

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. 11,381,866
Filing Date: January 28, 2022
Issue Date: July 5, 2022
Title: CABLE TELEVISION DEVICE

Inter Partes Review No.: IPR2024-00436

DECLARATION OF DAVID B. LETT

**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, David B. Lett, 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.

1. 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. 11,381,866 (“the ’866 patent”) (Ex. 1101) and the unpatentability grounds set forth in the Petition for this proceeding. My experience with television distribution systems, Set Top Boxes (STBs), modulation schemes, radio frequency systems, Video on Demand (VOD), and content delivery systems provides me with an understanding of the subject matter described and claimed in the ’866 patent.

3. I am being compensated at my usual consulting rate or testimony rate of \$385 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.

2. PROFESSIONAL BACKGROUND AND QUALIFICATIONS

4. I am a technical consultant and product development industry veteran with expertise in electronics, software, hardware, video, audio, and data communications, having led product development organizations in cable, satellite, consumer electronics, home automation, asset tracking, remote tank logistics, and alarm industries. My current curriculum vitae is attached as Ex. 1103 and some highlights follow.

5. I earned my B.S. in Electrical Engineering (1982) with high honors from the University of Tennessee in Knoxville, Tennessee. I also attended the Georgia Institute of Technology from 1986 to 1987, completing 40% of the required degree hours for the M.S. Electrical Engineering program.

6. From 1982 to 1985, I worked at Scientific Atlanta as an Electrical Engineer designing video, audio, and data communications equipment for the cable television industry. I designed software and hardware including addressable data transmitters, video sync suppression scramblers, transaction format converters, and data channel monitors for addressable Cable Television systems and Set Top Boxes.

7. From 1983 to 1985, while working at Scientific Atlanta, I also worked as an Assistant Professor at DeVry Institute of Technology, teaching courses in electronics and microprocessor hardware/software.

8. From 1985 to 1990, I worked at Wegener Communications as a Senior Electrical Engineer, designing satellite communications equipment including forward error correction (FEC) coding systems, PSK modems, and analog control systems for RF modulators and PSK demodulators. I was promoted to the Hardware Engineering Manager, where I managed product development of video, audio, and data satellite receivers, modulators, graphics display systems, DSP-based companders, FSK and PSK satellite modems, multiplexers, forward error correction (FEC) codecs, RF upconverters and downconverters, and baseband analog and digital processing components.

9. In 1990, I returned to Scientific Atlanta, which was acquired by Cisco in 2006. I worked as Engineering Manager running the set top box engineering group where I was promoted to Director and Vice President during my tenure until 2011. I led the design of many cable set top boxes and systems through the evolution of analog video, addressability, downloadable software, electronic program guides, digital video, VOD, software applications, high-definition TV, DVR, DOCSIS, full spectrum tuners, and multiroom DVR. These systems implemented various technologies including DOCSIS 1/2/3 and hybrid gateways, 802.11, IPTV, DVR, cable modems, ADSL, VDSL, DVB-T/C/S, bootloaders, factory diagnostics, application frameworks, Nagra, DRMs, conditional access, secure microprocessors, device management, Android, Adobe Flash, Linux, DVD play/record, MPEG-4,

MPEG-2, H.264, NTSC, PAL, DAVIC, MoCA, high-performance CPUs, cablecards, network processors, HDMI, multiple video/audio display interfaces, 2D/3D graphics, multiple RF tuners, and full spectrum tuners.

10. From 2011 to 2016, I worked for EchoStar Technologies, which served as the product development organization for sister company DISH Network. I served as Vice President of Engineering and was the Head of the Atlanta research and development center. I led the development of satellite set top boxes, consumer electronic equipment, and a home automation and security system. Technologies used included video/audio, IoT, H.265, HEVC, 3D, Satellite, wireless, MoCA, transcoding, embedded C Linux applications, mobile applications (IOS and Android), SaaS, web applications (JavaScript, HTML), BSS/OSS, AWS cloud storage, 2-way video/audio streaming, authentication, and VoIP.

11. In 2016, I started an independent consulting business in technology and intellectual property projects. I have consulted in various technology areas and industries including consumer electronics, Internet of Things (IoT), cable, satellite, television, media, and cryptocurrency.

12. From 2019 to 2022, I worked as Chief Technology Officer for Telular, an Ametek company. I was responsible for the development of Industrial Internet of Things (IIoT) recurring revenue solutions, combining wireless technologies,

purpose-built hardware, and SaaS in the commercial telematics, security and home automation markets and sold under the SkyBitz and Telguard brands.

13. My record of professional service includes awards on products I designed and developed from several organizations in my field of expertise, including Best of Show, Technology Emmy, and Best of Innovations.

14. I am a named inventor on at least 87 patents and published patent applications corresponding to the areas of my professional work. The patents and published applications involving video and audio technologies include:

- U.S. Patent No. 9,882,736 titled “Remote Sound Generation for a Home Automation System”
- U.S. Patent No. 9,615,139 titled “Determining Device That Performs Processing of Output Pictures”
- U.S. Patent No. 8,549,567 titled “Media Content Sharing Over a Home Network”
- U.S. Patent No. 8,161,388 titled “Interactive discovery of display device characteristics”
- U.S. Patent Nos. 8,120,924, 7,240,217, 6,785,817, 6,564,324, 6,212,278, and 5,440,632 titled “Reprogrammable Subscriber Terminal”
- U.S. Patent No. 7,908,625 titled “Networked Multimedia System”

- U.S. Patent Nos. 7,861,272 and 7,849,486 titled “Networked Subscriber Television Distribution”
- U.S. Patent Nos. 7,774,820 and 7,069,578 titled “Settop Cable Television Control Device and Method Including Bootloader Software and Code Version Table for Maintaining and Updating Settop Receiver Operating System Software”
- U.S. Patent No. 5,771,064 titled “Home Communications Terminal having an Applications Module”
- U.S. Patent No. 5,715,515 titled “Method and Apparatus for Downloading On-Screen Graphics and Captions to a Television Terminal”
- U.S. Patent No. 5,657,414 titled “Auxiliary Device Control for a Subscriber Terminal”
- U.S. Patent No. 5,592,551 titled “Method and Apparatus for Providing Interactive Electronic Programming Guide”
- U.S. Patent No. 5,539,822 titled “System and Method for Subscriber Interactivity in a Television System”
- U.S. Patent No. 5,357,276 titled “Method of Providing Video On Demand with VCR Like Functions”
- U.S. Patent Application Publication Nos. 2004/0068753 and 2008/0072272 titled “Video Transmission Systems and Methods for a Home Network”

- U.S. Patent Application Publication No. 2004/0133911 titled “Subscriber Network in a Satellite System”

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

16. I believe that my extensive industry experience and educational background qualify me as an expert in the relevant field of digital signal processing (DSP) and radio frequency (RF) tuning systems for satellite and/or cable communications. 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 invention of the '866 patent, which I (as I discuss below in Section 5) understand is early 2009 or early 2010.

3. MATERIALS CONSIDERED

17. In formulating my opinion, I reviewed and considered the '866 patent (U.S. Pat. No. 11,381,866 to Reddy, et al.) (Ex. 1101), as to which I am offering my opinion regarding the validity of certain claims, as discussed herein.

18. In preparing this declaration, I also reviewed and considered the Petition and the file history of the '866 patent (included in Ex. 1104) as well as the following references:

Ex. 1101: U.S. Patent No. 11,381,866 (“the '866 patent”)

Ex. 1102: Expert Declaration of David B. Lett

- Ex. 1103: Curriculum Vitae of David B. Lett
- Ex. 1104: Certified Prosecution History of the '866 patent
- Ex. 1107: Certified Prosecution History of U.S. Provisional App. No. 61/170,526 (“’526 provisional”)
- Ex. 1108: U.S. Pub. No. 2009/0290659 (“Petrovic”)
- Ex. 1109: Certified Prosecution History of U.S. Provisional App. No. 61/054,886 (“Petrovic ’886”)
- Ex. 1110: U.S.P.T.O Assignment Record for U.S. Application No. 12/414,892
- Ex. 1114: U.S. Patent No. 7,237,214 (“Pandey”)
- Ex. 1115: Excerpts of “IEEE Std 100-2000, The Authoritative Dictionary of IEEE Standards Terms, Seventh Edition” (IEEE Press. 2000) (“IEEE Std 100”)
- Ex. 1116: Excerpts of Jan M Rabaey, “Digital Integrated Circuits: A Design Perspective” (Pearson, 2nd ed. 2002) (“Rabaey”)
- Ex. 1117: A. P. Chandrakasan, “Ultra low power digital signal processing,” Proceedings of 9th International Conference on VLSI Design, Bangalore, India, 1996, pp. 352-357 (“Chandrakasan”)
- Ex. 1118: S. Mirabbasi and K. Martin, “Classical and Modern Receiver Architectures,” IEEE Communications Magazine, vol. 38, no. 11, pp. 132-139, November 2000 (“Mirabbasi”)
- Ex. 1119: U.S. Patent No. 6,061,406 (“Carson”)

- Ex. 1121: “Data-Over-Cable Service Interface Specifications: Radio Frequency Interface Specification CM-SP-RFIV2.0-I11-060602,” DOCSIS, June 2006
- Ex. 1125: J. Crols and M. S. J. Steyaert, “Low-IF topologies for high-performance analog front ends of fully integrated receivers,” IEEE Transactions on Circuits and Systems II: Analog and Digital Signal Processing, vol. 45, no. 3, pp. 269-282, March 1998 (“Crols”)
- Ex. 1127: U.S. Patents and Patent Applications Family Tree for U.S. Pat. 11,381,866
- Ex. 1133: Excerpts of W. Ciciora, J. Farmer, D. Large, and M. Adams, “Modern Cable Television Technology: Video, Voice, and Data Communications” (2nd ed. 2004) (“Ciciora”)
- Ex. 1134: Excerpts of J. Crols and M. Steyaert, “CMOS Wireless Transceiver Design” (1997)
- Ex. 1135: U.S. Patent No. 7,340,230 (“Khoini-Poorfard”)
- Ex. 1136: U.S. Pub. No. 2003/0217362 (“Summers”)
- Ex. 1137: U.S. Pub. No. 2006/0256799 (“Eng”)
- Ex. 1138: U.S. Pub. No. 2006/0083335 (“Seendripu”)
- Ex. 1139: Excerpts of Chris Bowick, “RF Circuit Design” (2nd ed. 2008)
- Ex. 1141: Excerpts of Roland Priemer, “Introductory Signal Processing” (1991)
- Ex. 1142: U.S. Patent No. 7, 272, 375 (“Tuttle”)
- Ex. 1143: U.S. Patent No. 7,130,576 (“Gurantz”)

- Ex. 1144: U.S. Patent No. 5,278,837 (“Kelly”)
- Ex. 1145: Jeffrey Hugh Reed, “Software Radio: A Modern Approach to Radio Engineering” (2002)
- Ex. 1146: U.S. Patent No. 7,213,042 (“Cannon”)
- Ex. 1148: Excerpts of William Buchanan, “Computer Busses” (2000)
- Ex. 1149: U.S. Patent No. 7,079,528 (“Ziegler”)
- Ex. 1150: Excerpts of “Software Defined Radio: Enabling Technologies” (Walter H.W. Tuttlebee ed., 2003)
- Ex. 1153: U.S. Pub. No. 2008/0039036 (“Lee”)
- Ex. 1158: U.S. Pub. No. 2010/0020794 (“Cholas”)
- Ex. 1159: U.S. Patent No. 7,714,229 (“Burris”)
- Ex. 1160: U.S. Patent No. 6,160,443 (“Maalej”)
- Ex. 1161: U.S. Pub. No. 2006/0256216 (“Takahiko”)
- Ex. 1170: U.S.P.T.O Assignment Record for U.S. Patent No. 8,526,898
- Ex. 1173: Expert Declaration of Dr. Sylvia Hall-Ellis
- Ex. 1175: U.S. Patent No. 6,791,995 (“Azenkot”)
- Ex. 1176: U.S. Patent No. 6,542,203 (“Shadwell”)

4. UNDERSTANDING OF APPLICABLE LEGAL STANDARDS

19. 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. I understand that the Petitioner is challenging the patentability of the claims of the '866 patent based on the following grounds:

- (A) claims 27-33, 37, 40-47, 51, and 54 as obvious under pre-AIA 35 U.S.C. § 103(a) based on Cholas in view of Petrovic;
- (B) claims 28 and 42 as obvious under pre-AIA 35 U.S.C. § 103(a) based on Cholas in view of Petrovic, and further in view of Burris;
- (C) claims 32, 33, 46, and 47 as obvious under pre-AIA 35 U.S.C. § 103(a) based on Cholas in view of Petrovic, and further in view of Maalej;
- (D) claims 1-9, 11, 13-22, 24, 26, 34, 35, 36, 48, 49, and 50 as obvious under pre-AIA 35 U.S.C. § 103(a) based on Cholas in view of Petrovic, and further in view of Rabaey;
- (E) claims 2 and 15 as obvious under pre-AIA 35 U.S.C. § 103(a) based on Cholas in view of Petrovic, and further in view of Rabaey and Burris;
- (F) claims 6-8, 19-21, 34, and 48 as obvious under pre-AIA 35 U.S.C. § 103(a) based on Cholas in view of Petrovic, and further in view of Rabaey and Maalej;
- (G) claims 38-39, 52-53, 55-61, 65-69, 70-75, and 79-82 as obvious under pre-AIA 35 § 103(a) based on Cholas in view of Petrovic, and further in view of Lee;
- (H) claims 56 and 70 as obvious under pre-AIA 35 U.S.C. § 103(a) based on Cholas in view of Petrovic, and further in view of Lee and Burris;

- (I) claims 60, 61, 74, and 75 as obvious under pre-AIA 35 U.S.C. § 103(a) based on Cholas in view of Petrovic, and further in view of Lee and Maalej;
- (J) claims 62 and 76 as obvious under pre-AIA 35 U.S.C. § 103(a) based on Cholas in view of Petrovic, and further in view of Lee, Maalej, and Rabaey;
- (K) claims 10, 12, 23, 25, 63, 64, 77, and 78 as obvious under pre-AIA 35 U.S.C. § 103(a) based on Cholas in view of Petrovic, and further in view of Lee and Rabaey;
- (L) claims 27-33, 37, 40-47, 51, and 54 as obvious under pre-AIA 35 U.S.C. § 103(a) based on Cholas in view of Petrovic, and further in view of Takahiko;
- (M) claims 28 and 42 as obvious under pre-AIA 35 U.S.C. § 103(a) based on Cholas in view of Petrovic, and further in view of Takahiko and Burris;
- (N) claims 32, 33, 46, and 47 as obvious under pre-AIA 35 U.S.C. § 103(a) based on Cholas in view of Petrovic, and further in view of Takahiko and Maalej;

- (O) claims 1-9, 11, 13-22, 24, 26, 35, 36, 49, and 50 as obvious under pre-AIA 35 U.S.C. § 103(a) based on Cholas in view of Petrovic, and further in view of Takahiko and Rabaey;
- (P) claims 2 and 15 as obvious under pre-AIA 35 U.S.C. § 103(a) based on Cholas in view of Petrovic, and further in view of Takahiko, Rabaey, and Burris;
- (Q) claims 6-8, 19-21, 34, and 48 as obvious under pre-AIA 35 U.S.C. § 103(a) based on Cholas in view of Petrovic, and further in view of Takahiko, Rabaey, and Maalej;
- (R) claims 38, 39, 52, 53, 55-61, 65-75, and 79-82 as obvious under pre-AIA 35 U.S.C. § 103(a) based on Cholas in view of Petrovic, and further in view of Takahiko and Lee;
- (S) claims 56 and 70 as obvious under pre-AIA 35 U.S.C. § 103(a) based on Cholas in view of Petrovic, and further in view of Takahiko, Lee, and Burris;
- (T) claims 60, 61, 74, and 75 as obvious under pre-AIA 35 U.S.C. § 103(a) based on Cholas in view of Petrovic, and further in view of Takahiko, Lee, and Maalej;

(U) claims 62 and 76 as obvious under pre-AIA 35 U.S.C. § 103(a) based on Cholas in view of Petrovic, and further in view of Takahiko, Lee, Maalej, and Rabaey; and

(V) claims 10, 12, 23, 25, 63, 64, 77, and 78 as obvious under pre-AIA 35 U.S.C. § 103(a) based on Cholas in view of Petrovic, and further in view of Takahiko, Lee, and Rabaey.

20. I understand that, in this *inter partes* review, Petitioner has the burden of proving that each challenged claim is unpatentable by a preponderance of the evidence.

21. 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 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 to make and use the claimed invention without undue experimentation.

22. I understand that a patent claim is unpatentable if, at the time of the invention, it would have been obvious to one of ordinary skill in the art to combine the teachings of the prior art to yield the patent claim. It is my understanding that this determination is made after weighing the following factors: (1) the level of ordinary skill in the pertinent art; (2) the scope and content of the prior art; (3) the

differences between the prior art as a whole and the claim at issue; and (4) as appropriate, other objective considerations identified below.

23. 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 further 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.

24. 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 person of ordinary skill in the pertinent art to combine elements of the references in a way that yields the claimed invention.

25. 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) substituting one known element for another to obtain predictable results;
- (C) use of a known technique to improve similar devices in the same way;
- (D) applying a known technique to a known device ready for improvement to yield predictable results;
- (E) choosing from a finite number of identified, predictable solutions with a reasonable expectation of success;
- (F) known work in a field that prompts variations in the work in the same or a different field that leads to predictable results; and
- (G) some teaching, suggestion, or motivation in the prior art that would have led a person of ordinary skill in the art to modify a prior art reference or combine multiple prior art references or teachings to arrive at the claimed invention.

26. I understand that various objective or “real world” factors may be indicative of non-obviousness. I understand that such factors 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.

27. 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 based on the common sense of the person of ordinary skill in the pertinent art. I further understand that obviousness analysis recognizes that market demand, rather than scientific literature, often drives innovation, and market demand is sufficient motivation to combine references.

28. 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.

29. 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.

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

30. I understand that obviousness is determined from the vantage point of a person of ordinary skill in the relevant art at the time of the alleged invention (“POSITA”). The ’866 patent describes a wideband receiver system for “receiving multiple desired television channels” in a “broad frequency spectrum.” Ex. 1101, 1:29-34. I understand that a person of ordinary skill in the art 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.

31. I believe that a person of ordinary skill in the art of the ’866 patent, at the time of the alleged invention of the ’866 patent, would have a degree in electrical engineering or a similar discipline, along with three-to-four years of experience with digital signal processing (DSP) and radio frequency (RF) tuning systems for satellite and/or cable communications. Additional education may substitute for professional experience, and significant work experience may substitute for formal education. I worked in the relevant field with such persons at, and leading up to, the time of the alleged invention of the ’866 patent, and thus, I am familiar with the knowledge that such persons had at the time (*i.e.*, early 2009 or early 2010). At that time, I had a

skill level that was at least as high as the skill level I describe above for a person of ordinary skill in the art of the '866 patent.

32. All of my statements in this declaration regarding what a person of ordinary skill in the art would have known, understood, appreciated, been motivated to do, etc., refer to a person of ordinary skill in the art, before the earliest claimed priority date of the '866 patent (which, as I discuss below, is April 17, 2009). Although some claims of the '866 patent are entitled to different priority dates, the level of ordinary skill in the art would not have changed significantly between April 17, 2009, and April 19, 2010, and in any event, would not have decreased.

6. CLAIM CONSTRUCTION

33. I understand that my analysis requires an understanding of the scope of the claims of the '866 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. I further understand that certain claim terms may be means plus function limitations. In particular, I understand that a “means plus function” limitation should be interpreted to cover only the corresponding structure described in the specification that performs the recited

function, and equivalents thereof. I also understand that a limitation will be presumed to be a means plus function limitation if (a) the claim limitation uses the phrase “means for”; (b) the “means for” is modified by functional language; and (c) the phrase “means for” is not modified by sufficient structure for achieving the specified function. I understand that a structure will be considered structurally equivalent to the corresponding structure identified in the specification only if the differences between them are insubstantial. For example, a structure may be deemed to be a structural equivalent to the corresponding structure where the structure performs the same function in substantially the same way to achieve substantially the same result.

34. I understand that all claim terms herein should be given their ordinary and customary meaning to a POSITA, consistent with the prosecution history, as they would be given in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b). It is my understanding that Petitioner does not contend that the claims include any means-plus-function limitations.

6.1 “Wideband”

35. The claims use the term “wideband.” The ’866 patent implicitly defines “wideband” as a band that carries multiple channels. For example, the ’866 patent states that a receiver is “wideband” if it is “designed to concurrently receive several

TV channels.” Ex. 1101, 1:36-39. In my opinion, this is consistent with the ordinary and customary meaning of “wideband.”

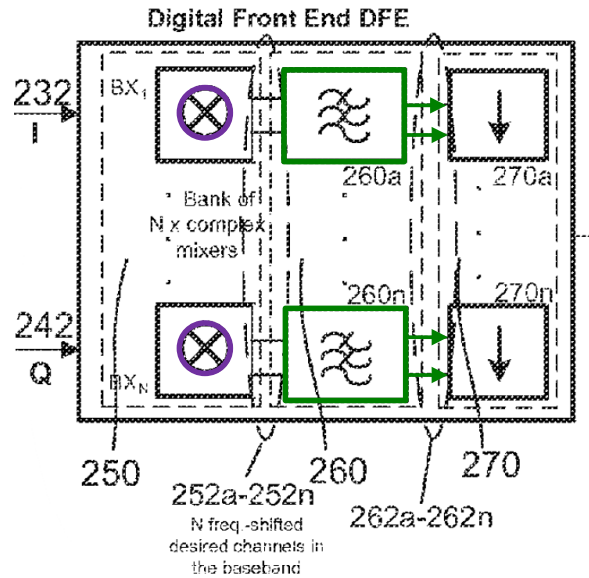
6.2 “Digital Down Converter”/“Digital Front End”

36. Independent claims 14, 41, and 69 recite a “plurality of digital down converters” that are “operable to generate a digital channel output corresponding to each desired channel.” A POSITA would have understood that the plain and ordinary meaning of digital down converter, as the term states, is digital circuitry that downconverts a digital signal. The ’866 patent specification and figures omit the term “digital down converter” (or “down converter”), but describe a “Digital Front End (DFE)” that downconverts digital signals and with components operable to perform the functions and comprise the elements attributed to “digital down converters” in the claims. Ex. 1101, Figs. 2-3, 5:51-7:9, 9:50-60. Independent claims 1, 27 and 25 use the term DFE that, similar to the digital downconverters of claims 14, 41, and 69, is “configured to concurrently select and provide each of the plurality of desired channels,” but also requires “without providing any of the plurality of undesired channels.”

37. The example DFE from Figure 2 (below) includes a plurality of signal paths, with each path including a complex mixer 250 (**purple**), a low pass filter 260 (**green**), and optionally a demodulator with a serial or parallel interface to the

demodulator.¹ Ex. 1101, Figs. 2-3, 5:51-7:9, 9:50-60. Each of these signal paths performs the function that claims 14, 41, and 69 ascribe to a digital down converter—generating a digital channel output corresponding to a desired channel. Ex. 1101, 5:51-7:9, 9:50-60, Figs. 2-3. That this structure is the digital down converter in the '866 patent is consistent with the dependent claims, which require the digital down converter(s) to have a digital mixer, filter, demodulator, and a serial or parallel interface. Ex. 1101, claims 16, 18-21, 40, 43-50, 68, and 71-76. The complex mixer in each path further performs “down-converting,” which the '866 patent describes as shifting of the frequency of a signal to a lower frequency (also termed “down shift” and “frequency shift). Ex. 1101, 1:38-40, 2:2-6, 2:13-28, 2:59-63, 2:65-3:2, 4:60-66, 6:3-6, 6:7-56, 7:47-55, 9:18-26.

¹ The '866 patent alternatively refers to the boxes following the filters in Figures 2 and 3 as decimators and/or demodulators, and also discloses the DFE as having outputs to a demodulator. Ex. 1101, Figs. 2-3, 6:8-14, 7:4-9, 9:50-60.



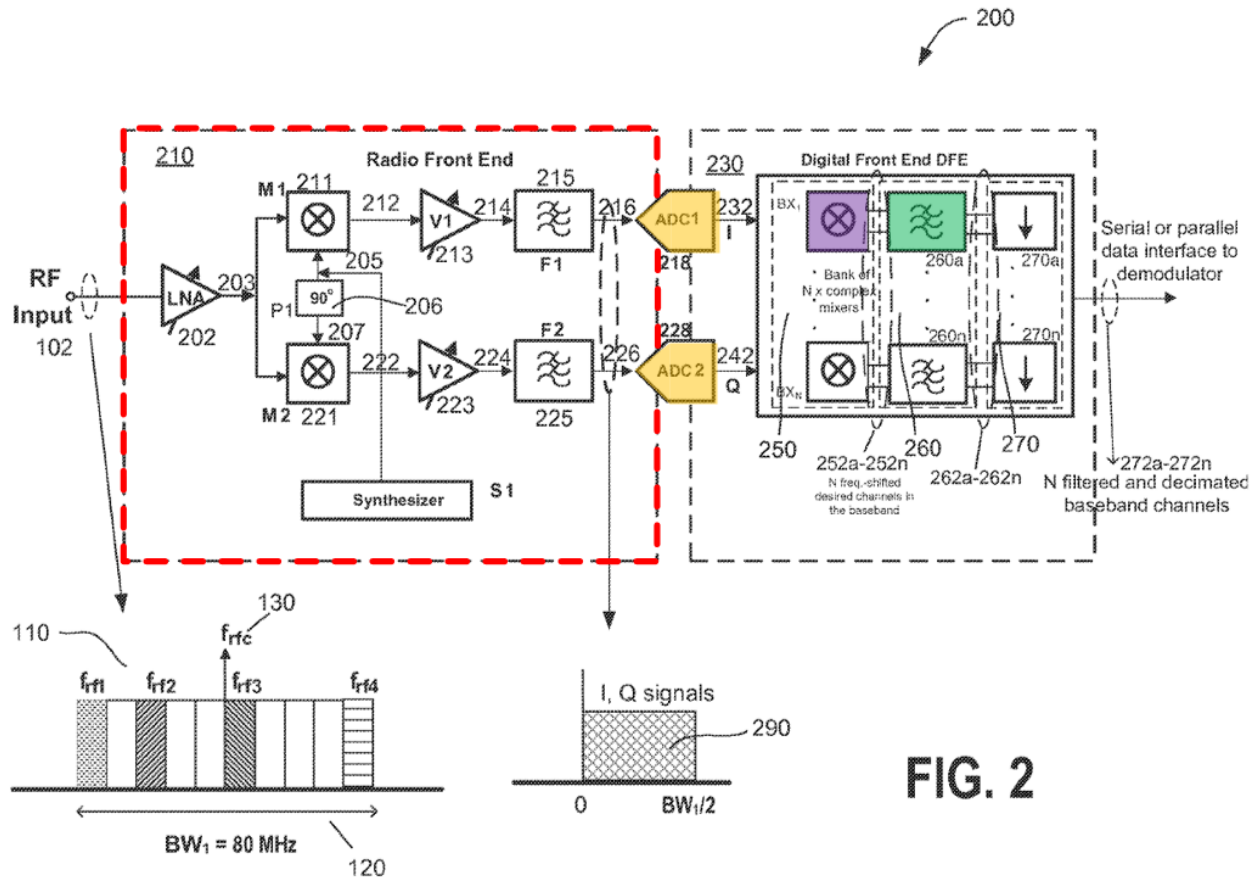
Ex 1101, Fig. 2 (annotated and excerpted)

38. I do not believe that “digital down converter” and “digital front end” are means-plus-function terms. To the extent that either term is so construed to be a means-plus-function term, the corresponding structure for “digital down converter” includes the components in one signal path in the DFE, i.e., a complex mixer 250 and a filter 260, and the corresponding structure for a “digital front end” include two such signal paths. Ex. 1101, Figs. 2-3, 5:51-7:9, 9:50-60.

7. OVERVIEW OF THE '866 PATENT

39. The '866 patent describes a wideband receiver system 200 (illustrated below) “capable of receiving multiple radio frequency channels located in a broad radio frequency spectrum.” Ex. 1101, 1:27-29.

40. According to the '866 patent, a receiver is “wideband” if it is “designed to concurrently receive several TV channels.” *Id.*, 1:35-38. Figure 2 is a “schematic block diagram of a wideband receiver system 200.” *Id.*, 4:35-36.



Ex. 1101, Fig. 2 (annotated)

41. The wideband receiver system 200, shown in Figure 2, receives desired and undesired television channels as frequencies dispersed within a frequency bandwidth BW_1 . Ex. 1101, 4:35-50. A radio frontend 210 (red) downconverts the bandwidth of channels as in-phase and quadrature signals 212 and 222 at an intermediate frequency (IF), which are digitized by wideband analog-to-digital

converters ADC1, ADC2 (**gold**). Ex. 1101, 2:59-65, 4:61-5:7, 5:20-24, 5:48-51. U.S. Provisional App. No. 61/170,526 (“526 provisional”), which the ’866 patent incorporates by reference, admits the left side of Figure 2 (including ADC1 and ADC2) “is similar to conventional tuners.” Ex. 1107 at 5; Ex. 1101, 1:6-22.

42. The digital I and Q signals 232 and 242 from ADC1 and ADC2 are input to a bank of N complex mixers 250 (**purple**) in a digital front end 230. Ex. 1101, 5:51-55. “Each of the N complex mixers ... extract[s] a different one of the desired channels” from the I and Q signals and “frequency-shifts the extracted signals to the baseband frequency.” *Id.*, 6:2-6. Filters 260a-260n (**green**) filter each frequency-shifted desired channel. *Id.*, 6:6-8. After (optional) decimation, baseband channels from multiple rows of digital front end 230 “will be sent as a serial or parallel digital data stream to a demodulator using a serial or parallel data interface according to commonly known methods.” *Id.*, 7:10-14.

