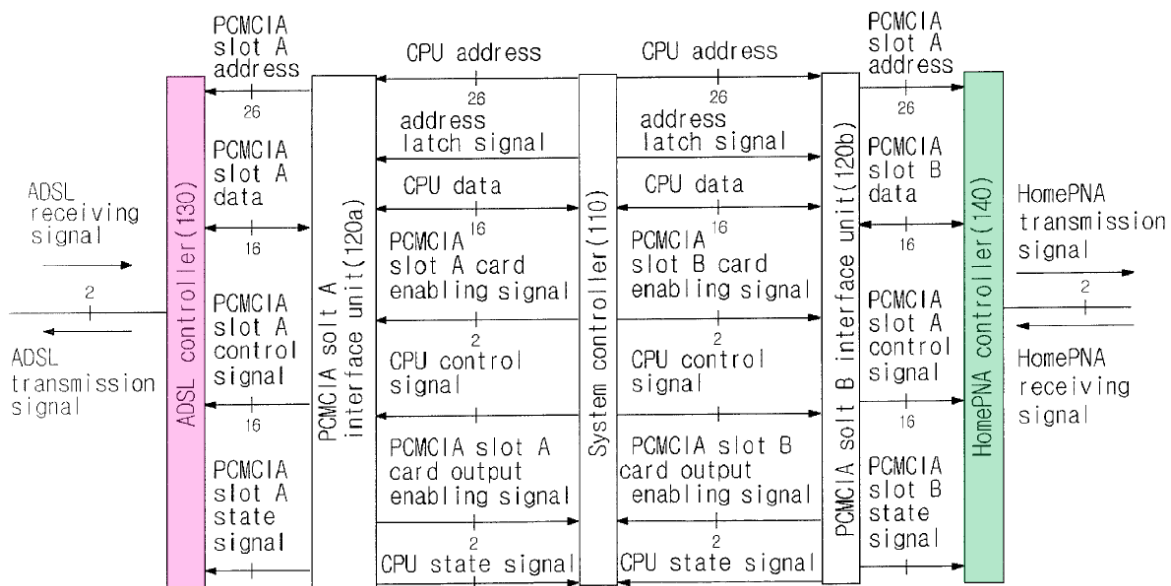
includes a residential gateway. Ex. 1007, Abstract, [0001]-[0014]. Similar to Rabenko, Kim's residential gateway includes a HomePNA controller that provides home networking functionality and an ADSL (Asymmetric Digital Subscriber Line) controller for interfacing with an access network (similar to Rabenko's DOCSIS MAC/PHY interfacing with the WAN). Ex. 1007, [0001], [0007], [0011], [0026], [0028], [0061], Figs. 1-2; Ex. 1005, [0044], Fig. 1b.



Ex. 1007, Fig. 2

127. Kim teaches that its residential gateway is “modular-type” such that the HomePNA controller and the ADSL controller are partitioned and can be independently upgraded. Ex. 1007, [0026]. Kim identifies a concern that “conventional” HomePNA gateway systems “integrate[] both [the] HomePNA controller and [the] ADSL controller with a system controller.” Ex. 1007, [0005]. Thus, in such conventional systems, “if a user wants to improve a performance of

[the] HomePNA controller or ADSL controller, the **whole** home gateway system should be improved, thereby incurring a user's inconvenience as well as cost ineffectiveness." Ex. 1007, [0005] (emphasis added). To overcome this identified concern, Kim describes that its residential gateway is "modular-type." *See, e.g.*, Ex. 1007, Abstract, [0001], [0006]-[0010], [0014], [0026]-[0028], [0061], [0062]. In Kim's modular-type residential gateway, "**either** the modular-type HomePNA controller (**green**) **or** ADSL controller (**pink**) is replaced, thereby improving the total performance of the home gateway device." Ex. 1007, [0001] (emphasis added).



Ex. 1007, Fig. 3 (annotated)

128. Kim’s use of modular controllers beneficially provides “a small-sized and economical structure,” that results in less cost and inconvenience when updating the controllers. Ex. 1007, [0007]; *see also id.*, [0002]-[0006], [0008]. Thus, it is my opinion that it would have been obvious to a POSITA reading the teachings of

Rabenko and Kim to make Rabenko's home gateway modular as taught by Kim such that its DOCSIS MAC/PHY and voice/data processor are separate from the HomePNA controller and AFE so that the independent engines could be efficiently and independently upgradable (as expressly taught by Kim). Incorporating the modular design of Kim in this way would allow the efficient updating of any of Rabenko's partitioned components.

129. It is my opinion that it would have been obvious for a POSITA to apply Kim's teaching to Rabenko to yield a system wherein Rabenko's HomePNA controller is independently upgradeable from other components (as taught in Kim), such as the DOCSIS MAC/PHY, proxy gateway and voice/data processor, in order to allow the efficient updating of Rabenko's partitioned components resulting in less cost and inconvenience to the user. Ex. 1007, [0002]-[0008]. Additionally, a POSITA would have recognized that such a combination would be using known techniques (implementing the HomePNA controller functions of Rabenko by the modular type HomePNA controller of Kim that allows for independent updating) to improve similar devices (the HomePNA controller taught in Rabenko and Kim) in the same way (such that Rabenko's components are conveniently and economically updated independently of each other). Ex. 1007, [0005]-[0007]. For example, as described above, both Rabenko and Kim teach home gateway systems that include multiple controllers (including a HomePNA controller and a network (e.g.,

Rabenko's WAN and Kim's access network) interface (e.g., Rabenko's DOCSIS/MAC/PHY and Kim's ADSL). A POSITA would have understood that these controllers, especially standards-compliant controllers like Rabenko's and Kim's HomePNA controllers, would have required frequent updates or replacement. *See, e.g.,* Ex. 1007, [0005]. Kim further states that **either** its HomePNA controller or ADSL controller can be replaced, resulting in less cost and inconvenience to a user. Ex. 1007, [0001], [0005], [0006], [0008]. Thus, it would have been obvious to a POSITA to use Kim's modular technique, enabling the independent updating of its separate controllers to improve Rabenko in the same way by modularly configuring Rabenko's separate components to be similarly independently upgradable.

130. Additionally or alternatively, it is my opinion that a POSITA would have also recognized that the combination of Rabenko and Kim as described would have been simply applying a known technique to a known device ready for improvement to yield predictable results. As described above, both Rabenko and Kim describe home gateway systems that include multiple controllers (including a HomePNA controller and a network (e.g., Rabenko's WAN and Kim's access network) interface (e.g., Rabenko's DOCSIS/MAC/PHY and Kim's ADSL). A POSITA would have understood that these controllers, especially standards-compliant controllers like Rabenko's and Kim's HomePNA controllers, would have to be frequently upgraded or replaced. Kim further explicitly states that **either** its

HomePNA controller or ADSL controller can be replaced, resulting in less cost and inconvenience to a user. Ex. 1007, [0001], [0005], [0006], [0008]. Thus, it would have been obvious to a POSITA to use Kim's modular technique of enabling the independent updating of its separate controllers in Rabenko's system to improve Rabenko in a way to yield predictable results: ensuring that Rabenko's separate components are modular and independently upgradable.

131. It is my opinion that a POSITA would have had the skill to implement Rabenko's components to be partitioned and independently upgradeable, as taught by Kim. Ex. 1005, [0268]; Ex. 1007, [0005]-[0008]. This combination requires only minor hardware, software, and/or firmware modifications, leading to an expectation of success in yielding predictable results: ensuring that Rabenko's partitioned components can be independently upgraded. Ex. 1005, [0268]

132. Therefore, it is my opinion that Rabenko alone, Rabenko in view of Gaspar, or Rabenko in view of Kim teach that Rabenko's home gateway would be configured such that its DOCSIS MAC/PHY and/or voice/data controller ("cable modem engine") would be configured to enable upgrades to its software in a manner that is independent of upgrades to the software of the HomePNA controller and AFE 226 ("data networking engine").

133. Accordingly, it is my opinion that each of the proposed combinations, or at least the combinations that include Gaspar and/or Kim, also teach "the cable

modem engine configured to enable upgrades to its software in a manner that is independent of upgrades to the software of the data networking engine,” as claimed.

e. Limitation [18E]: “the cable modem engine including a DOCSIS controller and a DOCSIS MAC processor,”

134. It is my opinion that Rabenko discloses limitation [18E].

135. As I discuss above in Section IX.A.1.c, it is my opinion that Rabenko teaches that its cable modem engine includes a voice/data processor 136/213 (claimed “DOCSIS controller”) and DOCSIS MAC/PHY 134/DOCSIS MAC 212 (claimed “DOCSIS MAC processor”). Like the “DOCSIS controller” of the ’775 Patent, Rabenko’s voice and data processor 136/213 is used for processing and transporting voice over packet based networks. Ex. 1005, [0074], [0085], [0087].

136. I note that claim 18 does not recite any function or structure for the “DOCSIS controller.” Rather, the DOCSIS controller is merely claimed to be bypassed—so that “downstream PDU packets” can be forwarded “directly to the data networking engine without the involvement of the DOCSIS controller” (*see* Limitation [18F] below). Ex. 1001, claim 18. Rabenko describes that all packets between the WAN and the residential gateway flow through the DOCSIS MAC/PHY. Ex. 1005, [0044]. If an arriving DOCSIS packet payload is voice, the packet is routed to the proxy gateway and ultimately to the voice data/processor (or the packets are routed directly to the voice/data processor in configurations where “the voice and data processor 213 includes the proxy gateway function,”). Ex. 1005,

[0045], [0074]. Further, Rabenko describes that its voice/data processor is used for processing and transporting voice “over packet based networks.” Ex. 1005, [0074]. A POSITA would have understood DOCSIS to be a packet-based network protocol. As Rabenko describes, “[all] **packets**” between the WAN and the residential gateway flow through the DOCSIS MAC/PHY. Ex. 1005, [0044] (emphasis added). Accordingly, because DOCSIS packets are forwarded to Rabenko’s voice/data processor, or because the voice/data processor is used for processing and transporting voice over packet-based networks, Rabenko’s voice/data processor teaches the “DOCSIS controller” (which, as discussed below in Section IX.A.1.f, is bypassed as recited in claim 18).

137. Further, the ’775 Patent describes a function of the DOCSIS controller—“a DOCSIS controller implementing VoIP [(Voice over IP)] functionality.” Ex. 1001, 2:10-11. Similarly, Rabenko describes:

[0085] . . . [T]he voice and data processor performs a translation function between the packets in a HomePNA LAN format (VOHN) to packets in the VoIP format. The specific translation is direction dependent. Packets arriving from the HomePNA controller are translated to a VoIP format and delivered to the DOCSIS MAC.

[0086] Packets arriving from the DOCSIS MAC are translated to a VoHN format and delivered to the HomePNA controller.

[0087] The voice and data processor also performs a media and protocol translation between VoIP formats and PCM voice samples

Ex. 1005, [0085]-[0087]. Accordingly, Rabenko’s voice/data processor teaches the claimed “DOCSIS controller.”

138. As I discuss above, Rabenko describes that all packets between the residential gateway 102 and the WAN flow through the DOCSIS MAC/PHY. Ex. 1005, [0044]. Further, “[t]he DOCSIS MAC/PHY 134 translates the packet format from DOCSIS to an internal format that, at least in some embodiments, is protocol independent.” Ex. 1005, [0044]. Therefore, it is my opinion that Rabenko’s DOCSIS MAC/PHY teaches the claimed “DOCSIS MAC processor.”

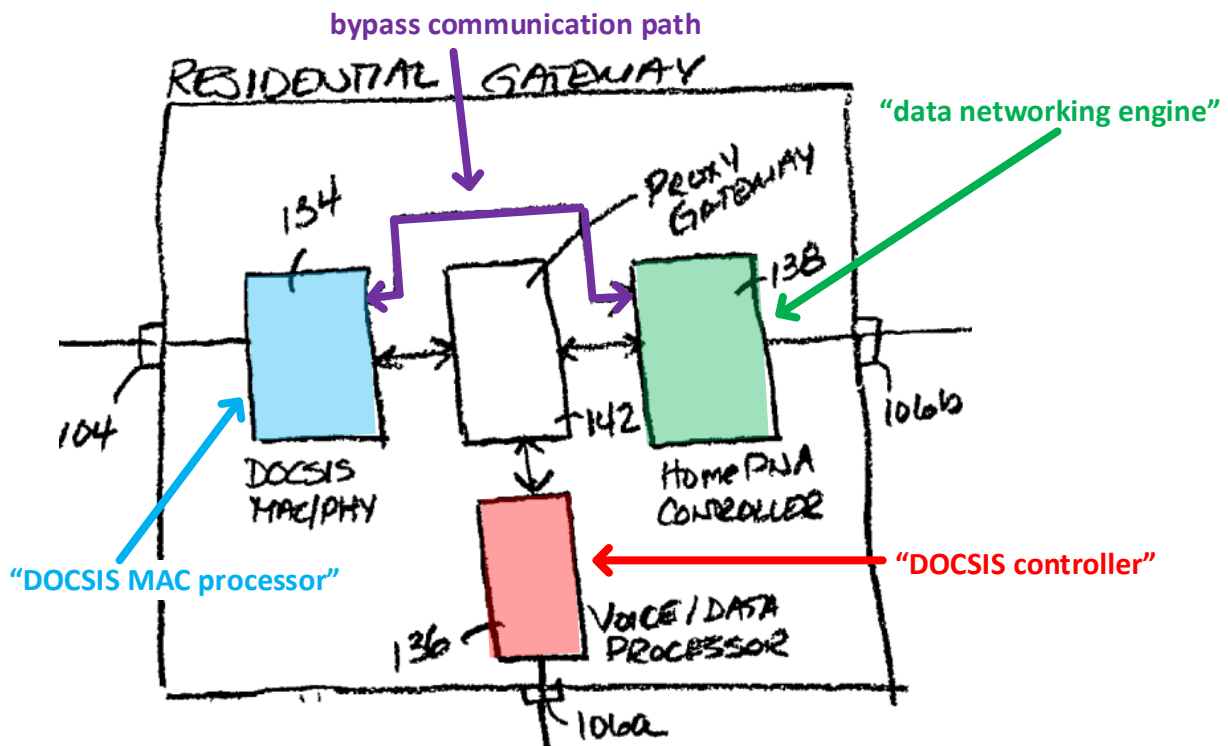
139. Therefore, it is my opinion that Rabenko teaches “the cable modem engine” (including DOCSIS MAC/PHY 134/DOCSIS MAC 212 and voice/data processor 136/213) “including a DOCSIS controller” (voice/data processor 136/213) “and a DOCSIS MAC processor” (DOCSIS MAC/PHY 134/DOCSIS MAC 212), and Rabenko (and each of the proposed combinations) teaches limitation [18E].

f. Limitation [18F]: “the DOCSIS MAC processor configured to process downstream PDU packets and forward the processed packets directly to the data networking engine without the involvement of the DOCSIS controller in order to boost downstream throughput; and”

140. It is my opinion that Rabenko teaches limitation [18F].

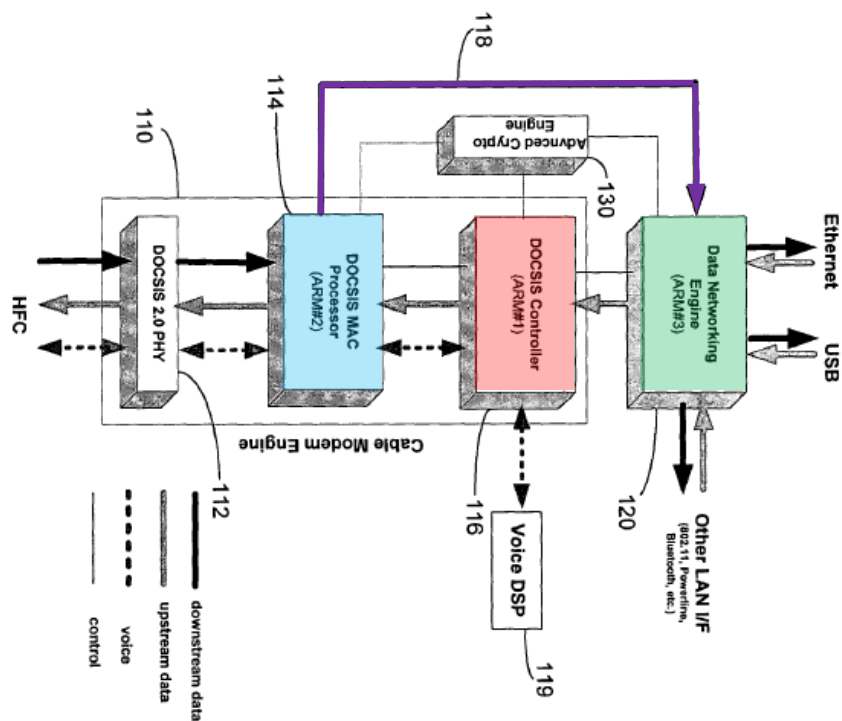
141. Rabenko describes that the DOCSIS MAC/PHY 134/DOCSIS MAC 212 (blue) (claimed “DOCSIS MAC processor”) translates (claimed “configured to process”) the arriving packets (claimed “downstream . . . packets”). Ex. 1005, [0044]. Further, “[i]f the packet payload is data, then the DOCSIS MAC/PHY 134 routes the packet **directly** to [(via control flow line in purple below)] a HomePNA

controller 138” (**green**) (claimed “forward the processed packets directly to the data networking engine without the involvement of the DOCSIS controller”). Ex. 1005, [0045] (emphasis added), Fig. 1b. Figure 1b (reproduced and annotated below) shows that voice/data processor 136/213 (**red**) (the claimed “DOCSIS controller”) is bypassed (claimed “without the involvement of the DOCSIS controller”) when a packet received by DOCSIS MAC/PHY 134/DOCSIS MAC 212 is a data packet. Ex. 1005, [0045], Fig. 1b.



Ex. 1005, Fig. 1b (annotated)

142. Figure 1 of the '775 Patent illustrates a similar packet flow:



Ex. 1001, Fig. 1 (rotated and annotated)

143. Rabenko describes protocol data units (PDUs) in the context of the operation of the gateway control protocol (GCP) logic 530 included within the residential gateway. Ex. 1005, [0108]. Specifically, in describing Figure 5c, Rabenko states, “the GCP logic implements the NCS features of the PacketCable 1.0 specification including protocol transaction management, parsing, verification and formatting of protocol data units (PDUs) and other utility functions.” Ex. 1005, [0108]. A POSITA would have understood that PDUs, as described in Rabenko, are packets. For example, a POSITA would have understood PDU as “OSI (Open System Interconnection) terminology for a generic ‘packet.’ . . . Basically, PDU is

OSI [] terminology for ‘packet.’” Ex. 1008, pp. 8-9. Further, a POSITA would have understood that OSI is:

A reference model developed by the ISO (International Organization for Standardization, as translated in English). The OSI Reference Model is the only internationally accepted framework of standards for communication between different systems made by different vendors. . . . Most of the dominant communications protocols used today have a structure based on the OSI model.

Ex. 1008. pp. 8-9. Therefore, by the earliest priority date of the ’775 Patent, a POSITA would have been well aware that:

- 1) PDU is simply OSI terminology for a packet; and
- 2) most of the dominant communications protocols used at the time had structures based on the OSI model.

Therefore, a POSITA would have understood that Rabenko’s “packets” could be PDUs.

144. It is my opinion that the clause “in order to boost downstream throughput” is an aspirational result of the prior features (in particular, the “bypass” feature) and or an intended use. I have been informed by counsel that when a claim merely recites an intended use and/or an intended result of previously recited features, the intended use or result is to be given no patentable weight since it does not limit the structure or function of the claim.

145. Alternatively, if this limitation does limit the structure, the result of “forward[ing] the processed packets directly to the data networking engine without the involvement of the DOCSIS controller” causes the result “in order to boost

downstream throughput.” Specifically, the ’775 Patent simply states, “[t]o increase downstream throughput, all processing of DS PDU (protocol data unit) packets is done within processor 114 without involving controller 116. After being processed, DS PDU packets are forwarded by processor 116 directly to data networking engine 120 along path 118, bypassing controller 116.” Ex. 1001, 3:11-16. Similarly, for downstream communications, Rabenko’s DOCSIS MAC/PHY 134/DOCSIS MAC 212 forwards determined and processed data packets directly to HomePNA controller 139 along bus 218 (shown as the “bypass” line in **purple** above in Figure 1b). Thus, Rabenko’s structure/function teaches the same result of boosting downstream throughput.

146. A POSITA would have understood that, as a signal passes through a circuit, by bypassing an electrical component, such as Rabenko’s voice/data processor 136 (**red**) in Figure 1b above, (the claimed “DOCSIS controller”), downstream throughput is increased or boosted since the signal travels through fewer components to reach its particular destination, thus avoiding potential bottlenecks.

147. Accordingly, Rabenko teaches that its DOCSIS MAC/PHY 134/DOCSIS MAC 212 (claimed “DOCSIS MAC processor”) “is configured to process downstream PDU packets and forward the processed packets directly to the HomePNA controller 138 (included in the claimed “data networking engine”)

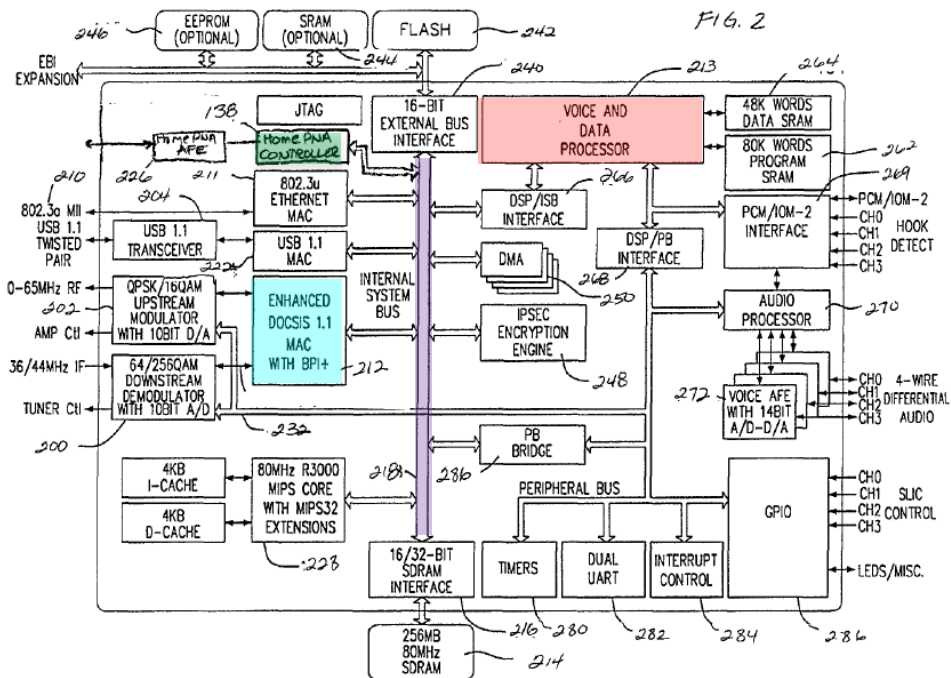
resulting in boosted downstream throughput (at least compared to the alternative of forwarding the data packets to the HomePNA controller through the voice/data processor).

148. Therefore, it is my opinion that Rabenko (and therefore each proposed combination) teaches “the DOCSIS MAC processor configured to process downstream PDU packets and forward the processed packets directly to the data networking engine without the involvement of the DOCSIS controller in order to boost downstream throughput” as claimed.

- g. Limitation [18G]: “a data bus that connects the data networking engine to the cable modem engine, wherein the cable modem functions performed by the cable modem engine are completely partitioned from the home networking functions performed by the data networking engine.”**

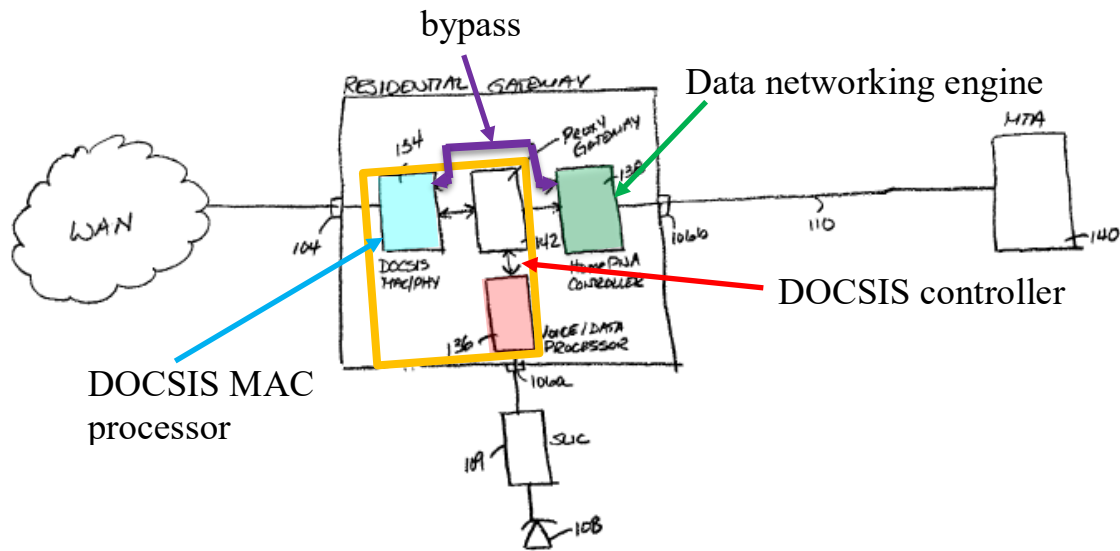
149. It is my opinion that Rabenko teaches limitation [18G].

150. Particularly, Rabenko describes an internal system bus 218 (purple) (claimed “data bus”) that connects the HomePNA controller 138 (green) (included in the claimed “data networking engine”) to the DOCSIS MAC/PHY 134/DOCSIS MAC 212 (blue) (part of the claimed “cable modem engine”). Ex. 1005, [0057], [0060], Fig. 2.



Ex. 1005, Fig. 2.

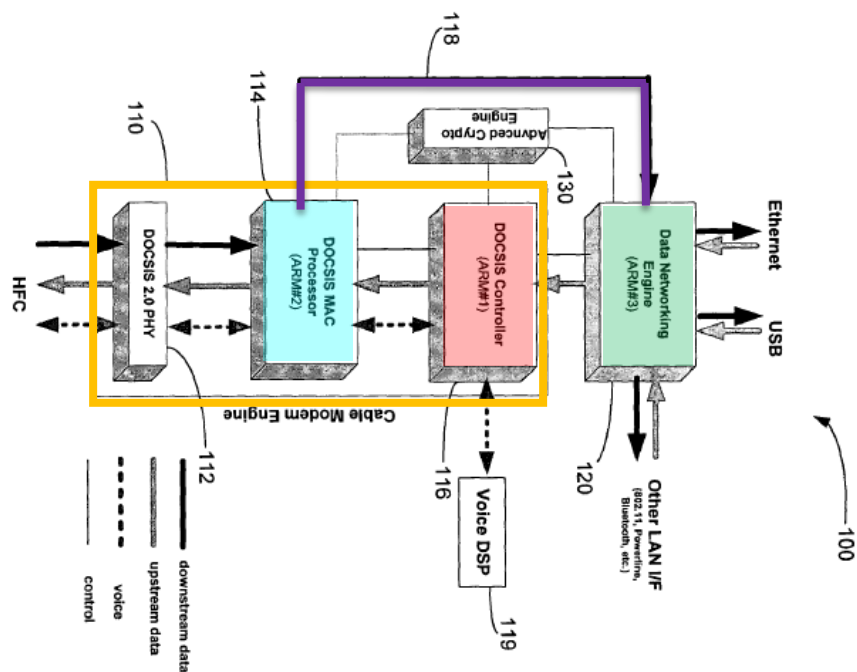
151. Figure 1b of Rabenko is a functional block diagram describing flow of packets in residential gateway 102. The description associated with Figure 1b (reproduced and annotated below) describes functions performed by the cable modem engine (**orange**) that are completely partitioned from the functions performed by HomePNA controller 138 (**green**). Ex. 1005, [0044], Fig. 1b.



Ex. 1005, Fig. 1b (annotated)

152. Specifically, home networking functions performed by the data networking engine are completely partitioned from the cable modem functions performed by the cable modem engine since the home networking functions, described above in Section IX.A.1.b, are performed by HomePNA controller 138 and/or AFE 226 (and not the DOCSIS MAC/PHY 134/DOCSIS MAC 212 or voice/data processor 136/213), while cable modem functions, described above in Section IX.A.1.c, are performed by the DOCSIS MAC/PHY 134/DOCSIS MAC 212 + voice/data processor 136/213 and/or MIPS core 228 and not the HomePNA controller 138.

153. The '775 Patent similarly describes its “partitioned” engines. Ex. 1001, 4:13-24, 2:20-27.



Ex. 1001, Fig. 1 (rotated and annotated)

154. The '775 Patent describes “Functional Partitioning” as “[c]able modem 100 completely partitions data networking functions ... from DOCSIS cable modem functionality. This is accomplished by localizing data networking functions in the data networking engine processor and localizing cable modem functions in the cable modem engine processor.” Ex. 1001, 4:13-19. Further, the '775 Patent describes:

Another embodiment of the invention is a method for providing a flexible and partitioned cable modem gateway. Data and home networking functionality is provided by a data networking engine, and DOCSIS and VoIP functionality is provided by a cable modem engine. The data networking engine is partitioned from the cable

modem engine so that the data and home networking functionality is completely decoupled from the DOCSIS and VoIP functionality.

Ex. 1001, 2:20-27.

155. Thus, it is my opinion that a POSITA would have understood that the cable modem functions performed by the cable modem are completely partitioned from the home networking functions performed by the data networking engine as claimed when respective functions are localized in respective processors/devices. Rabenko describes that since the home networking functions, as described above in Section IX.A.1.b, are performed by HomePNA controller 138 and/or AFE 226 and **not** the DOCSIS MAC/PHY 134/DOCSIS MAC 212 or voice/data processor 136/213, while cable modem functions, described above in Section IX.A.1.c, are performed by the DOCSIS MAC/PHY 134/DOCSIS MAC 212, voice/data processor 136/213 and/or MIPS core 228 and **not** the HomePNA controller 138.

156. If it is determined that the claim construction for the “wherein” clause from the *Entropic-Charter* case, as identified above in Section VI, applies, Rabenko still teaches that “the cable modem engine and the data networking engine are not necessarily physically separate but are functionally separate such that the cable modem functions are performed only by the cable modem engine and the home networking functions are performed only by the data networking engine” (Ex. 1011, p. 17) as described above in Sections IX.A.1.b-c.

157. Thus, Rabenko teaches a system bus 218 (“data bus”) that connects the HomePNA controller 138 (included in the claimed “data networking engine”) to the DOCSIS MAC/PHY 134/DOCSIS MAC 212+voice/data processor 136/213 (and/or MIPS core 228) (claimed “cable modem engine”). Rabenko further teaches that the cable modem functions performed by the DOCSIS MAC/PHY 134/DOCSIS MAC 212 and/or voice/data processor 136/213 (and/or MIPS core 228) (claimed “cable modem engine”) are completely partitioned from the home networking functions performed by the HomePNA controller 138.

158. Accordingly, it is my opinion that Rabenko (and each of the proposed combinations) teaches “a data bus that connects the data networking engine to the cable modem engine, wherein the cable modem functions performed by the cable modem engine are completely partitioned from the home networking functions performed by the data networking engine,” as claimed.