7.1 Prosecution History

43. It is my understanding that U.S. Application No. 17/587,415 (“415 application”), which issued as the ’866 patent, was filed on January 28, 2022, with a preliminary amendment that canceled claims 1-18 and added claims 19-48. Ex. 1104 at 2-109. An April 18, 2022, an Office Action rejected claims 19-48 for non-statutory double patenting over claims 1-27 U.S. Patent No. 9,100,622 and rejected claims 19-27, 29, 30, 33-42, 44, 45, and 48 as being obvious over U.S. Patent No.

6,760,342 (Skones, *et al.*) in view of International Publication No. WO 02/087230 (Uskali, *et al.*). Ex. 1104 at 119-132. The Office Action indicated that dependent claims 28 and 43 (which recited a DFE/digital down converter operable to provide channels/outputs “via a serial interface”), claims 31 and 46 (which recited a “DVR”), and claims 32 and 47 (which recited “a picture-in-picture display”) contained allowable subject matter. Ex. 1104 at 131.

44. On April 18, 2022, Applicant filed a terminal disclaimer and an amendment that added the limitations of claim 28 to claim 19 (which issued as claim 1), added the limitations of claim 43 to claim 34 (which issued as claim 14), added new independent claim 49 (which issued as claim 27) based on original claims 19 and 31, added new independent claim 63 (which issued as claim 41) based on original claims 34 and 46, added new independent claim 77 (which issued as claim 55) based on original claims 19 and 32, and added new independent claim 91 (which issued as claim 69) based on original claims 34 and 47. Ex. 1104 at 148-164, 170-171. The amendment also added multiple sets of new dependent claims that paralleled existing dependent claims. Ex. 1104 at 148-175. In response, the U.S. Patent and Trademark Office issued a Notice of Allowance on May 25, 2022. Ex. 1104 at 188-195. The ’866 patent issued on July 5, 2022. Ex. 1101, cover.

45. It appears that none of Cholas, Petrovic, Burris, Maalej, Rabaey, Takahiko, and Lee (the prior art relied on in this declaration) were considered during prosecution of the '866 patent. Ex. 1101, cover.

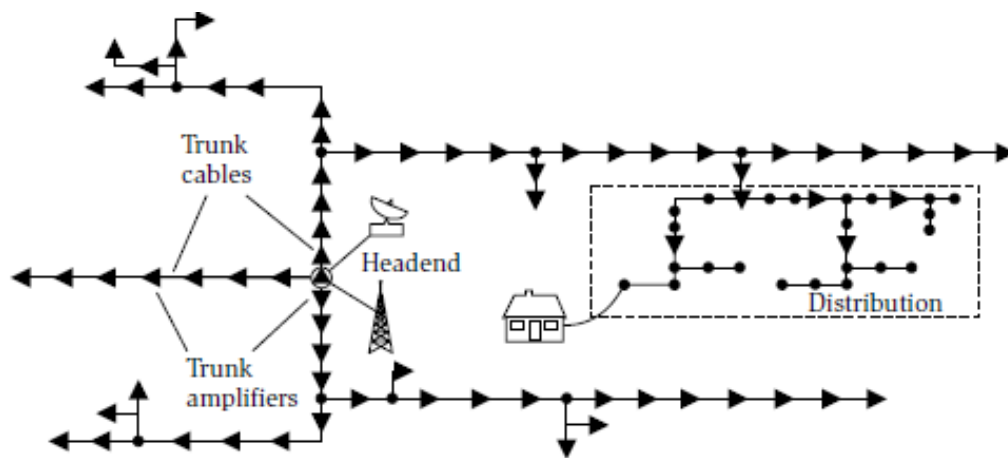
7.2 Earliest Priority Date for the Claims

46. I understand that '415 application, which issued as the '866 patent, was filed on January 28, 2022. It is further my understanding that the '866 application claims priority to a chain of applications that claim priority to the '526 provisional, which was filed on April 17, 2009. It is further my understanding that the '866 patent asserts to be entitled to a priority date of the filing date of the earliest application from which the '866 patent claims priority, *i.e.*, April 17, 2009, which is the filing date of the '526 provisional. The earliest possible effective filing date for claims 1-9, 13-22, and 26 of the '866 patent is April 17, 2009, the filing date of the '526 provisional. However, the earliest possible priority date for claims 10-12, 23-25, and 27-82 is April 19, 2010, the filing date of Application No. 12/762,900. This is because the '526 provisional is silent regarding “DOCSIS[] protocol,” a “DVR,” or a “picture-in-picture display,” as recited in those claims. Ex. 1107 at 3-7. I understand that all of the references that I rely on in this Declaration were published or filed before April 17, 2009, and are prior art to that date.

8. OVERVIEW OF THE PRIOR ART

8.1 Cable and Satellite Television Networks

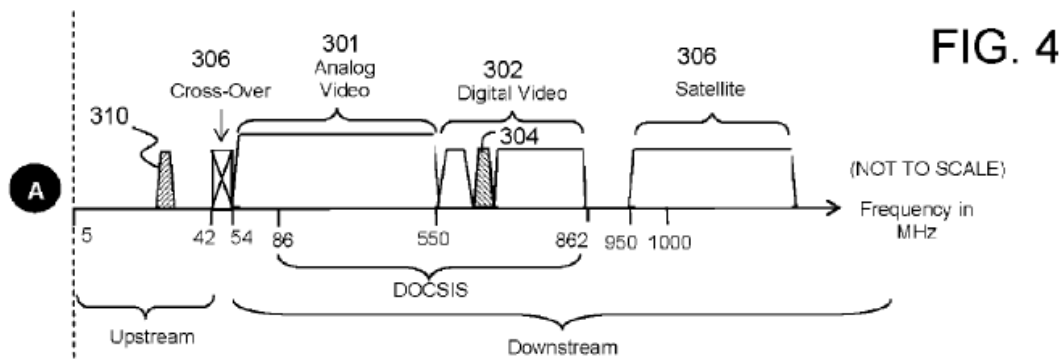
47. The origins of the cable and satellite television networks long predate the earliest claimed priority date (April 17, 2009) of the '866 patent. Cable television networks are entertainment distribution systems that allow consumers to access and enjoy various television channels. Ex. 1133 at 22. The cable television networks include one or more headends that are designed to broadcast and distribute, via coaxial cables, the data for the television channels as modulated radio frequency (RF) signals to multiple terminal equipment belonging to the consumers (e.g., television receivers, set-top boxes, data modems, digital video recorders, personal video recorders, and other terminal equipment). *Id.* at 22, 29-30, 40, 352; Ex. 1134 at 20-21. This is illustrated in Figure 1.1 of Ex. 1133.



Ex. 1133, Fig. 1.1 (page 34)

RF is the frequency range starting from 10 kHz to 100,000 MHz in the electromagnetic spectrum; signals having frequencies from this RF range are used for data transmission (wired or wireless) between devices. *See* Ex. 1115 at 7. The transmissions between the headends and the terminal equipment are governed by various well-known industry standards, including Data Over Cable Systems Interface Specification (DOCSIS). Ex. 1121 at 2-5, Fig. 1-2; Ex. 1133 at 27, 211-212.

48. Consumers can also access television channels from satellites via conventional home satellite television systems. Ex. 1135, 1:30-31; Ex. 1136, [0006]. Such home satellite television systems typically include a fixed dish antenna that receives television channels in modulated RF signals, as well as a satellite receiver or set-top box designed to process and demodulate the modulated RF signals. Ex. 1135, 1:31-35; Ex. 1136, [0013]. Satellites may also be used to distribute the television channels to headends of cable television networks, which are then redistributed to the consumers. Ex. 1133 at 262, 280-282; Ex. 1136, [0009].



Ex. 1137, Fig. 4 (Excerpted)

49. Figure 4 of Exhibit 1137 (partially reproduced above) illustrates the RF spectrum usage of television channels from cable and satellite television networks. Ex. 1137, [0079]-[0080]. In North America, television channels from cable television networks occupy the RF spectrum from 54 to 864 MHz, with digital channels occupying the RF spectrum above 550 MHz. Ex. 1133 at 413, 503; Ex. 1137, [0079]-[0080]. In 1941, the National Television System Committee, established by the United States Federal Communications Commission, set a standard that each television channel should be allocated 6 MHz of RF bandwidth and that the set of allocated television channels should occupy the RF spectrum in a contiguous manner. Ex. 1121 at 1, 23-24; Ex. 1133 at 45, 413, 515-520.

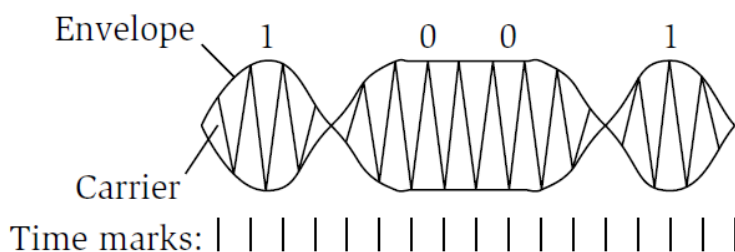
50. Television channels from satellite networks occupy various bands in frequencies greater than 950 MHz. Ex. 1135, 1:37-48; Ex. 1137, [0079]-[0080]. Signals in satellite bands are sent to a satellite receiver or set-top box, with the

satellite bands carrying multiple transponder channels and each transponder channel carrying a number of different television channels. Ex. 1135, 1:37-48.

8.2 Modulated RF Signals

51. Modulation is a method where an RF carrier signal is varied (e.g., in amplitude, frequency, and/or phase) with information to be transmitted. Ex. 1133 at 155. The information to be transmitted can be digital data comprising of bits “1” and “0,” such as the digital data of television channels for transmission from headends of cable television networks or subscriber locations. *Id.* One of the main goals of modulation is to squeeze as much data into the allocated RF bandwidth as possible, and that objective, known as spectral efficiency, measures how quickly data can be transmitted in an assigned RF bandwidth. *Id.* at 156. The unit of measurement of spectral efficiency is bits per second per Hz (b/s/Hz). *Id.* As I discuss below, by the earliest claimed priority date of the '866 patent, multiple modulation techniques facilitating high spectral efficiencies were known to a POSITA.

8.2.1 Biphase Shift Keying



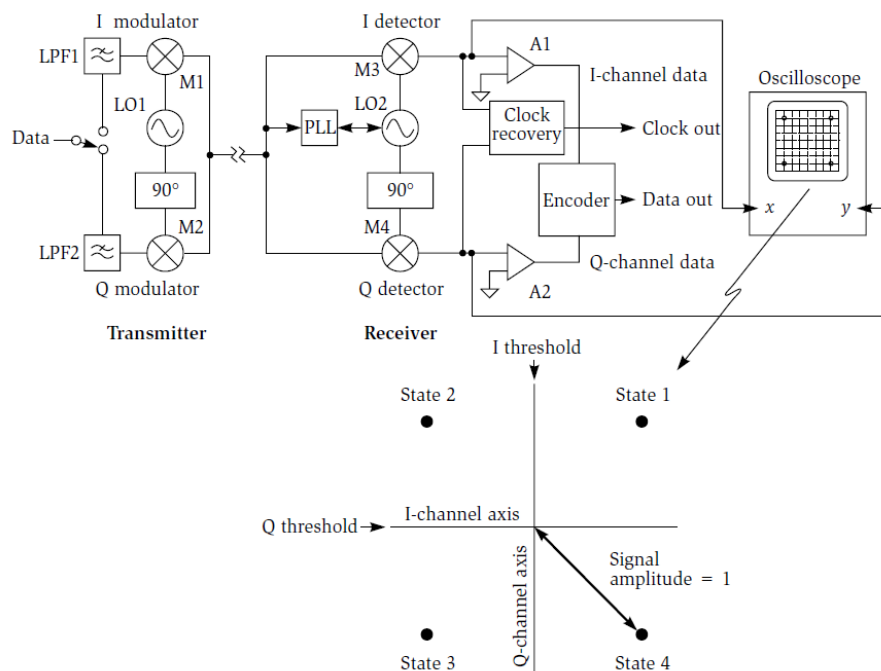
Ex. 1133, Fig. 4.3 (Excerpted) (page 161)

52. Biphase shift keying (BPSK) is a simple form of modulation that can be used in digital cable and satellite television networks, where the phase of an RF signal is shifted 180° in phase between transmission of bit “0” and bit “1.” Ex. 1133 at 160-161, Fig. 4.3 (partially reproduced above). The spectral efficiency of BPSK modulation is 1 bit/s/Hz. *Id.* at 156.

8.2.2 Quadrature Phase Shift Keying (QPSK)

53. In Quadrature Phase Shift Keying (also called 4-Quadrature Amplitude Modulation (4-QAM)), digital data is split into two components, an I (in-phase) component and a Q (quadrature) component. Ex. 1133 at 163-164, Fig. 4.4 (reproduced below). The same RF carrier signal is used for each component, but the phases of the two signals in the two components are 90° apart or in quadrature. *Id.* Signals in quadrature are orthogonal and do not interfere with one another. *Id.* Quadrature modulation takes advantage of this principal by combining two signals in quadrature for a combined output signal. *Id.* In quadrature modulation, digital data are broken into a discrete number of symbols, which are used to convey information. *Id.* at 164-165. These symbols are mapped to a discrete set of magnitude and phase values on an I/Q constellation, which are referred to as constellation points. *Id.* For example, in BPSK, each symbol can only represent a bit “0” or a bit “1” because the constellation of BPSK modulation has just two possible constellation points representing two possible states, or symbols, where each symbol represents a single

bit of information. The constellation of QPSK modulation has four constellation points representing four different states, or symbols: state 1 (bits “00”), state 2 (bits “01”), state 3 (bits “11”), and state 4 (bits “11”). *Id.* QPSK can, therefore, transmit 2 bits per symbol. *Id.* The RF carrier signals in each of the I and Q components are encoded with one of the two bits of the symbol. *Id.* at 163. Therefore, QPSK can transmit twice as much data using the same amount of bandwidth as BPSK, or it could transmit the same amount of data using half the bandwidth. *Id.* at 156.



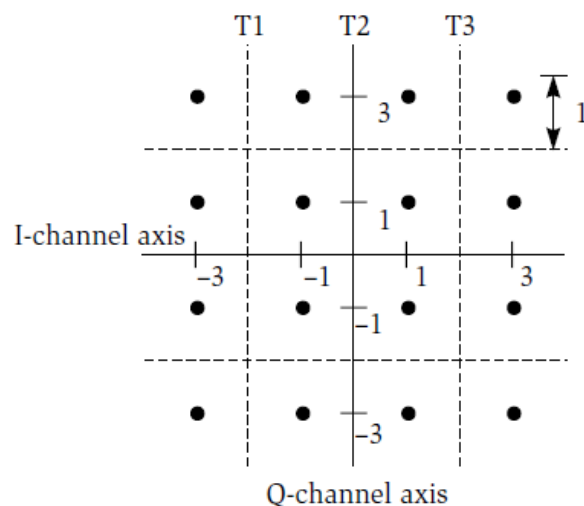
Ex. 1133, Fig. 4.4 (page 164)

54. After the two RF carrier signals from the two components I and Q are modulated, the RF carrier signals are combined for transmission to the receiver. Ex. 1133 at 163. At the receiver, the received combined signal is split back into the I-component and the Q-component by two mixers, M3 and M4. *Id.* The separation

back into I/Q components allows the encoder inside the receiver to map the two components onto the QPSK I/Q constellation and interpret which of the four possible symbols are encoded in the components. *Id.* at 164.

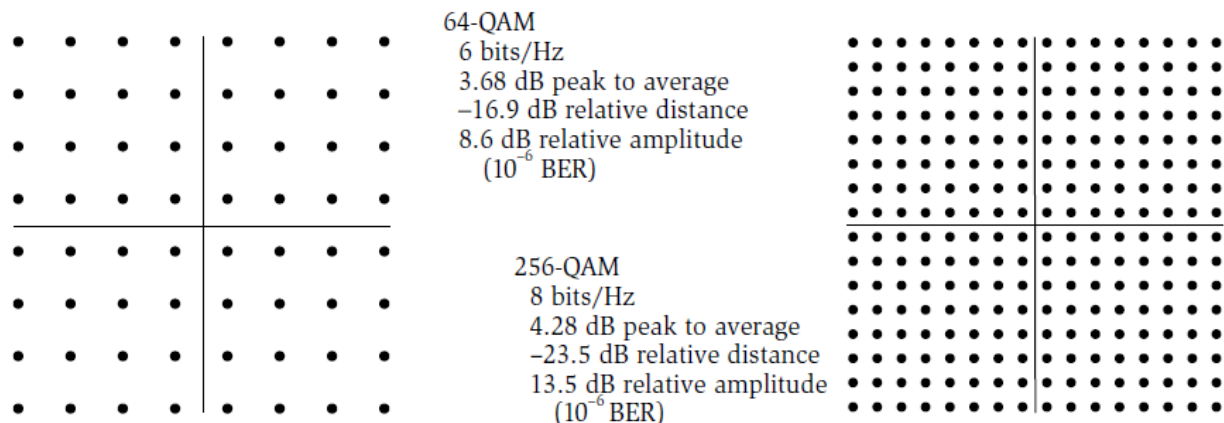
55. A POSITA would have been well aware that satellite television networks primarily used QPSK modulation. Ex. 1133 at 280; Ex. 1136, [0071], [0075]. Satellite transponders that transmit RF signals to headends and dish antennas are simply a frequency translator and a power amplifier, and for the sake of efficiency, it was preferred to use modulation formats that do not depend on amplitude changes to communicate information. Ex. 1133 at 280. QPSK modulation met this requirement of satellite transponders. *Id.*

8.2.3 16-Quadrature Amplitude Modulation (QAM), 64-QAM, and 256-QAM



Ex. 1133, Fig. 4.5 (Partial Excerpt) (page 167)

56. Modulation schemes with greater numbers of constellation points are able to transmit more information per symbol. Ex. 1133 at 166-169. The next denser known modulation format after QPSK was 16-QAM, where data is split into I and Q components and carried by two RF signals in quadrature. *Id.* at 166. However, the 16-QAM I/Q constellation has sixteen different states (as illustrated by the sixteen dots in Figure 4.5 of Ex. 1133, partially reproduced above), where each state is a symbol that contains one of 16 different combinations of amplitude and phase levels. *Id.* Each symbol contains up to 4 bits and, therefore, can represent values from “0000” to “1111.” *Id.* The spectral efficiency of 16-QAM is 4 bit/s/Hz. *Id.* at 168, Fig. 4.6.



Ex. 1133, Fig. 4.6 (Partial Excerpt) (page 168)

57. Similarly, the I/Q constellation of 64-QAM (illustrated by Figure 4.6 of Ex. 1133, partially reproduced above) has sixty-four different states, where each state is a symbol that contains one of 64 different combinations of amplitude and

phase levels. *Id.* Each symbol contains up to 6 bits (representing values from “000000” to “111111”), and the spectral efficiency of 64-QAM is 6 bit/s/Hz. *Id.* The I/Q constellation of 256-QAM has 256 different states, where each state is a symbol that contains one of 256 different combinations of amplitude and phase levels. *Id.* Each symbol contains up to 8 bits (representing values from “00000000” to “11111111”), and the spectral efficiency of 256-QAM is 8 bit/s/Hz. *Id.*

58. DOCSIS (finalized in 1997), DOCSIS 1.1 (finalized in 2001), and DOCSIS 2.0 (finalized in 2002) mandate the use of either 64-QAM or 256-QAM for downstream data transmission from headends to consumers’ terminal equipment. Ex. 1133 at 168, 213-214. Therefore, a POSITA would have known that terminal equipment receiving signals from headends of cable television networks were required to demodulate signals that have been modulated using 64-QAM or 256-QAM. Moreover, a POSITA would have understood the relative benefits of using 64-QAM or 256-QAM versus BPSK, as 64-QAM and 256-QAM offer higher rates of spectral efficiencies than BPSK. *Id.* at 156.

8.3 Radio Receivers or Tuners for Cable and Satellite Television Networks

59. As discussed in Section 8.1, it was well-known to a POSITA that consumer terminal equipment (e.g., television receivers, cable set-top boxes, satellite set-top boxes, digital video recorders, personal video recorders, and other terminal equipment) receive modulated RF signals from headends and satellites. Ex. 1133 at

22, 30, 40, 352; Ex. 1135, 1:30-35; Ex. 1136, [0006]. A POSITA was also aware that consumer terminal equipment included a radio receiver (also known as a tuner) that received the RF signals and processed them in such a way that a demodulator could demodulate the RF signals to recover the digital data encoded in the RF signals. Ex. 1133 at 408-411, Fig. 22.1; Ex. 1135, 1:35-37, 1:49-52; Ex. 1136, [0018], [0020]-[0021].

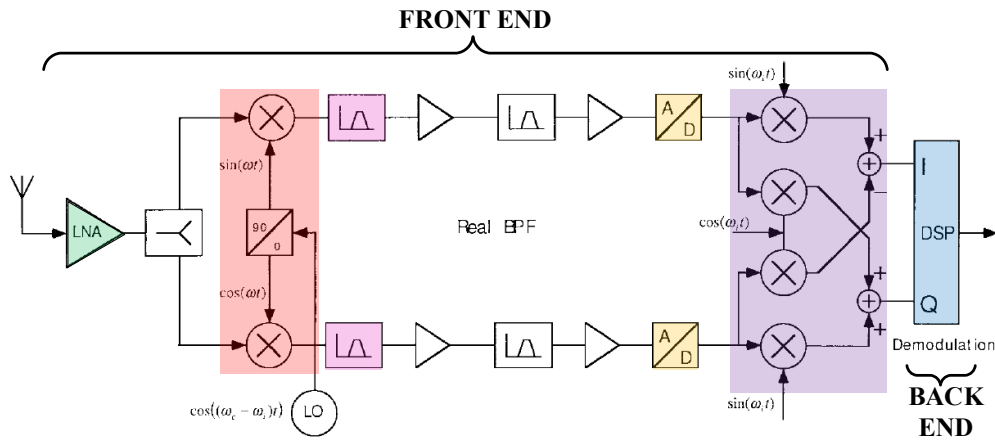
60. Cable television RF receivers concurrently receive RF signals for multiple digital television channels allocated in the RF frequency spectrum of 550 to 862 MHz. Ex. 1133 at 413, 503; Ex. 1137, [0079]-[0080], Fig. 4. Satellite RF receivers concurrently receive RF signals for multiple television channels allocated in the RF frequency spectrum above 950 MHz. Ex. 1135, 1:37-47; Ex. 1137, [0080]. Furthermore, the POSITA was aware that cable and satellite television radio receivers could tune (i.e., select and extract) signals for certain desired television channels (e.g., channels selected for viewing by a consumer) from the received RF frequency spectrum. Ex. 1133 at 299; Ex. 1136, [0020]-[0021]; Ex. 1142, 4:10-36; Ex. 1144, 1:51-58.

61. One type of receiver is known as an IF (intermediate frequency) receiver, and in particular, a type of receiver known as a low-IF receiver. By the earliest claimed priority date of the '866 patent, IF receivers, including low-IF receivers, were well-known in wireless communication systems for their high

performance and low power consumption. Ex. 1125 at 270, 272; Ex. 1134 at 17, 65-74. It was also known to a POSITA, by the earliest claimed priority date of the '866 patent, that low-IF receivers were conventionally used for receiving RF signals from cable television networks and satellite television networks. Ex. 1135, 1:49-61; Ex. 1138, [0022]-[0023], [0029]-[0030], [0042].

62. IF receivers have been used for a long time, and their way of operating is very well known. Ex. 1125 at 270. In general, IF receivers operate by initially downconverting RF signals, which may comprise multiple RF sub-bands each carrying one or more separate signals, from its RF carrier frequency to an intermediate frequency (IF). *Id.* The downconverted signals can be demodulated at the IF or further downconverted to baseband before being demodulated. *Id.* at 270, 279. When a band of signals is at baseband, the low end of the band is near zero frequency in the frequency spectrum or includes zero frequency. Ex. 1115 at 4. Intermediate frequency falls below the frequency of the RF signals but above the baseband frequency. Ex. 1134 at 22. Low-IF receivers initially downconvert to an IF that is at a relatively low frequency, such as a few hundred kilohertz. Ex. 1125 at 269.

8.3.1 Architecture of Low-IF receivers



Ex. 1125, Fig. 22(a) (Annotated)

63. Low-IF receivers (illustrated by Figure 22(a) of Ex. 1125, reproduced and annotated above) comprise two main portions: a front end that performs frequency downconversion of the RF signals, and a back end including a digital signal processor (DSP) that performs the actual demodulation of the RF signals. Ex. 1134 at 22-23. The demodulation technique that will be used in the DSP depends on the modulation technique used to modulate the incoming RF signals, and therefore, if the incoming RF signals are modulated using QPSK or QAM techniques (which modulate I and Q components), then demodulation is typically performed to extract the I and Q components of the incoming RF signals. *Id.* at 23. DSPs typically perform demodulation on baseband signals. *Id.*; Ex. 1139 at 11; Ex. 1125 at 269, 279. However, the received RF signals are at much higher (non-baseband)

frequencies. *Id.* Therefore, the front end must produce baseband quadrature I and Q components of the incoming RF signals to be usable by the DSP. Ex. 1134 at 23.

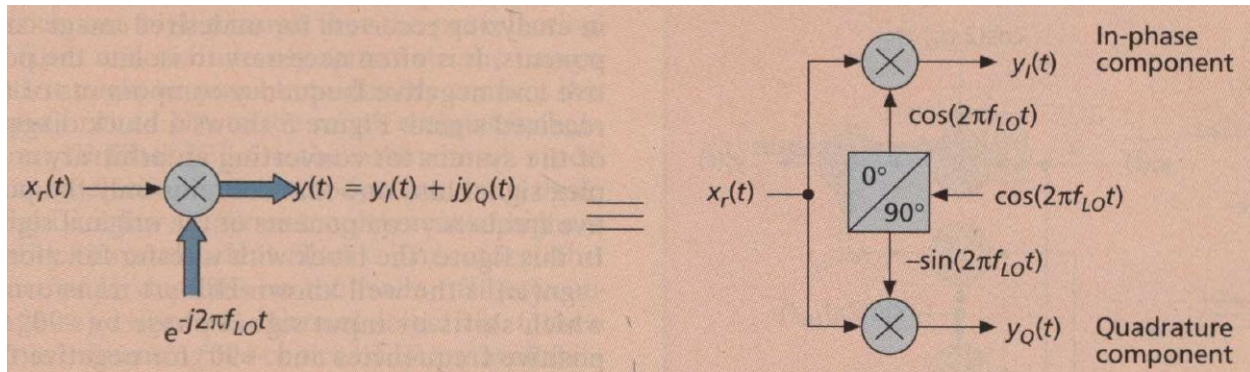
64. Still referring to Figure 22(a) of Ex. 1125 (reproduced and annotated above), in the front end of a low-IF receiver, the incoming RF signals are first amplified by a front-end low noise amplifier (LNA) (**green**) to provide enough gain to boost the received RF signal levels to an acceptable level such that further signal processing can be performed on the received RF signals; the LNA compensates for the attenuations of the RF signals during the transmission of the RF signals from another device. Ex. 1134 at 41; Ex. 1139 at 16. The RF signals are downconverted to baseband signals in two steps, where the first step (**red**) converts the RF signals to Intermediate Frequency (IF) signals before one or more analog-to-digital converters (ADCs) (**gold**) convert IF signals to digital signals, and the second step (**purple**) converts the digital signals of IF to baseband signals. Ex. 1125 at 270, 272; Ex. 1134 at 23.

65. In the first downconversion step, from RF to IF, the incoming RF signals are split and then down-converted by a quadrature downconverter (**red**), also referred to as a complex mixer or complex multiplier, which comprises two real mixers to produce I and Q components of the signals in IF. Ex. 1134 at 65-72; Ex. 1139 at 11 (“Two mixers are needed to retain both the amplitude and phase of the original modulated signal: one for the in-phase (I) and another for a quadrature (Q)

baseband output.”); Ex. 1118 at 133-134. For example, as explained in an article by Shahriar Mirabbasi and Ken Martin in IEEE Communications Magazine in November 2000:

The realization of a multiplier for mixing a real signal with a complex exponential requires two real multipliers, as illustrated in Fig. 2. The real and imaginary parts of the mixer output are called the in-phase (I) and quadrature (Q) components of the downconverted signal (since cosine and sine are in quadrature). In Fig. 2 the frequency of the complex exponential is chosen to be the same as the center frequency of the passband signal, for comparison with case 2 in Fig. 1. In this case there is no image problem associated with the complex mixer.

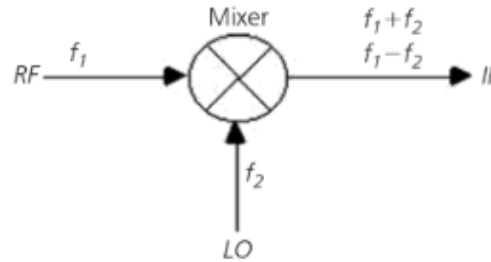
Ex. 1118 at 134 (emphasis added).



Ex. 1118, Fig. 2

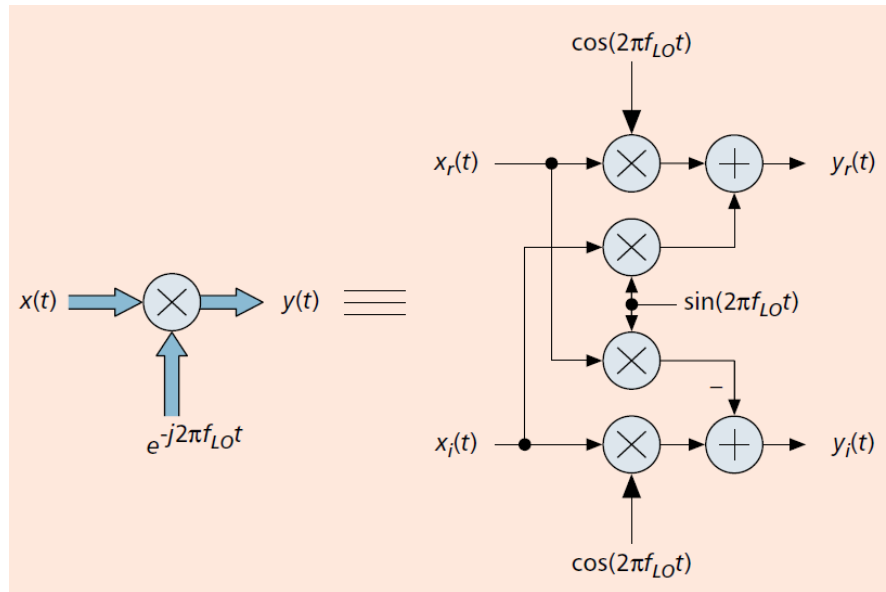
The term “mixer” and “multiplier” are often used interchangeably to refer to an analog or digital electrical circuit (represented by the symbol $\otimes$) that multiplies a modulated input signal (e.g., an RF signal) at frequency f_1 and a reference signal (e.g., from a local oscillator LO) at frequency f_2 , which produces new signals at the

sum and difference of the input frequencies, f_1+f_2 and f_1-f_2 . Ex. 1139 at 12-13. This is illustrated in Figure 8-9 from Ex. 1139.



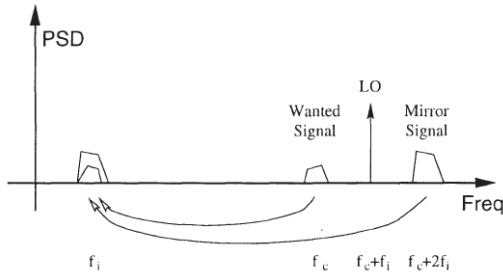
Ex. 1139, Fig. 8-9

By filtering out the signal with the sum (f_1+f_2), and passing only the signal with difference (f_1-f_2), the center frequency of the modulated input signal is reduced, or down-converted. A mixer/multiplier is “complex,” if it multiplies the input signal by a complex signal, having real and imaginary parts, to produce in-phase and quadrature signals. Ex. 1118 at 133. A complex mixer/multiplier can include two real mixers/multipliers when the input signal is real and the reference signal is complex as shown in Figure 22(a) of Ex. 1125 above, or it can include four real mixers/multipliers if both the input signal and reference signal are complex as shown below. Ex. 1118 at 133-134, Fig. 3. As shown in the figure below, the symbol $\otimes$ is used interchangeably to refer to a complex mixer (left) or individual real multiplier/mixers (right) that make up a complex mixer.

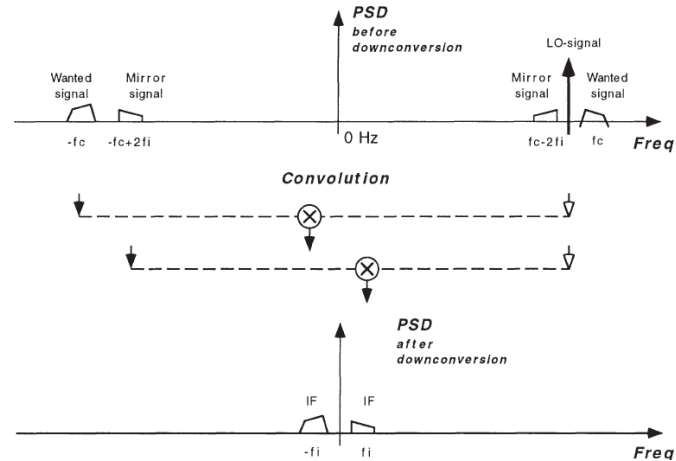


Ex. 1118, Fig. 3 (excerpted)

Referring back to Figure 22(a) of Ex. 1125, the RF signals could also be downconverted using a single mixer and a sinusoidal signal (as shown by Figure 2.6 of Ex. 1134, reproduced below); however, the main disadvantage of mixing an RF signal of frequency f_c with just a single sinusoidal signal $\cos(2\pi f_{LO}t)$ to downconvert to intermediate frequency f_i is that a second mirror signal of frequency $f_c + 2f_i$ is also downconverted to frequency f_i . Ex. 1134 at 24.



Ex. 1134, Fig. 2.6 (page 26)



Ex. 1134, Fig. 3.23 (page 67)

66. It was known that the mirror signal problem could be avoided by mixing the incoming RF signals with a complex signal, $\cos(2\pi f_i t) + j\sin(2\pi f_i t)$. Ex. 1134 at 28, 43; Ex. 1139 at 13. Mixing with such complex signals shifts a wanted RF signal at frequency f_c to frequency f_i while the unwanted mirror (or image) frequency signal at f_{c+2i} is shifted to frequency f_i . *Id.* Furthermore, separately mixing the RF signals with the signal $\sin(2\pi f_i t)$ produces the I-components of the RF signals, while mixing with $\cos(2\pi f_i t)$ produces the Q-components for the RF signals, and both of these components are needed for the DSP at the back end to ultimately demodulate the incoming RF signals. Ex. 1134 at 23. Filters (pink) can be used after the first stage of downconversion to filter out unwanted mirror signals. *Id.* at 28; Ex. 1139 at 17.

67. One could directly downconvert the incoming RF signal to baseband in the analog part of the RF receivers by using quadrature downconverters such that a

second downconversion stage is not needed before the signals are forwarded to a demodulator; for example, zero-IF receivers perform such direct conversion. Ex. 1134 at 28; Ex. 1150 at 13-14. However, a significant problem in direct downconversion is the introduction of parasitic baseband signals at baseband, known as DC-offset, in the output of the quadrature downconverters. Ex. 1118 at 136; Ex. 1134 at 29; Ex. 1150 at 14-15. This DC-offset is mainly the result of the crosstalk between the incoming RF signals and the complex signal of the quadrature downconverters, the self-mixing phenomenon of the local oscillator producing the complex signal, the leakage of the complex signals to the input of the LNA, and/or capacitive/inductive bondings between the different components of the RF receivers. Ex. 1118 at 136; Ex. 1134 at 29, 55-62; Ex. 1150 at 14-15. Such DC-offset issues are not present in low-IF receivers as the output of the first stage of mixing is at IF and not at baseband, and the downconversion at the second step is digitally performed. Ex. 1118 at 137-138; Ex. 1134 at 74. Furthermore, in the analog part of the RF receivers, mismatches between the two components of the complex signal and differences along the two branches of quadrature mixers and any following amplifiers and filters can cause the corruption of the I/Q components of the downconverted signals. Ex. 1118 at 138; Ex. 1134 at 29, 42, 55. However, such mismatches are not an issue in the second digital downconversion step. Ex. 1118 at 137; Ex. 1134 at 74, 76.

68. Analog-to-digital converters (ADCs) (**gold**) were commonly used in RF receivers for either IF or baseband signal sampling. Ex. 1139 at 18. Therefore, referring again to Figure 22(a) of Ex. 1125 (reproduced and annotated above), the quadrature downconverter (**red**) downconverts the incoming RF signals to produce I and Q components in IF before two ADCs separately digitize the IF I and Q components. Ex. 1134 at 42. The digitized I and Q components are further downconverted to baseband by a digital complex mixer (**purple**) (comprising four digital mixers represented by the symbol $\otimes$ and two summers) before being forwarded to the DSP (**blue**).

8.3.2 Channel Selection based on Digital Filters

69. RF receivers receive RF signals for multiple television channels from cable and satellite television networks. Ex. 1135, 1:37-47. An important function for RF receivers is the ability to tune or filter out the signals for a desired television channel from the received RF signals such that only the signals of the desired television channels are demodulated. Ex. 1133 at 510. A POSITA would have known that digital filters based on digital signal processing are far superior to analog filters as digital filters do not suffer from manufacturing variations or aging, are easily programmable and tunable, have low power consumption, are unaffected by environmental influences, and have a superior performance-to-cost ratio. Ex. 1141 at 43. Digital filters, such as low pass filters and band pass filters, were known to

select signals of desired television channels in RF receivers. Ex. 1135, 11:13-23, Fig. 7A; Ex. 1142, 6:5-8, Fig. 1B; Ex. 1143, 5:13-29, 5:46-53; Ex. 1150 at 44, 48.

- Low pass filter: A low-pass filter is a filter that passes signals with a frequency lower than a selected cutoff frequency (ω_c) and attenuates signals with frequencies higher than the cutoff frequency. Ex. 1141 at 14.

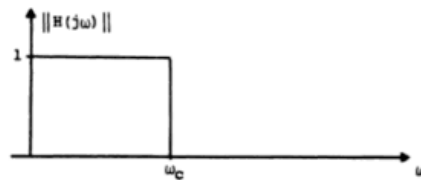


Fig. 1.23. Ideal LP filter magnitude frequency response.

Ex. 1141, Fig. 1.23

- Bandpass filter: A bandpass filter allows a specific range of frequencies (ω_1 to ω_2) to pass through while attenuating frequencies outside that range. Ex. 1141 at 21.

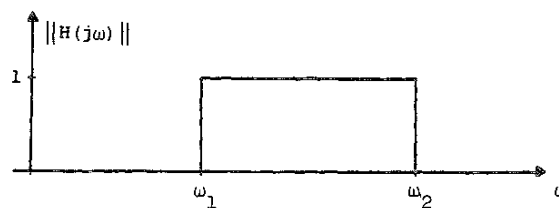


Fig. 1.27. Ideal BP filter.

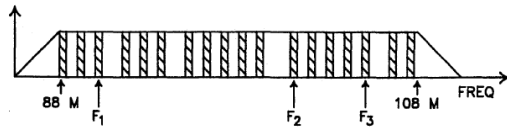
Ex. 1141, Fig. 1.27

A bandpass filter allows signals within a selected frequency range (e.g., signals for a selected television channel) to be isolated from undesired signals from outside the range. Ex. 1143, 5:13-15; Ex. 1150 at 44. Signals for a desired television channel

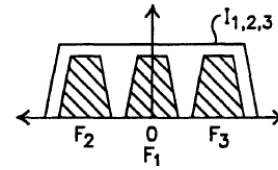
can also be isolated from signals of undesired television channels by downconverting all the signals such that the signals for the desired television frequency are placed at baseband and then applying a low pass filter function to isolate the signals of the desired television channel. Ex. 1143, 5:46-50; Ex. 1150 at 48. However, low pass filters are preferred over bandpass filters as low pass filters require fewer computational steps and, therefore, less computational power than bandpass filters. Ex. 1150 at 33, 48-49. It was also known to a POSITA that low pass filters and bandpass filters use well-known digital architectures of Finite Impulse Response (FIR) filters. Ex. 1141 at 24-63; Ex. 1143, 5:15-17; Ex. 1150 at 44.

70. Some receivers may allow signals of two or more desired channels to be filtered out such that consumers may enjoy a feature called picture-in-picture, where a small window showing one of the desired television channels is inserted into a larger window showing another one of the desired television channels. Ex. 1133 at 467; Ex. 1135, 4:37-43. For example, Khoini-Poorfard (Ex. 1135) describes using two RF receivers to filter and demodulate two television channels such that the filtered television channels can be used in the picture-in-picture feature. Ex. 1135, 4:37-43, Fig. 7A.

8.3.3 Stacking of Desired Channels before Demodulation



Ex. 1144, Fig. 1



Ex. 1144, Fig. 6

71. Khoini-Poorfard (Ex. 1135) describes using two RF receivers that individually filter and demodulate two television channels. Ex. 1135, 4:37-43, 11:13-23, Fig. 7A. Kelly (Ex. 1144) describes an RF receiver that demodulates multiple desired channel bands without expensive hardware requirements and hardware duplications. Ex. 1144, 2:42-50. The RF receiver in Kelly digitizes RF signals comprising multiple desired RF bands in an RF spectrum (e.g., bands F_1 , F_2 , and F_3 in Figure 1 of Ex. 1144 reproduced above) and subjects the digitized signals to multiple frequency translations such that the desired bands are adjacent to each other (e.g., bands F_1 , F_2 , and F_3 are adjacent to each other in Figure 6 of Ex. 1144 reproduced above). *Id.*, 2:51-58, 4:38-40, 4:54-5:9. The desired frequency bands are then digitally separated, demodulated and processed to provide multiple outputs from the single receiver. *Id.*, 2:58-60.

8.3.4 Decimation

72. ADCs in RF receivers convert incoming RF signals to digital signals by sampling the RF signals at a rate that is at least twice the highest frequency of the RF signals. Ex. 1145 at 70. The reason for the high sampling rate is to prevent

information loss during digitization; the Nyquist theorem specifies that a sinusoidal function in time or distance can be regenerated with no loss of information as long as it is sampled at a frequency greater than or equal to twice per cycle. *Id.*; Ex. 1133 at 98. That is, if you digitize an analog signal by sampling the signal at two or more times the highest frequency contained in the signal, that signal can be theoretically converted back to the exact same analog signal by passing the signal through a low pass filter. The Nyquist theorem is a fundamental principle that enables us to digital signal process (DSP) analog signals (radio waves, sound waves, vibrations, etc.) that exist in the real world. Ex. 1133 at 98-101. Because the sample rate of the resulting signal from an ADC may be too high for subsequent DSP processing, decimation is typically performed on the sampled signals at baseband to lower the sampling rate. Ex. 1134 at 104; Ex. 1145 at 70. Decimation is a well-known process that reduces the original sample rate of a signal to a lower rate. Ex. 1145 at 14-15. A decimation filter can be implemented in a digital signal processing block of an RF receiver after the second downconverting step. Ex. 1134 at 104; Ex. 1145, Fig. 3.57 (page 71); Ex. 1146, 2:51-57.

8.3.5 Demodulation of Multiple Channels

73. A POSITA would have been well aware that either a single demodulator or multiple demodulators can perform demodulation of signals for multiple selected television channels. Ex. 1119, 1:67-2:7, 2:32-35, 2:61-63,

3:50-52; Ex. 1144, 7:53-57. For example, Carson (Ex. 1119) describes a multichannel time-shared demodulator that demodulates the signals of multiple channels concurrently using time division multiple access (TDMA) techniques. Ex. 1119, 1:67-2:7, 2:32-35, 2:61-63, 3:50-52. Kelly (Ex. 1144) illustrates an RF receiver that demodulates two channels separately with two demodulators. Ex. 1144, 7:53-57. Another example is shown in Azenkot (Ex. 1175), which describes a single shared demodulator for demodulating multiple time-division multiplexed QAM channels in a cable modem termination system (CMTS) in a hybrid fiber-cable (HFC) network. Ex. 1175, Abstract, 1:6-14, 6:14-22, 6:30-37; 7:15-20, 32:53-33:14. As another example, Shadwell (Ex. 1176) discloses the system shown below, which receives multiple digitized downconverted channels (**green**), which are time-multiplexed together (**purple**) into a data stream (**orange**) that is output to a single demodulator (**brown**), which then provides a demodulated time-multiplexed output (**light blue**).

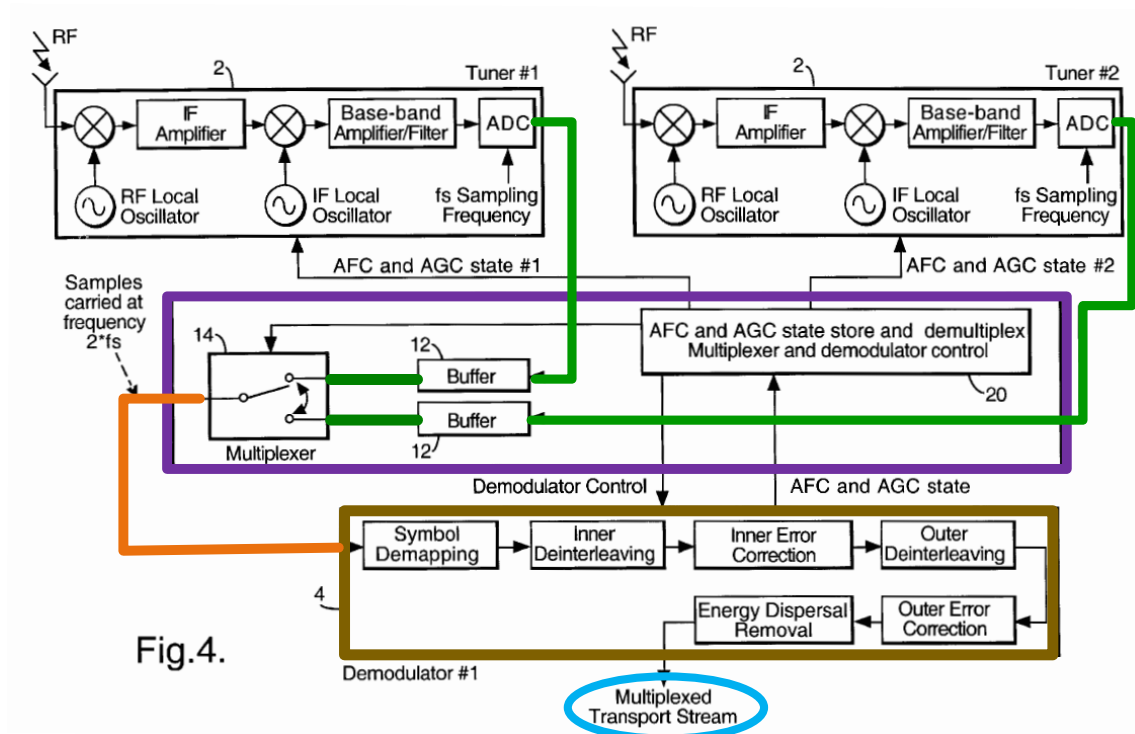


Fig.4.

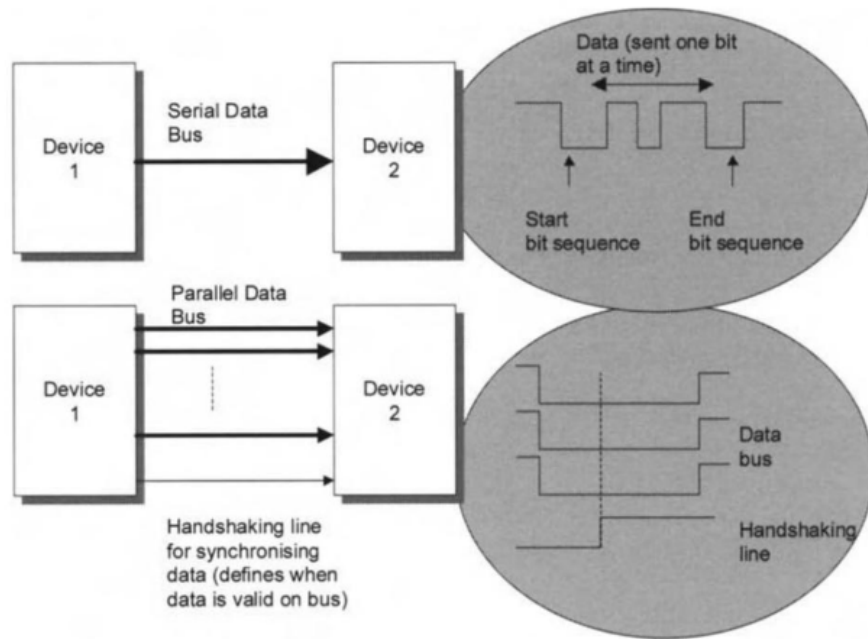
Ex. 1176, Fig. 4 (annotated)

A POSITA would have been well aware that single demodulator at the time, such as those disclosed in Carson, Azenkot, and Shadwell, were capable of demodulating multiple selected channels. Ex. 1176, Abstract, 2:28-52, 3:6-17, 4:21-32, 6:19-37, Figs. 1a, 1b, 2, 4. The use of a single demodulator would reduce cost of the system, and enable certain functionality, such as providing a transport stream including two demodulated television channels, for example, for decoding a picture-in-picture stream. Ex. 1176, 2:13-26, 2:53-59.

8.4 Serial vs. Parallel Data Communication

74. As described throughout subsection 8.3 above, the different components of an IF receiver, including a low-IF receiver, were known to a POSITA

prior to the '866 patent. It was also known to the POSITA by the earliest claimed priority date (April 17, 2009) of the '866 patent that the different components of low-IF receivers, such as the front end and the back end, could be fabricated on the same chipset or as different chipsets, and different types of buses could later connect the chipsets. Ex. 1134 at 23, 183; Ex. 1148 at 16. Data buses were known to pass data between electronic components. Ex. 1148 at 16. The data could be either passed in a serial manner by passing one bit at a time in a single bus, or in a parallel manner where several bits are transmitted simultaneously and each along its own separate channel. *Id.*; Ex. 1149, 1:10-28.



Ex. 1148, Fig. 2.3 (page 17)

75. A POSITA would have known that data transmission using parallel data buses offers a much higher data transmission rate than data transmission using

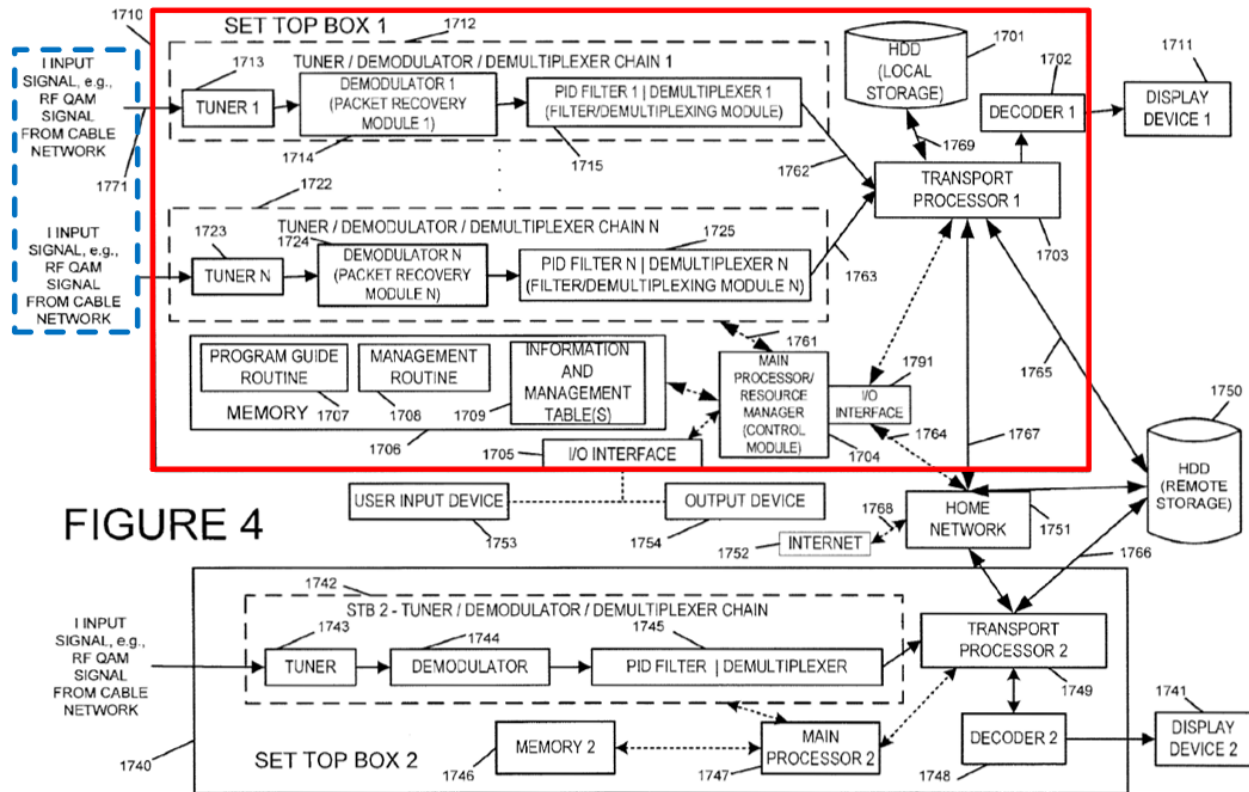
a serial data bus. Ex. 1148 at 16. However, the parallel bus structure requires a larger number of conductors and more space on the chip. Ex. 1149, 1:32-40. Furthermore, due to natural aberrations in the structure of each bus (e.g., resistance), signals in parallel data buses do not arrive at the same time, creating a problem known as “skew.” *Id.*, 1:24-40. This problem becomes more severe as the distances between chipsets increase. *Id.*

76. Therefore, it was well known before the claimed priority date of the ’866 patent to use technologies such as those described above in subsections 8.2.2-8.2.3 to broadcast data for television channels using QPSK and QAM modulated RF signals, and to use radio frequency receivers and tuners, such as low-IF receivers, to receive and process the RF signals to select one or more desired television channels. As also discussed above, such processing was well-known to include channel stacking, downconversion, channel selection (e.g., filtering), demodulation, and decimation, as well as parallel and serial bussing between receiver components.

8.5 Cholas (Ex. 1158)

77. U.S. Patent Application Publication No. 2010/0020794 (“Cholas”) (Ex. 1158) is a publication of U.S. Application No. 11/754,714 that was filed May 29, 2007. Ex. 1158, cover. Thus, I understand that Cholas is prior art under pre-AIA 35 U.S.C. § 102(e), because the application on which Cholas is based was filed before the earliest possible priority date of the ’866 patent (i.e., before April 17, 2009).

78. Referring to annotated Figure 4 below, Cholas describes a set top box (STB) 1710 (red) with tuner/demodulator/demultiplexer chains 1-N that “each receives an input signal [blue] ... from the cable network.” Ex. 1158, [0044], [0010]-[0011], [0024], [0059]-[0071], Figs. 4, 6



Ex. 1158, Fig. 4 (annotated)

79. In my opinion, Cholas is analogous art, because Cholas is in the same field of endeavor as the '866 patent and is reasonably pertinent to problems with which the '866 patent is concerned. Like the '866 patent, Cholas “relates to wideband receiver systems that are capable of receiving multiple desired television channels.” Ex. 1101, 1:30-32; Ex. 1158, [0001], [0043]-[0045], [0052]-[0057], Figs.

4-5. Cholas also relates to STBs in a cable network, which would have been an expected environment for the wideband receiver system of the '866 patent. Ex. 1101, 1:46-48, 5:8-12, claim 1; Ex. 1158, [0043]-[0045], Fig. 4.

8.6 Petrovic (Ex. 1108)

80. U.S. Patent Application Publication No. 2009/0290659 ("Petrovic") (Ex. 1108) is a publication of U.S. Application No. 12/414,892 ("the '892 Application"), which claims priority to, and incorporates by reference, U.S. Provisional Patent Application No. 61/054,886 to Petrovic et al. ("Petrovic '886", Ex. 1109), which was filed May 21, 2008. Ex. 1108, cover, [0001]. In my analysis below, I provide parallel citations where appropriate to both Petrovic '886 (Ex. 1109) and the published paragraphs of Petrovic (Ex. 1108).

81. As I show below in Section 8.6.1 of this Declaration, it is my opinion that Petrovic '886 provides written description support for at least independent claim 14 of Petrovic and provides written description support for the disclosure relied on in Petrovic. Petrovic '886 was filed on May 21, 2008. Ex. 1108, cover. Thus, I understand that Petrovic is prior art to the '866 patent under pre-AIA 35 U.S.C. § 102(e) for at least the material included in Petrovic '886, because both the filing date of the application on which Petrovic is based (March 31, 2009) and the earliest priority date of Petrovic (May 21, 2008) are before the earliest possible priority date of the '866 patent (April 17, 2009). I also understand that neither Petrovic nor

Petrovic '886 were considered during prosecution of the '866 patent. Ex. 1101, cover, page 2. I refer to Petrovic '886 using paragraph numbers and figure numbers from the specification and drawings of Petrovic '886, which are at pages 5-60 of Ex. 1109.

82. Similar to the '866 patent, Petrovic describes a wideband receiver system that it calls a “channel stacking system 100” and that “assemble[s] channels resident within an RF signal into a composite signal in which the received channels are placed (or sequenced) in desired channel slots for output to a rendering device, such as a set-top box.” Ex. 1108, [0028]; Ex. 1109, [0008]. For convenience, Petrovic Figure 4 is annotated below using colors that match annotation colors for corresponding features of the '866 patent drawings in Section 7, above. Petrovic Figure 4 shows details of the system 100. Ex. 1108, [0028]; *See* Ex. 1109, [0008], Fig. 1.