159. Thus, it is my opinion that Rabenko alone, Rabenko in view of Gaspar, Rabenko in view of Kim, and Rabenko in view of Gaspar and Kim each renders claim 18 obvious. Therefore, it is also my opinion that each of the proposed combinations renders claim 18 obvious.

2. Dependent Claim 19: “A cable modem system as claimed in claim 18, wherein all DOCSIS functions are localized in the cable modem engine.”

160. Claim 19 depends from claim 18 and simply adds that “all DOCSIS functions are localized in the cable modem engine.” Ex. 1001, claim 19. As discussed above in Section IX.A.1, it is my opinion that each of the proposed combinations teaches claim 18. Further, as discussed below, it is my opinion that Rabenko teaches the limitation of claim 19.

161. It is my opinion that Rabenko’s functions performed by the DOCSIS MAC/PHY 134/DOCSIS MAC 212 and/or voice/data processor 136/213 teach the claimed “all DOCSIS functions.” As I discuss above in Section IX.A.1.c, Rabenko describes that DOCSIS MAC/PHY 134/DOCSIS MAC 212 performs cable modem functions according to the CableLabs DOCSIS. Ex. 1005, [0034], [0044]. Rabenko describes that “[t]he DOCSIS MAC/PHY 134 *translates* the packet format from DOCSIS to an internal format that, at least in some embodiments, is protocol independent.” Ex. 1005, [0044] (emphasis added). Translation of the packet format is one “DOCSIS function” performed by the DOCSIS MAC/PHY 134/DOCSIS MAC 212 in Rabenko’s cable modem engine.

162. Further, Rabenko describes that “[i]n the downstream direction, the DOCSIS MAC/PHY 134 determines whether the packet payload is voice or data.” Ex. 1005, [0045]. Determining whether a packet from WAN has a payload that is

voice or data is another “DOCSIS function” performed by the DOCSIS MAC/PHY 134/DOCSIS MAC 212 in Rabenko. Accordingly, translation of the packet format and/or determination of whether a packet payload is voice or data are the claimed “all DOCSIS functions.” These functions are both performed by DOCSIS MAC/PHY 134/DOCSIS MAC 212 and are localized in Rabenko’s cable modem engine.

163. Accordingly, it is my opinion that Rabenko teaches the system of claim 18 wherein “all DOCSIS functions are localized in the cable modem engine, as claimed.” Therefore, it is my opinion that Rabenko teaches the limitation of claim 19.

3. Dependent Claim 20: “The cable modem system as claimed in claim 18 wherein the DOCSIS MAC processor is configured to implement real-time MAC functions for both upstream and downstream communications.”

164. Claim 20 depends from claim 18 and simply adds that “the DOCSIS MAC processor” (introduced in claim 18) “is configured to implement real-time MAC functions for both upstream and downstream communications.” Ex. 1001, claim 20. As discussed above in Section IX.A.1, it is my opinion that each of the proposed combinations teaches claim 18. It is also my opinion, as discussed below, that Rabenko teaches the limitation of claim 20.

165. Rabenko describes that the DOCSIS MAC/PHY 134/DOCSIS MAC 212 (claimed “DOCSIS MAC processor” as I describe above in Sections IX.A.1.e-f) “provides an interface to the WAN within the residential gateway.” Ex. 1005, [0044]. “All packets that arrive to or leave from the residential gateway via the WAN must go through the DOCSIS MAC/PHY 134.” Ex. 1005, [0044]. A POSITA would have understood that packets that “arrive to . . . the residential gateway via the WAN” are the claimed “downstream” communications, and the packets that “leave from the residential gateway via the WAN” are the claimed “upstream” communications. Further, a POSITA would have understood that Rabenko’s packets arrive at and leave from the residential gateway (including the DOCSIS MAC/PHY 134/DOCSIS MAC 212) in real-time.

166. Further, Rabenko teaches the claimed “real-time MAC functions” at least because the DOCSIS MAC/PHY 134/DOCSIS MAC 212 is a “DOCSIS MAC” that operates in real-time in both the downstream and upstream directions. Ex. 1005, [0044]-[0046], [0050]-[0056]. Thus, a POSITA would understand that Rabenko’s DOCSIS MAC/PHY 134/DOCSIS MAC 212 is “configured to implement real-time MAC functions for both upstream and downstream communications,” as claimed.

167. Additionally or alternatively, for example, Rabenko describes that the DOCSIS MAC/PHY 134/DOCSIS MAC 212 performs real-time functions by translating packets from DOCSIS to an internal format in the downstream direction

and translating packets from an internal format to DOCSIS in the upstream direction.

Ex. 1005, [0044]-[0046].

168. Additionally or alternatively, for example, Rabenko describes:

The DOCSIS MAC 212 may include baseline privacy encryption and decryption as well as robust frame acquisition and multiplexing with MPEG2-TS compliant video and audio streams. The DOCSIS MAC 212 implements the downstream portions of the DOCSIS protocol. The DOCSIS MAC 212 extracts DOCSIS MAC frames from MPEG-2 frames, processes MAC headers, and filters and processes messages and data.

Ex. 1005, [0053]. Rabenko further describes that “[t]he DOCSIS MAC 212 can also implement the upstream portions of the DOCSIS protocol.” Ex. 1005, [0055]. A POSITA would understand these functions to be real-time upstream and downstream MAC functions.

169. Therefore, it is my opinion that Rabenko teaches the system of claim 18 wherein “the DOCSIS MAC processor is configured to implement real-time MAC functions for both upstream and downstream communications,” as claimed.

4. Independent Claim 1

a. Limitation [1A]: “A cable modem system comprising:”

170. As I discuss more fully above in Section IX.A.1.a, to the extent the preamble is limiting, it is my opinion that each of the proposed combinations discloses “[a] cable modem system.”

- b. Limitation [1B]: “a data networking engine implemented in a first circuit that includes at least one processor, the data networking engine programmed with software that when executed by the at least one processor of the first circuit causes the data networking engine to perform home networking functions including interfacing with customer provided equipment, wherein the at least one processor is a RISC processor;”**

171. It is my opinion that each of the proposed combinations teaches limitation [1B]. As I discuss above in Section IX.A.1.b, it is my opinion that each of the proposed combinations teaches limitation [18B]. In comparison to limitation [18B], limitation [1B] further recites “wherein the at least one processor is a RISC processor.” Ex. 1001, claim 1.

172. The ’775 Patent describes that the DOCSIS MAC processor 114 may be an ARM9TDMI-based RISC processor. Ex. 1001, 3:16-18. A POSITA would have understood “RISC” (“Reduced Instruction Set Computing”) processor as “[a] microprocessor architecture that favors the speed at which individual instructions execute over the robustness of the instruction set.” Ex. 1008, p. 12; *see also* Ex. 1012, [0124]. A POSITA would have also recognized RISC as a prevailing technology for workstations around the time of (and before) the priority of the ’775 Patent—“RISC is the prevailing technology for workstations today.” Ex. 1008, p. 12. A POSITA further would have understood an ARM9TDMI RISC processor as a 32-bit RISC ARM processor core licensed by ARM Holdings. *See e.g.*, 1016, [0024].

173. As described above in Section IX.A.1.b, Rabenko's HomePNA controller 138 teaches the claimed data networking engine including at least one processor. Rabenko describes that a person of skill in the art would understand that its modules and circuits (e.g., the HomePNA controller 138) "may be implemented in any number of way[s] including electronic hardware, computer software or combinations of both." Ex. 1005, [0268]. Rabenko further states that:

various illustrative components, blocks, modules, circuits, and steps have been described generally in terms of their functionality. Whether the functionality is implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. Skilled artisans recognize the interchangeability of hardware and software under these circumstances, and how best to implement the described functionality for each particular application.

Ex. 1005, [0268].

174. A POSITA would have understood that Rabenko's HomePNA controller 138 may be implemented by any of a number of different electronic hardware, computer software, or combinations of both and that the particular choice for a processor to be a RISC processor would have been an obvious design choices considering "how best to implement the described functionality for each particular application." Ex. 1005, [0268]. Indeed, a POSITA may have selected a RISC processor if they were considering a design "that favors the speed at which individual instructions execute over the robustness of the instruction set." See Ex. 1008, p. 12.

This is especially true considering the prevalence of RISC processors at the time of the '775 Patent (“RISC is the prevailing technology for workstations today” (Ex. 1008, p. 12), and considering Rabenko’s description regarding the skilled artisan recognizing the “interchangeability of hardware and software” and “how best to implement the described functionality for each particular application.” Ex. 1005, [0268]. A POSITA would have looked to commonly-known processors (and especially to the “prevailing technology”) as electronic hardware that would have been used to implement the functions of the HomePNA controller 138 based upon availability, prevalence, cost, quality of service requirements, geographic impairments, reliability, programmability, interchangeability, and/or any of a number of other factors for a particular use.

175. Therefore, it is my opinion that, although Rabenko does not explicitly describe a RISC processor for the HomePNA controller 138, it would have been an obvious design choice for a POSITA. A POSITA would have known that a RISC processor was a commonly used processor that, when programmed, would have implemented the functions of the data networking engine.

176. Further, it was generally known before the priority date of the '775 Patent that a RISC processor was a commonly known processor type for use in components that utilize a MAC layer, as described by Lu. Lu is directed to a MAC architecture for managing data flow over an open system interconnection (OSI) type

network, which includes a physical layer and a media access control layer. Ex. 1012, Abstract, [0005], [0010]. Lu describes that the MAC 315 can be implemented in a microprocessor or MAC controller 300. Ex. 1012, [0050]. Further, Lu describes MAC controller 300 implementations for HomePNA 2.0/1.0 use. Ex. 1012, [0050]-[0051], [0057], [0078], [0081]-[0082], [0113], [0129]-[0130]. Finally, similar to the '775 Patent which describes that DOCSIS MAC processor 114 may be an ARM9TDMI-based RISC processor (Ex. 1001, 3:16-18), Lu describes four illustrative implementations of its MAC architecture including a first implementation in a single dedicated reduced instruction set controller (RISC) machine. Ex. 1005, [0124]-[0128], Fig. 23.

177. Rabenko describes that a POSITA would understand that various components, circuits, and steps described may be implemented in any of a number of ways, including “electronic hardware, computer software, or combinations of both.” Ex. 1005, [0268]. Rabenko continues that “various illustrative components, blocks, modules, circuits, and steps have been described generally in terms of their functionality” and “[w]hether the functionality is implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. Skilled artisans recognize the interchangeability of hardware and software under these circumstances, and how best to implement the described functionality for each particular application.” Ex. 1005, [0268].

178. It is my opinion that a POSITA would have found it obvious to implement the HomePNA controller functions of Rabenko using the RISC structure as taught by Lu because, when designing Rabenko's HomePNA controller, a POSITA would have looked to incorporate the standard architecture of Lu's RISC as an implementation suitable to applications like Rabenko's that involve MAC functions because "it would be advantageous to provide a new software based or programmable MAC implementation architecture which would speed up MAC implementation development, MAC/PHY and MAC/host integration, enable multiple MAC implementations, and increase MAC portability for different applications and platforms." Ex. 1012, [0009]. Further, a POSITA would look to implement a RISC structure to implement a particular application that "favors the speed at which individual instructions execute over the robustness of the instruction set," Ex. 1008, p. 12) . Ex. 1005, [0268]. A POSITA would have recognized the interchangeability of hardware and software under these circumstances, and how best to implement the described functionality for each particular application, including the MAC implementations taught by Lu, one option of which is utilizing a RISC structure for the MAC functions of Rabenko's HomePNA controller. Ex. 1005, [0268]; Ex. 1012, [0124]-[0125]. Accordingly, a POSITA, recognizing the interchangeability of hardware and software, would look to various types of

architectures for implementation of a HomePNA controller, such as the one taught in Lu, for implementing the home networking functions taught by Rabenko.

179. It is my opinion that combining Rabenko and Lu would be merely using known techniques to improve similar devices in the same way. For example, implementing the HomePNA controller functions of Rabenko with Lu's RISC processor was a known technique. The HomePNA controllers taught in Rabenko and Lu are similar devices. Rabenko's device would be improved in the same way, for example, by ensuring that Rabenko's HomePNA controller includes the necessary architecture (*i.e.*, RISC processor) to efficiently perform its required functionality and to provide a new software based or programmable MAC implementation architecture which would speed up MAC implementation development, MAC/PHY and MAC/host integration, enable multiple MAC implementations, and increase MAC portability for different applications and platforms). Ex. 1005, [0268]; Ex. 1012, [0009].

180. Additionally or alternatively, it is also my opinion that combining Rabenko and Lu would be combining prior art elements (Rabenko's HomePNA controller and Lu's RISC processor) according to known methods (implementing functions of a HomePNA controller with a RISC processor) to yield predictable results (Rabenko's HomePNA controller implemented with Lu's structure (*i.e.*, RISC processor)).

181. Additionally or alternatively, it is also my opinion that combining Rabenko and Lu would be applying a known technique (implementing the HomePNA controller functions of Rabenko with the RISC processor structure of Lu) to a known device ready for improvement (Rabenko's HomePNA controller) to yield predictable results (the functionality of Rabenko's HomePNA controller implemented with Lu's structure (*i.e.*, RISC processor)).

182. Additionally, it is my opinion that a POSITA would have had the skill to implement a RISC processor based HomePNA controller in Rabenko's system, as taught by Lu, by programming a RISC processor with software to comply with HomePNA Version 2.0. As taught by Rabenko, such a combination requires only minor hardware, software, and/or firmware modifications, leading to an expectation of success. Ex. 1005, [0268]. Further, it is my opinion that a POSITA would have been familiar with RISC processors and how to program them to implement data networking engine and other functionality.

183. Therefore, it is my opinion that each of the proposed combinations, or at least each of the proposed combinations that include Lu, teaches "a data networking engine implemented in a first circuit that includes at least one processor, the data networking engine programmed with software that when executed by the at least one processor of the first circuit causes the data networking engine to perform

home networking functions including interfacing with customer provided equipment, wherein the at least one processor is a RISC processor,” as claimed.

- c. **Limitation [1C]: “a cable modem engine implemented in a second circuit that includes at least one processor, the second circuit being separate from the first circuit, the cable modem engine including a DOCSIS PHY layer, a DOCSIS controller, and a DOCSIS controller and programmed with software that when executed by the at least one processor of the second circuit causes the cable modem engine to perform cable modem functions other than the home networking functions performed by the data networking engine, the cable modem functions including interfacing with cable media,”**

184. Initially, it is my opinion that limitation [1C] renders the metes and bounds of claim 1 unclear. I have indicated as much to counsel, who informed me that my concerns may render the claim indefinite.

185. To the extent claim 1 and limitation [1C] are considered definite, it is my opinion that each of the combinations teaches it. As I described above in Section IX.A.1.c and IX.A.1.e, it is my opinion that Rabenko teaches limitations [18C] and [18E]. In comparison to limitations [18C] and [18E], claim 1 does not recite a DOCSIS MAC processor but recites the “cable modem engine including a DOCSIS PHY layer, a DOCSIS controller, and a DOCSIS controller.” Ex. 1001, claim 1.

186. Because limitation [1F] below recites “without the involvement of the DOCSIS controller” and limitation [1C] recites two DOCSIS controllers, for discussion and reference purposes of this Declaration only, I will discuss the first

instance of DOCSIS controller in limitation [1C] as the “first” DOCSIS controller, and the second instance of DOCSIS controller in limitation [1C] as the “second” DOCSIS controller. Referring to Section IX.A.1.e above, and at least for the same reasons described therein, Rabenko teaches a DOCSIS controller by its voice/data processor 136/213 (“[first] DOCSIS controller”). Further, referring to Section IX.A.1.e, Rabenko describes a DOCSIS MAC/PHY 134/DOCSIS MAC 212. Ex. 1005, Ex. 1005, [0044]-[0060]. At least considering the functionality of Rabenko’s DOCSIS MAC/PHY 134/DOCSIS MAC 212 as discussed above in Section IX.A.1 (e.g., Section IX.A.1.e) (e.g., Rabenko’s description that all packets between the gateway and the WAN flow through the DOCSIS MAC/PHY and/or the DOCSIS MAC/PHY 134 translating packets from DOCSIS to an internal format (Ex. 1005, [0044]) Rabenko’s DOCSIS MAC/PHY 134/DOCSIS MAC 212 teaches a DOCSIS controller (“[second] DOCSIS controller”).