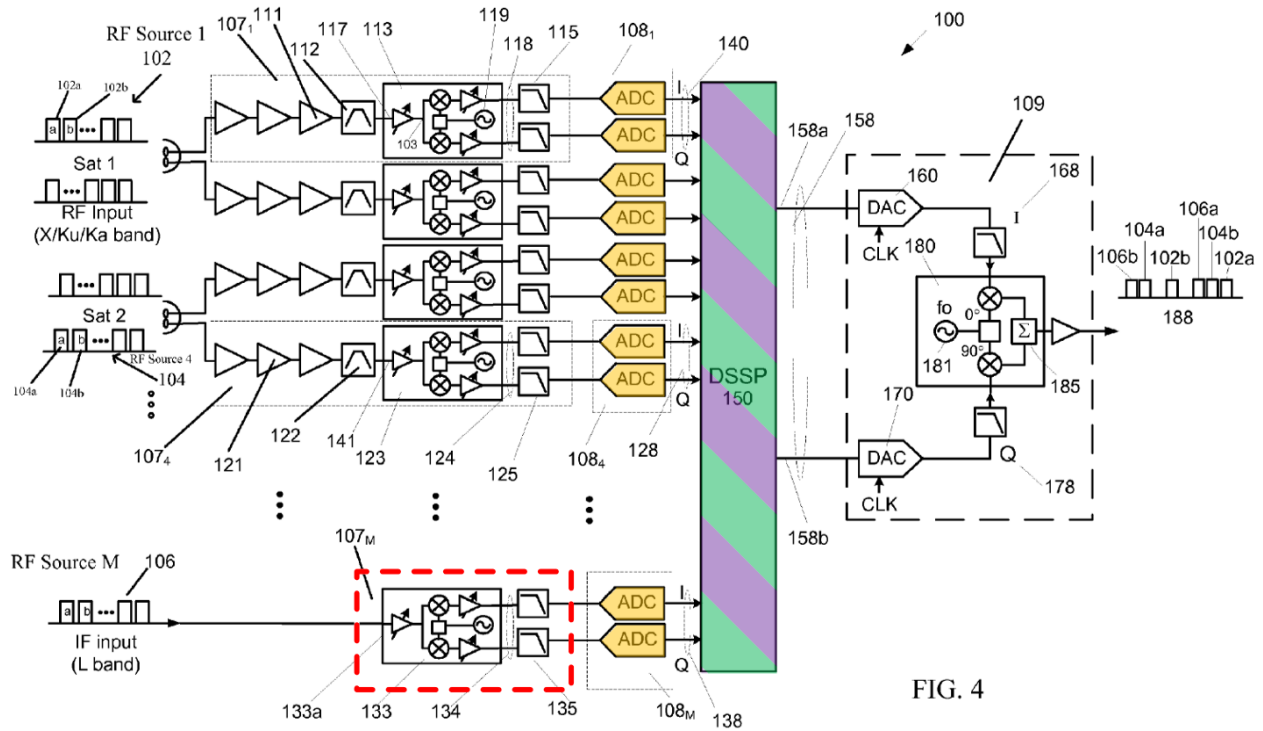


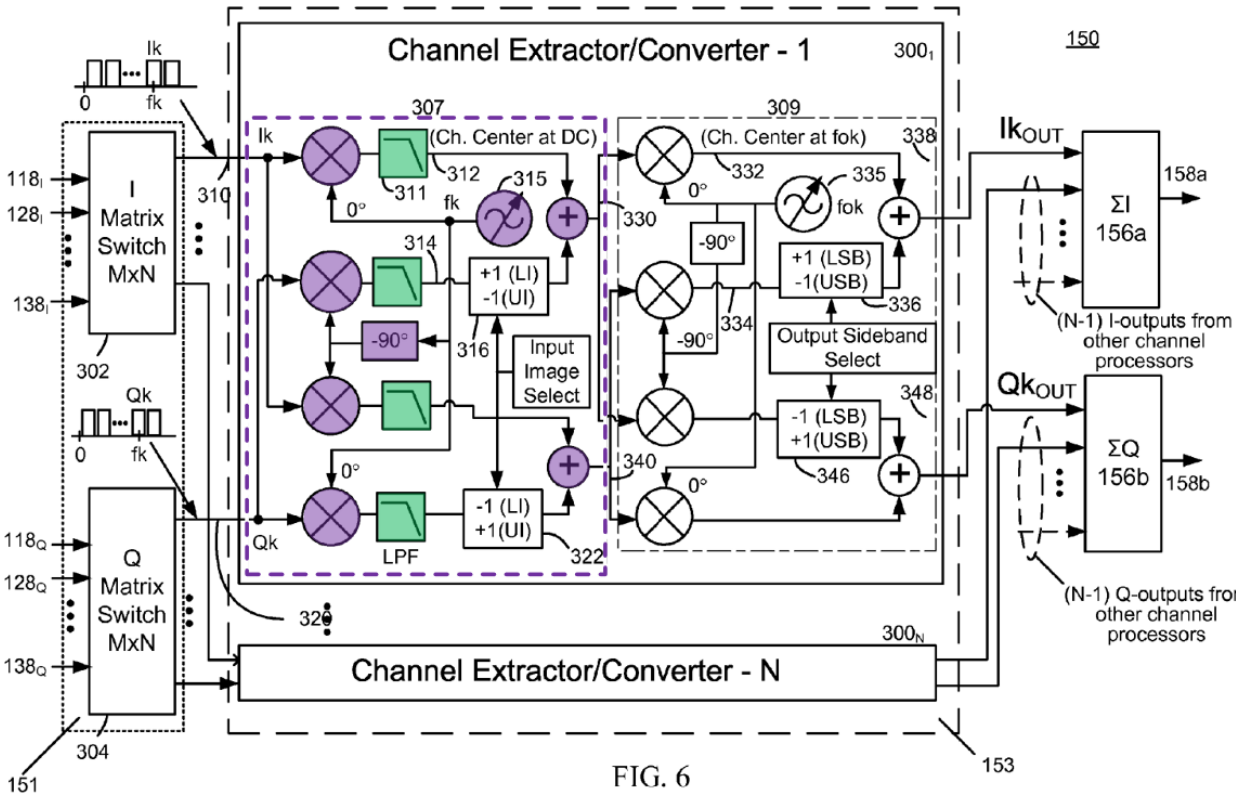
FIG. 4

Ex. 1108, Fig. 4 (annotated)

83. The system 100 receives signals 102-106 from a plurality of RF sources, such as satellites. Ex. 1108, [0029], Fig. 4; Ex. 1109, [0010]-[0013], [0016], [0023], [0026], Fig. 1. Each of those signals is “wideband,” as each comprises multiple channels. Ex. 1108, [0029], Fig. 4; Ex. 1109, [0016], Fig. 1. The signals 102-106 are coupled to respective “analog preprocessing and downconversion (APD) stages 107_{1-M},” one of which is marked in **red**. Ex. 1108, [0032], Fig. 4; Ex. 1109, [0010], [0013], [0020], Fig. 1. The APD stages include downconverters that downconvert RF signals into in-phase (I) and quadrature (Q) intermediate frequency (IF) signals. Ex. 1108, [0032]-[0038], Figs. 4-6; Ex. 1109, [0010], [0013], [0018]-[0023], [0031], [0032], Figs. 1-3A. The downconverted I and Q signals are filtered

and converted to digital form in analog-to-digital converters 108_{I-M} , (gold). Ex. 1108, [0032]-[0039], [0050]-[0052], Figs. 4-6; Ex. 1109, [0010], [0013], [0018]-[0020], [0022], [0024], [0031]-[0032], Figs. 1-3A.

84. A digital signal switching and pre-processing (DSSP) stage 150 (green/purple) receives the digitized signals and “extract[s] the channels of interest ... (i.e., removes all the channels that are not of interest).” Ex. 1108, [0040], [0042], Fig. 4; Ex. 1109, [0015], [0025], [0033], Fig. 1. Figure 6 shows additional details of the DSSP 150, including “channel extractor/converter circuit 300.” Ex. 1108, [0058]; Ex. 1109, [0033], Fig. 3A.



Ex. 1108, Fig. 6 (annotated)

85. Also similar to the '866 patent, a channel is extracted from the digitized I and Q signals corresponding to one of the RF sources 102-106 by downconverting those signals to baseband in a complex mixer (purple and/or purple broken-line box) of a stage 307, and filtering using low pass filters 311 (green) to create I, Q components 330, 340 for an extracted channel. Ex. 1108, [0060]-[0077]; Ex. 1109, [0037]-[0054]. The frequency f_k used for the downconversion to baseband (much like frequency ω_{ci} in the '866 patent) is selected based on a frequency corresponding to a desired channel. Ex. 1108, [0066]; Ex. 1109, [0045].

86. The I and Q signals 330 and 340 of the extracted channel are upconverted to a desired output frequency in the stage 309, and then summed with other upconverted channels (from stages 309 of other channel/extractor converters) in combiners 156a and 156b to result in the signals 158a and 158b. Ex. 1108, [0078]-[0086]; Ex. 1109, [0055]-[0061].

87. It is my opinion that Petrovic is in the same field of endeavor as the '866 patent, and thus is analogous art. For example, Petrovic describes a system and method for receiving a wideband RF signal comprising multiple channels. Ex. 1108, Abstract, [0029]-[0030], [0047], [0050], Fig. 4; Ex. 1109, [0010], [0011], [0013], [0016], [0020], [0023], Fig. 1. Petrovic is also reasonably pertinent to problems with which the '866 patent is concerned, and is also analogous art on that basis. For

example, Petrovic describes selecting individual channels by conversion to baseband and filtering in the same way as the '866 patent. Ex. 1101, 6:16-7:9, Fig. 3; Ex. 1108, [0042], [0058]-[0077], Fig. 6; Ex. 1109, [0015], [0033], [0037]-[0054].

8.6.1 Petrovic is Entitled to a Priority date of May 21, 2008

88. It is my understanding that a reference patent or printed publication is entitled to claim the benefit of the filing date of an earlier-filed application if the disclosure of the earlier-filed application provides support for one or more claims in the patent or printed publication.

89. As shown in the table below, Petrovic '886 provides written description support for at least claim 14 of Petrovic. Thus, Petrovic is entitled to the May 21, 2008 priority date of Petrovic '886, and is prior art to the '866 patent under pre-AIA 35 U.S.C. § 102(e) because its priority date is before the earliest possible priority date of the '866 patent (April 17, 2009).

Petrovic – Claim 14 (Ex. 1108)	Petrovic '886 (Ex. 1109)
14. A method for assembling channels in a composite signal, the method comprising:	[0001], [0004], [0008], claim 16.
a) downconverting, in a single frequency translation process, a first input signal comprising a first plurality of channels to a first IF signal comprising said plurality of first channels;	[0005], [0010], [0014], [0029], [0031], [0032], claim 16, Figs. 1, 2

Petrovic – Claim 14 (Ex. 1108)	Petrovic '886 (Ex. 1109)
b) converting the first IF signal into a first digital IF signal;	[0010], claim 16, Fig. 1
c) downconverting, in a single frequency translation process, a second input signal comprising a plurality of second channels to a second IF signal comprising said plurality of second channels;	[0005], [0013], [0014], [0023], [0029], [0031], [0032], claim 16, Figs. 1, 2
d) converting the second IF signal into a second digital IF signal; and	[0005], [0013], [0024], claim 16, Fig.1
e) assembling, in the digital domain, at least one of the first channels and at least one of the second channels into a digital composite signal.	[0015], [0025], [0036]-[0068], [0080], claim 16, Figs. 3A, 3B

8.7 Burris (Ex. 1159)

90. Burris (Ex. 1159) is a U.S. Patent Application Publication published October 4, 2007, and is prior art to the '866 patent under pre-AIA 35 U.S.C. § 102(b), because Burris published more than one year before the earliest possible priority date of the '866 patent. Ex. 1159, cover. Burris describes coaxial connector assemblies that may be used, e.g., for connection to ports on cable television devices. Ex. 1159, [0005]. In my opinion, Burris is reasonably pertinent to problems with which the '866 patent is concerned, and is analogous art to the '866 patent on at least

that basis. For example, Burris describes connectors that may be used to connect to a claimed feature (“cable network connector”). Ex. 1159, [0005].

8.8 Maalej (Ex. 1160)

91. Maalej (Ex. 1160) is a U.S. Patent that issued December 12, 2000. Ex. 1160, cover. Maalej is prior art to the ’866 patent under pre-AIA 35 U.S.C. § 102(b), because Maalej published more than one year before the earliest possible priority date of the ’866 patent. Maalej discloses a QAM demodulator for, e.g., demodulating 6 MHz CATV channels. Ex. 1160, 1:6-8, 1:28-33, 3:47-52. In my opinion, Maalej is reasonably pertinent to problems with which the ’866 patent is concerned, and is analogous art to the ’866 patent on at least that basis. For example, Maalej describes demodulators that can be used to perform a claimed feature (for example, “demodulators” and “provide a plurality of demodulated desired channels” as claimed). Ex. 1160, 1:6-8, 1:28-32, 3:47-52.

8.9 Rabaey (Ex. 1116)

92. Rabaey is a textbook on digital integrated circuit design (Ex. 1116) (“Digital Integrated Circuits[;] A Design Perspective”). Rabaey is prior art to the ’866 patent under pre-AIA 35 U.S.C. § 102(b), because Rabaey was publicly available more than one year before the earliest possible priority date of the ’866 patent. Ex. 1173, ¶¶ 47-54. In my opinion, Rabaey is reasonably pertinent to problems with which the ’866 is concerned, and is analogous art. The ’866 patent

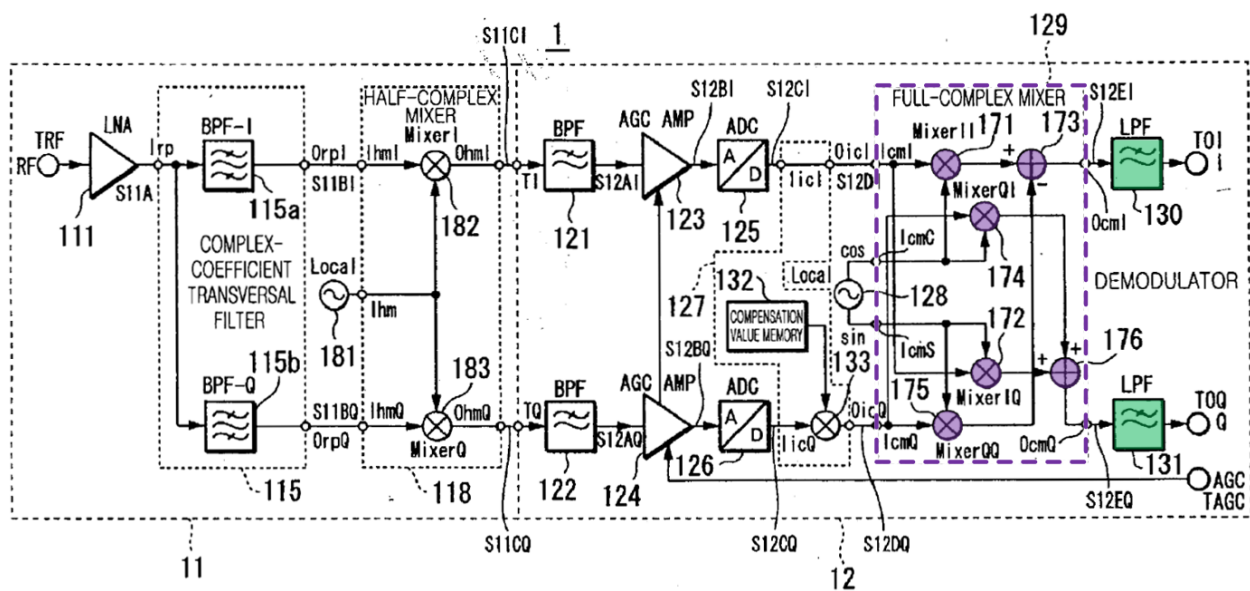
describes at length how signals may be processed in digital form. Ex. 1101, 5:51-7:9, Figs. 2-3. Integrated circuits were a well-known and widely-used way to implement digital processing in electronics. Ex. 1116 at 17 (recognizing “continuous trend towards digital solutions in all other areas of electronics”), 28 (“The purpose of this textbook is to provide a bridge between the abstract vision of digital design and the underlying digital circuit and its peculiarities”). In my opinion, a POSITA would have known that Rabaey describes the “commonly known methods” of sending “a serial or parallel digital data stream to a demodulator using a serial or parallel data interface” that the ’866 patent also refers to. Ex. 1101, 7:10-14.

8.10 Lee (Ex. 1153)

93. Lee (Ex. 1153) is a U.S. Patent Application Publication published February 14, 2008. Ex. 1153, cover. Lee is prior art to the ’866 patent under pre-AIA 35 U.S.C. § 102(b), because Lee published more than one year before the earliest possible priority date of the ’866 patent. Lee describes an STB that receives cable broadcasting signals. Ex. 1153, [0035]. In my opinion, Lee is analogous art, as it is in the same field of endeavor as the ’866 patent (e.g., receiving cable signals) and reasonably pertinent to problems with which the ’866 patent is concerned. For example, Lee describes an STB having claimed features (DOCSIS channels and picture-in-picture display). Ex. 1153, [0007], [0031].

8.11 Takahiko (Ex. 1161)

94. Takahiko (Ex. 1161) is a U.S. Patent Application Publication published November 16, 2006. Ex. 1161, cover. Takahiko is prior art to the '866 patent under pre-AIA 35 U.S.C. § 102(b), because Takahiko published more than one year before the earliest possible priority date of the '866 patent. Referring to the annotated figure below, Takahiko discloses a downconverter of a radio receiver that includes a digital baseband complex mixer (purple) and low pass filters (green) similar to those of the '866 patent. Ex. 1161, [0143], [0153], [0156].



Ex. 1161, Fig. 1 (annotated)

95. In my opinion, Takahiko is reasonably pertinent to problems with which the '866 patent is concerned, and is analogous art to the '866 patent on at least that basis. For example, Takahiko describes circuits, also described by the '866

patent, and which are used for similar purposes (reception and tuning of RF signals).
Ex. 1161, [0143]-[0156], Fig. 1.

9. OPINIONS WITH RESPECT TO THE '866 PATENT

96. The '866 patent has 82 total claims: six independent claims (1, 14, 27, 41, 55, and 69), with 12-13 dependent claims each. All of the claims are directed to a cable television (TV) device as illustrated in Figure 2 of the '866 patent.

97. Claims 1, 27, and 55 identically recite “a wideband analog-to-digital converter (ADC) configured to digitize a contiguous band of frequencies in an input signal ...” and “a digital front end (DFE) ... configured to concurrently select and provide each of the plurality of desired channels [] without providing any of the plurality of undesired channels.” Claims 1, 27, and 55 differ only by inclusion of a single, well-known ancillary feature: “a serial interface” (claim 1), “a digital video recorder” (claim 27), or “a picture-in-picture” display (claim 55).

98. Independent claims 14, 41, and 69 are nearly identical to claims 1, 27, and 55, respectively, except they lack a “contiguous band of frequencies” and replace the “digital front end” (DFE) with “a plurality of digital down converters.”

99. In my opinion, Cholas in view of Petrovic teaches a “wideband analog-to-digital converter,” a “digital front end,” a “plurality of digital down converters,” a digital video recorder, and numerous other claim features. *See* Section 9.1. To the extent that the patent owner might argue that a “digital front end” or a “plurality of

digital down converters” requires a specific placement of filters relative to a complex mixer, in my opinion Cholas in view of Petrovic and Takahiko teaches a “digital front end”/“plurality of digital down converters.” *See* Sections 9.12.1 and 9.12.2. It is further my opinion that Rabaey and Lee respectively show that a serial interface (claims 1 and 14, *see* Sections 9.4.1, 9.4.3, and 9.4.4) and a picture-in-picture display (claims 55 and 69, *see* Sections 9.7.2, 9.7.3, and 9.7.4) were features that were well-known to a POSITA.

100. In my opinion, the dependent claims are directed to various well-known features, such as a “a cable connector” and “at least one of an analog amplifier and an analog filter” (claims 2, 15, 28, 42, 56, 70), complex signals having I and Q components (claims 3, 16, 29, 43, 57, 71), baseband I and Q complex signal components (claims 4, 17, 30, 44, 58, 72), filters for complex signals (claims 5, 18, 31, 45, 59, 73), demodulating complex signals/desired channels (claims 6/7, 19/20, 32/33, 46/47, 60/61, 74/75), output via a parallel interface (claims 8, 21, 35, 49, 62, 76), a cable broadcast channel (claims 9, 22, 37, 51, 65, 79), and a DOCSIS channel (claims 10, 23, 38, 52, 66, 80). As discussed herein, Lee, Burris, Rabaey, and Maalej show that all of these claim features were well-known to a POSITA.

101. Also, in my analysis throughout this declaration, I will sometimes refer to combinations of references with dashes between them. For example, I will refer to a combination of Cholas and Petrovic as “Cholas-Petrovic.”

9.1 Cholas in View of Petrovic Renders Claims 27-33, 37, 40-47, 51, and 54 Obvious

102. In the following, I provide a limitation-by-limitation analysis showing how Cholas in view of Petrovic renders claims 27-33, 37, 40-47, 51 and 54 obvious. To help illustrate how the disclosures of these references map to the claim limitations, I have color coded some of my remarks and some figures in the noted art below.

9.1.1 Independent Claim 27

103. The limitations of claim 27 appear in the Claims Listing Appendix, labeled as limitations [27A]-[27D]. For the following reasons, it is my opinion that claim 27 is rendered obvious over Cholas in view of Petrovic.

a. [27A] “A cable television (TV) device comprising:”

104. It is my opinion that Cholas discloses “[a] cable television (TV) device comprising:” as claimed.

105. In my opinion, the preamble in limitation [27A] simply refers to claim 27 being a device claim and does not impose any particular limitations on the claim. Nevertheless, to the extent the preamble is considered limiting, it is my opinion that Cholas teaches limitation [27A]. Referring to the annotated figure below, Cholas describes set top box (STB) 1710 (**red**) that receives a television signal “from the cable network.” Ex. 1158, [0010]-[0011], [0024], [0044], [0059]-[0071], Figs. 4, 6.

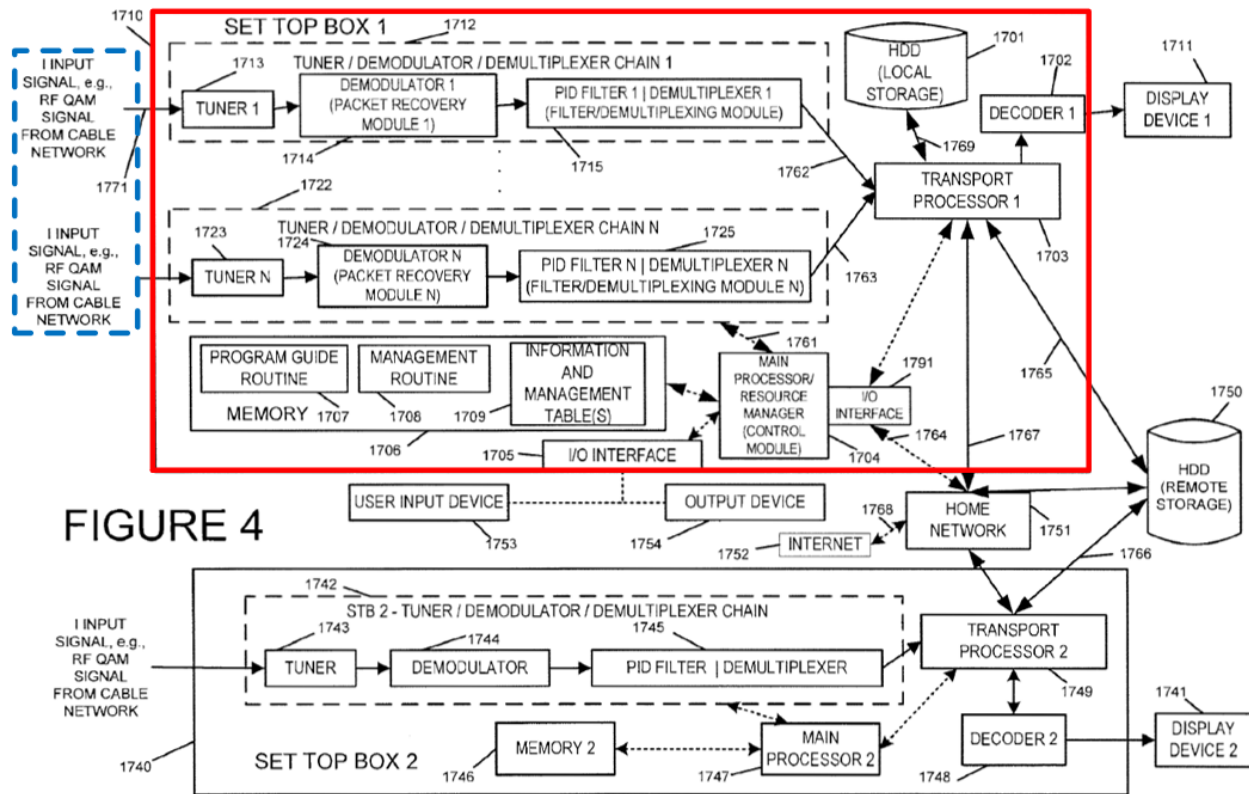


FIGURE 4

Ex. 1158, Fig. 4 (annotated)

106. The STB 1710 receives an input signal (blue) having RF QAM (quadrature amplitude modulation) channels carrying TV programs. Ex. 1158, Abstract, [0001], [0002], [0004], [0006], [0011]-[0017], [0033], [0044], [0052]-[0057], Fig. 5.

- b. [27B] “a wideband analog-to-digital converter (ADC) configured to digitize a contiguous band of frequencies in an input signal, wherein the contiguous band of frequencies comprises a plurality of desired channels and a plurality of undesired channels; and”

107. It is my opinion that Cholas in view of Petrovic discloses “a wideband analog-to-digital converter (ADC) configured to digitize a contiguous band of

frequencies in an input signal, wherein the contiguous band of frequencies comprises a plurality of desired channels and a plurality of undesired channels; and,” as claimed.

108. Cholas STB 1710 receives an input signal comprising the claimed “contiguous band of frequencies in an input signal,” and “the contiguous band of frequencies comprises a plurality of desired channels and a plurality of undesired channels.” According to Cholas, a “typical RF signal enters” the STB 1710 “with multiple carriers between, e.g., frequencies 50-1000 MHz,” a bandwidth greater than the 800 MHz “wide bandwidth” of the ’866 patent. Ex. 1158, [0045]; Ex. 1101, 2:34. Each tuner (**gold/green/purple** striped) of the set top box 1710 (**red**) “selects a single 6 MHz carrier frequency and passes the signal corresponding to the band” to a demodulator. Ex. 1158, [0045].

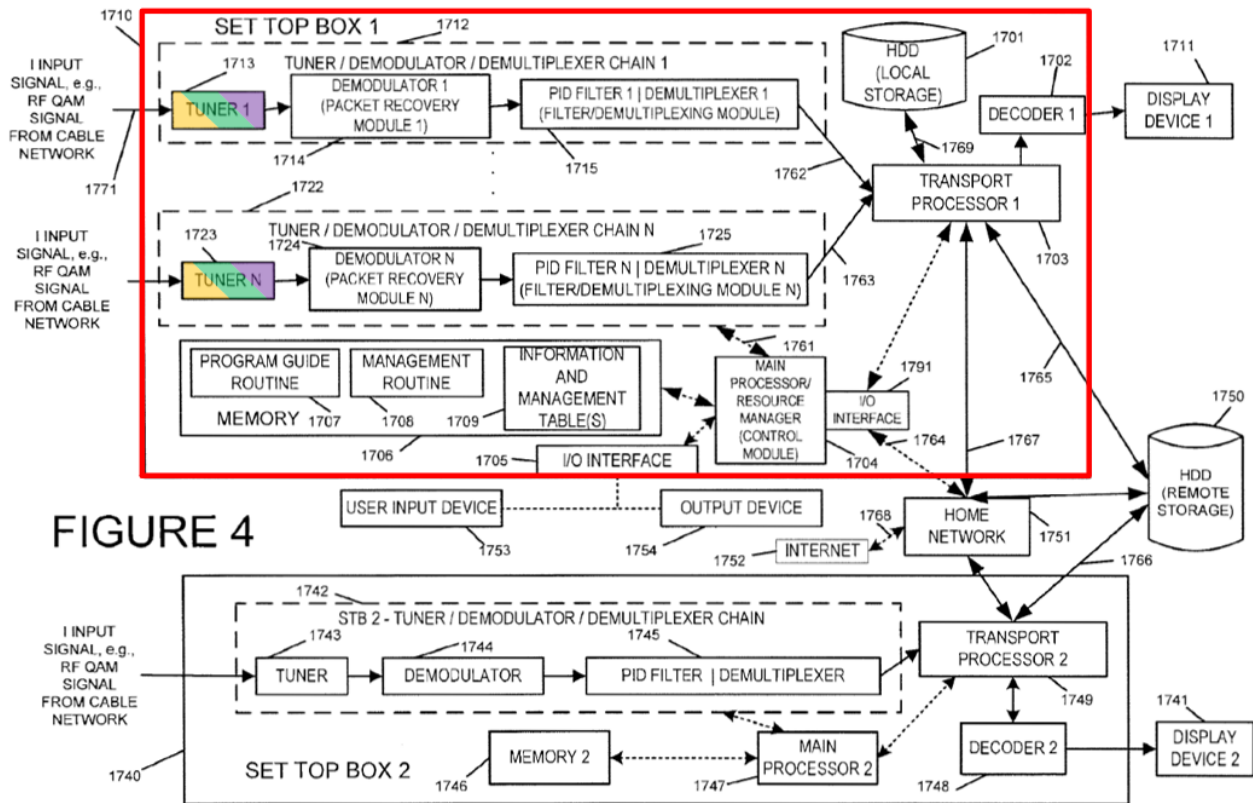


FIGURE 4

Ex. 1158, Fig. 4 (annotated)

109. Any of the tuners in multiple chains of the STB 1710 can be available to tune to a particular channel. Ex. 1158, [0062]-[0064], Fig. 6. For example, if a first tuner is available, the first tuner is tuned to a determined channel, but if the first tuner is not available, then a second available tuner is tuned to that determined channel. *Id.* Because various tuners (in various chains of the STB 1710) can be tuned to the same determined channel, each of the various tuners (and thus each of the various chains) must receive the same set of channels. In other words, STB 1710 has multiple chains (each having the structure of representative chain 1712), and at least some of those multiple chains have tuners (such as tuner 1713) connected to the

same input signal 1771 so that they receive the same set of channels. Moreover, it was known to a POSITA (and indeed, it was even common knowledge to a lay person) as of the earliest possible priority date of the '866 patent that typically a single cable TV cable containing all available channels is provided to a premises such as a home (rather than, for example, one cable for some channels and another cable for other channels). Cholas describes its tuners as being deployed in a home premises. Ex. 1158, [0012], [0016].

110. Because a channel is tuned by one of the tuners 1712-1722 in response to a user selection of a program carried on that channel, a tuned channel is a “desired” channel. Ex. 1158, [0059]-[0063]. There are numerous 6 MHz channels between 50-1000 MHz. In Cholas, and even if limited to channels between 550 and 862 MHz, the number of 6 MHz contiguous channels for the user to select from would be relatively large, on the order of about $(862 \text{ MHz} - 550 \text{ MHz}) / 6 \text{ MHz}$, or 52 channels. *See*, Ex. 1133 at 45, 413, 515-520 (each television channel is allocated 6 MHz of RF bandwidth and the set of allocated television channels occupies the RF spectrum in a contiguous manner). Moreover, and as a POSITA would have appreciated, very few (if any) users of a STB would ever have wanted or needed to simultaneously tune more than a handful of channels, much less 52 channels, so there would frequently have been multiple “undesired” channels. A POSITA would have recognized this and taken it into account when designing a STB, as it would have

been a relevant consideration when determining how many tuners (such as the Cholas tuners 1713-1723) or tuning circuits (such as the Petrovic first stages 307, described below) to include in an STB. Including more tuners/tuning circuits than would reasonably have been expected to be needed would have increased cost and power consumption of the device and made it needlessly complicated. Therefore, in a conventional cable TV system with numerous 6 MHz channels between 50-1000 MHz, such as Cholas describes, in my opinion a POSITA would have understood from Cholas that there would always be channels that were not tuned by a particular STB, and that were thus “undesired.” Ex. 1158, [0045].

111. Petrovic discloses a channel stacking system 100 that performs tuning functions similar to those described by Cholas, and that includes a wideband ADC that digitizes a contiguous band of frequencies in an input signal. Referring to the annotated figure below, the system 100 receives signal 106 (blue broken-line box) that may be between 950-2150 MHz. Ex. 1108, [0029], [0031], [0050], Fig. 4; Ex. 1109, [0012], [0020], [0028], Fig. 1. Signal 106 is wideband, as it comprises multiple channels. Ex. 1108, [0050], Fig. 4; Ex. 1109, [0028], Fig. 1. The signal 106 bandwidth is greater than the 800 MHz “wide bandwidth” of the ’866 patent. Ex. 1101, 2:34.

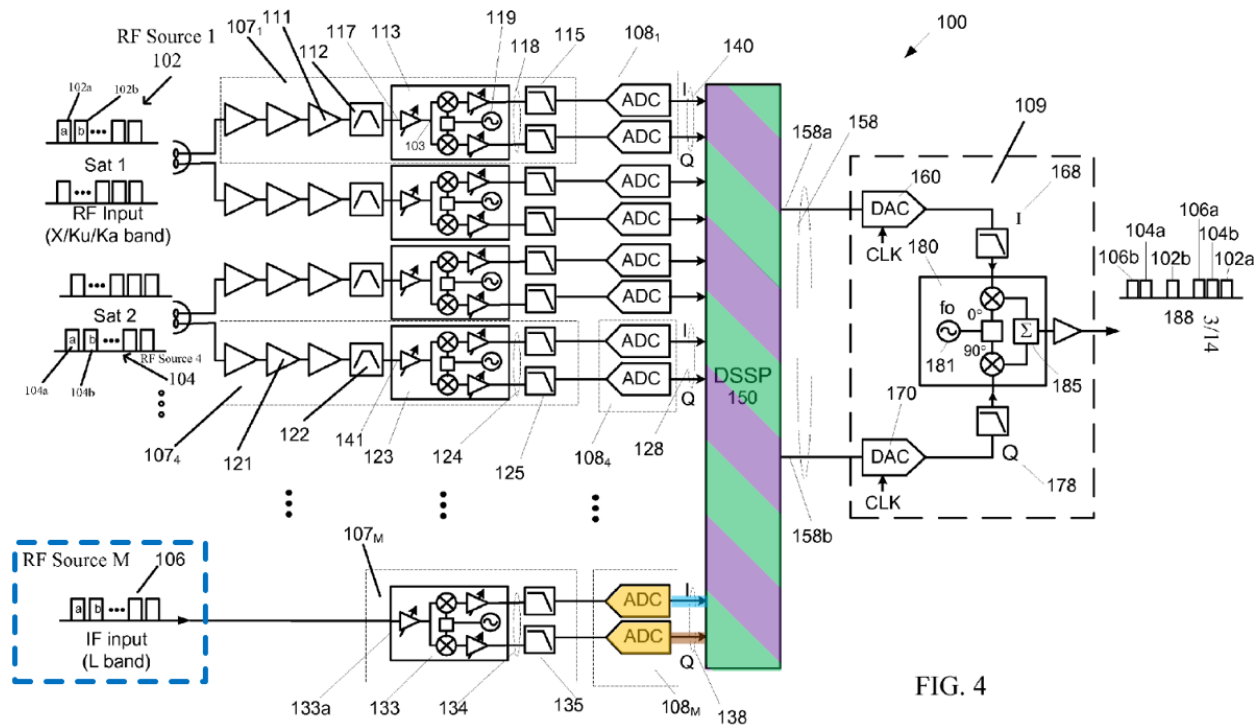


FIG. 4

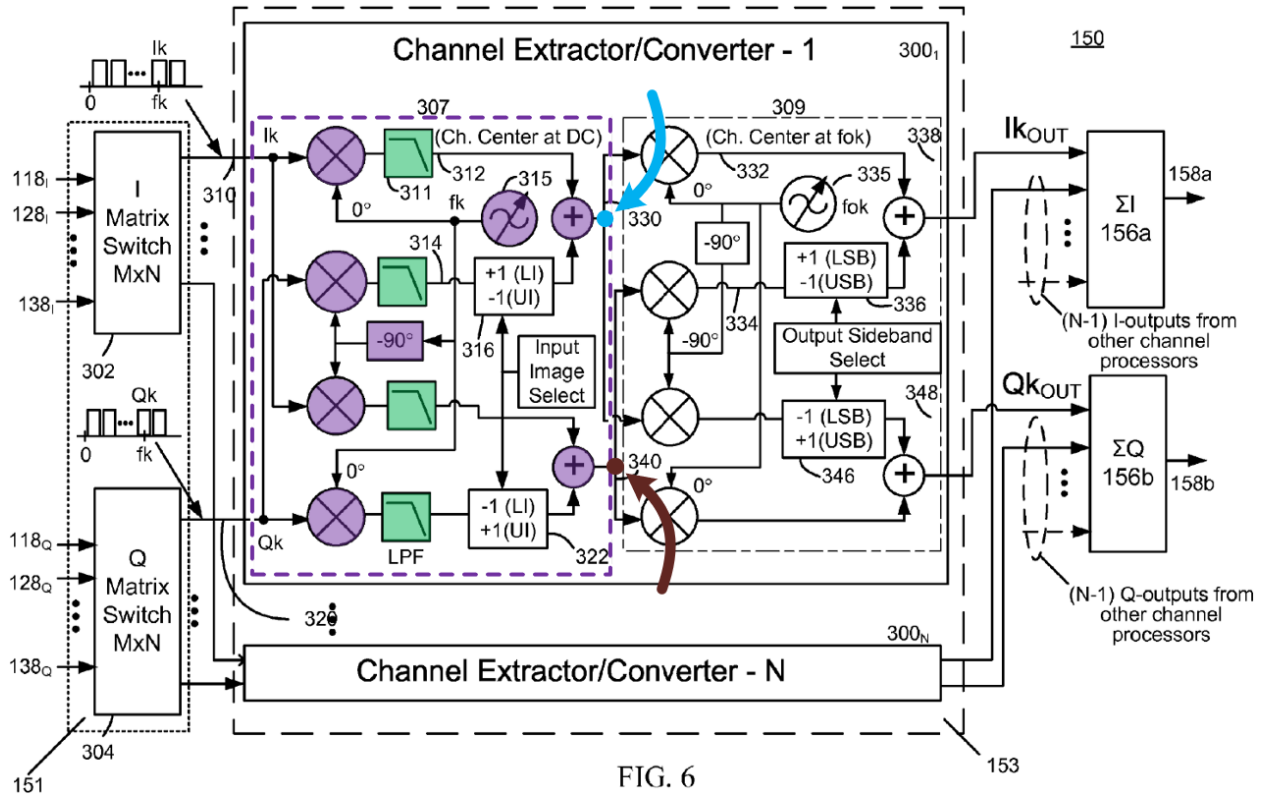
Ex. 1108, Fig. 4 (annotated)

112. The system 100 receives signal 106 (**blue** broken-line box) that may be between 950-2150 MHz. Ex. 1108 [0029], [0031], [0050], Fig. 4; Ex. 1109, [0012], [0020], [0028], Fig. 1. Signal 106 is wideband, as it comprises multiple channels. Ex. 1108, [0050], Fig. 4; Ex. 1109, [0028], Fig. 1. The signal 106 bandwidth is greater than the 800 MHz “wide bandwidth” of the ’866 patent. Ex. 1101, 2:34.

113. “Analog preprocessing and downconversion (APD)” stage 107_M downconverts RF signal 106 into I, Q intermediate frequency (IF) signals 134. Ex. 1108, [0032]-[0035], [0050], Figs. 4-5; Ex. 1109, [0020], [0028], [0031], [0032], Figs. 1-2. The downconverted I, Q signals 134 are filtered and then converted to digital form in analog-to-digital converters (ADCs) 108_M (**gold**). Ex. 1108, [0048],

[0050], [0052], Fig. 4; Ex. 1109, [0020], [0022], [0028], Fig. 1. The entire band provided by the APD stage 107_M, which includes all received channels that exist in the signal 106, is digitized by the ADCs 108_M to generate digital I (**blue**), Q (**brown**) signals 138, thus making the ADCs 108_M are “wideband” ADCs. Ex. 1108, [0039], Fig. 4; Ex. 1109, [0029], Fig. 1.

114. Referring to the annotated figure below, a digital signal switching and pre-processing (DSSP) stage 150 (**green/purple**) receives the digitized signals 138 and “extract[s] the channels of interest ... (i.e., removes all the channels that are not of interest).” Ex. 1108, [0040], [0042], Fig. 4; Ex. 1109, [0015], [0025], [0033], Fig. 1. Figure 6 shows additional details of the DSSP 150. Ex. 1108, [0058], Fig. 6; Ex. 1109, [0033], Fig. 3A.

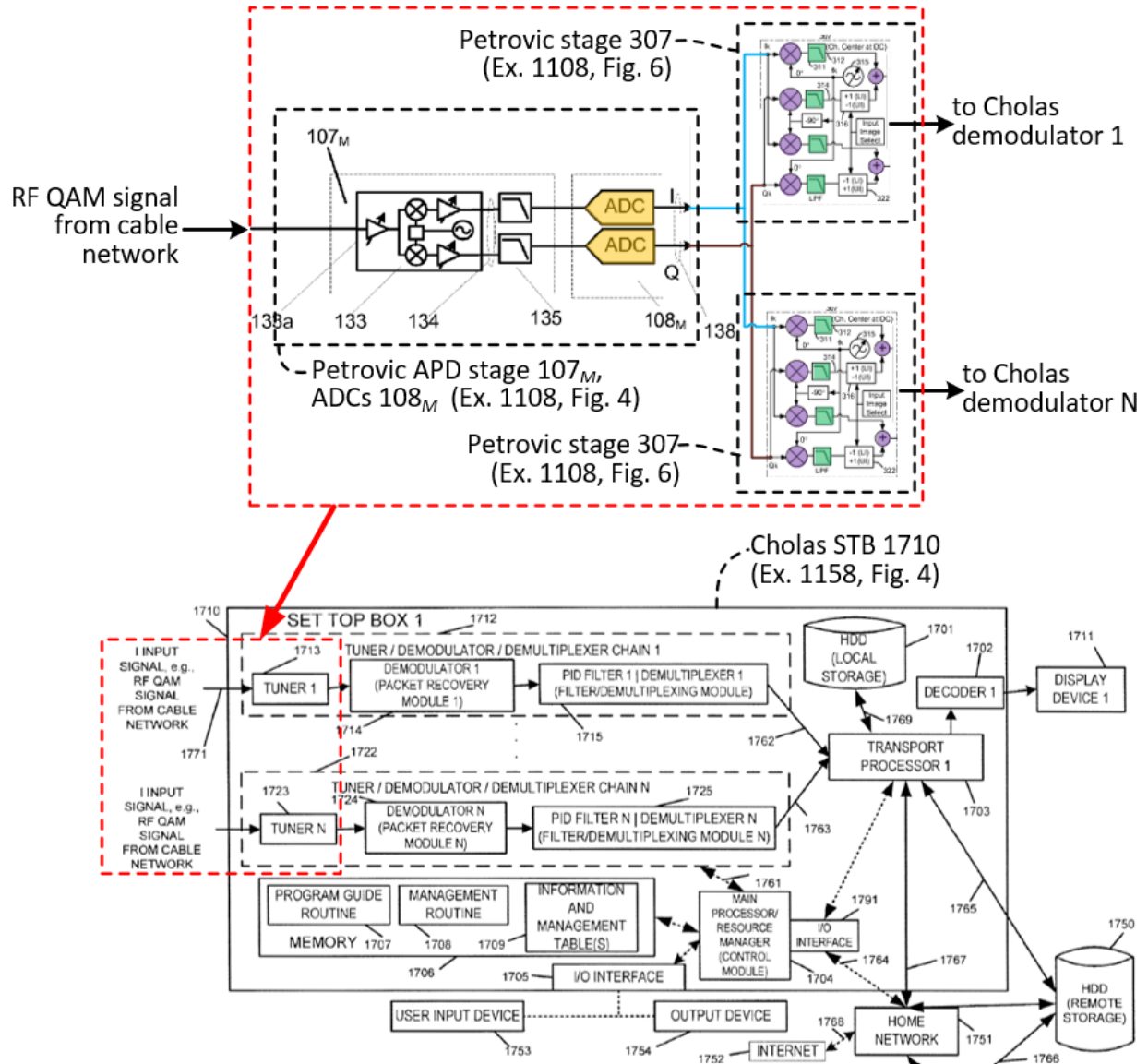


Ex. 1108, Fig. 6 (annotated)

115. The DSSP 150 includes multiple circuits 300, with each of those circuits 300 comprising a stage 307, and with each stage 307 able to select a different channel. Ex. 1108, [0055], [0059]-[0077], Fig. 6; Ex. 1109, [0033], [0037]-[0054], Fig. 3A. A stage 307 extracts a channel from the digitized I, Q signals 138_i, 138_q corresponding to the RF source 106 by digitally downconverting those signals so a desired channel is at baseband, and by filtering (green), in a complex mixer (purple and purple broken-line box). Ex. 1108, [0060]-[0077]; Ex. 1109, [0037]-[0054]. The frequency f_k used for the downconversion is selected based on a frequency corresponding to a desired channel. Ex. 1108, [0066]; Ex. 1109, [0045]. The

complex mixer of a stage 307 outputs, from the adders (unnumbered **purple** “ $\oplus$ ” symbols) a quadrature pair comprising a digital I component 330 (**blue** dot and arrow) and a digital Q component 340 (**brown** dot and arrow) corresponding to a selected/desired channel. Ex. 1108, [0077]; Ex. 1109, [0054].

116. It is my opinion that a POSITA would have replaced the Cholas tuners 1-N (tuners 1713-1723) with a single Petrovic tuner that would have included the Petrovic APD stage 107_M, ADCs 108_M, and multiple stages 307 of the DSSP 150. Each of the stages 307 would, like one of the replaced Cholas tuners 1-N, output a signal (a digital I, Q pair 330, 340) corresponding to a selected “desired” channel. The annotated Figure below, prepared using Cholas Figure 4 and Petrovic Figures 4 and 6, shows the Cholas-Petrovic STB.



Cholas-Petrovic STB

117. In the Cholas-Petrovic STB, the entire received band is output by the Petrovic APD stage 107_M, including all received channels that exist in the input RF QAM signal (desired and undesired). All of these channels would be digitized by the ADCs 108_M, and desired channels are selected by Petrovic stages 307, as explained

for limitation [27C]. Ex. 1108, [0039], Fig. 4; Ex. 1109, [0029]; Ex. 1158, [0045], [0052]-[0053], [0055]-[0056], Fig. 5.

118. In my opinion, a POSITA would have implemented the Cholas STB with a single Petrovic tuner (e.g., the Petrovic APD stage 107_M, ADCs 108_M, and multiple stages 307 of the DSSP 150) instead of multiple separate tuners. Implementing the Cholas STB with a single tuner would have improved the Cholas STB, relative to an implementation with multiple separate tuners, by beneficially simplifying the STB and reducing the number of components. And although Cholas does not disclose the tuners 1713-1723 performing downconversion, downconversion of a received RF signal before further processing was a standard technique used in receivers. *See* Section 8.3. A single downconverter (as part of the APD stage 107_M) would use less power and be less expensive to implement than separate downconverters for multiple tuners.

119. A single Petrovic tuner would also have improved the Cholas STB with digital tuning. For example, selecting channels in the digital domain avoids the need for bandpass filtering and Hilbert transformers, thereby reducing circuit complexity and power consumption. Ex. 1108, [0007], [0096]; Ex. 1109, [0003], [0069].

120. Implementing the Cholas STB with a Petrovic tuner instead of multiple separate tuners would have been a simple substitution of one known element for another to obtain predictable results, a substitution that would have been well within

a POSITA's ability. For numerous reasons, A POSITA would have been able to substitute a Petrovic tuner for the multiple tuners 1713-1723 of the Cholas STB, and the results would have been predictable.

121. For example, and as explained above, the output of each Petrovic stage 307 is an I, Q pair that corresponds to a selected channel. Cholas shows the output of each tuner as the input to a dedicated QAM demodulator. Ex. 1158, Fig. 4. Generating I, Q components was a well-known preliminary step in QAM demodulation. *See* Section 8.2. Indeed, and as discussed in more detail in Section 9.3.1 for dependent claims that recite "demodulators", it was known that QAM demodulators may digitize, and create I, Q components for, a signal being demodulated. Ex. 1160, 4:5-19, Fig. 2. In my opinion, a POSITA would thus have recognized that the outputs of Petrovic stages 307 could be inputs to demodulators. As another example, Petrovic discloses downconverting, digitizing, and tuning channels in a 950-2150 MHz band. Ex. 1108, [0031], Fig. 4; Ex. 1109, [0012], Fig. 1. In my opinion, any bandwidth or frequency differences between that band and the 50-1000 MHz band disclosed by Cholas would not have created any technical challenges to implementing the Cholas STB with a Petrovic tuner. Ex. 1158, [0045].

122. In my opinion, modifying a Cholas STB to replace multiple separate tuners with a Petrovic tuner would have merely involved the use of a known technique (digitally tuning multiple channels using a Petrovic tuner) to improve a

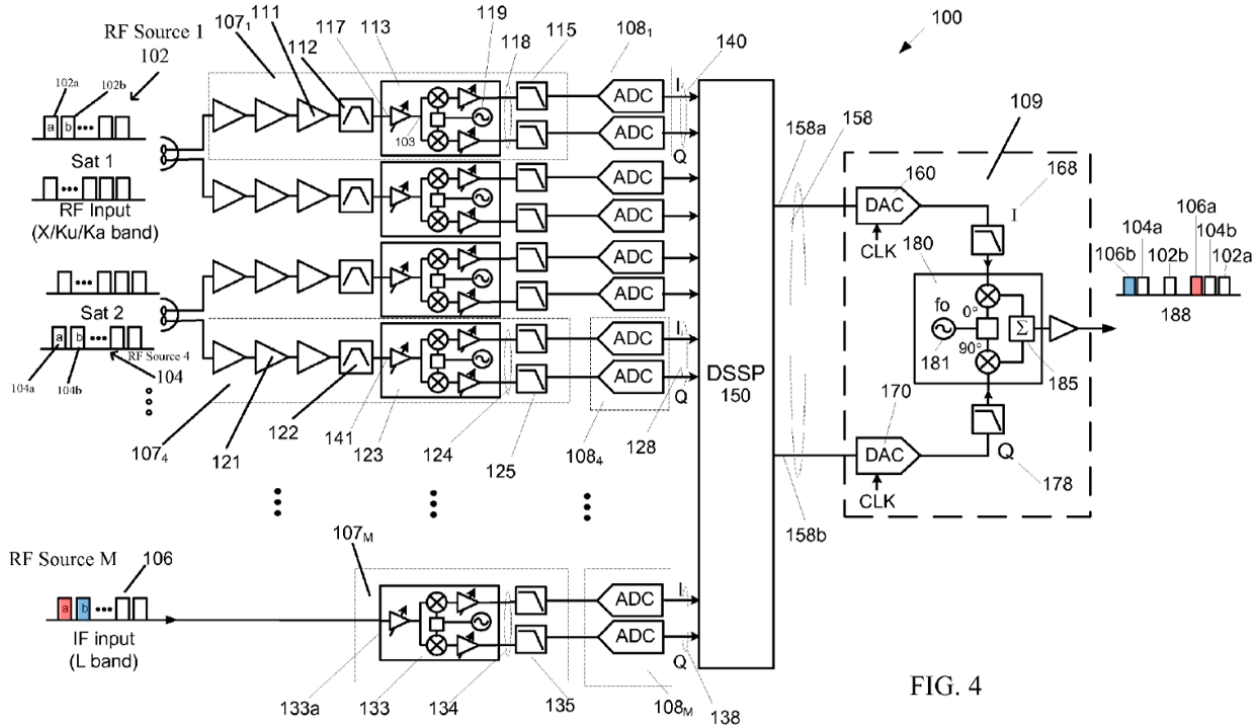
similar device (a Cholas STB) in the same way. For the same reasons explained above, a POSITA would have applied the improvement of the Petrovic tuner to the Cholas STB, and the results would have been predictable to a POSITA.

- c. **[27C] “a digital frontend (DFE) coupled to the wideband ADC, wherein the DFE is configured to concurrently select and provide each of the plurality of desired channels without providing any of the plurality of undesired channels, and”**

123. It is my opinion that Cholas in view of Petrovic discloses “a digital frontend (DFE) coupled to the wideband ADC, wherein the DFE is configured to concurrently select and provide each of the plurality of desired channels without providing any of the plurality of undesired channels, and” as claimed.

124. Petrovic’s stages 307, coupled to the ADC pair 108_M, select and provide desired channels without providing undesired channels. Ex. 1108, [0055]; Ex. 1109, [0033]. In Cholas, various channels are received in an input signal from a cable network, and multiple channels may be tuned (i.e., “selected”) concurrently. Ex. 1158, [0052]-[0053], [0055]-[0056]; *see also* Ex. 1158, [0007], [0011]. This functionality remains in Cholas-Petrovic, as the multiple Petrovic stages 307 receive the same I, Q signals carrying multiple channels and operate in parallel to select channels. Ex. 1108, [0055], [0059]-[0077], Fig. 6; Ex. 1109, [0033], [0037]-[0054], Fig. 3A.

125. This can be seen in Petrovic Figure 4, where input RF signal 106 comprises channels 106a (red) and 106b (blue). These channels are eventually selected and output via parallel stages 307 within DSSP 150; output 188 (and the equivalent digital version of the complex signal 158a/158b) in this example shows channels 106a (red), 106b (blue), 102a, 102b, 104a, and 104b, but does not include any other “undesired” channels from 102, 104, or 106. Ex. 1108, [0050], Figs. 4, 6; Ex. 1109, [0020], Figs. 1, 3A.

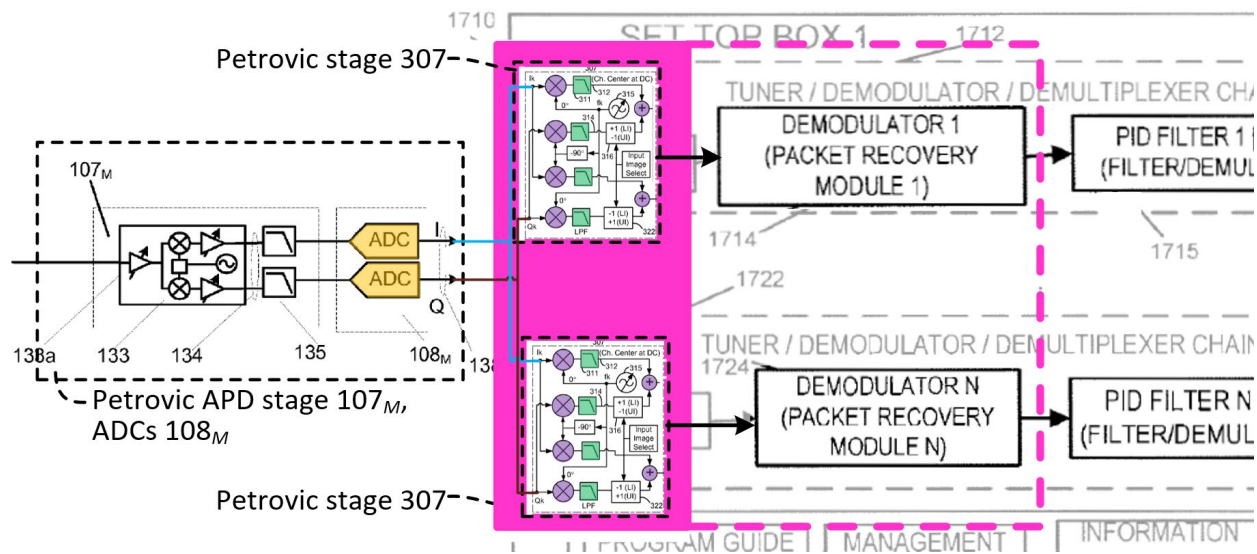


Ex. 1108, Fig. 4 (annotated)

126. It is my opinion that, in a Cholas-Petrovic STB, the stages 307 would be configured to concurrently select each of the plurality of desired channels without selecting undesired channels. Ex. 1158, [0052]-[0053], [0055]-[0056], Fig. 5; Ex.

1108, [0042], [0050], [0053], [0055], [0058], Figs. 4, 6; Ex. 1109, [0004]-[0005], [0015], [0020], [0025], [0033], [0036], Figs. 1, 3A; *see also* Ex. 1158, [0007], [0011]. The Cholas STB tunes channels in response to user selection of program carried on those channels, so tuned (or selected) channels are “desired” and “undesired” channels are not tuned. Ex. 1158, [0059]-[0063]. This would not change in Cholas-Petrovic, as only the components used to perform tuning (vs. components that cause tuning to be performed) would be modified.

127. The stages 307 of Cholas-Petrovic may be a DFE according to limitation [27C], or the DFE may include more components of the Cholas-Petrovic STB. For example, dependent claims 32 and 33 indicate that the DFE may “comprise[] a plurality of digital demodulators.” This is shown in the below Figure showing the Cholas-Petrovic system, which has been rearranged so that the stages 307 are aligned with the Cholas demodulators, and where portions of Cholas Figure 4 and of the STB have been omitted or faded for simplicity.



“DFE” in Cholas-Petrovic

128. The stages 307 (solid pink box) are a DFE coupled to the wideband ADC (ADC pair 108_M) and configured to concurrently select and provide (to the demodulators) each of the plurality of desired channels without providing any of the plurality of undesired channels. The stages 307 and the demodulators (solid and broken-line pink boxes) are also a DFE coupled to the wideband ADC and configured to concurrently select and provide (to the PID filters) each of the plurality of desired channels without providing any of the plurality of undesired channels.

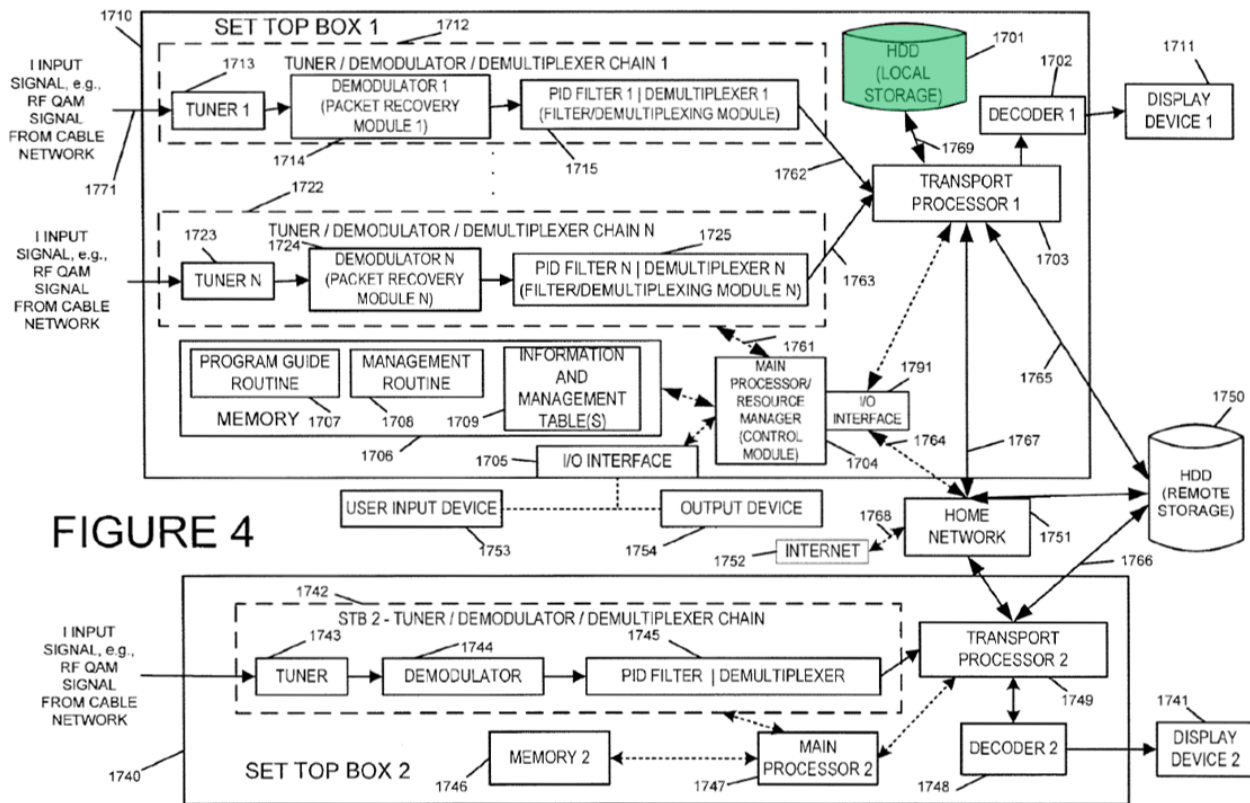
129. To the extent that the DFE of limitation [27C] is treated as means-plus-function, it is still disclosed by Cholas-Petrovic. Each stage 307 has a complex mixer and low pass filters that select a desired channel. See above discussion for limitation [27B] (purple and green in annotated Figure 6). This is the same or equivalent structure as the DFE of '866 patent Figure 2, which has a complex mixer 250 and

filter 260 to select each desired channel. Ex. 1101, 5:51-65, 6:6-8, Fig. 2. The Petrovic stages 307 operate in the same (or an equivalent) way as the '866 patent DFE (digitally downconverting digital I, Q components so that a desired channel is at baseband, and filter out other channels), perform the same function, and achieve the same result (desired channels are selected and provided).

d. [27D] “wherein the cable TV device comprises a digital video recorder (DVR).”