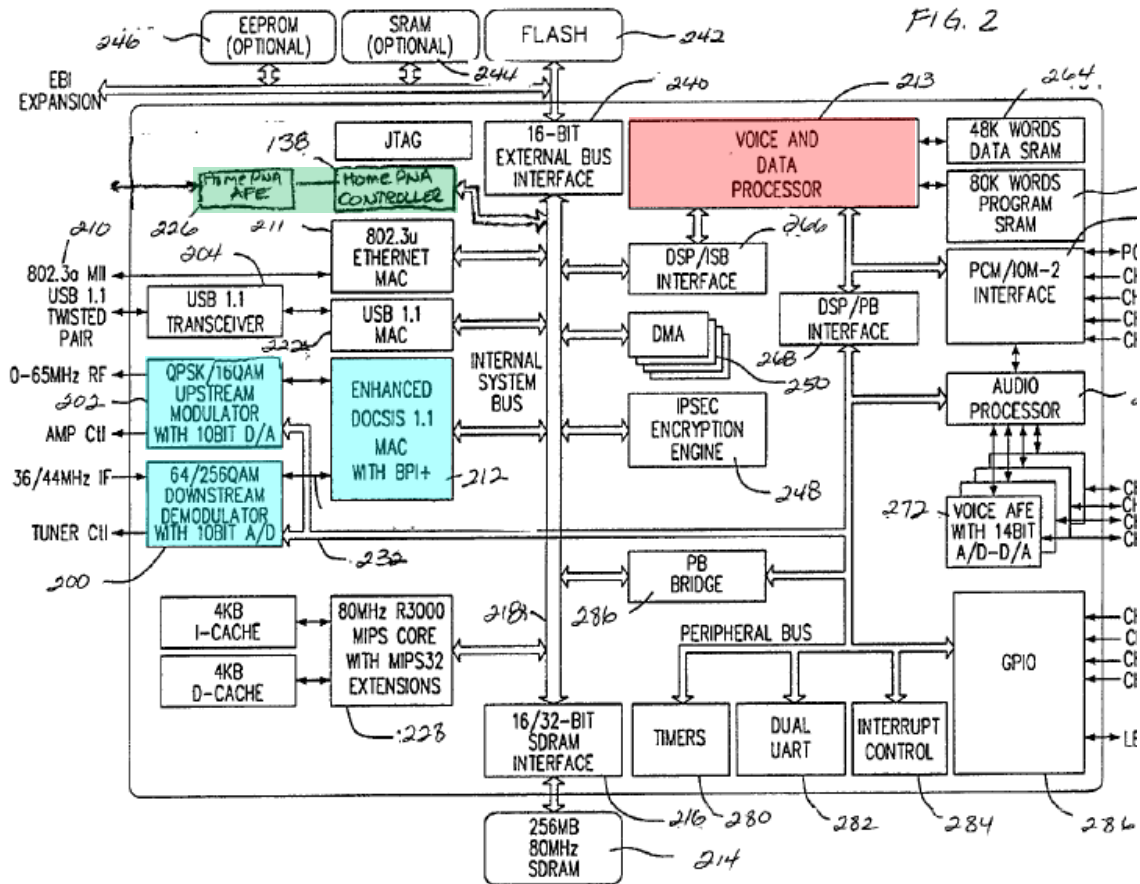
187. In comparing limitations [18C] and [18E], limitation [1C] also recites “the cable modem engine including a DOCSIS PHY layer.” Ex. 1001, claim 1. Rabenko’s DOCSIS MAC/PHY 134 (included in the claimed “cable modem engine” as described in Section IX.A.1 above) for transmitting to and receiving transmissions from the WAN includes a “DOCSIS PHY layer.” Ex. 1005, [0044]-[0047]. Further, a POSITA would have understood that the physical layer (PHY) in a layered network

model concerns transmitting and receiving raw bits. *See e.g.*, Ex. 1014, pp. 38, 73,

134. Rabenko states:

By way of example, a QPSK upstream modulator 202 is configured to transmit data to the cable head end, and a QAM downstream demodulator 200 is configured to receive data from the cable head end, and a QPSK out of band downstream demodulator 206 is configured to receive out of band MPEG-2 encoded messages from the cable head end.

Ex. 1005, [0050]. Thus, a POSITA would have understood upstream modulator 202 (blue) and downstream demodulator 200 (blue) (which send and receive data) as the DOCSIS physical layer (PHY) corresponding to the DOCSIS PHY of DOCSIS MAC/PHY 134. *See e.g.*, Ex. 1014, pp. 98, 99, 134.



Ex. 1005, Fig. 2 (annotated)

188. Therefore, it is my opinion that, to the extent claim 1 and limitation [1C] are considered definite, Rabenko (and each of the proposed combinations) teaches “a cable modem engine implemented in a second circuit that includes at least one processor, the second circuit being separate from the first circuit, the cable modem engine including a DOCSIS PHY layer, a DOCSIS controller, and a DOCSIS controller and programmed with software that when executed by the at least one processor of the second circuit causes the cable modem engine to perform

cable modem functions other than the home networking functions performed by the data networking engine, the cable modem functions including interfacing with cable media, the cable modem engine configured to enable upgrades to its software in a manner that is independent of upgrades to the software of the data networking engine,” as claimed.

- d. **Limitation [1D]: “the cable modem engine configured to enable upgrades to its software in a manner that is independent of upgrades to the software of the data networking engine;”**

189. Limitation [1D] recites the same features as limitation [18D]. At least for the same reasons as discussed above in Section IX.A.1.d, each of the proposed combinations teaches limitation [1D].

- e. **Limitation [1E]: “a data bus that connects the data networking engine to the cable modem engine, wherein the cable modem functions performed by the cable modem engine are completely partitioned from the home networking functions performed by the data networking engine;”**

190. Limitation [1E] recites the same features as limitation [18G]. At least for the same reasons as discussed above in Section IX.A.1.g, each of the proposed combinations teaches limitation [1E].

- f. Limitation [1F]: “wherein the DOCSIS MAC processor is configured to process downstream PDU packets and forward the processed packets directly to the data networking engine without the involvement of the DOCSIS controller in order to boost downstream throughput.”**

191. Initially, I note that no “DOCSIS MAC processor” is previously recited in claim 1. Ex. 1001, claim 1. Further, claim 1 previously recites “a DOCSIS controller” twice. Therefore, it is unclear to what “the DOCSIS MAC processor” refers. More fatally, it is unclear which “DOCSIS controller” is being “bypassed.” In other words, it is unclear whether the “DOCSIS controller” or the “DOCSIS controller and programmed with software that, when executed by the at least one processor of the second circuit causes the cable modem engine to perform cable modem functions other than the home networking functions performed by the data networking engine” is being “bypassed.” Therefore, it is my opinion that the metes and bounds of the subject matter of claim 1 are indefinite.

192. The above notwithstanding, to any degree claim 1 and limitation [1F] are considered definite, “the DOCSIS MAC processor,” for this Declaration, is the “[second] DOCSIS controller,” and limitation [1F] otherwise recites substantially the same features as limitation [18F]. Therefore, at least for the same reasons as I discuss above in Section IX.A.1.f, each of the proposed combinations teaches limitation [1E].

193. Therefore, it is my opinion that Rabenko alone, Rabenko in view of Gaspar, Rabenko in view of Kim, Rabenko in view of Lu, Rabenko in view of Gaspar and Kim, Rabenko in view of Gaspar and Lu, Rabenko in view of Gaspar, Kim, and Lu, and Rabenko in view of Kim and Lu each renders claim 1 obvious.

5. Dependent Claim 2: “A cable modem system as claimed in claim 1, wherein all DOCSIS functions are localized in the cable modem engine.”

194. Claim 2 depends from claim 1 and further recites that “all DOCSIS functions are localized in the cable modem engine.” Ex. 1001, claim 2. To the extent claim 2 is considered definite, claim 2 recites the same features as claim 19. As I describe above in Section IX.A.2, it is my opinion that each of the proposed combinations teaches the limitations of claim 19. Therefore, at least for the same reasons discussed above in Section IX.A.2, it is my opinion that each of the proposed combinations teaches the limitations of claim 2.

6. Dependent Claim 3: “A cable modem system as claimed in claim 2, wherein VoIP functionality is embedded in the cable modem engine.”

195. Claim 3 depends from claim 2 (which depends from claim 1) and adds that “VoIP functionality is embedded in the cable modem engine.” As described above in Sections IX.A.4-5, it is my opinion that to the extent claims 1 and 2 are considered definite, each of the proposed combinations teaches claims 1 and 2.

196. Further, as described above in Section IX.A.1.e, Rabenko's voice/data processor 136/213 is a part of the claimed "cable modem engine." Rabenko states that "[a] voice and data processor 213 is used for processing and transporting *voice over packet based networks* such as PCs running network on a USB (Universal Serial Bus) or an asynchronous serial interface, LANs such as Ethernet, *WANs such as IP*, Frame Relay (FR), Asynchronous Transfer Mode (ATM), Public Digital Cellular Network such as TDMA (IS-13x), CDMA (IS-9x) or GSM for terrestrial wireless applications, or any other packet based system." Ex. 1005, [0074] (emphasis added). Rabenko continues, "[t]he voice and data processor 213 may be implemented with a variety of technologies including, by way of example, *embedded communications software* that enables transmission of voice over packet based networks." Ex. 1005, [0074] (emphasis added). Rabenko further describes:

[T]he voice and data processor performs a translation function between the packets in a HomePNA LAN format (VOHN) to packets in the VoIP format. The specific translation is direction dependent. Packets arriving from the HomePNA controller are translated to a VoIP format and delivered to the DOCSIS MAC.

Packets arriving from the DOCSIS MAC are translated to a VoHN format and delivered to the HomePNA controller. The voice and data processor also performs a media control translation between VoIP formats and PCM voice samples.

Ex. 1005, [0085]-[0087].

197. Therefore, Rabenko teaches VoIP functionality embedded in the voice/data processor 136/213 (included in the “cable modem engine”). Therefore, it is my opinion that to the extent claim 3 is considered definite, each of the proposed combinations teaches the limitations of claim 3.

7. Dependent Claim 4: “A cable modem system as claimed in claim 1, and further comprising an advanced crypto engine configured to perform all crypto functions for both the data networking engine and the cable modem engine, the advanced crypto engine being separate from both the data networking engine and the cable modem engine.”

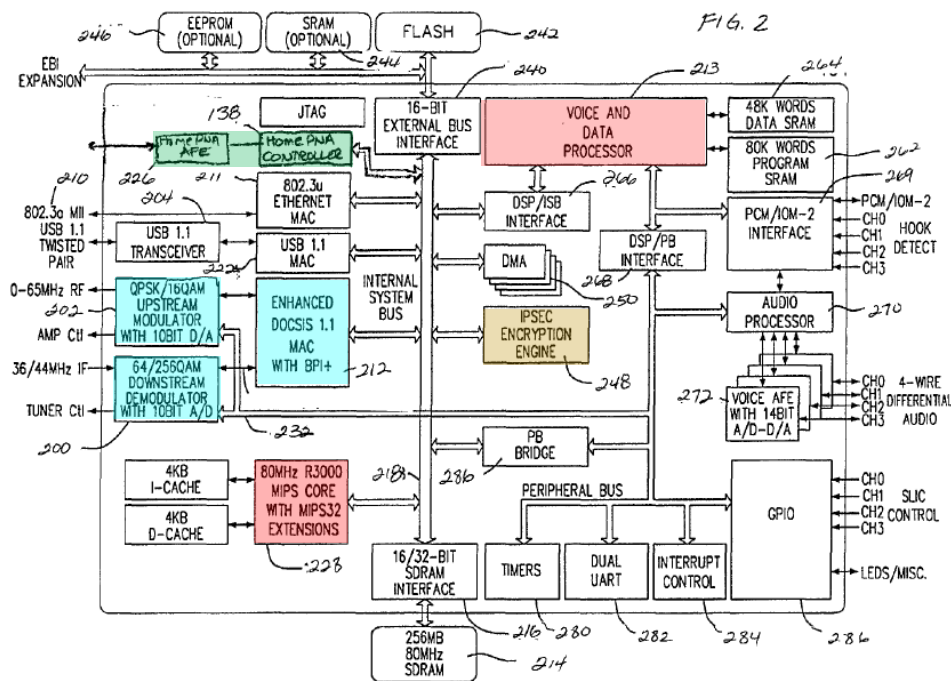
198. Claim 4 depends from claim 1 and recites the system “further comprising an advanced crypto engine configured to perform all crypto functions for both the data networking engine and the cable modem engine, the advanced crypto engine being separate from both the data networking engine and the cable modem engine.” As I describe above in Section IX.A.4, it is my opinion that claim 1 is indefinite, and to the extent it is considered definite, each of the proposed combinations teaches it.

199. The '775 Patent briefly describes its “advanced crypto engine.” Ex. 1001, 2:52, 4:4-8. The '775 Patent states:

Advanced crypto engine 130 provides hardware support for crypto functions. These include common crypto functions required by the baseline DOCSIS link-layer security, PacketCable voice security and data-networking security (e.g. VPN). These functions include DES/3DES, AES and HMAC-MD5/SH-1.

Ex. 1001, 4:4-9.

200. Similarly, Rabenko describes IP security module 248. Ex. 1005, [0064]. Like the “crypto” functions described in the ’775 Patent, Rabenko’s IP security module 248 supports “single DES (CBC and ECB modes) triple DES (CBC and ECB modes) MD-5 and SHA.” Ex. 1005, [0064], *see also id.*, [0065]-[0067]. As shown in Figure 2 below, IP security module 248 (gold) is separate from both the data networking engine (green) and the cable modem engine (red and blue). Rabenko’s IP security module 248 performs all crypto functions for both its data networking engine and its cable modem engine.



Ex. 1005, Fig. 2 (annotated)

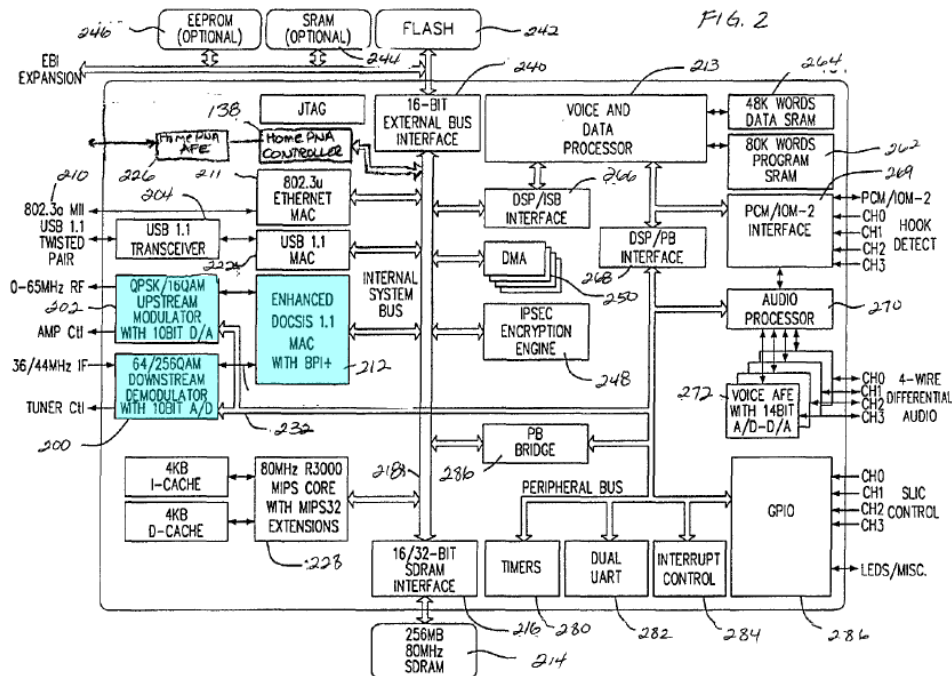
201. Therefore, it is my opinion that, to the extent the limitations of claim 4 are considered definite, each of the proposed combinations teaches them.