130. It is my opinion that Cholas discloses “wherein the cable TV device comprises a digital video recorder (DVR),” as claimed.

131. Referring to the annotated figure below, the STB 1710 of Cholas has a DVR 1701 (**green**), and this DVR remains in the Cholas-Petrovic system. Ex. 1158, [0033] (“a digital storage device, e.g., a DVR, ... corresponding to the STB”), [0045] (streams can be directed to “internal HDD (local storage) 1701, typically a hard drive”), [0054]-[0057], Fig. 5.



Ex. 1158, Fig. 4 (annotated)

9.1.2 Independent Claim 41

132. The limitations of claim 41 appear in the Claims Listing Appendix, labeled as limitations [41A]-[41D]. For the following reasons, it is my opinion that claim 41 is rendered obvious over Cholas in view of Petrovic.

a. [41A] “A cable TV device comprising:”

133. It is my opinion that Cholas in view of Petrovic discloses the preamble of limitation [41A], which is not limiting to the claim, for the same reasons I explained above for limitation [27A]. See Section 9.1.1.a.

- b. [41B] “a wideband analog-to-digital converter (ADC) configured to digitize an input signal, wherein the input signal comprises a plurality of desired channels and a plurality of undesired channels; and”**

134. It is my opinion that Cholas in view of Petrovic discloses limitation [41B] for the same reasons I explained above for limitation [27B]. *See* Section 9.1.1.b.

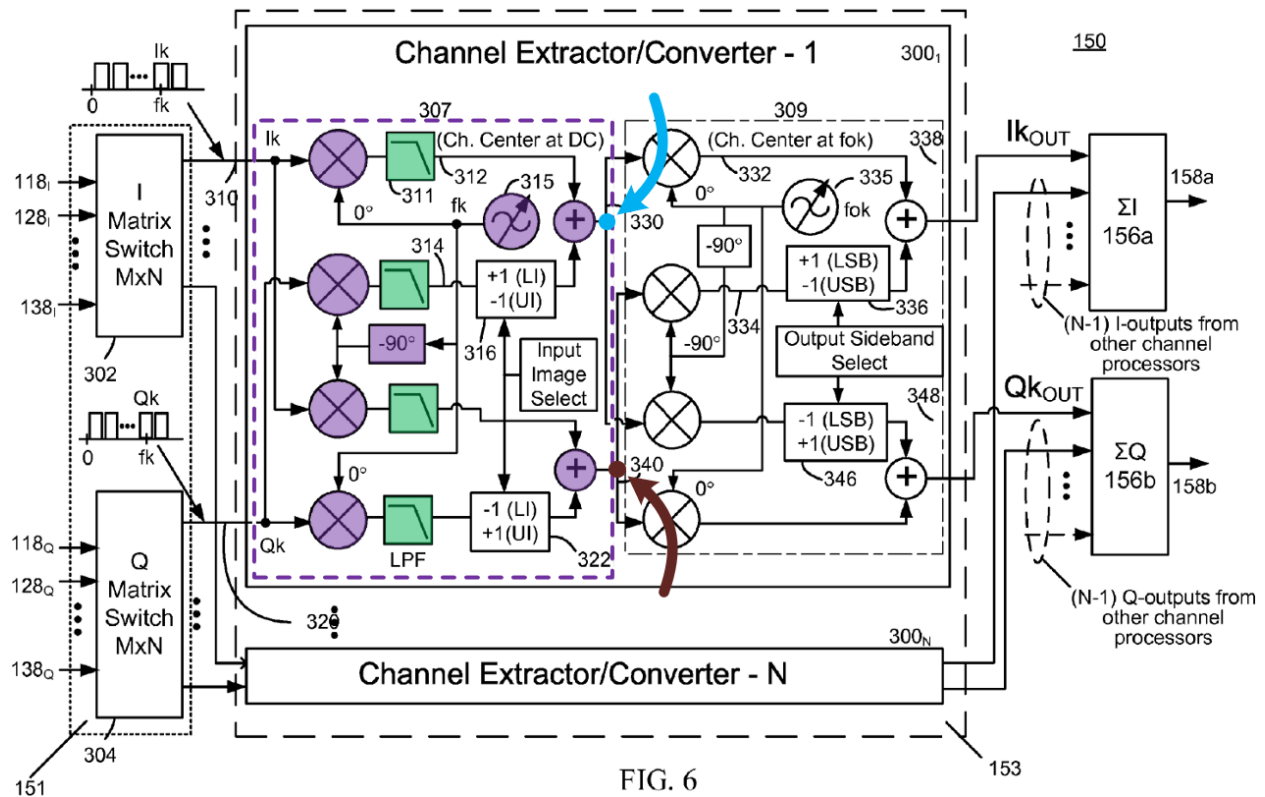
135. For the reasons explained for limitation [27B], in my opinion a POSITA would have been motivated to implement the Cholas STB to include a single Petrovic tuner (e.g., the Petrovic APD stage 107_M, ADCs 108_M, and multiple stages 307 of the DSSP 150) as described for limitation 27B. *Id.* To the extent there is any difference between limitation 27B, which recites that the wideband ADC is “configured to digitize a contiguous band of frequencies in an input signal,” and limitation 41B, which recites “configured to digitize an input signal,” both limitations are taught. In Cholas-Petrovic, the entire band provided by the Petrovic APD stage 107_M includes all received channels (desired and undesired) and is digitized by the ADCs 108_M. Ex. 1108, [0039], Fig. 4; Ex. 1109, [0029]; Ex. 1158, [0045], [0052]-[0053], [0055]-[0056], Fig. 5.

- c. **[41C] “a plurality of digital down converters coupled to the wideband ADC, wherein each digital down converter, of the plurality of digital down converters, is operable to generate a digital channel output corresponding to each desired channel, of the plurality of desired channels, and”**

136. It is my opinion that Cholas in view of Petrovic discloses limitation [41C] for the same reasons I explained above for limitation [27C]. *See* Section 9.1.1.c.

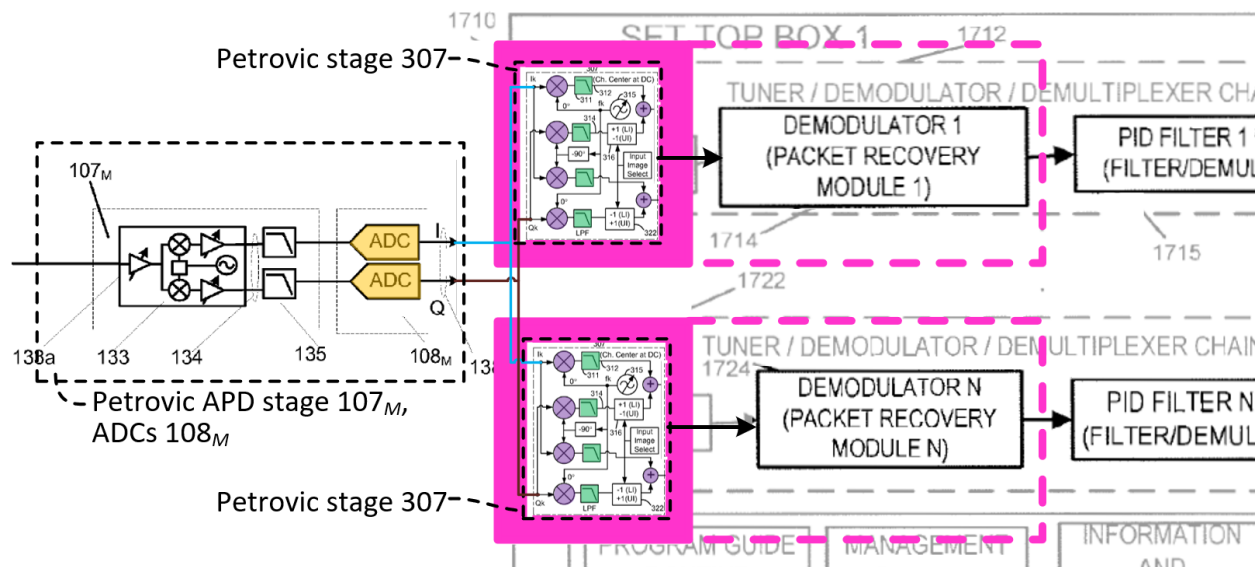
137. Cholas in view of Petrovic discloses the “plurality of digital down converters” of limitation [41C] for the same reasons explained for limitation [27C]. *See* Section 9.1.1.c. Each of Petrovic’s stages 307 in Cholas-Petrovic is coupled to the ADC pair 108_M. Ex. 1108, [0055]; Ex. 1109, [0033].

138. Referring to the annotated figure below, each stage 307 has a complex mixer (**purple**) and low pass filters (**green**) that select a desired channel and that generate a digital output (I, Q signals 330 (**blue**), 340 (**brown**)) corresponding to the desired channel. *See* Section 9.1.1.b.



Ex. 1108, Fig. 6 (annotated)

139. Each of the stages 307 of Cholas-Petrovic may be a digital down converter according to limitation [41C], or digital down converters may include more components of the Cholas-Petrovic STB. For example, dependent claims 46 and 47 indicate that the digital down converters may also “comprise[] a digital demodulator.”



“Digital Down Converters” in Cholas-Petrovic

140. Each of the stages 307 (solid pink boxes) is a digital down converter that is coupled to the wideband ADC and that is configured to generate (and provide to a demodulator) a digital output corresponding to a desired channel. Each of the stages 307 and a corresponding demodulator (solid and broken-line pink boxes) is a digital down converter that is coupled to the wideband ADC and that is configured to generate (and provide to a PID filter) a digital output corresponding to a desired channel.

141. To the extent “digital down converters” of limitation [41C] is treated as means-plus-function, it is still disclosed by Cholas-Petrovic. Each stage 307 has a complex mixer and low pass filters that select a desired channel. This is the same or equivalent structure of '866 patent Figure 2, which has a complex mixer 250 and filter 260 to select each desired channel. Ex. 1101, 5:51-65, 6:6-8, Fig. 2. The

Petrovic stages 307 operate in the same (or an equivalent) way as the '866 patent mixer 250 and filter 260 (digitally downconvert digital I, Q components so that a desired channel is at baseband, and filter out other channels), perform the same function, and achieve the same result (desired channel digital channel outputs are generated).

d. [41D] “wherein the cable TV device comprises a digital video recorder (DVR).”

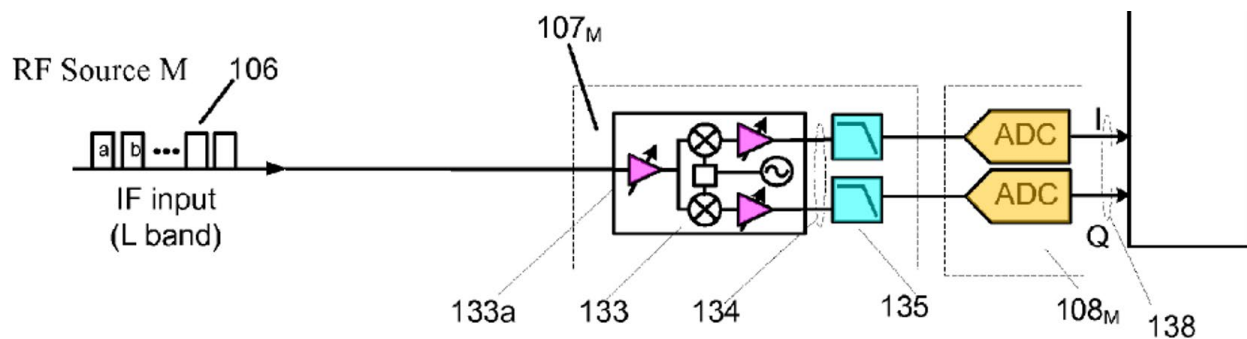
142. It is my opinion that Cholas in view of Petrovic discloses limitation [41D] for the same reasons explained for limitation [27D]. *See* Section 9.1.1.d.

9.1.3 Dependent Claims 28 and 42

[28/42] “The cable TV device of claim [27/41], wherein: the cable TV device comprises a cable network connector, and the input signal is operably communicated from the cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.”

143. It is my opinion that claims 28 and 42 are obvious over Cholas in view of Petrovic. The Cholas-Petrovic STB receives input from a cable network. In my opinion, a POSITA would have known that the Cholas-Petrovic STB obviously would have had a “cable network connector,” as STBs typically did, so that the STB could connect to that cable network to receive the input signal. Ex. 1158, [0044]. A POSITA would have known that, unless the Cholas-Petrovic STB could be connected to the cable network, the STB would not be able to function properly.

144. Moreover, referring to the annotated figure below, Petrovic discloses an analog amplifier (pink) and an analog filter (aqua) between an RF signal input and ADCs 108_M (gold). Ex. 1108, [0050], [0052], Figs. 4-5; Ex. 1109, [0020], [0031]-[0032], Figs. 1-2. In the Cholas-Petrovic STB, the Petrovic analog amplifier and analog filter would be located between the cable network connector and the ADC pair 108_M.



Ex. 1108, Fig. 4 (excerpted and annotated)

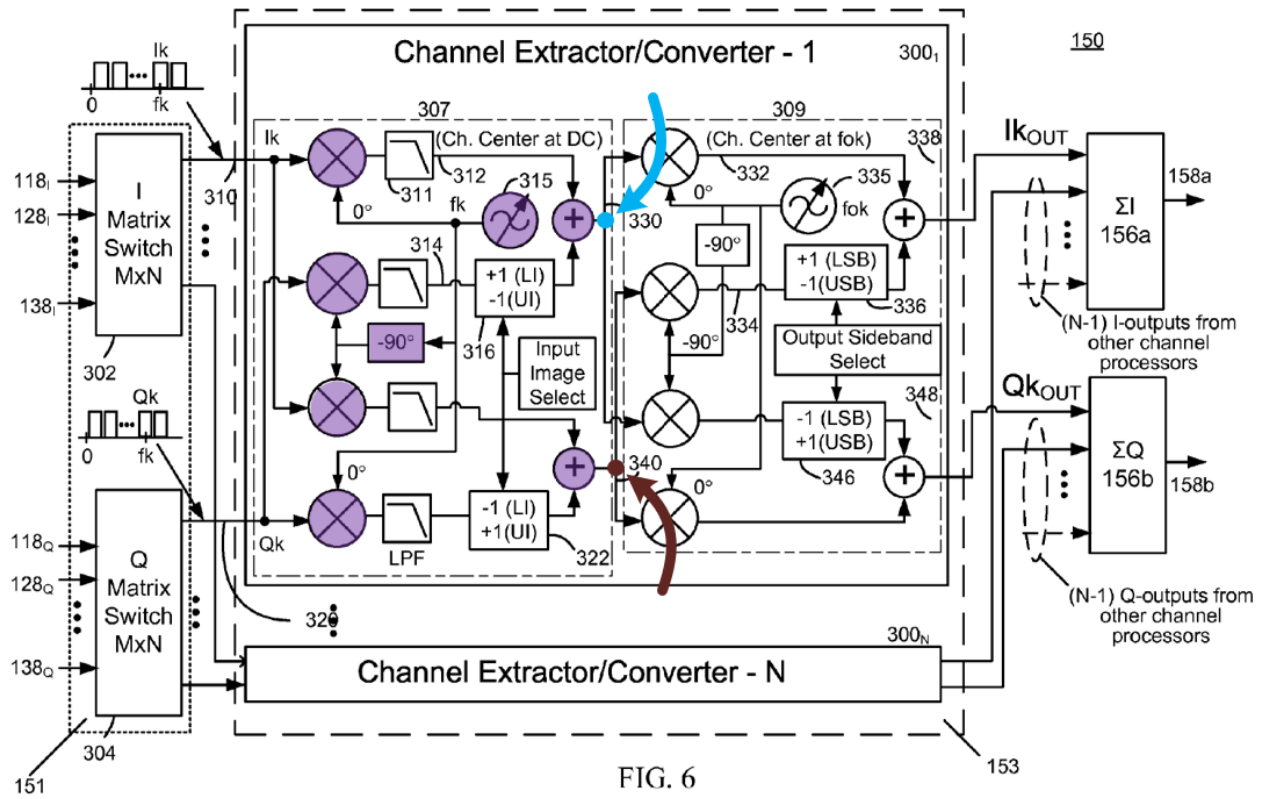
9.1.4 Dependent Claims 29, 30, 43, and 44

[29] “The cable TV device of claim 27, wherein: the DFE comprises a plurality of mixers, and each mixer, of the plurality of mixers, is operable to generate a corresponding complex signal comprising an in-phase (I) component and a quadrature (Q) component.”

[43] The cable TV device of claim 41, wherein: each digital down converter comprises a digital mixer operable to generate a corresponding complex signal comprising an in-phase (I) component and a quadrature (Q) component.

[30/44] “The cable TV device of claim [29/43], wherein: the I and Q components of each corresponding complex signal are at baseband.”

145. The limitations of claims 29, 30, 43, and 44 appear in the Claims Listing Appendix. For the following reasons, it is my opinion that claims 29, 30, 43, and 44 are rendered obvious over Cholas in view of Petrovic for the same reasons explained for limitation [27C] (Section 9.1.1.c) and limitation [41C] (Section 9.1.2.c). As I explain for limitations [27C] and [41C], each of the stages 307 of Petrovic includes a complex mixer that digitally downconverts a signal (I, Q components 138_I and 138_Q) so that a desired channel is at baseband. Ex. 1108, [0060]-[0077]; Ex. 1109, [0037]-[0054]. Each of those complex mixers outputs, from the adders (unnumbered **purple** “⊕” symbols in the annotated figure below) a quadrature pair comprising an I component 330 (**blue** dot and arrow) and a Q component 340 (**brown** dot and arrow) corresponding to a selected channel. Ex. 1108, [0077]; Ex. 1109, [0054].



Ex. 1108, Fig. 6 (annotated)

9.1.5 Dependent Claims 32, 33, 46, and 47

[32] “The cable TV device of claim 29, wherein: the DFE comprises a plurality of digital demodulators, and each digital demodulator, of the plurality of digital demodulators, is operable to demodulate the corresponding complex signal.”

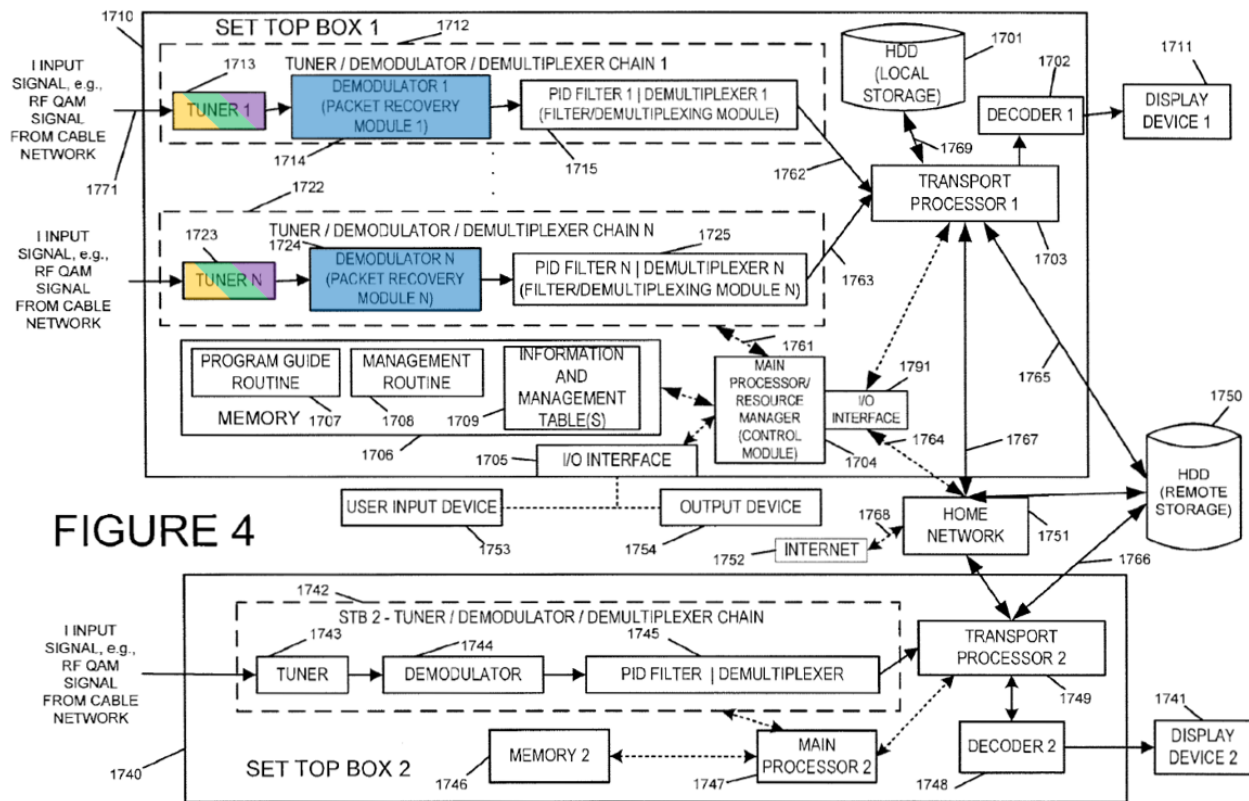
[33] “The cable TV device of claim 27, wherein: the DFE comprises a plurality of digital demodulators, and each digital demodulator, of the plurality of digital demodulators, is operable to demodulate a desired channel, of the plurality of desired channels.”

[46] “The cable TV device of claim 43, wherein: each digital down converter comprises a digital demodulator operable to demodulate the corresponding complex signal to provide a demodulated channel as the digital channel output.”

[47] “The cable TV device of claim 41, wherein: each digital down converter comprises a digital demodulator operable to demodulate a desired channel, of the plurality of desired channels, to provide a demodulated channel as the digital channel output.”

146. The limitations of claims 32, 33, 46, and 47 appear in the Claims Listing Appendix. It is my opinion that claims 32, 33, 46, and 47 are rendered obvious over Cholas in view of Petrovic.

147. Referring to the annotated figure below, Cholas discloses each tuner (gold/green/purple striped) outputting, to a corresponding demodulator (blue), a selected 6 MHz carrier frequency QAM channel. Ex. 1158, [0044]-[0045], [0050]-[0056], Figs. 4-5.



Ex. 1158, Fig. 4 (annotated)

148. In the Cholas-Petrovic STB, Petrovic stages 307 would output, to corresponding demodulators of Cholas, I, Q pairs 330, 340 corresponding to selected channels. See Sections 9.1.1.b (limitation [27B]) and 9.1.2.b (limitation [41B]). Those demodulators would demodulate the Cholas, I, Q pairs 330, 340 to provide demodulated channels. Ex. 1158, [0045].

9.1.6 Dependent Claims 31 and 45

[31] “The cable TV device of claim 29, wherein: the DFE comprises a plurality of filters, and each filter, of the plurality of filters, is operable to filter the corresponding complex signal comprising a 6 MHz channel.”

[45] “The cable TV device of claim 43, wherein: each digital down converter comprises a filter operable to select the corresponding complex signal comprising a 6 MHz channel.”

149. The limitations of claims 31 and 45 appear in the Claims Listing Appendix. It is my opinion that claims 31 and 45 are rendered obvious over Cholas in view of Petrovic for the same reasons I explain for limitation [27C] (Section 9.1.1.c) and limitation [41C] (Section 9.1.2.c). As I explain for those limitations, the Petrovic stages 307 comprise low pass filters 311. Moreover, Cholas discloses that signals received by the STB 1710 comprise 6 MHz channels. Ex. 1158, [0045].

9.1.7 Dependent Claims 37 and 51

[37/51] “The cable TV device of claim [27/41], wherein: the plurality of desired channels comprises at least one cable broadcast channel.”

150. The limitations of claims 37 and 51 appear in the Claims Listing Appendix. It is my opinion that claims 37 and 51 are rendered obvious over Cholas in view of Petrovic.

151. The Cholas-Petrovic STB would receive cable broadcast channels. Ex. 1158, [0004]-[0006], [0044]-[0057], Figs. 4-5.

9.1.8 Dependent Claims 40 and 54

[40] “The cable TV device of claim 27, wherein: the contiguous band of frequencies comprises a portion of a frequency spectrum of the input signal.”

[54] “The cable TV device of claim 41, wherein: the plurality of desired channels and the plurality of undesired channels comprise a portion of a frequency spectrum of the input signal.”

152. The limitations of claims 40 and 54 appear in the Claims Listing Appendix. It is my opinion that claims 40 and 54 are rendered obvious over Cholas in view of Petrovic.

153. The Cholas-Petrovic STB receives cable network signals comprising 6 MHz channels and a 50-1000 MHz range. Ex. 1158, [0045], Fig. 4. As explained for limitation [27B] and limitation [41B], Cholas in view of Petrovic discloses a wideband ADC configured to digitize a “contiguous band of frequencies”/“input signal” that comprises a plurality of desired and undesired channels. *See* Sections 9.1.1.b and 9.1.2.b. A plurality of (i.e., at least two) desired channels and a plurality of (i.e., at least two) undesired channels total to be four or more channels. Four channels (or even forty channels), in the Cholas-Petrovic system, would comprise a portion of the 50-1000 MHz frequency spectrum of the input signal.

9.2 Cholas in View of Petrovic and Burris Render Claims 28 and 42 Obvious

154. In the following, I provide a limitation-by-limitation analysis showing how Cholas in view of Petrovic and Burris renders claims 28 and 42 obvious.

9.2.1 Dependent Claims 28 and 42

[28/42] “The cable TV device of claim 27 [or 41], wherein: the cable TV device comprises a cable network connector, and the input signal is operable communicated from the cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter. ”

155. The limitations of claims 28 and 42 appear in the Claims Listing Appendix. It is my opinion that claims 28 and 42 are rendered obvious over Cholas in view of Petrovic and Burris.

156. Burris teaches that a cable network connector in the form of a coaxial port was a known feature of STBs. Ex. 1159, 1:41-45. In my opinion, a POSITA would have included a coaxial port such as that taught by Burris in the Cholas STB 1710, because it was a routine way of connecting an STB to a cable network. The remaining limitations of claims 28 and 42 are disclosed by Cholas-Petrovic for the reasons explained in Section 9.1.3, and modification in view of Burris does not affect that disclosure.

9.3 Cholas in View of Petrovic and Maalej Render Claims 32, 33, 46, and 47 Obvious

157. In the following, I provide a limitation-by-limitation analysis showing how Cholas in view of Petrovic and Maalej, as well as Cholas in view of Petrovic, Takahiko, and Maalej, render claims 32, 33, 46, and 47 obvious. To help illustrate how the disclosures of these references map to the claim limitations, I have color coded some of my remarks and some figures in the noted art below.

9.3.1 Dependent Claims 32, 33, 46, and 47

[32] “The cable TV device of claim 29, wherein: the DFE comprises a plurality of digital demodulators, and each digital demodulator, of the plurality of digital demodulators, is operable to demodulate the corresponding complex signal.”

[33] “The cable TV device of claim 27, wherein: the DFE comprises a plurality of digital demodulators, and each digital demodulator, of the plurality of digital demodulators, is operable to demodulate a desired channel, of the plurality of desired channels.”

[46] “The cable TV device of claim 43, wherein: each digital down converter comprises a digital demodulator operable to demodulate the corresponding complex signal to provide a demodulated channel as the digital channel output.”

[47] “The cable TV device of claim 41, wherein: each digital down converter comprises a digital demodulator operable to demodulate a desired channel, of the plurality of desired channels, to provide a demodulated channel as the digital channel output.”

158. The limitations of claims 32, 33, 46, and 47 appear in the Claims Listing Appendix. It is my opinion that claims 32, 33, 46, and 47 are rendered obvious over Cholas in view of Petrovic and Maalej.

signals comprise baseband digital I, Q components of a signal that is to be demodulated. Moreover, and similar to the Cholas demodulators, the Maalej demodulator outputs MPEG2 Transport System (TS) packets. Ex. 1160, 5:12-15; Ex. 1158, [0045]. When applying the teachings of Maalej to Cholas-Petrovic, each of the Cholas demodulators would be implemented to include components of the Maalej demodulators (e.g., blocks 35, 210, 40, 45, 50, 230, 220, 55, 61, 65, and 70) that receive I, Q components 330, 340 from a Petrovic stage 307 and that output, to a respective Cholas PID filters 1715-1725, MPEG2 TS packets.

161. In my opinion, this would have been merely a basic combination of known prior art elements according to known methods to yield predictable results. The POSITA would have recognized the functional equivalence of a Petrovic first section 307 output and the output from the Maalej DDS 30, as well as the functional equivalence of the Maalej demodulator output and the inputs to the Cholas PID filters/demultiplexers 1715-1725. A POSITA would also have recognized that, if I, Q signals of a QAM-modulated signal were to be demodulated so as to output, e.g., MPEG2 TS packets, the components of the Maalej demodulator could beneficially be used for a demodulator in the Cholas-Petrovic STB so that the signal could be demodulated. Thus, the POSITA would have easily combined a Petrovic first section 307 and components of the Maalej demodulator, knowing that each would perform the same function in the combination that would have been performed individually

prior to the combination to beneficially demodulate the I and Q components. For these same reasons, it is also my opinion that the results of combining a Petrovic first section 307 with Maalej demodulator components would have been highly predictable to a POSITA, with an expectation of success.

9.4 Cholas in View of Petrovic and Rabaey Renders Claims 1-9, 11, 13-22, 24, 26, 34, 35, 36, 48, 49, and 50 Obvious

162. In the following, I provide a limitation-by-limitation analysis showing how Cholas in view of Petrovic and Rabaey renders claims 1-9, 11, 13-22, 24, 26, 34, 35, 36, 48, 49, and 50 obvious. To help illustrate how the disclosures of these references map to the claim limitations, I have color coded some of my remarks and some figures in the noted art below.

9.4.1 Dependent Claims 35, 36, 49, and 50

[35/36] “The cable TV device of claim 27, wherein: the DFE is operable to provide the plurality of desired channels via a [parallel/serial] interface.”

[49] “The cable TV device of claim 41, wherein: the plurality of digital down converters is operable to provide a plurality of digital channel outputs, comprising each digital channel output, via a parallel interface.”

[50] “The cable TV device of claim 41, wherein: the plurality of digital down converters is operable to provide each digital channel output via a serial interface.”

163. The limitations of claims 35, 36, 49, and 50 appear in the Claims Listing Appendix. The claims differ regarding an interface (parallel or serial) via which the DFE/digital down converters are operable to provide desired channels (claims 35 and 36) or digital channel outputs (claims 49 and 50). Choosing either interface would have been an obvious design choice, as explained below. It is my opinion that claims 35, 36, 49, and 50 are rendered obvious over Cholas in view of Petrovic and Rabaey.

164. At the most fundamental level, a digital integrated circuit represents data (such as the I, Q signals 330, 340 output by a section 307 of Petrovic) as binary units referred to as “bits,” in the form of electrical signals on wires (e.g., high and low voltages for binary values “1” and “0” respectively). Ex. 1116 at 23-24, 27-29, 48-51. To output multiple bits (i.e., as a “digital datastream”), the circuit can either transmit the bits over multiple separate wires, one wire for each bit, which was

known as a “parallel interface,” or the circuit can transmit the set of bits one at a time as sequential pulses over a single wire, according to a fixed sequence, which was known as a “serial interface.” See my discussion above, in Section 8.4, about serial versus parallel data communication. *See also*, Ex. 1115 at 5-6, 8; Ex. 1116 at 79-80 (Figure 6.25, annotated below).

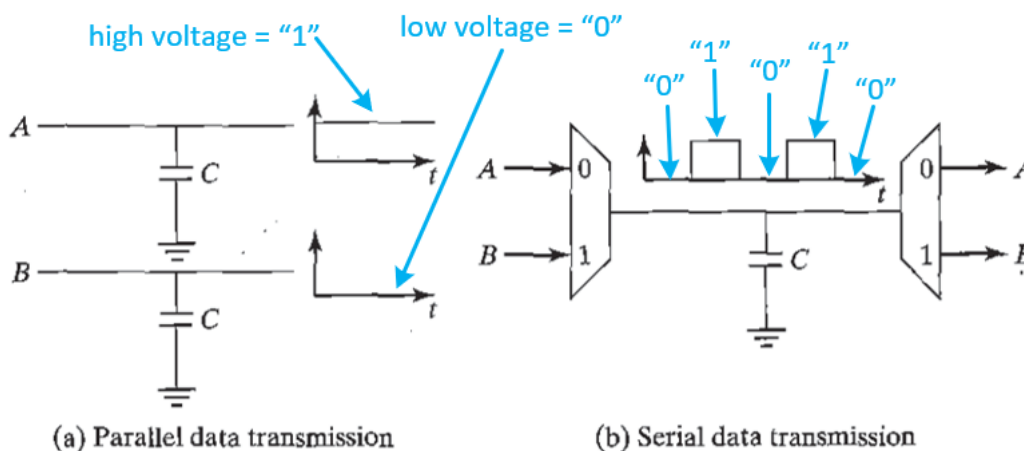


Figure 6-25 Parallel versus time-multiplexed data busses.

Ex. 1116, Fig. 6.25 (annotated) (page 80)

165. In my opinion, either interface would have been an obvious design choice in Petrovic. As explained in Section 9.1.1.b (for limitation [27B]) and Section 9.1.2.b (for limitation [41B]), the stages 307 of Petrovic output desired channels as digital I, Q pairs 330, 340. The '866 patent concedes that outputs of digital data via both interface types were “commonly known methods.” Ex. 1101, 7:10-14. Basic textbooks and technical papers on digital integrated circuit design at the time confirm that a POSITA would have understood these two interfaces as the common options for outputting digital data. Ex. 1114, 30:31-42, 31:15-22; Ex. 1115 at 5-6, 8 (defining

serial and parallel transmission); Ex. 1116 at 79-80; Ex. 1117 at 354-355. *Also see* Section 8.4 above for my discussion of serial data communication and parallel data communication. For the same reasons, it is my opinion that implementing serial and parallel interfaces would have been well within the POSITA's skillset, and thus, a POSITA would have had a high expectation of success leading to a predictable result.

166. Moreover, various background references teach and confirm why a POSITA would have applied parallel and serial interfaces to Petrovic's digital design. For example, Rabaey, a textbook on implementing digital integrated circuits, teaches that both serial and parallel interfaces as illustrated in the Figure 6.25 above were beneficially used in integrated circuits. Ex. 1116 at 79-80. According to Rabaey, time-multiplexing (i.e., a serial interface) "is a technique often used to minimize the implementation area" of a design on a chip, but that this "minimum area solution does not always result in the lowest switching activity," for example, when the data signals have high "temporal correlation." Ex. 1116 at 79-80, *see also* at 72-74. Minimizing circuit area minimizes the cost of the integrated circuit, while minimizing the switching activity minimizes the "dynamic power consumption" of the integrated circuit. Ex. 1116 at 29-33, 43-44, 72-74, 76-80. In fact, the area taken up by a circuit on an integrated circuit can have a major impact on the cost of that integrated circuit. Where a circuit is implemented on a die of an integrated circuit

wafer, “die costs are proportional to the fourth power of the area” of the die. Ex. 1116 at 31. Thus, Rabaey teaches selecting between serial and parallel interfaces for transmitting digital data between two points, both of which have advantages over each other, depending upon area and power constraints and the temporal correlation between the signals. Ex. 1116 at 29-33, 43-44, 72-74, 76-80.

167. In my opinion, it would have been obvious to apply either of Rabaey’s parallel or serial interfaces as illustrated in Figure 6.25 to interconnections between Petrovic’s first stages 307 and demodulators, as the choice of interface would be a basic engineering choice between limited, predictable alternatives enabled by Rabaey. Ex. 1108, [0027], [0040], [0124]; Ex. 1109, [0009], [0115]; Ex. 1116 at 76-80. Petrovic teaches implementation in an integrated circuit, and the techniques taught in Rabaey would have enabled such implementation. Ex. 1108, [0027], [0040], [0124]; Ex. 1109, [0009], [0115]; Ex. 1116 at 259-263. As such, implementation of either interface type in Petrovic would have been nothing more than a combination of prior art elements (Petrovic’s circuit design and Rabaey’s serial or parallel interface interconnects) according to known methods (Rabaey’s process for implementing circuit designs, including selecting a serial interface to minimize chip area and cost or a parallel interface to minimize switching and power) to yield predictable results (data is sent serially or in parallel).

168. The resultant combinations of Petrovic and Rabaey would have been predictable and a POSITA would have had a reasonable expectation of success, because Rabaey teaches basic techniques used by POSITAs to design integrated circuits, and how those basic techniques relate to design issues, such as meeting area and power constraints as I discussed above, with which a POSITA was very familiar, , and which a POSITA would customarily balance in their designs. Ex. 1116 at 29-33, 43-44, 72-74, 76-80.

9.4.2 Dependent Claims 34 and 48

[34] “The cable TV device of claim 33, wherein: the DFE is operable to provide a plurality of demodulated desired channels via a parallel interface.”

[48] “The cable TV device of claim 47, wherein: the plurality of digital down converters is operable to provide a plurality of demodulated desired channels via a parallel interface.”

169. The limitations of claims 34 and 48 appear in the Claims Listing Appendix. It is my opinion that claims 34 and 48 are rendered obvious over Cholas in view of Petrovic and Rabaey.

170. Claims 34 and 48 depend from claims 33 and 47, which are obvious over Cholas-Petrovic. *See* Section 9.3.1. Claims 34 and 48 add a limitation taught by Rabaey, and are obvious over Cholas-Petrovic-Rabaey. As explained for claims 35-36 and 49-50, in my opinion, sending data via a parallel interface would have been a routine design choice, implementing a parallel interface would have been

well within a POSITA's skillset, a POSITA implementing a parallel interface would have had a high expectation of success leading to a predictable result, and implementing a parallel interface would have been nothing more than a combination of prior art elements (Petrovic's circuit design and Rabaey's parallel interface interconnects) according to known methods (Rabaey's process for implementing circuit designs, including selecting a parallel interface to minimize switching and power) to yield predictable results. *See* Section 9.4.1.

171. This applies to demodulators. Cholas teaches that its demodulators 1714 and 1724 output digital data to respective PID filters/demultiplexers 1715 and 1725. Ex. 1158, [0044]-[0045], Fig. 4. As with the providing of "desired channels" or "digital channel outputs" of Petrovic's stages 307 to demodulators, and for the same reasons explained in Section 9.4.1, the selection of a parallel interface between Cholas' demodulators and Cholas' PID filters/demultiplexers would have been a routine design choice, implementing a parallel interface would have been well within a POSITA's skillset, and a POSITA would have had a high expectation of success leading to a predictable result. Similarly, in my opinion, implementing a parallel interface between Cholas' demodulators and Cholas' PID filters/demultiplexers would have been a combination of prior art elements (Cholas' demodulators, Cholas' PID filters/demultiplexers, and Rabaey's parallel interface interconnects) according to known methods (Rabaey's process for implementing circuit designs, including

selecting a parallel interface to minimize switching and power) to yield predictable results (data sent in parallel).

9.4.3 Independent Claim 1

172. The limitations of claim 1 appear in the Claims Listing Appendix, labeled as limitations [1A]-[1C]. For the following reasons, it is my opinion that claim 1 is rendered obvious over Cholas in view of Petrovic and Rabaey.

a. [1A] “A cable television (TV) device comprising:”

173. It is my opinion that Cholas in view of Petrovic discloses the non-limiting preamble [1A] for the same reasons explained for limitation [27A]. *See* Section 9.1.1.a. Modification in view of Rabaey does not affect that disclosure.

b. [1B] “a wideband analog-to-digital converter (ADC) configured to digitize a contiguous band of frequencies in an input signal, wherein the contiguous band of frequencies comprises a plurality of desired channels and a plurality of undesired channels; and”

174. It is my opinion that Cholas in view of Petrovic discloses limitation [1B] for the same reasons explained for limitation [27B]. *See* Section 9.1.1.b. Modification in view of Rabaey does not affect that disclosure.

- c. **[1C] “a digital frontend (DFE) coupled to the wideband ADC, wherein the DFE is configured to concurrently select and provide each of the plurality of desired channels, via a serial interface, without providing any of the plurality of undesired channels.”**

175. It is my opinion that Cholas in view of Petrovic and Rabaey disclose limitation [1C] for the same reasons explained for limitation [27C] and for the reasons explained for claim 36. *See* Sections 9.1.1.c. and 9.4.1. But for the insertion of “via a serial interface,” limitation [1C] is the same as limitation [27C], which is disclosed by Cholas-Petrovic for the reasons explained in Section 9.1.1.c. The “via a serial interface” portion of limitation [1C] is disclosed by Cholas-Petrovic-Rabaey for the reasons explained in Section 9.4.1. Accordingly, it is my opinion that claim 1 is obvious over Cholas-Petrovic-Rabaey

9.4.4 Independent Claim 14

176. The limitations of claim 14 appear in the Claims Listing Appendix, labeled as limitations [14A]-[14D]. For the following reasons, it is my opinion that claim 14 is rendered obvious over Cholas in view of Petrovic and Rabaey.

- a. **[14A] “A cable TV device comprising:”**

177. It is my opinion that Cholas in view of Petrovic discloses the non-limiting preamble [14A] for the same reasons explained for limitation [41A]. *See* Section 9.1.2.a.

- b. **[14B] “a wideband analog-to-digital converter (ADC) configured to digitize an input signal, wherein the input signal comprises a plurality of desired channels and a plurality of undesired channels; and”**

178. It is my opinion that Cholas in view of Petrovic discloses limitation [14B] for the same reasons explained for limitation [41B]. *See* Section 9.1.2.b, as well as the discussion of similar limitation [27B] at Section 9.1.1.b. Modification in view of Rabaey does not affect that disclosure.

- c. **[14C] “a plurality of digital down converters coupled to the wideband ADC, wherein each digital down converter, of the plurality of digital down converters, is operable to generate a digital channel output corresponding to each desired channel, of the plurality of desired channels, and”**

179. It is my opinion that Cholas in view of Petrovic discloses limitation [14C] for the same reasons explained for limitation [41C]. *See* Section 9.1.2.c. Modification in view of Rabaey does not affect that disclosure.

- d. **[14D] “wherein the plurality of digital down converters is operable to provide each digital channel output via a serial interface.”**

180. It is my opinion that Cholas in view of Petrovic and Rabaey discloses limitation [14D] for the same reasons explained for claim 50. *See* Section 9.4.1.

9.4.5 Dependent Claims 2 and 15

[2/15] “The cable TV device of claim [1/14], wherein: the cable TV device comprises a cable network connector, and the input signal is operably communicated from the cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.”

181. The limitations of claims 2 and 15 appear in the Claims Listing Appendix, and add the same limitations as claims 28 and 42. Claims 2 and 15 add the same limitations as claims 28 and 42 and are disclosed by Cholas-Petrovic for the same reasons explained in section 9.1.3. Modification of Cholas-Petrovic in view of Rabaey does not affect the Cholas-Petrovic disclosure of the limitations of claims 2 and 15, which are obvious over Cholas-Petrovic-Rabaey.

9.4.6 Dependent Claims 3, 4, 16, and 17

[3] “The cable TV device of claim 1, wherein: the DFE comprises a plurality of mixers, and each mixer, of the plurality of mixers, is operable to generate a corresponding complex signal comprising an in-phase (I) component and a quadrature (Q) component.”

[16] “The cable TV device of claim 14, wherein: each digital down converter comprises a digital mixer operable to generate a corresponding complex signal comprising an in-phase (I) component and a quadrature (Q) component.”

[4/17] “The cable TV device of claim [3/16], wherein: the I and Q components of each corresponding complex signal are at baseband.”

182. The limitations of claims 3, 4, 16, and 17 appear in the Claims Listing Appendix, and add the same limitations as claims 29, 30, 43, and 44. It is my opinion that the limitations of claims 3, 4, 16, and 17 are disclosed by Cholas in view of

Petrovic for the same reasons explained for claims 29, 30, 43, and 44. *See* Section 9.1.4. Modification of Cholas-Petrovic in view of Rabaey does not affect the Cholas-Petrovic disclosure of the limitations of claims 3, 4, 16, and 17, which are obvious over Cholas-Petrovic-Rabaey.

9.4.7 Dependent Claims 5 and 18

[5] “The cable TV device of claim 3, wherein: the DFE comprises a plurality of filters, and each filter, of the plurality of filters, is operable to filter the corresponding complex signal comprising a 6 MHz channel.”

[18] “The cable TV device of claim 16, wherein: each digital down converter comprises a filter operable to select the corresponding complex signal comprising a 6 MHz channel.”

183. The limitations of claims 5 and 18 appear in the Claims Listing Appendix, and add the same limitations as claims 31 and 45. It is my opinion that the limitations of claims 5 and 18 are disclosed by Cholas in view of Petrovic for the same reasons explained for limitation [27C] and [41C], and for claims 31 and 45. *See* Sections 9.1.1.c, 9.1.2.c, and 9.1.6. Modification of Cholas-Petrovic in view of Rabaey does not affect the Cholas-Petrovic disclosure of the limitations of claims 5 and 18, which are obvious over Cholas-Petrovic-Rabaey.

9.4.8 Dependent Claims 6, 7, 19, and 20

[6] “The cable TV device of claim 3, wherein: the DFE comprises a plurality of digital demodulators, and each digital demodulator, of the plurality of digital demodulators, is operable to demodulate the corresponding complex signal.”

[7] “The cable TV device of claim 1, wherein: the DFE comprises a plurality of digital demodulators, and each digital demodulator, of the plurality of digital demodulators, is operable to demodulate a desired channel, of the plurality of desired channels.”

[19] “The cable TV device of claim 16, wherein: each digital down converter comprises a digital demodulator operable to demodulate the corresponding complex signal to provide a demodulated channel as the digital channel output.”

[20] “The cable TV device of claim 14, wherein: each digital down converter comprises a digital demodulator operable to demodulate a desired channel, of the plurality of desired channels, to provide a demodulated channel as the digital channel output.”

184. The limitations of claims 6, 7, 19, and 20 appear in the Claims Listing Appendix, add the same limitations as claims 32, 33, 46, and 47 and are disclosed by Cholas-Petrovic for the reasons explained in Section 9.1.5. Modification of Cholas-Petrovic in view of Rabaey does not affect the Cholas-Petrovic disclosure of the limitations of claims 6, 7, 19, and 20, which are obvious over Cholas-Petrovic-Rabaey.

9.4.9 Dependent Claims 8 and 21

[8] “The cable TV device of claim 7, wherein: the DFE is operable to provide a plurality of demodulated desired channels via a parallel interface.”

[21] “The cable TV device of claim 20, wherein: the plurality of digital down converters is operable to provide a plurality of demodulated desired channels via a parallel interface.”

185. The limitations of claims 8 and 21 appear in the Claims Listing Appendix, and add the same limitations as claims 34 and 48, which are disclosed by Cholas-Petrovic-Rabaey for the reasons explained in Section 9.4.2. To the extent that claim 8 or claim 21 is considered to require a demodulator to output via a parallel interface and via a serial interface, this is also taught by Cholas-Petrovic-Rabaey, which shows that transmission via a parallel interface (light green) may multiplexed into transmission via a serial interface (light blue), and vice versa. Ex. 1116 at 80.

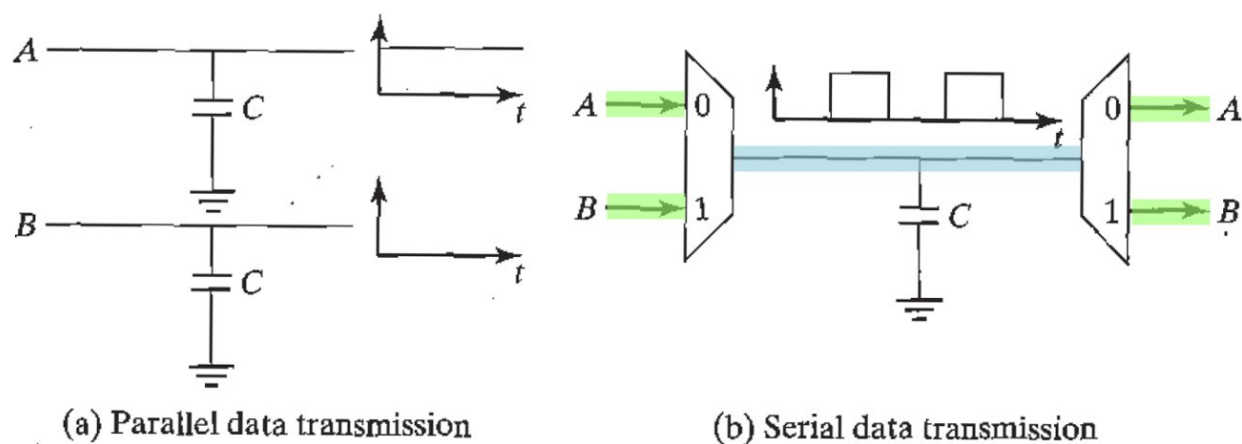


Figure 6-25 Parallel versus time-multiplexed data busses.

Ex. 1116, Figure 6.25 (annotated) (page 80)

186. For the reasons explained in Section 9.4.1, a POSITA would have predictably combined Cholas-Petrovic demodulators and PID filters with the known multiplexing configuration, shown in Rabaey Figure 6.25, to change from parallel transmission to serial (or vice versa) to accommodate area, timing, and other constraints associated with communicating digital data between functional blocks (e.g., between demodulators and PID) of a STB

9.4.10 Dependent Claims 9 and 22

[9/22] “The cable TV device of claim [1/14], wherein: the plurality of desired channels comprises at least one cable broadcast channel.”

187. The limitations of claims 9 and 22 appear in the Claims Listing Appendix, and add the same limitations as claims 37 and 51. It is my opinion that the limitations of claims 9 and 22 are disclosed by Cholas in view of Petrovic for the same reasons explained for claims 37 and 51. *See* Section 9.1.7. Modification of Cholas-Petrovic in view of Rabaey does not affect the Cholas-Petrovic disclosure of the limitations of claims 9 and 22, which are obvious over Cholas-Petrovic-Rabaey.

9.4.11 Dependent Claims 11 and 24

[11/24] “The cable TV device of claim [1/14], wherein: the cable TV device comprises a digital video recorder (DVR).”

188. The limitations of claims 11 and 24 appear in the Claims Listing Appendix, and add the same limitations as limitations [27D] and [41D]. It is my opinion that the limitations of claims 11 and 24 are disclosed by Cholas in view of

Petrovic for the same reasons explained for limitations [27D] and [41D]. *See* Sections 9.1.1.d and 9.1.2.d. Modification of Cholas-Petrovic in view of Rabaey does not affect the Cholas-Petrovic disclosure of the limitations of claims 11 and 24, which are obvious over Cholas-Petrovic-Rabaey.

9.4.12 Dependent Claims 13 and 26

[13] “The cable TV device of claim 1, wherein: the contiguous band of frequencies comprises a portion of a frequency spectrum of the input signal.”

[26] “The cable TV device of claim 14, wherein: the plurality of desired channels and the plurality of undesired channels comprise a portion of a frequency spectrum of the input signal.”

189. The limitations of claims 13 and 26 appear in the Claims Listing Appendix, and add the same limitations as claims 40 and 54. It is my opinion that the limitations of claims 13 and 26 are disclosed by Cholas-Petrovic in view of Rabaey for the same reasons explained for claims 40 and 54. *See* Section 9.1.8. Modification of Cholas-Petrovic in view of Rabaey does not affect the Cholas-Petrovic disclosure of the limitations of claims 13 and 26, which are obvious over Cholas-Petrovic-Rabaey.

9.5 Cholas in View of Petrovic, Rabaey, and Burris Renders Claims 2 and 15 Obvious

190. In the following, I provide a limitation-by-limitation analysis showing how Cholas in view of Petrovic, Rabaey, and Burris renders claims 2 and 15 obvious.

9.5.1 Dependent Claims 2 and 15

[2/15] “The cable TV device of claim [1/14], wherein: the cable TV device comprises a cable network connector, and the input signal is operably communicated from the cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.”

191. The limitations of claims 2 and 15 appear in the Claims Listing Appendix and add the same limitations as claims 28 and 42, which are disclosed by Cholas in view of Petrovic and Burris for the reasons explained in Section 9.2. Because of dependency from claims 1 and 14, which are obvious over Cholas-Petrovic-Rabaey, claims 2 and 15 are obvious over Cholas-Petrovic-Rabaey-Burris, as adding Rabaey does not affect the modification of Cholas-Petrovic in view of Burris.

9.6 Cholas in View of Petrovic, Rabaey, and Maalej Renders Claims 6-8, 19-21, 34, and 48 Obvious

192. In the following, I provide a limitation-by-limitation analysis showing how Cholas in view of Petrovic, Rabaey, and Maalej renders claims 6-8, 9-21, 34, and 48 obvious.

9.6.1 Dependent Claims 6, 7, 19, and 20

[6] “The cable TV device of claim 3, wherein: the DFE comprises a plurality of digital demodulators, and each digital demodulator, of the plurality of digital demodulators, is operable to demodulate the corresponding complex signal.”

[7] “The cable TV device of claim 1, wherein: the DFE comprises a plurality of digital demodulators, and each digital demodulator, of the plurality of digital demodulators, is operable to demodulate a desired channel, of the plurality of desired channels.”

[19] “The cable TV device of claim 16, wherein: each digital down converter comprises a digital demodulator operable to demodulate the corresponding complex signal to provide a demodulated channel as the digital channel output.”

[20] “The cable TV device of claim 14, wherein: each digital down converter comprises a digital demodulator operable to demodulate a desired channel, of the plurality of desired channels, to provide a demodulated channel as the digital channel output.”

193. The limitations of claims 6, 7, 19, and 20 appear in the Claims Listing Appendix, and add the same limitations as claims 32, 33, 46, and 47, which are obvious over Cholas-Petrovic-Maalej (Section 9.3). Claims 6, 7, 19, and 20, in addition to being obvious over Cholas-Petrovic-Rabaey (Section 9.4.8), are obvious over Cholas-Petrovic-Rabaey-Maalej. The reasons it would be obvious to add Maalej to Cholas-Petrovic (Section 9.3) are also the reasons it would be obvious to add Maalej to Cholas-Petrovic-Rabaey, and modification in view of Rabaey does not affect modification of Cholas-Petrovic in view of Maalej.

9.6.2 Dependent Claims 8 and 21

[8] “The cable TV device of claim 7, wherein: the DFE is operable to provide a plurality of demodulated desired channels via a parallel interface.”

[21] “The cable TV device of claim 20, wherein: the plurality of digital down converters is operable to provide a plurality of demodulated desired channels via a parallel interface.”

194. The limitations of claims 8 and 21 appear in the Claims Listing Appendix. Claims 8 and 21 depend from claims 7 and 20, which are obvious in view of Cholas-Petrovic-Rabaey-Maalej. *See* Section 9.6.1. Claims 8 and 21 add a limitation taught by Rabaey, and are also obvious over Cholas-Petrovic-Rabaey-Maalej. As explained for claims 35, 36, 49, and 50, sending data via a parallel interface would have been a routine design choice, implementing a parallel interface would have been well within a POSITA’s skillset, a POSITA implementing a parallel interface would have had a high expectation of success leading to a predictable result, and implementing a parallel interface would have been nothing more than a combination of prior art elements according to known methods to yield predictable results. *See* Section 9.4.1.

195. All of this applies to being “operable to provide a plurality of demodulated desired channels via a parallel interface.” Maalej teaches digital output (MPEG2 TS packets) from its demodulator 99. Ex. 1160, 5:12-15. As with the providing of “desired channels” or “digital channel outputs” of Petrovic’s stages 307

to demodulators, and for the reasons explained in Section 9.4.1, the selection of a parallel interface between Maalej's demodulators and Cholas' PID filters/demultiplexers would have been a routine design choice, implementing a parallel interface would have been well within a POSITA's skillset, and a POSITA would have had a high expectation of success leading to a predictable result. Similarly, implementing a parallel interface between Maalej's demodulators and Cholas' PID filters/demultiplexers would have been a combination of prior art elements (Maalej's circuit design, Cholas' PID filters/demultiplexers, and Rabaey's parallel interface interconnects) according to known methods (Rabaey's process for implementing circuit designs, including selecting a parallel interface to minimize switching and power) to yield predictable results (data sent in parallel). To the extent claim 8 or claim 21 requires a demodulator to output via a parallel interface and via a serial interface, and for the reasons explained in Section 9.4.1, it is my opinion that a POSITA would have predictably combined Cholas-Petrovic-Maalej demodulators and PID filters with the known multiplexing configuration, shown in Rabaey Figure 6.25, to change from parallel transmission to serial (or vice versa) to accommodate area, timing, and other constraints associated with communicating digital data between functional blocks (e.g., between demodulators and PID) of a STB

9.6.3 Dependent Claims 34 and 48

[34] “The cable TV device of claim 33, wherein: the DFE is operable to provide a plurality of demodulated desired channels via a parallel interface.”

[48] “The cable TV device of claim 47, wherein: the plurality of digital down converters is operable to provide a plurality of demodulated desired channels via a parallel interface.”

196. The limitations of claims 34 and 48 appear in the Claims Listing Appendix. It is my opinion that claims 34 and 48 are rendered obvious over Cholas in view of Petrovic, Rabaey, and Maalej. Claims 34 and 48 add the same limitations to claims 33 and 47 that claims 8 and 21 add to claims 7 and 20, which are obvious over Cholas-Petrovic-Rabaey-Maalej (Section 9.6.1). For the reasons in explained for claims 8 and 21 (Section 9.6.2), claims 34 and 48 are obvious over Cholas-Petrovic-Rabaey-Maalej.

9.7 Cholas in View of Petrovic and Lee Renders Claims 38, 39, 52, 53, 55-61, 65-75, and 79-82 Obvious

197. In the following, I provide a limitation-by-limitation analysis showing how Cholas in view of Petrovic and Lee renders claims 38, 39, 52, 53, 55-61, 65-75, and 79-82 obvious.

9.7.1 Dependent Claims 38 and 52

[38/52] “The cable TV device of claim [27/41], wherein: the plurality of desired channels comprises at least one channel delivered via a Data Over Cable Service Interface Specification (DOCSIS) protocol.”

198. The limitations of claims 38 and 52 appear in the Claims Listing Appendix. It is my opinion that claims 38 and 52 are rendered obvious over Cholas in view of Petrovic and Lee.

199. Lee discloses that it was known for STBs to include tuners to receive DOCSIS channel signals. Ex. 1153, [0007]. In my opinion, a POSITA would have configured the Cholas-Petrovic STB to receive DOCSIS channels so that, for example, the STB could provide an open cable application platform (OCAP). Ex. 1153, [0006]-[0007]. A POSITA would also have been motivated to configure the Cholas-Petrovic STB to receive DOCSIS channels so that a common 2-way data infrastructure in the cable system could be used for cable modems as well as STB communications.

200. Using the Cholas-Petrovic STB to receive DOCSIS channels would also have been a use of a known technique (receiving DOCSIS channels in an STB, per Lee) to improve a similar device (a Cholas-Petrovic STB) in the same way. A POSITA could have readily modified the Cholas-Petrovic STB to receive DOCSIS channels, as taught by Lee, because DOCSIS protocols were established and

understood. For the same reasons, the results of that modification would have been predictable and POSITA would have had an expectation of success

9.7.2 Dependent Claims 39 and 53

[39] “The cable TV device of claim 27, wherein: the cable TV device is operable to configure at least some of the plurality of desired channels as an output for a picture-in-picture display.”

[53] “The cable TV of claim 41, wherein: the cable TV device is operable to provide a picture-in-picture display according to the plurality of digital channel outputs.”

201. The limitations of claims 39 and 53 appear in the Claims Listing Appendix. It is my opinion that claims 39 and 53 are rendered obvious over Cholas in view of Petrovic and Lee.

202. Lee discloses that it was known for STBs to tune multiple channels and use the multiple tuned channels to provide picture-in-picture (PIP) functionality. Ex. 1153, [0031]. In my opinion, a POSITA would have configured the Cholas-Petrovic STB to provide a PIP display so that the STB could provide additional functionality for the user. Ex. 1153, [0006].