8. Dependent Claim 5: “A cable modem system as claimed in claim 1, wherein the DOCSIS PHY layer includes a hardware transmitter and receiver.”

202. Claim 5 depends from claim 1 and adds that “the DOCSIS PHY layer includes a hardware transmitter and receiver.” As I discuss above in Section IX.A.4, it is my opinion that claim 1 is indefinite, and to the extent it is considered definite, each of the proposed combinations teaches it.

203. Further, Rabenko’s DOCSIS MAC 212 (blue) is connected to upstream modulator 202 (claimed “transmitter”) (blue) and downstream demodulator 200 (claimed “receiver”) (blue) (together the modulator 202 and demodulator 200 are “the DOCSIS PHY layer”). A POSITA would understand that in a layered network model (such as DOCSIS), the PHY (physical layer) is concerned with the transmission and reception of bits. *See e.g.*, Ex. 1014, pp. 38, 73, 134. Thus, a POSITA would understand the downstream demodulator 200 and upstream modulator 202 as the PHY layer (“DOCSIS PHY layer”) corresponding to the PHY layer of DOCSIS MAC/PHY 134 (*i.e.*, the PHY layer corresponding to the DOCSIS MAC 212). pp. 98, 99, 134. Indeed, Rabenko describes, “a QPSK upstream modulator 202 is configured to *transmit* data to the cable head end, and a QAM downstream demodulator 200 is configured to *receive* data from the cable head end, and a QPSK out of band downstream demodulator 206 is configured to

receive out of band MPEG-2 encoded messages from the cable head end.” Ex. 1005, [0050] (emphasis added).



Ex. 1005, Fig. 2 (annotated)

204. Rabenko describes that a POSITA would understand that various components, circuits, and steps described may be implemented in any of a number of ways, including “electronic hardware, computer software, or combinations of both.” Ex. 1005, [0268]. Thus, a POSITA would have understood that QPSK upstream modulator 202 (“transmitter”) and QAM downstream demodulator 200 (“receiver”) would obviously be implemented as hardware. Indeed, a POSITA would understand that it would be impossible to have a transmitter and receiver without hardware that transmits and receives signals.

205. Therefore, it is my opinion that each of the proposed combinations teaches the limitations of claim 5.

9. Dependent Claim 6: “A cable modem system as claimed in claim 1, wherein all VoIP functionality is implemented in the DOCSIS controller.”

206. Claim 6 depends from claim 1 and adds that “all VoIP functionality is implemented in the DOCSIS controller.” Ex. 1001, claim 6. As I describe above in Section IX.A.4, it is my opinion that claim 1 is indefinite. Further, for similar reasons to those described in Section IX.A.4.f, it is unclear which of the two “DOCSIS controllers” of claim 1 is being limited. Therefore, it is my opinion that claim 6 is indefinite. Further, as I describe above in Section IX.A.4, to the extent claim 1 is definite, each of the proposed combinations teaches it.

207. Claim 6 depends from claim 1 and claim 3 depends from claim 2 which depends from claim 1. Claim 6 recites “all VoIP functionality is implemented in the DOCSIS controller,” and claim 3 recites “VoIP functionality is embedded in the cable modem engine.” As I discuss above in Section IX.A.6 with respect to claim 3, Rabenko teaches that VoIP functionality is implemented in voice/data processor 136/213 (claimed “DOCSIS controller”) by processing and transporting voice over packet based networks. Ex. 1005, [0074], [0085], [0087].

208. Therefore, is it my opinion that to the extent claim 6 is considered definite, Rabenko (and each of the proposed combinations) teaches the limitations of claim 6.

10. Dependent Claim 7: “A cable modem system as claimed in claim 6, wherein the VoIP functionality is in conformance with the PacketCable specification.”

209. Claim 7 depends from claim 6, which depends from claim 1, and adds that the VoIP functionality (introduced in claim 6) is “in conformance with the PacketCable specification.” Ex. 1001, claim 7. As I discuss above in Sections IX.A.4 and IX.A.9, it is my opinion that claims 1 and 6 are indefinite. Further, as I discuss above in Sections IX.A.4 and IX.A.9, to the extent either of claims 1 or 6 are definite, each of the proposed combinations teaches them.

210. Rabenko’s voice and data processor 213 is used for processing and transporting voice over packet based networks. Ex. 1005, [0074], [0085], [0087]. Rabenko also describes Figure 5c as a residential gateway control protocol logic that interfaces with an external control limitation to terminate and generate call signaling from and to a voice and data processor 213 in compliance with the network-based call signaling (NCS) protocol specification. Ex. 1005, [0014]. Specifically, for VoIP, “gateway control protocol (GCP) logic 530 receives and mediates call-signaling information between the DOCSIS network and a PSTN [(Public Switched Telephone Network)].” Ex. 1005, [0098]. Rabenko further describes that the GCP

logic 530 “implements the NCS features of the PacketCable 1.0 specification including protocol transaction management, parsing, verification, and formatting of protocol data units (PDUs) and other utility functions.” Ex. 1005, [0108]. “The PacketCable protocol typically requires an acknowledgment that a request has been received.” Ex. 1005, [0108]. Accordingly, Rabenko describes that the VoIP functionality of the voice and data processor 213 is “in conformance with the PacketCable specification.”

211. Therefore, it is my opinion that to the extent claim 7 is definite, each of the proposed combinations teaches the limitations of claim 7.

11. Dependent Claim 10:

- a. Limitation [10A]: “A cable modem system as claimed in claim 1, wherein with regard to the cable modem engine:”**

“the DOCSIS PHY layer includes a transmitter and receiver;”

212. Claim 10 depends from claim 1. Ex. 1001, claim 10. As I discuss above in Section IX.A.4, it is my opinion that claim 1 is indefinite, and to the extent it is definite, each of the proposed combinations teaches it. Limitation [10A] adds that the DOCSIS PHY layer (introduced in claim 1) includes a transmitter and receiver.

213. As I discuss above in Section IX.A.8 with respect to claim 5, Rabenko teaches that the DOCSIS PHY layer includes a transmitter and receiver (e.g.,

modulator 202 and demodulator 200). Therefore, it is my opinion that to the extent claim 10 is definite, each of the proposed combinations teaches limitation [10A].

b. Limitation [10B]: “the DOCSIS MAC processor is configured to implement real-time MAC functions for both upstream and downstream communications; and;”

214. Limitation [10B] adds that the DOCSIS MAC processor (introduced in claim 1) is “configured to implement real-time MAC functions for both upstream and downstream communications.” Ex. 1001, claim 10.

215. To the extent limitation [10B] is definite, it is substantially similar to claim 20, which depends from claim 18 and recites “wherein the DOCSIS MAC processor is configured to implement real-time MAC functions for both upstream and downstream communications.” In Section IX.A.3, I describe that Rabenko teaches the limitations of claim 20. At least for the same reasons I describe above in Section IX.A.3, it is my opinion that Rabenko teaches limitation [10B]—“the DOCSIS MAC processor is configured to implement real-time MAC functions for both upstream and downstream communications.”

216. Therefore, it is my opinion that each of the proposed combinations teaches limitation [10B].

c. Limitation [10C]: “the DOCSIS controller is configured to implement VoIP functionality; and”

217. Limitation [10C] adds that the DOCSIS controller (introduced (twice) in claim 1) is “configured to implement VoIP functionality.” Ex. 1001, claim 10.

218. Similar to what I discuss above in Sections IX.A.4 with respect to claim 1 and IX.A.9 with respect to claim 6, it is unclear which “DOCSIS controller” of claim 1 is being modified. Therefore, it is my opinion that limitation [10C] is indefinite. To the extent limitation [10C] is considered definite, it is substantially similar to claim 6, which depends from claim 1 and recites “wherein all VoIP functionality is implemented in the DOCSIS controller.” In Section IX.A.9, I describe that Rabenko teaches the limitations of claim 6. At least for the same reasons I describe above in Section IX.A.9, it is my opinion that Rabenko teaches limitation [10C]—“the DOCSIS controller is configured to implement VoIP functionality.”

219. Therefore, it is my opinion that each of the proposed combinations teaches limitation [10C].

- d. Limitation [10D]: “wherein the data networking engine includes a RISC processor configured to implement a majority of data networking processing and home networking applications decoupled from the implementation of the MAC functions and the VoIP functionality of the cable modem engine.”**

220. Limitation [10D] recites that the “data networking engine includes a RISC processor.” Ex. 1001, claim 10. Claim 1, from which claim 10 depends, already states “a data networking engine . . . includes at least one processor . . . , wherein the at least one processor is a RISC processor.” Ex. 1001, claim 1. Thus, this feature does not further limit claim 1. As I describe above in Section IX.A.4.b,

it is my opinion that each of the proposed combinations, or at least the proposed combinations that include Lu, also teach that the at least one processor of the data networking engine is a RISC processor.

221. Limitation [10D] further recites that the “data networking engine . . . [is] configured to implement a majority of data networking processing and home networking applications decoupled from the implementation of the MAC functions and the VoIP functionality of the cable modem engine.” Ex. 1001, claim 10. Claim 1, from which claim 10 depends, recites “the cable modem engine [] perform[s] cable modem functions other than the home networking functions performed by the data networking engine,” and “wherein the cable modem functions performed by the cable modem engine are completely partitioned from the home networking functions performed by the data networking engine.” Ex. 1001, claim 1. As I describe above in Sections IX.A.1.c, IX.A.4.c, IX.A.1.g, and IX.A.4.e, it is my opinion that Rabenko teaches that its cable modem engine (including DOCSIS MAC/PHY 134 and 212+200+202) performs cable modem functions other than and “completely partitioned from” home networking functions performed by its data networking engine (including HomePNA controller 138).

222. Further, Rabenko describes two personal computers connected to the HomePNA LAN 100: 1) 128 described as application Net Meeting, and 2) 130

described as application Netscape. Ex. 1005, [0042], Fig. 1a. Regarding these computers/applications, Rabenko states:

These describe two possible *applications* that are supported by personal computers connected to networks, in this case a[] HomePNA LAN. Those skilled in the art will appreciate that any computer *application* can be substituted or added.

Ex. 1005, [0042] (emphasis added). Further, it would be readily clear to a POSITA that executing such home networking applications and home networking functions (e.g., as described in Section IX.A.1.b) would require data networking processing. Rabenko describes that the HomePNA controller 138 (included in the claimed “data networking engine”) provides bi-directional communication with customer equipment/devices such as, for example, HomePNA phone 126, computer 128, computer 130, etc. operating on the HomePNA LAN. Accordingly, Rabenko describes home networking applications and data networking processing implemented by the HomePNA controller 138.

223. I have described in Sections IX.A.11.b-c that Rabenko teaches the claimed “MAC functions” and “VoIP functionality.” I have also explained in Sections IX.A.1.g and IX.A.4.e how Rabenko’s home networking functions performed by the data networking engine are “completely partitioned” from the cable modem functions performed by the cable modem engine.

224. Therefore, it is my opinion that Rabenko teaches “wherein the data networking engine includes a RISC processor configured to implement a majority of data networking processing and home networking applications decoupled from the implementation of the MAC functions and the VoIP functionality of the cable modem engine.”

225. It is, therefore, my opinion that each of the proposed combinations teaches the limitations of claim 10.

12. Dependent Claim 12: “A cable modem system as claimed in claim 11, wherein the DOCSIS MAC processor is an ARM9TDMI-based RISC processor, and wherein the DOCSIS controller is an ARM940-based RISC processor.”

226. Claim 12 depends from claim 11 which depends from claim 1. Ex. 1001, claim 12. As I describe in Section IX.A.4, to the extent claim 1 is definite, it is my opinion that each of the proposed combinations teaches it. Additionally, as I describe below in Section IX.D.1, it is my opinion that the prior art teaches claim 11. Claim 1 recites “a data networking implemented in a first circuit that includes at least one processor . . . , wherein the at least one processor is a RISC processor.” Ex. 1001, claim 1. Claim 12 adds that the DOCSIS MAC processor “is an ARM9TDMI-based RISC processor” and the DOCSIS controller “is an ARM940-based RISC processor.” Ex. 1001, claim 12. As I describe below, it is my opinion that the limitations of claim 12 would have been obvious to a POSITA.

227. Although none of the references specifically recite an ARM9TDMI-based RISC processor or an ARM940-based RISC processor, a POSITA would have found it obvious to implement the functions of the DOCSIS MAC processor and DOCSIS controller using commonly known and available processors, based upon availability, prevalence, cost, quality of service requirements, geographic impairments, reliability, programmability, interchangeability, and/or any of a number of other factors for a particular use.

228. A POSITA would have understood a RISC processor to be a reduced instruction set computing processor. Ex. 1008, p. 12; Ex. 1012, [0124]. A POSITA would have further understood by the earliest priority date of the '775 Patent that RISC is a “microprocessor architecture that favors the speed at which individual instructions execute over the robustness of the instruction set” and that RISC was the prevailing technology for workstations around that time. Ex. 1008, p. 12. A POSITA further would have understood an ARM9TDMI RISC processor as a 32-bit RISC ARM processor core licensed by ARM Holdings.

229. As I describe above in Sections IX.A.1.c and IX.A.1.e, Rabenko’s DOCSIS MAC/PHY 134/DOCSIS MAC 212 teaches the claimed “DOCSIS MAC processor” and voice/data processor 136/213 teaches the claimed “DOCSIS controller” of the cable modem engine. Rabenko describes that a POSITA would understand that various components, circuits, and steps described may be

implemented in any of a number of ways, including “electronic hardware, computer software, or combinations of both.” Ex. 1005, [0268]. Rabenko continues that “various illustrative components, blocks, modules, circuits, and steps have been described generally in terms of their functionality” and [w]hether the functionality is implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. Skilled artisans recognize the interchangeability of hardware and software under these circumstances, and “how best to implement the described functionality for each particular application.” Ex. 1005, [0268].

230. Thus, it is my opinion that a POSITA would have understood that Rabenko’s DOCSIS MAC/PHY 134/DOCSIS MAC 212 and voice/data processor 136/213 may be implemented by any of a number of different electronic hardware, computer software, or combinations of both and that the particular choice for a processor to be a RISC processor, or a specific commercially-available RISC processor, would have been an obvious design choice taking into account “how best to implement the described functionality for each particular application.” Ex. 1005, [0268]. Similar to that which I describe above in Section IX.A.4.b, as the prevailing technology for workstations around the time of Rabenko, using RISC processors would have been obvious to a POSITA designing the Rabenko system, especially a POSITA looking to favor the speed at which individual instructions execute over the

robustness of the instruction set. *See* Ex. 1008, p. 12. A POSITA would have looked to commonly-known and utilized processors as electronic hardware that would have been used to implement the functions of the DOCSIS MAC/PHY 134/DOCSIS MAC 212 and voice/data processor 136/213 based upon availability, prevalence, cost, quality of service requirements, geographic impairments, reliability, programmability, interchangeability, and/or any of a number of other factors for a particular use.

231. Accordingly, although Rabenko does not explicitly disclose an ARM9TDMI-based RISC processor for DOCSIS MAC/PHY 134/DOCSIS MAC 212 or an ARM940-based RISC processor for voice/data processor 136/213, these would have been an obvious design choice as would have been understood by a POSITA. A POSITA would have known that a RISC processor was a commonly-known type of processor that, when programmed, would have implemented the functions of the cable modem engine, and a POSITA would have looked to existing RISC processors such as those claimed based upon the particular design choice of the system. A POSITA also would have known that it would have been obvious to try such known types of RISC processors to implement the Rabenko HomePNA controller and voice and data controller knowing it would lead to predictable results of hardware and software combinations suited to implement the functions of Rabenko's controllers recognizing "how best to implement the described

functionality for each particular application.” Ex. 1005, [0268]; *see., e.g.*, Ex. 1015, [0076]; Ex. 1016, [0024].

232. Additionally, before the priority date of the ’775 Patent, a POSITA would have known that an ARM9TDMI-based RISC processor was a commonly known and used processor for accommodating digital logic processing functions, such as in Rabenko’s DOCSIS MAC, in products that demand the highest levels of performance with small size, low cost, and low power consumption, as shown by Klein. Ex. 1016, [0008]. Klein is directed to a new silicon-based architecture and construction where the architecture satisfies conflicting imperatives—high computing performance at low size, cost and power consumption—demanded by shrinking portable, wireless and internet-connected devices. Ex. 1016, [0009]. Klein’s architecture utilized a RISC microcontroller for performing logic functions, specifying the ARM9TDMi from ARM, Ltd., among others, that may be used. Ex. 1016, [0024]. Similarly, before the priority date of the ’775 Patent a POSITA would have known that an ARM940-based RISC processor was a commonly known and used processor for offering high probability that each functional block having bus ownership can perform its operation compared to conventional exclusive bus arbitration schemes as shown by Kim ’678. Ex. 1015, [0193]. Kim ’678 is directed to systems having a system bus, an external bus, and a bus arbiter with programmable priorities for both buses, software, and methods for assigning such

priorities. Ex. 1015, [0002]. Kim '678's architecture utilized a RISC CPU for performing functions, specifying the ARM940T by ARM Co., among others, that may be used. Ex. 1015, [0076].

233. It is my opinion that it would have been obvious for a POSITA to implement the DOCSIS MAC functions of Rabenko using an ARM9TDMI-based RISC processor as taught by Klein. A POSITA would have looked to incorporate the standard architecture of Klein's RISC processors as an implementation suitable to applications like Rabenko's because it "satisfies conflicting imperatives—high computing performance at low size, cost and power consumption—demanded by shrinking portable, wireless and internet-connected devices," like Rabenko's devices. Ex. 1016, [0008]. Further, it is my opinion that it would have been obvious for a POSITA to implement the DOCSIS controller functions of Rabenko using an ARM-940-based RISC processor as taught by Kim '678. A POSITA would have looked to use the RISC architecture identified in Kim '678 as a suitable application for Rabenko's DOCSIS controller at least to increase the probability that each functional block having bus ownership in the Rabenko DOCSIS controller can perform its operation. Ex. 1015, [0193].

234. Combining Rabenko and Klein would be merely using known techniques implementing the DOCSIS MAC functions of Rabenko with the particular ARM9TDMI-based RISC processor of Klein) to improve similar devices

(Klein's RISC processor within Rabenko's DOCSIS MAC processor) in the same way (Rabenko's DOCSIS MAC processor includes the necessary architecture (*i.e.*, ARM9TDMI-based RISC processor) to perform its required functionality efficiently and to satisfy conflicting imperatives—high computing performance at low size, cost and power consumption—demanded by shrinking portable, wireless and internet-connected devices, and/or to favor the speed at which individual instructions execute over the robustness of the instruction set. Ex. 1005, [0268]; Ex. 1016, [0008]; Ex. 1008, p. 12.

235. Further, it is my opinion that combining Rabenko and Kim '678 would be merely using known techniques (implementing Rabenko's DOCSIS controller functions with the ARM-940-based RISC processor of Kim '678) to improve similar devices (Kim '678's RISC processor within Rabenko's DOCSIS controller) in the same way (Rabenko's DOCSIS controller includes the necessary architecture (*i.e.*, ARM940-based RISC processor) to increase the probability that each functional block having bus ownership in the Rabenko DOCSIS controller can perform its operation, and/or to favor the speed at which individual instructions execute over the robustness of the instruction set. Ex. 1015, [0193]; Ex. 1008, p. 12.

236. Additionally, a POSITA would have had the skill to implement the RISC processors based DOCSIS MAC and DOCSIS controller in Rabenko's system, as taught by Klein and Kim '678, by programming an ARM9TDMI-based RISC

processor with software to comply with the functions of Rabenko's DOCSIS MAC and by programming an ARM940-based RISC processor with software to comply with the functions of Rabenko's DOCSIS controller. Additionally, a POSITA would have had the skill to implement these RISC processors in Rabenko's system, as taught by Klein and Kim '678, because the POSITA would be familiar with RISC processors and the programming of RISC processors, leading to an expectation of success. Ex. 1005, [0268].

237. Therefore, it is my opinion that each of the proposed combinations teaches the limitations of claim 12.

13. Independent Claim 14

238. I note that the method of claim 14 includes substantial overlap with the systems of claim 1 and claim 18. At least for the same reasons I describe above in Sections IX.A.4. and IX.A.1, it is my opinion that each of the proposed combinations similarly teaches claim 14.

a. Limitation [14A]: “A method of cable modem operation comprising:”

239. To the extent the preamble is limiting, at least for the same reasons I discuss in Section IX.A.1 and IX.A.4, it is my opinion that each of the combinations discloses “[a] method of cable modem operation.”

- b. Limitation [14B]: “executing, via at least one processor of a first circuit that implements a data networking engine, first software that causes the data networking engine to perform home networking functions including interfacing with customer provided equipment, wherein the at least one processor is a RISC processor;”**

240. It is my opinion that each of the combinations teaches limitation [14B].

241. Limitation [14B] is a method step that substantially corresponds to the system limitation [1B] and includes substantial overlap with the system limitation [18B]. As I discuss more fully in Sections IX.A.1.b with respect to limitation [18B] and IX.A.4.b with respect to limitation [1B], it is my opinion that the combinations identified in those sections ^{teach} executing software via at least one RISC processor of a first circuit that implements its HomePNA controller 138 (included in the “data networking engine”) to perform home networking functions including interfacing with equipment, for example, HomePNA phone 126, computer 128, computer 130, etc. (“customer provided equipment”).

242. Therefore, at least for the same reasons I discuss above in Sections IX.A.1.b and IX.A.4.b, it is my opinion that each of the proposed combinations teaches limitation [14B].

- c. **Limitation [14C]: “executing, via one or more processors of a second circuit that implements a cable modem engine programmed with second software, the second software to cause the cable modem engine to perform cable modem functions other than the home networking functions performed by the data networking engine, the cable modem functions including interfacing with cable media, the cable modem engine configured to enable upgrades to its software in a manner that is independent of upgrades to the software of the data networking engine, wherein the second circuit is separate from the first circuit, and wherein the cable modem engine includes a DOCSIS PHY layer, a DOCSIS controller and a DOCSIS controller;”**

243. It is my opinion that limitation [14C] is indefinite, and to the extent it is considered definite, each of the proposed combinations teaches it.

244. Initially, limitation [14C] twice recites “a DOCSIS controller.” Ex. 1001, claim 14. Thus, it is unclear whether the second occurrence of “a DOCSIS controller” refers to the same or different DOCSIS controller as the first instance. Therefore, it is my opinion that limitation [14C] renders claim 14 indefinite. To the extent claim 14 is considered definite, it is my opinion that each of the proposed combinations teaches limitation [14C].

245. Limitation [14C] is a method step substantially corresponding to the system limitations [18C], [18D], [18E], [1C], and [1E]. Therefore, at least for the same reasons I discuss above in Sections IX.A.1.c-e with respect to limitations

[18C]-[18E], IX.A.4.c with respect to limitation [1C], and IX.A.4.e with respect to limitation [1E], it is my opinion that Rabenko teaches limitation [14C].

246. Therefore, it is my opinion that each of the identified combinations teaches “executing, via one or more processors of a second circuit that implements a cable modem engine programmed with second software, the second software to cause the cable modem engine to perform cable modem functions other than the home networking functions performed by the data networking engine, the cable modem functions including interfacing with cable media, the cable modem engine configured to enable upgrades to its software in a manner that is independent of upgrades to the software of the data networking engine, wherein the second circuit is separate from the first circuit, and wherein the cable modem engine includes a DOCSIS PHY layer, a DOCSIS controller and a DOCSIS controller.”

- d. Limitation [14D]: “connecting, via a data bus, the data networking engine to the cable modem engine, wherein the cable modem functions performed by the cable modem engine are completely partitioned from the home networking functions performed by the data networking engine;”**

247. It is my opinion that Rabenko teaches limitation [14D].

248. Limitation [14D] is a method step that substantially corresponds to the system limitations [18G] and [1E]. At least for the same reasons I discuss in Sections IX.A.1.g with respect to limitation [18G] and IX.A.4.e with respect to limitation [1E], it is my opinion that each of the proposed combinations teaches “connecting,

via a data bus, the data networking engine to the cable modem engine, wherein the cable modem functions performed by the cable modem engine are completely partitioned from the home networking functions performed by the data networking engine.”

- e. **Limitation [14E]: “processing, via the DOCSIS MAC processor, downstream PDU packets and forwarding the processed packets directly to the data networking engine without the involvement of the DOCSIS controller in order to boost downstream throughput.”**

249. Initially, I note that no “DOCSIS MAC processor” is previously recited in claim 14. Ex. 1001, claim 14. Therefore, it is unclear to what “the DOCSIS MAC processor” refers. Further, claim 14 previously twice recites “a DOCSIS controller.” However, it is unclear which “DOCSIS controller” is being bypassed. Therefore, it is my opinion that claim 14 is indefinite.

250. The above notwithstanding, limitation [14E] is a method step that substantially corresponds to the system limitations [1F] and [18F]. At least for the same reasons I describe in Sections IX.A.1.f and IX.A.4.f, it is my opinion that, to the extent limitation [14E] is considered definite, each of the proposed combinations teaches “processing, via the DOCSIS MAC processor, downstream PDU packets and forwarding the processed packets directly to the data networking engine without the involvement of the DOCSIS controller in order to boost downstream throughput.”

14. Dependent Claim 15:

- a. Limitation [15A]: “A method of cable modem operation as claimed in claim 14, further comprising: providing a flexible and partitioned cable modem gateway comprising:”**

251. It is my opinion that each of the proposed combinations teaches limitation [15A].

252. The '775 Patent describes its “Flexibility” as the following objective: “[t]he architecture of the gateway cable modem should be flexible enough to allow independent software development and field-upgrade of gateway value-added services and basic DOCSIS cable modem services.” Ex. 1001, 1:30-33. Further, the '775 Patent describes that its system is flexible “[s]ince the data networking and cable modem functions are decoupled and implemented in different processors 110 and 120, independent software upgrading and maintenance of these functions is feasible.” Ex. 1001, 4:25-28. Accordingly, a POSITA would understand that according to the '775 Patent, the ability to independently upgrade software for different processors makes a cable modem flexible.

253. At least for the same reasons I describe above in Sections IX.A.1.d and IX.A.4.d-e, it is my opinion that each of the proposed combinations teaches “providing a flexible and partitioned cable modem gateway.”

b. Limitation [15B]: “providing data and home networking functionality in the data networking engine;”

254. At least for the same reasons I describe in Sections IX.A.1.b, IX.A.4.b, and IX.A.13.b, it is my opinion that Rabenko describes HomePNA controller 138 (“home networking engine”) that provides home networking functionality. Therefore, it is my opinion that each of the proposed combinations “teaches providing data and home networking functionality in the data networking engine.”

c. Limitation [15C]: “providing DOCSIS and VoIP functionality in the cable modem engine; and”

255. It is my opinion that Rabenko teaches limitation [15C]. At least for the same reasons I discuss in Sections IX.A.1.c and IX.A.1.e, Rabenko describes providing DOCSIS functionality in its cable modem (including DOCSIS MAC/PHY 134/DOCSIS MAC 212+modulator 202+demodulator 200 and voice/data processor 136/213). Further, at least for the reasons I discuss in Section IX.A.6, Rabenko describes providing VoIP functionality in the cable modem engine (including voice/data processor 136/213).

256. Therefore, it is my opinion that each of the proposed combinations teaches “providing DOCSIS and VoIP functionality in the cable modem engine.”

d. Limitation [15D]: “partitioning the data networking engine from the cable modem engine so that the data and home networking functionality is completely decoupled from the DOCSIS and VoIP functionality.”

257. It is my opinion that Rabenko teaches limitation [15D]. At least referring to Sections IX.A.1.g, IX.A.4.e, and IX.A.13.d I have explained that Rabenko describes that its home networking functions performed by the HomePNA controller 138 (included in the claimed “data networking engine”) are completely partitioned from the cable modem functions (including DOCSIS and VoIP functionality) performed by the DOCSIS MAC/PHY 134/DOCSIS MAC 212+modulator 202+demodulator 200 and voice/data processor 136/213 (included in the “cable modem engine”).

258. Therefore, it is my opinion that each of the proposed combinations teaches “partitioning the data networking engine from the cable modem engine so that the data and home networking functionality is completely decoupled from the DOCSIS and VoIP functionality.”

B. Grounds Q-X: Grounds A-H in view of Koperda render obvious Claim 8

259. As I set forth below, each of the proposed combinations that include Koperda renders obvious claim 8⁴.

⁴ The limitations of the claim appear and are labelled in the Claims Listing Appendix.

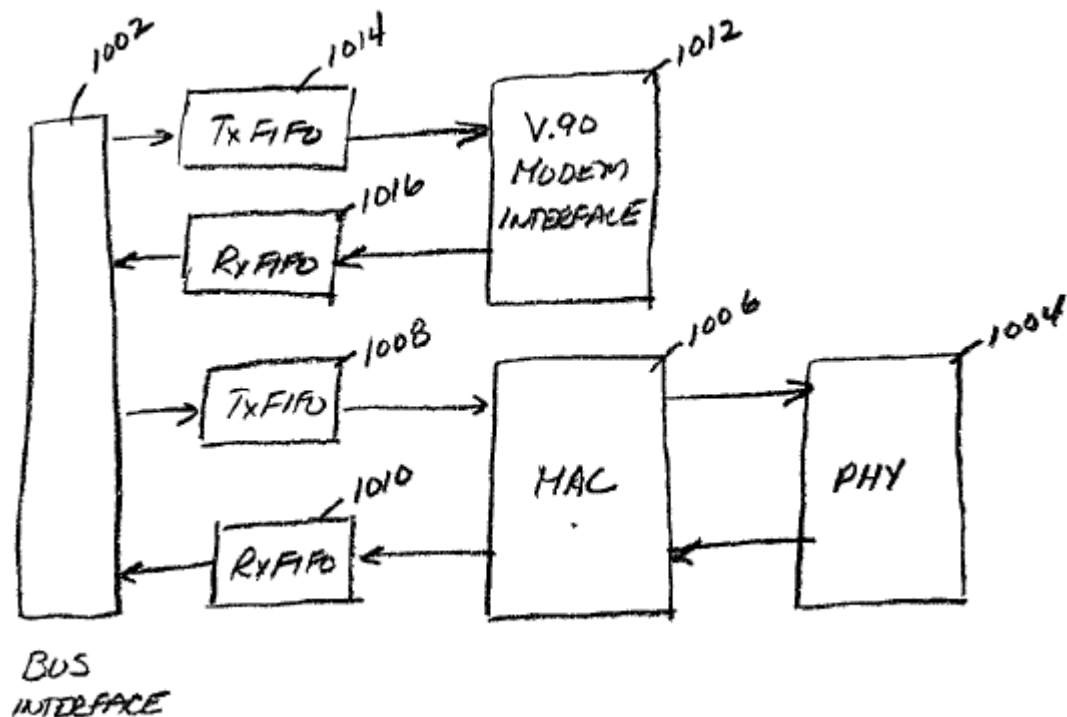
1. Dependent Claim 8: “A cable modem system as claimed in claim 1, wherein the data networking engine is configured to perform all data networking processing including advanced multi-port bridging routing with NAT/firewall and VPN, and home networking applications.”

260. Claim 8 depends from claim 1 and adds that the data networking engine (introduced in claim 1) is “configured to perform all data networking processing including advanced multi-port bridging routing with NAT/firewall and VPN, and home networking applications.” Ex. 1001, claim 8. I have explained above in Section IX.A.4 that, to the extent claim 1 is definite, each of the proposed combinations teaches it. I also explain above in Section IX.A.11.d regarding claim 10 and below that Rabenko teaches that the data networking engine is “configured to implement a majority of data networking processing and home networking applications.” Further, as I describe below, it is my opinion that it would have been obvious to configure Rabenko’s data networking engine to perform all data networking processing, including advanced multi-port bridging routing with NAT/firewall and VPN.

261. As noted above in Section IX.A.1.b, Rabenko’s HomePNA controller performs all data networking processing for the devices attached to the HomePNA LAN 110. Ex. 1005, Figs. 1a, 1b. Rabenko also describes two personal computers, 128 and 130, connected to the HomePNA LAN 110, where personal computer 128 is described as Net Meeting and personal computer 130 is described as Netscape. Ex. 1005, [0042]. Rabenko states that “[t]hese describe two possible

applications that are supported by personal computers connected to networks, in this case an HomePNA LAN. Those skilled in the art will appreciate that any computer *application* can be substituted or added.” Ex. 1005, [0042] (emphasis added). Accordingly, Rabenko, therefore, also describes home networking applications being performed or managed by the HomePNA controller 138.

262. Figure 10 of Rabenko is a system block diagram of an exemplary HomePNA controller. Ex. 1005, [0024], Fig. 10. “Referring to FIG. 10, the exemplary HomePNA controller 138 (see FIG. 1a) can be a fully integrated MAC/PHY that transmits and receives data over the HomePNA LAN.” Ex. 1005, [0217].



Ex. 1005, Fig. 10

263. Although Rabenko does not explicitly teach “data networking processing including advanced multi-port bridging routing with NAT/firewall and VPN,” as I discuss above in Section IX.A.1.b, Rabenko’s HomePNA controller performs all data networking processing for the devices attached to the HomePNA LAN 110. *See, e.g.*, Ex. 1005, Figs. 1a-1b. Rabenko further explicitly teaches that “depend[ing] upon the particular application and design constraints imposed on the overall system,” “[s]killed artisans recognize the interchangeability of hardware and software under these circumstances, and how best to implement the described functionality for each particular application.” Ex. 1005, [0268]. Accordingly, a POSITA, recognizing the interchangeability of hardware and software depending on the particular application and design constraints, would have understood that any of a number of different modules of known functionality for a HomePNA controller may be implemented in a module as described in Koperda.

264. Like Rabenko, Koperda is directed to a home-based telecommunications system that includes a residential gateway that may be configured to perform any of a number of different functions. Ex. 1010, Abstract, [0003]-[0007], [0023]-[0024]. Koperda’s residential gateway is a modular design that allows for any of a variety of different network access technologies, home network technologies, and network services to be implemented in one or more modules. Ex. 1010, [0023]-[0025]. In particular, Koperda provides a non-

exhaustive list “of the network technologies categories that could be provided by modules in the gateway system.” Ex. 1010, [0025], Table 1.

TABLE 1

Network interfaces	Home interfaces	Wireless modules	Misc. modules
DOCSIS	Ethernet	IEEE 802.11a	power
ADSL	HomePNA	IEEE 802.11b	Security
ADSLite	Bluetooth	HomeRF	Firewall/ Router
T1	Homepower	HiperLAN II	VPN
T3	2-Line POTs	900 MHz cordless phone	Standby power
SDSL	4-Line POTs	2.4 GHz cordless phone	NAT/DHCP
ISDN	Security Panel Monitoring		Softswitch PBX functions
V.90 (56K) modem	Utility Monitoring		
HDTV Tuner	Multi-port Ethernet Hub		
VDSL	Cordless Telephony		
FDDI	Camcorder Video (HAVI - IEEE 1394)		

Ex. 1010, Table 1 (annotated)

265. A POSITA would have understood that NAT (Network Address Translation) is “[a]n Internet standard that enables a local area network (LAN) to use one set of IP addresses for internal traffic and a second set of addresses for external traffic.” Ex. 1008, pp. 6-7. As shown by Table 1 reproduced above, Koperda teaches that for a DOCSIS network, as taught in Rabenko, that utilizes a HomePNA interface, as taught in Rabenko, data networking processing, including “Firewall/Router,” “VPN,” and “NAT” may be implemented by the HomePNA controller. Ex. 1010, [0025], Table 1. Koperda explicitly teaches that “[m]any of the functions shown in Table 1 may be combined into a single module.” Ex. 1010,

[0043]. It is my opinion that it would have been obvious to apply Koperda's teachings to Rabenko to yield a system wherein the HomePNA controller is configured to perform advanced multi-port bridging routing with network address translation functions, firewall functions, and virtual private network functions.

266. Accordingly, it is my opinion that it would have been obvious to a POSITA to combine a module comprising the VPN, NAT, firewall, and routing functions, as taught in Koperda, in the HomePNA controller of Rabenko because the modular design of Koperda has low initial costs and scales well as additional networks are added. Ex. 1010, [0023]. The combination would further have been obvious because Koperda provides that such functions may be combined into a single "Home interface[]" (e.g., Rabenko's HomePNA controller) and because the data networking engine, which is controlling all of the communications with the local home devices, would be the logical location to have these functionalities in order to provide such functionalities to the local home devices on the HomeLAN. Ex. 1010, [0005], [0043], Table 1.

267. It is my opinion that a POSITA would have recognized that such a combination would be using known techniques (implementing multiple HomePNA controller functions of Rabenko so as to include the functionality of the module in the HomePNA controller of Koperda) to improve similar devices (the HomePNA controller taught in Rabenko) in the same way (by ensuring that Rabenko's

HomePNA controller included the various functionalities of Koperda's HomePNA). Ex. 1010, [0005], [0043]; Ex. 1005, [0268]. As explained above, both Rabenko and Koperda teach home gateway systems that include a HomePNA controller. It would have been obvious to a POSITA to use Koperda's technique of enabling multiple functions in a single HomePNA controller module to improve Rabenko's HomePNA controller. Ex. 1010, [0032]-[0036].

268. Additionally, it is my opinion that a POSITA would have had the skill to implement Koperda's functionality in Rabenko's HomePNA controller and as a single module type architecture, as taught by Koperda, to allow for Koperda's identified functionalities to the local home devices on the HomeLAN. Ex. 1005, [0268]; Ex. 1010, [0005], [0043]. As taught by both Rabenko and Koperda, such a combination requires only minor hardware, software, and/or firmware modifications, leading to an expectation of success in yielding predictable results ensuring that Rabenko's HomePNA controller implements VPN, NAT, firewall, and advanced multi-port bridging routing functions Ex. 1005, [0268]; Ex. 1010, [0043].

269. Therefore, it is my opinion that each of the proposed combinations that include Koperda teaches "wherein the data networking engine is configured to perform all data networking processing including advanced multi-port bridging routing with NAT/firewall and VPN, and home networking applications."

C. Grounds Y-FF: Grounds Q-X in view of Johnson render obvious Claim 9

270. As I set forth below, each of the proposed combinations that include and Johnson renders obvious claim 9⁵.

1. Dependent Claim 9: “A cable modem system as claimed in claim 8, wherein the data networking engine comprises the entire embedded portal services functionality of the CableHome specification.”

271. Claim 9 depends from claim 8 which depends from claim 1 and adds that the data networking engine (introduced in claim 1) “comprises the entire embedded portal services functionality of the CableHome specification.” Ex. 1001, claim 9. As I describe above in Section IX.A.4, it is my opinion that each of the proposed combinations teaches claim 1. Further, as I describe above in Section IX.B.1, it is my opinion that each of the proposed combinations that include Koperda teaches claim 8. Additionally, as I describe below, it would have been obvious to a POSITA for the data networking engine to comprise the known entire embedded portal services functionality of the known CableHome specification.

272. As I describe above in Sections IX.A.1.b and IX.A.4.b, Rabenko’s HomePNA controller 138 and AFE 226 teaches the claimed “data networking engine.” Additionally, Rabenko describes that HomePNA controller 138 can be a fully integrated MAC/PHY device that provides bi-directional communication with

⁵ The limitations of the claim appear and are labelled in the Claims Listing Appendix.

multiple devices such as HomePNA phone 126, computer 128, television 132, etc., operating on HomePNA LAN 110. Ex. 1005, [0033]-[0034], [0042]-[0043], [0045], [0080]. Specifically, Rabenko describes television 132 for displaying “television programming *streamed from the external IP network* or spooled from memory systems of an attached video server.” Ex. 1005, [0043], (emphasis added).

273. Rabenko describes that a DOCSIS (Data Over Cable Service Interface Specification) network is used for delivery of broadband services, such as IP services over the IP network (an HFC network), to the network port 104. Ex. 1005, [0033]. Rabenko continues that “[i]n the exemplary residential gateway, a cable modem is used as described by the CableLabs DOCSIS specification except that the telephony and services delivered to the subscriber port 106*b* are not limited to Ethernet, but rather can support any physical media and protocol compatible with the specific in home LAN.” Ex. 1005, [0034]. Accordingly, it is my opinion that a POSITA would have understood that Rabenko describes a cable modem that complies with the CableLabs DOCSIS specification except for not being limited to Ethernet.

274. A POSITA would have understood that CableLabs refers to Cable Television Laboratories, Inc., a research and development consortium of cable television system operators established in 1988. Ex. 1008, p. 4. A POSITA further would have understood that, at the time of the priority date of the ’775 Patent, CableLabs’ current projects included PacketCable and CableHome, a “trademarked

term of CableLabs for a project to develop interface specifications to extend high quality cable-based (i.e., cable TV-based) services to network devices within the residence.” Ex. 1008, p. 4. Thus, a POSITA would have understood that Rabenko’s CableLabs DOCSIS compliance was a commonly known initiative for cable modems at the priority date of the ’775 Patent. Understanding that Rabenko’s cable modem “is used as described by the CableLabs DOCSIS specification” and CableLabs DOCSIS compliant (Ex. 1005, [0034]), a POSITA would have been motivated to implement one or more other well-known CableLabs specifications, such as CableHome, as taught by Johnson, for functionalities of Rabenko’s gateway in order to ensure uniformity, interactivity, and operability in a CableLabs DOCSIS network.

275. Like Rabenko, Johnson is directed to designing and managing a home network that distributes data such as voice and video. Ex. 1009, Abstract, [0002], [0020], [0048]. Johnson teaches a networking device that includes a networking management capability (as defined in the CableHome Specification) and data interfaces that are also CableHome compliant. Ex. 1009, [0032]-[0035], [0062]-[0067], Figs. 10-14. Johnson recognizes that as more users gain access to high speed Internet access or digital television, “users will desire to transmit video or other timing critical data over their home networks.” Ex. 1009, [0004]. Johnson’s system allows for “distributing broadcast quality video (or similar timing critical data) in

the home over a network that is also carrying IP traffic,” a feature absent in prior systems which transmitted video in MPEG formats and thus were often incompatible with IP networks “due to the timing considerations inherent in high quality video.” Ex. 1009, Abstract, [0004].

276. It is my opinion that a POSITA would have been motivated to incorporate the CableHome specification functionality of Johnson into Rabenko to allow for the integration of IP traffic with non-IP video traffic to ensure that video data transmitted in MPEG format, which is not necessarily compatible with IP networks due to the timing considerations inherent in high quality video, will work in Rabenko’s system. A POSITA would have been motivated because Rabenko’s HomePNA controller provides bi-directional communication with television 132, which displays “television programming *streamed from the external IP network.*” Ex. 1005, [0043] (emphasis added). When implementing Rabenko’s system, a POSITA would have looked to Johnson for similar networks and specific specification compliances implemented by Johnson in order to allow for the integration of non-IP video into its system.

277. Further, a POSITA would have recognized that such a combination would be using known techniques (Johnson’s implementation of CableHome-compliant networking devices) to improve a similar device (Rabenko’s HomePNA controller within a residential gateway) in the same way (by ensuring that Rabenko’s

HomePNA controller, which handles transmissions to television 132 on the Home LAN 110, is compliant with CableLabs' CableHome specification as taught by Johnson to allow for the integration of IP traffic with non-IP video traffic).

278. It is, therefore, my opinion that each of the proposed combinations that include Johnson and Koperda discloses "wherein the data networking engine comprises the entire embedded portal services functionality of the CableHome specification."

D. Grounds GG-NN: Grounds A-H in view of Johnson renders obvious Claims 11, 13, and 16-17

279. As I set forth below, each of the proposed combinations that include Johnson renders obvious claims 11, 13, and 16-17⁶.

- 1. Dependent Claim 11: "A cable modem system as claimed in claim 10, wherein the DOCSIS controller is configured to provide VoIP functionality in accordance with the PacketCable specification, wherein the data networking engine is configured to provide the embedded portal services functionality of the CableHome specification, and wherein the CableHome functionality provided by the data networking engine is completely decoupled from the PacketCable and DOCSIS functionality provided by the cable modem engine."**

280. Claim 11 depends from claim 10, which depends from claim 1 and adds that the DOCSIS controller is configured to provide VoIP functionality (as introduced in claim 10) "in accordance with the PacketCable specification, wherein

⁶ The limitations of the claims appear and are labelled in the Claims Listing Appendix.

the data networking engine is configured to provide the embedded portal services functionality of the CableHome specification, and wherein the CableHome functionality provided by the data networking engine is completely decoupled from the PacketCable and DOCSIS functionality provided by the cable modem engine.” As I describe above in Sections IX.A.4 and IX.A.11, it is my opinion that each of the proposed combinations teaches claims 1 and 10.

281. As described in Sections IX.A.1.g and IX.A.4.e, Rabenko teaches “the cable modem functions performed by the cable modem engine are completely partitioned from the home networking functions performed by the data networking engine.” Further, as I describe in Section IX.A.10, with respect to claim 7, Rabenko teaches “wherein the VoIP functionality is in conformance with the PacketCable specification.” Finally, as I describe above in Section IX.C.1, Rabenko in view of Johnson teaches “wherein the data networking engine comprises the entire embedded portal services functionality of the CableHome specification.”

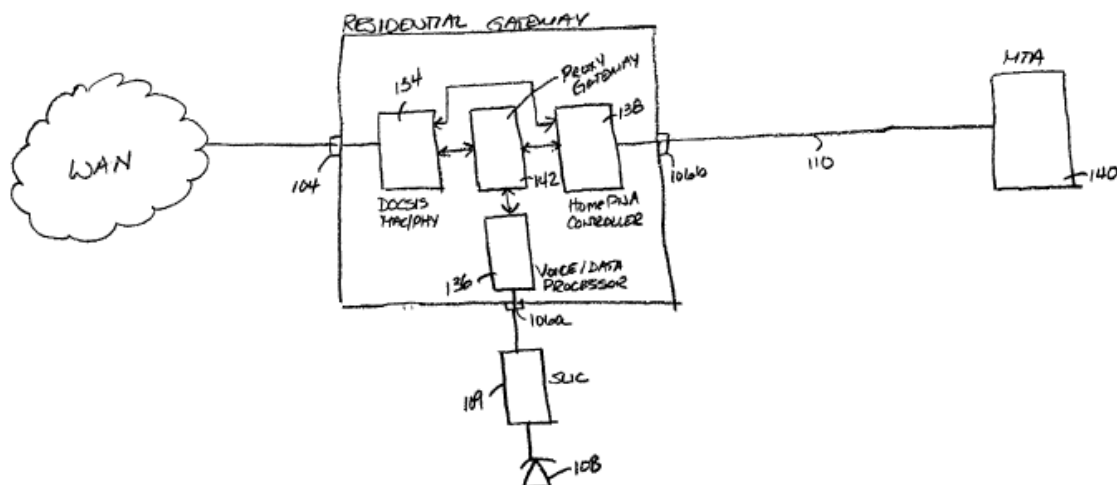
282. Therefore, it is my opinion that each of the proposed combinations that include Johnson teach the limitations of claim 11.

2. Dependent Claim 13:

- a. **Limitation [13A]: “A cable modem system as claimed in claim 1, wherein the data networking engine includes consumer provided equipment drivers including a USB driver and an Ethernet driver and”**

283. Claim 13 depends from claim 1. Ex. 1001, claim 13. As I describe above in Section IX.A.4, it is my opinion that claim 1 is taught each of the proposed limitations. Limitation [13A] adds that the data networking engine (introduced in claim 1) “includes consumer provided equipment drivers including a USB driver and an Ethernet driver.” As described below, it is my opinion that Rabenko teaches limitation [13A].

284. Rabenko describes that in a downstream direction, DOCSIS MAC/PHY 134 of a residential gateway determines whether a packet is voice or data, and if it is data, the packet is routed to HomePNA controller 138. Ex. 1005, [0045], Fig. 1b.



Ex. 1005, Fig. 1b (annotated)

285. Rabenko discloses that, “[a]n exemplary embodiment of the residential gateway [shown in Fig. 1b] is shown schematically in FIG. 2. The described exemplary embodiment may provide a highly integrated solution implemented in a single chip that is compliant with the Data Over Cable Service Interface Specification (DOCSIS). DOCSIS was developed to ensure that cable modem equipment built by a variety of manufacturers is compatible, as is the case with traditional dial-up modems. The described exemplary embodiment can provide integrated functions for communicating with a cable head (not shown) end via the network port 104 [shown in Fig. 1b].” Ex. 1005, [0050].

286. While describing Figure 2, Rabenko describes “a universal serial bus transceiver 204 can provide transparent bi-directional IP traffic between devices operating on a USB such as for example a PC (personal computer) workstation, server printer or other similar devices (not shown). Additionally, an IEEE 802.3 compliant media independent interface (MII) 210 in conjunction with an Ethernet MAC 211 can also provide bi-directional data exchange between devices such as, for example a number of PCs and/or Ethernet phones (not shown).” Ex. 1005, [0051]. A POSITA would have understood these to be home networking functions implemented by the USB transceiver 204/USB MAC 222 and the Ethernet MAC 211 that also includes a USB driver and an Ethernet driver, respectively. In addition,

a POSITA would have understood that since in a downstream direction, if a packet is data, it is routed to HomePNA controller 138, which uses USB transceiver 204 to provide transparent bi-directional IP traffic between devices operating on a USB and Ethernet MAC 211 to provide bi-directional data exchange between devices via MII 210, Ex. 1005, [0045], [0051], Fig. 1b, the HomePNA controller 138 would include consumer provided equipment drivers including USB and Ethernet drivers.

287. Therefore, it is my opinion that Rabenko teaches “wherein the data networking engine includes consumer provided equipment drivers including a USB driver and an Ethernet driver.”

b. Limitation [13B] “the data networking engine is configured to provide the embedded portal services functionality of the CableHome specification,”

288. Limitation [13B] adds that the data networking engine (introduced in claim 1) is “configured to provide the embedded portal services functionality of the CableHome specification.” Ex. 1001, claim 13.

289. As I describe above in Section XI.C.1, each of the proposed combinations that include Johnson teaches “the data networking engine comprises the entire embedded portal services functionality of the CableHome specification.”

290. Similarly, it is my opinion that Johnson teaches limitation [13B].

c. Limitation [13C]: “wherein the DOCSIS controller is configured to provide VoIP functionality in accordance with the PacketCable specification, and”

291. Limitation [13C] adds that the DOCSIS controller (introduced in claim 1) is “configured to provide VoIP functionality in accordance with the PacketCable specification.”

292. As I describe above in Sections IX.A.9-IX.A.10, Rabenko teaches “wherein all VoIP functionality is implemented in the DOCSIS controller;” and “wherein the VoIP functionality is in conformance with the PacketCable specification.”

293. Similarly, and for at least the same reasons, it is my opinion that Rabenko teaches “wherein the DOCSIS controller is configured to provide VoIP functionality in accordance with the PacketCable specification” of limitation [13C].

d. Limitation [13D]: “wherein the CableHome functionality provided by the data networking engine is completely decoupled from the PacketCable and DOCSIS functionality provided by the cable modem engine.”

294. Limitation [13D] adds that the CableHome functionality provided by the data networking engine (if definite, introduced in limitation [13B]) “is completely decoupled from” the PacketCable and DOCSIS functionality provided by the cable modem (if definite, introduced in limitation [13D]). As I describe below and in Section IX.A.11.d, Rabenko teaches “decoupling” the functions of the data networking engine from the functions of the cable modem engine.

295. The '775 Patent describes that because “[t]he data networking engine is partitioned from the cable modem engine,” “the data and home networking functionality is completely decoupled from the DOCSIS and VoIP functionality.” Ex. 1001, 2:24-27. As I describe above in Section IX.A.11.d, Rabenko teaches partitioning the data networking engine (HomePNA Controller 138 and AFE 226) from the cable modem engine (DOCSIS MAC/PHY, proxy gateway 142 and voice/data processor 136/213) so that the data and home networking functionality is completely decoupled from the DOCSIS and VoIP functionality. Similarly, a POSITA would have understood that Rabenko teaches that the CableHome functionality provided by the data networking engine is completely decoupled from the PacketCable and DOCSIS functionality provided by the cable modem engine.

296. Therefore, it is my opinion that each of the combinations that include Johnson teaches “wherein the CableHome functionality provided by the data networking engine is completely decoupled from the PacketCable and DOCSIS functionality provided by the cable modem engine.”

297. Accordingly, it is my opinion that each of the proposed combinations that includes Johnson teaches the limitations of claim 13.

3. **Dependent Claim 16: “A method as claimed in claim 14, further comprising: providing VoIP functionality in accordance with the PacketCable specification in the DOCSIS controller; and providing the embedded portal services functionality of the CableHome specification in the data networking engine; wherein the CableHome functionality provided by the data networking engine is completely decoupled from the PacketCable and DOCSIS functionality provided by the cable modem engine.**

298. Claim 16 depends from claim 14. Ex. 1001, claim 16. As I describe above in Section IX.A.13, it is my opinion that each of the proposed combinations teaches claim 14.

299. Additionally, the limitations of claim 16 are substantially similar to claim 13. As I describe above in Section IX.D.2, each of the proposed combinations that include Johnson teaches claim 13. Therefore, it is my opinion that, at least for the same reasons, each of the proposed combinations that includes Johnson teaches the limitations of claim 16.

4. **Dependent Claim 17: “A method as claimed in claim 14, further comprising: providing the embedded portal services functionality of the CableHome specification in the data networking engine; and providing VoIP functionality in accordance with the PacketCable specification in the DOCSIS controller; wherein the data networking engine includes consumer provided equipment drivers including a USB driver and an Ethernet driver; and wherein the CableHome functionality provided by the data networking engine is completely decoupled from the PacketCable and DOCSIS functionality provided by the cable modem engine.”**

300. Claim 17 depends from claim 14. Ex. 1001, claim 17. As I describe above in Section IX.A.13, it is my opinion that each of the proposed combinations teaches claim 14.

301. Additionally, the limitations of claim 17 are substantially similar to those of claim 13. As I described above in Sections IX.D.2, each of the combinations including Johnson teaches the limitations of claim 13. Similarly, it is my opinion that at least for the same reasons, each of the combinations including Johnson teaches the limitations of claim 17.

X. CONCLUSION

302. 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. I declare under penalty of perjury that the foregoing is true and correct.

Dated Feb 15-2024

A handwritten signature in cursive script, appearing to read "Sayfe Kiaei".

Sayfe Kiaei

CLAIMS LISTING APPENDIX

U.S. Pat. No. 8,223,775

Designation	Claim Language
Claim 1	
[1A]	1. A cable modem system comprising:
[1B]	a data networking engine implemented in a first circuit that includes at least one processor, the data networking engine programmed with software that when executed by the at least one processor of the first circuit causes the data networking engine to perform home networking functions including interfacing with customer provided equipment, wherein the at least one processor is a RISC processor;
[1C]	a cable modem engine implemented in a second circuit that includes at least one processor, the second circuit being separate from the first circuit, the cable modem engine including a DOCSIS PHY layer, a DOCSIS controller, and a DOCSIS controller and programmed with software that when executed by the at least one processor of the second circuit causes the cable modem engine to perform cable modem functions other than the home networking functions performed by the data networking engine, the cable modem functions including interfacing with cable media,
[1D]	the cable modem engine configured to enable upgrades to its software in a manner that is independent of upgrades to the software of the data networking engine; and
[1E]	a data bus that connects the data networking engine to the cable modem engine, wherein the cable modem functions performed by the cable modem engine are completely partitioned from the home networking functions performed by the data networking engine;
[1F]	wherein the DOCSIS MAC processor is configured to process downstream PDU packets and forward the processed packets directly to the data networking engine without the involvement of the DOCSIS controller in order to boost downstream throughput.
Claim 2	
2	2. A cable modem system as claimed in claim 1, wherein all DOCSIS functions are localized in the cable modem engine.
Claim 3	
3	3. A cable modem system as claimed in claim 2, wherein VoIP functionality is embedded in the cable modem engine.

Designation	Claim Language
Claim 4	
4	4. A cable modem system as claimed in claim 1, and further comprising an advanced crypto engine configured to perform all crypto functions for both the data networking engine and the cable modem engine, the advanced crypto engine being separate from both the data networking engine and the cable modem engine.
Claim 5	
5	5. A cable modem system as claimed in claim 1, wherein the DOCSIS PHY layer includes a hardware transmitter and receiver.
Claim 6	
6	6. A cable modem system as claimed in claim 1, wherein all VoIP functionality is implemented in the DOCSIS controller.
Claim 7	
7	7. A cable modem system as claimed in claim 6, wherein the VoIP functionality is in conformance with the PacketCable specification.
Claim 8	
8	8. A cable modem system as claimed in claim 1, wherein the data networking engine is configured to perform all data networking processing including advanced multi-port bridging routing with NAT/firewall and VPN, and home networking applications.
Claim 9	
9	9. A cable modem system as claimed in claim 8, wherein the data networking engine comprises the entire embedded portal services functionality of the CableHome specification.
Claim 10	
[10A]	10. A cable modem system as claimed in claim 1, wherein with regard to the cable modem engine: the DOCSIS PHY layer includes a transmitter and receiver;
[10B]	the DOCSIS MAC processor is configured to implement real-time MAC functions for both upstream and downstream communications; and
[10C]	the DOCSIS controller is configured to implement VoIP functionality; and
[10D]	wherein the data networking engine includes a RISC processor configured to implement a majority of data networking processing and home networking applications decoupled from the implementation of the MAC functions and the VoIP functionality of the cable modem engine.

Designation	Claim Language
Claim 11	
11	11. A cable modem system as claimed in claim 10, wherein the DOCSIS controller is configured to provide VoIP functionality in accordance with the PacketCable specification, wherein the data networking engine is configured to provide the embedded portal services functionality of the CableHome specification, and wherein the CableHome functionality provided by the data networking engine is completely decoupled from the PacketCable and DOCSIS functionality provided by the cable modem engine.
Claim 12	
12	12. A cable modem system as claimed in claim 11, wherein the DOCSIS MAC processor is an ARM9TDMI-based RISC processor, and wherein the DOCSIS controller is an ARM940-based RISC processor.
Claim 13	
[13A]	13. A cable modem system as claimed in claim 1, wherein the data networking engine includes consumer provided equipment drivers including a USB driver and an Ethernet driver and
[13B]	the data networking engine is configured to provide the embedded portal services functionality of the CableHome specification,
[13C]	wherein the DOCSIS controller is configured to provide VoIP functionality in accordance with the PacketCable specification, and
[13D]	wherein the CableHome functionality provided by the data networking engine is completely decoupled from the PacketCable and DOCSIS functionality provided by the cable modem engine.
Claim 14	
[14A]	14. A method of cable modem operation comprising:
[14B]	executing, via at least one processor of a first circuit that implements a data networking engine, first software that causes the data networking engine to perform home networking functions including interfacing with customer provided equipment, wherein the at least one processor is a RISC processor;
[14C]	executing, via one or more processors of a second circuit that implements a cable modem engine programmed with second software, the second software to cause the cable modem engine to perform cable modem functions other than the home networking functions performed by the data networking engine, the cable modem functions including interfacing with cable media, the cable

Designation	Claim Language
	modem engine configured to enable upgrades to its software in a manner that is independent of upgrades to the software of the data networking engine, wherein the second circuit is separate from the first circuit, and wherein the cable modem engine includes a DOCSIS PHY layer, a DOCSIS controller and a DOCSIS controller;
[14D]	connecting, via a data bus, the data networking engine to the cable modem engine, wherein the cable modem functions performed by the cable modem engine are completely partitioned from the home networking functions performed by the data networking engine;
[14E]	processing, via the DOCSIS MAC processor, downstream PDU packets and forwarding the processed packets directly to the data networking engine without the involvement of the DOCSIS controller in order to boost downstream throughput.
Claim 15	
[15A]	15. A method of cable modem operation as claimed in claim 14, further comprising: providing a flexible and partitioned cable modem gateway comprising:
[15B]	providing data and home networking functionality in the data networking engine;
[15C]	providing DOCSIS and VoIP functionality in the cable modem engine; and
[15D]	partitioning the data networking engine from the cable modem engine so that the data and home networking functionality is completely decoupled from the DOCSIS and VoIP functionality.
Claim 16	
16	16. A method as claimed in claim 14, further comprising: providing VoIP functionality in accordance with the PacketCable specification in the DOCSIS controller; and providing the embedded portal services functionality of the CableHome specification in the data networking engine; wherein the CableHome functionality provided by the data networking engine is completely decoupled from the PacketCable and DOCSIS functionality provided by the cable modem engine.
Claim 17	
17	17. A method as claimed in claim 14, further comprising: providing the embedded portal services functionality of the CableHome

Designation	Claim Language
	specification in the data networking engine; and providing VoIP functionality in accordance with the PacketCable specification in the DOCSIS controller; wherein the data networking engine includes consumer provided equipment drivers including a USB driver and an Ethernet driver; and wherein the CableHome functionality provided by the data networking engine is completely decoupled from the PacketCable and DOCSIS functionality provided by the cable modem engine.
Claim 18	
[18A]	18. A cable modem system comprising:
[18B]	a data networking engine implemented in a first circuit that includes at least one processor, the data networking engine programmed with software that when executed by the at least one processor of the first circuit causes the data networking engine to perform home networking functions including interfacing with customer provided equipment;
[18C]	a cable modem engine implemented in a second circuit that includes at least one processor, the second circuit being separate from the first circuit, the cable modem engine programmed with software that when executed by the at least one processor of the second circuit causes the cable modem engine to perform cable modem functions other than the home networking functions performed by the data networking engine, the cable modem functions including interfacing with cable media, and
[18D]	the cable modem engine configured to enable upgrades to its software in a manner that is independent of upgrades to the software of the data networking engine,
[18E]	the cable modem engine including a DOCSIS controller and a DOCSIS MAC processor,
[18F]	the DOCSIS MAC processor configured to process downstream PDU packets and forward the processed packets directly to the data networking engine without the involvement of the DOCSIS controller in order to boost downstream throughput; and
[18G]	a data bus that connects the data networking engine to the cable modem engine, wherein the cable modem functions performed by the cable modem engine are completely partitioned from the home networking functions performed by the data networking engine.
Claim 19	

Designation	Claim Language
19	19. A cable modem system as claimed in claim 18, wherein all DOCSIS functions are localized in the cable modem engine.
Claim 20	
20	20. The cable modem system as claimed in claim 18 wherein the DOCSIS MAC processor is configured to implement real-time MAC functions for both upstream and downstream communications.