203. Using the Cholas-Petrovic STB to provide PIP functionality would also have been a use of a known technique (providing PIP output using an STB, per Lee) to improve a similar device (a Cholas-Petrovic STB) in the same way. In my opinion, a POSITA could have readily modified the Cholas-Petrovic STB to provide PIP functionality, as taught by Lee, because PIP output was established and understood.

For the same reasons, the results of that modification would have been predictable and POSITA would have had an expectation of success.

9.7.3 Independent Claim 55

204. The limitations of claim 55 appear in the Claims Listing Appendix, labeled as limitations [55A]-[55D]. For the following reasons, it is my opinion that claim 51 is rendered obvious over Cholas in view of Petrovic and Lee.

a. [55A] “A cable television (TV) device comprising:”

205. Limitation [55A] is the same as limitation [27A]. It is my opinion that Cholas in view of Petrovic discloses limitation [55A] for the same reasons explained for limitation [27A]. *See* Section 9.1.1.a. Modification in view of Lee does not affect that disclosure.

b. [55B] “a wideband analog-to-digital converter (ADC) configured to digitize a contiguous band of frequencies in an input signal, wherein the contiguous band of frequencies comprises a plurality of desired channels and a plurality of undesired channels; and”

206. Limitation [55B] is the same as limitation [27B]. It is my opinion that Cholas in view of Petrovic discloses limitation [55B] for the same reasons explained for limitation [27B]. *See* Section 9.1.1.b. Modification in view of Lee does not affect that disclosure.

- c. **[55C] “a digital frontend (DFE) coupled to the wideband ADC, wherein the DFE is configured to concurrently select and provide each of the plurality of desired channels without providing any of the plurality of undesired channels, and”**

207. Limitation [55C] is the same as limitation [27C]. It is my opinion that Cholas in view of Petrovic discloses limitation [55C] for the same reasons explained for limitation [27C]. *See* Section 9.1.1.c. Modification in view of Lee does not affect that disclosure.

- d. **[55D] “wherein the cable TV device is operable to configure at least some of the plurality of desired channels as an output for a picture-in-picture display.”**

208. Limitation [55D] adds the same limitation as claim 39, which is taught by Lee (*see* Section 9.7.2). It is my opinion that Cholas in view of Petrovic discloses limitation [55D] for the same reasons explained for claim 39.

9.7.4 Independent Claim 69

209. The limitations of claim 69 appear in the Claims Listing Appendix, labeled as limitations [69A]-[69D]. For the following reasons, it is my opinion that claim 69 is rendered obvious over Cholas in view of Petrovic and Lee.

- a. **[69A] “A cable TV device comprising:”**

210. Limitation [69A] is the same as limitation [41A]. It is my opinion that Cholas in view of Petrovic discloses limitation [69A] for the same reasons explained

for limitation [41A]. *See* Section 9.1.2.a; *also see* Section 9.1.1.a. Modification in view of Lee does not affect that disclosure.

- b. **[69B] “a wideband analog-to-digital converter (ADC) configured to digitize an input signal, wherein the input signal comprises a plurality of desired channels and a plurality of undesired channels; and”**

211. Limitation [69B] is the same as limitation [41B]. It is my opinion that Cholas in view of Petrovic discloses limitation [69B] for the same reasons explained for limitation [41B]. *See* Section 9.1.2.b; *also see* Section 9.1.1.b. Modification in view of Lee does not affect that disclosure.

- c. **[69C] “a plurality of digital down converters coupled to the wideband ADC, wherein each digital down converter, of the plurality of digital down converters, is operable to generate a digital channel output corresponding to each desired channel, of the plurality of desired channels, and”**

212. Limitation [69C] is the same as limitation [41C]. It is my opinion that Cholas in view of Petrovic discloses limitation [69C] for the same reasons explained for limitation [41C]. *See* Section 9.1.2.c; *also see* Section 9.1.1.c. Modification in view of Lee does not affect that disclosure.

- d. **[69D] “wherein the cable TV device is operable to provide a picture-in-picture display according to the plurality of digital channel outputs.”**

213. Limitation [69D] adds the same limitation as claim 53, which is taught by Lee (*see* Section 9.7.2). It is my opinion that Cholas in view of Petrovic and Lee discloses limitation [69D] for the same reasons explained for claim 53.

9.7.5 Dependent Claims 57, 58, 71, and 72

[57] “The cable TV device of claim 55, wherein: the DFE comprises a plurality of mixers, and each mixer, of the plurality of mixers, is operable to generate a corresponding complex signal comprising an in-phase (I) component and a quadrature (Q) component.”

[71] “The cable TV device of claim 69, wherein: each digital down converter comprises a digital mixer operable to generate a corresponding complex signal comprising an in-phase (I) component and a quadrature (Q) component.”

[58/72] “The cable TV device of claim [57/71], wherein: the I and Q components of each corresponding complex signal are at baseband.”

214. The limitations of claims 57, 58, 71, and 72 appear in the Claims Listing Appendix, and respectively add the same limitations as claims 29, 30, 43, and 44. It is my opinion that claims 57, 58, 71, and 72 are disclosed by Cholas in view of Petrovic for the same reasons explained for claims 29, 30, 43, and 44. *See* Section 9.1.4. Modification of Cholas-Petrovic in view of Lee does not affect the Cholas-Petrovic disclosure of the limitations of claims 57, 58, 71, and 72, which are obvious over Cholas-Petrovic-Lee.

9.7.6 Dependent Claims 59 and 73

[59] “The cable TV device of claim 57, wherein: the DFE comprises a plurality of filters, and each filter, of the plurality of filters, is operable to filter the corresponding complex signal comprising a 6 MHz channel.”

[73] “The cable TV device of claim 71, wherein: each digital down converter comprises a filter operable to select the corresponding complex signal comprising a 6 MHz channel.”

215. The limitations of claims 59 and 73 appear in the Claims Listing Appendix, and add the same limitations as claims 31 and 45. It is my opinion that claims 59 and 73 are disclosed by Cholas in view of Petrovic for the same reasons explained for claims 31 and 45 (Section 9.1.6) as well as for limitations [27C] and [41C] (Sections 9.1.1.c, 9.1.2.c). Modification of Cholas-Petrovic in view of Lee does not affect the Cholas-Petrovic disclosure of the limitations of claims 59 and 73, which are obvious over Cholas-Petrovic-Lee.

9.7.7 Dependent Claims 60, 61, 74, and 75

[60] “The cable TV device of claim 57, wherein: the DFE comprises a plurality of digital demodulators, and each digital demodulator, of the plurality of digital demodulators, is operable to demodulate the corresponding complex signal.”

[61] “The cable TV device of claim 55, wherein: the DFE comprises a plurality of digital demodulators, and each digital demodulator, of the plurality of digital demodulators, is operable to demodulate a desired channel, of the plurality of desired channels.”

[74] “The cable TV device of claim 71, wherein: each digital down converter comprises a digital demodulator operable to demodulate the corresponding complex signal to provide a demodulated channel as the digital channel output.”

[75] “The cable TV device of claim 69, wherein: each digital down converter comprises a digital demodulator operable to demodulate a desired channel, of the plurality of desired channels, to provide a demodulated channel as the digital channel output.”

216. The limitations of claims 60, 61, 74, and 75 appear in the Claims Listing Appendix, add the same limitations as claims 32, 33, 46, and 47, and are disclosed by Cholas-Petrovic for the reasons explained in Section 9.1.5. Modification of Cholas-Petrovic in view of Lee does not affect the Cholas-Petrovic disclosure of the limitations of claims 60, 61, 74, and 75, which are obvious over Cholas-Petrovic-Lee.

9.7.8 Dependent Claims 65 and 79

[65/79] “The cable TV device of claim [55/69], wherein: the plurality of desired channels comprises at least one cable broadcast channel.”

217. The limitations of claims 65 and 79 appear in the Claims Listing Appendix, and add the same limitation as claims 37 and 51. It is my opinion that claims 65 and 79 are disclosed by Cholas in view of Petrovic for the same reasons explained for claims 37 and 51. *See* Section 9.1.7. Modification of Cholas-Petrovic in view of Lee does not affect the Cholas-Petrovic disclosure of the limitations of claims 65 and 79, which are obvious over Cholas-Petrovic-Lee.

9.7.9 Dependent Claims 66 and 80

[66/80] “The cable TV device of claim [55/69], wherein: the plurality of desired channels comprises at least one channel delivered via a Data Over Cable Service Interface Specification (DOCSIS) protocol.”

218. The limitations of claims 66 and 80 appear in the Claims Listing Appendix, and add the same limitation as claims 38 and 52. It is my opinion that claims 66 and 80 are disclosed by Cholas in view of Petrovic and Lee for the same reasons explained for claims 38 and 52. *See* Section 9.7.1.

9.7.10 Dependent Claims 67 and 81

[67/81] “The cable TV device of claim [55/69], wherein: the cable TV device comprises a digital video recorder (DVR).”

219. The limitations of claims 67 and 81 appear in the Claims Listing Appendix, and add the same limitation as limitations [27D] and [41D]. It is my

opinion that claims 67 and 81 are disclosed by Cholas in view of Petrovic for the same reasons explained for limitations [27D] and [41D]. *See* Sections 9.1.1.d and 9.1.2.d. Modification of Cholas-Petrovic in view of Lee does not affect the Cholas-Petrovic disclosure of the limitations of claims 67 and 81, which are obvious over Cholas-Petrovic-Lee.

9.7.11 Dependent Claims 68 and 82

[68] “The cable TV device of claim 55, wherein: the contiguous band of frequencies comprises a portion of a frequency spectrum of the input signal.”

[82] “The cable TV device of claim 69, wherein: the plurality of desired channels and the plurality of undesired channels comprise a portion of a frequency spectrum of the input signal.”

220. The limitations of claims 68 and 82 appear in the Claims Listing Appendix, and add the same limitations as claims 40 and 54. It is my opinion that claims 68 and 82 are disclosed by Cholas in view of Petrovic for the same reasons explained for claims 40 and 54. *See* Section 9.1.8. Modification of Cholas-Petrovic in view of Lee does not affect the Cholas-Petrovic disclosure of the limitations of claims 68 and 82, which are obvious over Cholas-Petrovic-Lee.

9.7.12 Dependent Claims 56 and 70

[56] “The cable TV device of claim 55, wherein: the cable TV device comprises a cable network connector, and the input signal is operably communicated from the cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.”

[70] “The cable TV device of claim 69, wherein: the cable TV device comprises a cable network connector, and the input signal is operably communicated from the cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.”

221. The limitations of claims 56 and 70 appear in the Claims Listing Appendix, and add the same limitations as claims 28 and 42. It is my opinion that claims 56 and 70 are disclosed by Cholas in view of Petrovic for the same reasons explained for claims 28 and 42. *See* Section 9.1.3. Modification of Cholas-Petrovic in view of Lee does not affect the Cholas-Petrovic disclosure of the limitations of claims 56 and 70, which are obvious over Cholas-Petrovic-Lee.

9.8 Cholas in View of Petrovic, Lee, and Burris Renders Claims 56 and 70 Obvious

222. In the following, I provide a limitation-by-limitation analysis showing how Cholas in view of Petrovic, Lee, and Burris render claims 56 and 70 obvious.

9.8.1 Dependent Claims 56 and 70

[56/70] “The cable TV device of claim [55/69], wherein: the cable TV device comprises a cable network connector, and the input signal is operably communicated from the cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.”

223. The limitations of claims 56 and 70 appear in the Claims Listing Appendix, and add the same limitations as claims 28 and 42. It is my opinion that claims 56 and 70 are obvious over Cholas in view of Petrovic, Lee, and Burris for the same reasons explained for claims 28 and 42. *See* Section 9.2.1. Modification in view of Lee does not affect the modification of Cholas-Petrovic in view of Burris.

9.9 Cholas in View of Petrovic, Lee, and Maalej Renders Claims 60, 61, 74, and 75 Obvious

224. In the following, I provide a limitation-by-limitation analysis showing how Cholas in view of Petrovic, Lee, and Maalej renders claims 60, 61, 74, and 75 obvious.

9.9.1 Dependent Claims 60, 61, 74, and 75

[60] “The cable TV device of claim 57, wherein: the DFE comprises a plurality of digital demodulators, and each digital demodulator, of the plurality of digital demodulators, is operable to demodulate the corresponding complex signal.”

[61] “The cable TV device of claim 55, wherein: the DFE comprises a plurality of digital demodulators, and each digital demodulator, of the plurality of digital demodulators, is operable to demodulate a desired channel, of the plurality of desired channels.”

[74] “The cable TV device of claim 71, wherein: each digital down converter comprises a digital demodulator operable to demodulate the corresponding complex signal to provide a demodulated channel as the digital channel output.”

[75] “The cable TV device of claim 69, wherein: each digital down converter comprises a digital demodulator operable to demodulate a desired channel, of the plurality of desired channels, to provide a demodulated channel as the digital channel output.”

225. The limitations of claims 60, 61, 74, and 75 appear in the Claims Listing Appendix. Claims 60, 61, 74, and 75 add the same limitations as claims 32, 33, 46, and 47, which are obvious over Cholas-Petrovic-Maalej (Section 9.3.1). Claims 60, 61, 74, and 75 are also obvious over Cholas-Petrovic-Lee-Maalej. The reasons it would be obvious to add Lee to Cholas-Petrovic (Sections 9.7.1-9.7.2) are also the reasons it would be obvious to add Lee to Cholas-Petrovic-Maalej, and modification in view of Maalej does not affect modification of Cholas-Petrovic in view of Lee.

9.10 Cholas in View of Petrovic, Lee, Maalej, and Rabaey Renders Claims 62 and 76 Obvious

226. In the following, I provide a limitation-by-limitation analysis showing how Cholas in view of Petrovic, Lee, Maalej, and Rabaey renders claims 62 and 76 obvious.

9.10.1 Dependent Claims 62 and 76

[62] “The cable TV device of claim 61, wherein: the DFE is operable to provide a plurality of demodulated desired channels via a parallel interface.”

[76] “The cable TV device of claim 75, wherein: the plurality of digital down converters is operable to provide a plurality of demodulated desired channels via a parallel interface.”

227. The limitations of claims 62 and 76 appear in the Claims Listing Appendix, and add the same limitations as claims 34 and 48. Claims 61 and 75 (from which claims 62 and 76 depend) are obvious over Cholas-Petrovic-Lee-Maalej (Section 9.9.1). In my opinion, it would be obvious to add Rabaey to Cholas-Petrovic-Lee-Maalej and render claims 62 and 76 obvious for the same reasons, explained in Section 9.6.3, that it would be obvious to add Rabaey to Cholas-Petrovic-Maalej. Modification of Cholas-Petrovic-Maalej in view of Lee does not affect modification in view of Rabaey.

9.11 Cholas in View of Petrovic, Lee, and Rabaey Render Claims 10, 12, 23, 25, 63, 64, 77, and 78 Obvious

228. In the following, I provide a limitation-by-limitation analysis showing how Cholas in view of Petrovic, Lee, and Rabaey renders claims 10, 12, 23, 25, 63, 64, 77, and 78 obvious.

9.11.1 Dependent Claims 10 and 23

[10/23] “The cable TV device of claim [1/14], wherein: the plurality of desired channels comprises at least one channel delivered via a Data Over Cable Service Interface Specification (DOCSIS) protocol.”

229. The limitations of claims 10 and 23 appear in the Claims Listing Appendix, add the same limitation as claims 38 and 52, and are disclosed by Cholas in view of Petrovic and Lee for the same reasons explained for claims 38 and 52. *See* Section 9.7.1. Modification of Cholas-Petrovic in view of Rabaey does not affect the Cholas-Petrovic-Lee disclosure of the limitations of claims 10 and 23, which are obvious over Cholas-Petrovic-Lee-Rabaey.

9.11.2 Dependent Claims 12 and 25

[12] “The cable TV device of claim 1, wherein: the cable TV device is operable to configure at least some of the plurality of desired channels as an output for a picture-in-picture display.”

[25] “The cable TV of claim 14, wherein: the cable TV device is operable to provide a picture-in-picture display according to the plurality of digital channel outputs.”

230. The limitations of claims 12 and 25 appear in the Claims Listing Appendix, add the same limitations as claims 39 and 53, and are disclosed by Cholas

in view of Petrovic and Lee for the same reasons explained for claims 39 and 53. *See* Section 9.7.2. Modification of Cholas-Petrovic in view of Rabaey does not affect the Cholas-Petrovic-Lee disclosure of the limitations of claims 12 and 25, which are obvious over Cholas-Petrovic-Lee-Rabaey.

9.11.3 Dependent Claims 63, 64, 77, and 78

[63/64] “The cable TV device of claim 55, wherein: the DFE is operable to provide the plurality of desired channels via a [parallel/serial] interface.”

[77] “The cable TV device of claim 69, wherein: the plurality of digital down converters is operable to provide a plurality of digital channel outputs, comprising each digital channel output, via a parallel interface.”

[78] “The cable TV device of claim 69, wherein: the plurality of digital down converters is operable to provide each digital channel output via a serial interface.”

231. The limitations of claims 63, 64, 77, and 78 appear in the Claims Listing Appendix, add the same limitations as claims 35, 36, 49, and 50, and are disclosed by Cholas in view of Petrovic and Rabaey for the same reasons explained for claims 35, 36, 49, and 50. *See* Section 9.4.1. Modification in view of Lee does not affect the Cholas-Petrovic-Rabaey disclosure of the limitations of claims 63, 64, 77, and 78, which are obvious over Cholas-Petrovic-Lee-Rabaey.

9.12 Cholas in View of Petrovic and Takahiko Renders Claims 27-33, 37, 40-47, 51, and 54 Obvious

232. In the following, I provide a limitation-by-limitation analysis showing how Cholas in view of Petrovic and Takahiko renders claims 27-33, 37, 40-47, 51, and 54 obvious.

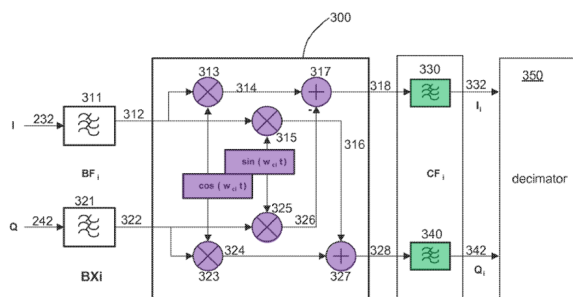
9.12.1 Independent Claim 27

a. Preamble [27A] and limitations [27B] and [27D]

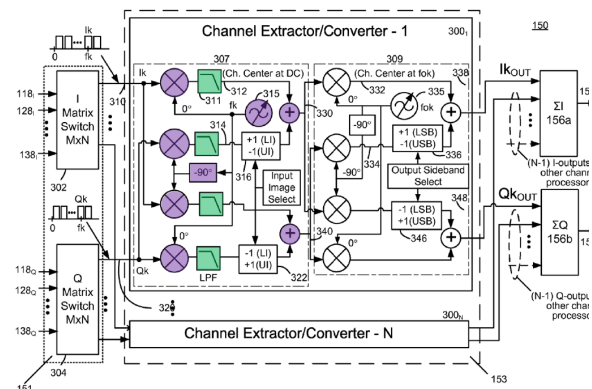
233. Preamble [27A] and limitations [27B] and [27D] are disclosed by Cholas-Petrovic for the reasons explained in Sections 9.1.1.a, 9.1.1.b, and 9.1.1.d. Modification in view of Takahiko, described below for limitation [27C], does not affect that Cholas-Petrovic disclosure.

b. Limitation [27C]

234. Petrovic low pass filters 311 are located within the complex mixer of a stage 307, while '866 patent filters 330 and 340 are located after the complex mixer:



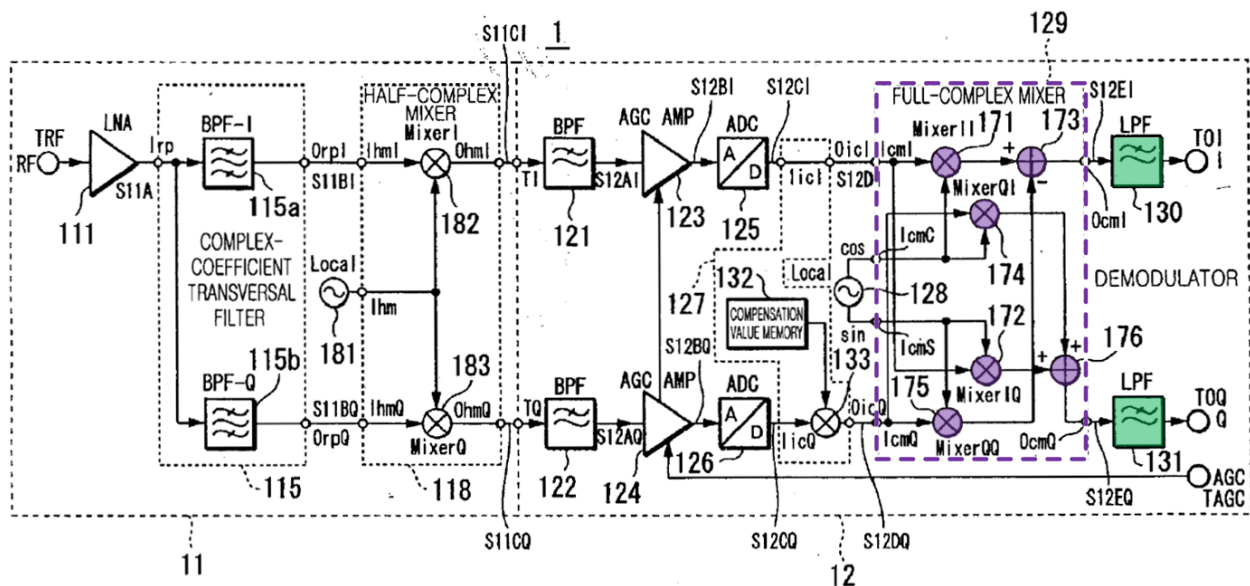
Ex. 1101, Fig. 3 (annotated)



Ex. 1108, Fig. 6 (annotated)

235. To the extent that the patent owner contends the configuration of the Petrovic stage 307 is not the same or equivalent structure as the complex 300 and filters 330 and 340 of the '866 patent (it is), it is my opinion that any difference would have been trivial, and the structure of the '866 patent (i.e., filters after the complex mixer) is taught by Cholas in view of Petrovic and Takahiko.

236. Placing four low pass filters (LPFs) before adders of a complex mixer (as shown in Petrovic Figure 6) or two LPFs after adders of a complex mixer (as shown in '866 patent Figures 2-3) would have been, in my opinion, functionally equivalent and a matter of design choice, as both options were well known. Takahiko describes a “downconverter” 1 that is used in a radio receiver, and that is very similar to the receiver of '866 patent Figure 2. Ex. 1161, [0143].



Ex. 1161, Fig. 1 (annotated)

237. The “full-complex mixer” 129 (**purple**, broken-line **purple** box) and low pass filters (**green**) 130 and 131 of Takahiko’s downconverter are the same as those of ’866 patent Figure 3. Takahiko full-complex mixer 129 and filters 130 and 131 are used the same way as complex mixer 300 and filters 330 and 340 of the ’866 patent: downconversion of digital I, Q signals so a desired channel is at baseband and removal of unwanted higher frequencies with low-pass filtering. Ex. 1161, [0153], [0156].

238. In my opinion, a POSITA would have modified the complex mixers of the Petrovic stages 307 to use two low pass filters after the adders of the complex mixer, similar to the configuration of the Takahiko full-complex mixer 129 and filters 130 and 131, and instead of four low pass filters within the complex mixer, to make the circuit simpler and less expensive. Because such a modification would have involved use of known circuit components in known arrangements, because of the similarity between the relevant portions of the Petrovic first sections 307 and the Takahiko full-complex mixer 129 and filters 130 and 131, and because the Takahiko full-complex mixer 129 and filters 130 and 131 would have been functionally equivalent to a Petrovic first section 307, a POSITA would have had a reasonable expectation of success and the results of the modification would have been predictable.

239. As modified in view of Takahiko, the Petrovic stages 307 would still be coupled to the ADC pair 108_M, and would still select and provide I, Q signals for desired channels (without providing undesired channels) as described in section 9.1.1.c, but with the I, Q, signals coming from the output of LPFs located after the complex mixer. The stages 307 would also have a structure (low pass filters after complex mixers) that is the same as (or equivalent to) the '866 patent structure, that operates in the same way (digitally downconvert I, Q components so desired channel is at baseband, filter out other channels), that performs the same function, and that achieves the same result (desired channels are selected and provided), and claim 27 is obvious over Cholas-Petrovic-Takahiko.

9.12.2 Independent Claim 41

a. Preamble [41A] and limitations [41B] and [41D]

240. Preamble [41A] and limitations [41B] and [41D] are disclosed by Cholas-Petrovic for the reasons explained in Sections 9.1.2.a, 9.1.2.b, and 9.1.2.d. Modification in view of Takahiko, described below for limitation [41C], does not affect that disclosure.

b. Limitation [41C]

241. For the reasons explained in Section 9.12.1.b, a POSITA would have been motivated to modify the complex mixers of the Petrovic stages 307 to have a structure that is the same as the '866 patent (LPFs after a complex mixer), that

operates in the same or an equivalent way (digitally downconvert I, Q components so desired channel is at baseband, filter out other channels), that performs the same function, and that achieves the same result (digital channel outputs for desired channels generated), and claim 41 is obvious over Cholas-Petrovic-Takahiko. As modified in view of Takahiko, the Petrovic stages 307 would operate, as described in Section 9.1.2.c, to generate (and provide to a demodulator) a digital output corresponding to a desired channel, but with the I, Q, signals coming from the output of LPFs located after the complex mixer.

9.12.3 Dependent Claims 28-30, 32, 33, 37, 40, 42-44, 46, 47, 51, and 54

242. Modification in view of Takahiko does not affect the disclosure by Cholas-Petrovic of the limitations of claims 28-30, 32-33, 37, 40, 42-44, 46-47, 51, and 54 explained in Sections 9.1.3 (claims 28, 42), 9.1.4 (claims 29-30, 43-44), 9.1.5 (claims 32-33, 46, 47), 9.1.7 (claims 37, 51), and 9.1.8 (claims 40, 54), and these claims are obvious over Cholas-Petrovic-Takahiko.

9.12.4 Dependent Claims 31 and 45

243. The limitations of claims 31 and 45 are taught by Cholas-Petrovic-Takahiko. As modified in view of Takahiko, the LPFs would be located after the adders of the complex mixer of a Petrovic first stage 307 and would filter the corresponding complex signal output by the complex mixer. Moreover, Cholas

discloses that signals received by the STB comprise 6 MHz channels. Ex. 1158, [0045]. Accordingly, claims 31 and 45 are obvious over Cholas-Petrovic-Takahiko.

9.13 Cholas in View of Petrovic, Takahiko, and Burris Renders Claims 28 and 42 Obvious

244. In the following, I provide a limitation-by-limitation analysis showing how Cholas in view of Petrovic, Takahiko, and Burris renders claims 28 and 42 obvious.

9.13.1 Dependent Claims 28 and 42

245. Modification in view of Takahiko does not affect the disclosure by Cholas-Petrovic-Burris of the limitations of claims 28 and 42 explained in Section 9.2.1, and so these claims are obvious over Cholas-Petrovic-Takahiko-Burris.

9.14 Cholas in View of Petrovic, Takahiko, and Maalej Renders Claims 32, 33, 46, and 47 Obvious

246. In the following, I provide a limitation-by-limitation analysis showing how Cholas in view of Petrovic, Takahiko, and Maalej renders claims 32, 33, 46, and 47 obvious.

9.14.1 Dependent Claims 32, 33, 46, and 47

247. Modification in view of Takahiko does not affect the disclosure by Cholas-Petrovic-Maalej of the limitations of claims 32, 33, 46, and 47 explained in Section 9.3.1, and so these claims are obvious over Cholas-Petrovic-Takahiko-Maalej.

9.15 Cholas in View of Petrovic, Takahiko, and Rabaey Renders Claims 1-9, 11, 13-22, 24, 26, 35, 36, 49, and 50 Obvious

248. In the following, I provide a limitation-by-limitation analysis showing how Cholas in view of Petrovic, Takahiko, and Rabaey renders claims 1-9, 11, 13-22, 24, 26, 35, 36, 49, and 50 obvious.

9.15.1 Independent Claim 1

249. Limitation [1C], with the exception of the “via a serial interface” limitation, is taught by Cholas-Petrovic-Takahiko for the reasons explained in Section 9.12.1.b., and preamble [1A], limitation [1B], and the “via a serial interface” portion of limitation [1C] are disclosed by Cholas-Petrovic-Rabaey for the reasons explained in Sections 9.4.3.a, 9.4.3.b, and 9.4.3.c. Modification of Cholas-Petrovic in view of Takahiko does not affect modification of Cholas-Petrovic in view of Rabaey. Accordingly, claim 1 is obvious over Cholas-Petrovic-Takahiko-Rabaey.

9.15.2 Independent Claim 14

250. Limitation [14C] is taught by Cholas-Petrovic-Takahiko for the reasons explained in Section 9.12.2.b. Preamble [14A] and limitations [14B] and [14D] are disclosed by Cholas-Petrovic-Rabaey for the reasons explained in Sections 9.4.4.a, 9.4.4.b, and 9.4.4.d. Modification of Cholas-Petrovic in view of Takahiko does not affect modification of Cholas-Petrovic in view of Rabaey. Accordingly, claim 14 is obvious over Cholas-Petrovic-Takahiko-Rabaey.

9.15.3 Dependent claims 2, 4, 6-9, 11, 13, 15-17, 19-22, 24, 26, 35, 36, 49, and 50

251. Modification in view of Takahiko does not affect the disclosure by Cholas-Petrovic-Rabaey of the limitations of claims 2-4, 6-9, 11, 13, 15-17, 19-22, 24, 26, 35, 36, 49, and 50 explained in Sections 9.4.1 (claims 35-36, 49, 50), 9.4.5 (claims 2, 15), 9.4.6 (claims 3-4, 16-17), 9.4.8 (claims 6-7, 19-20), 9.4.9 (claims 8, 21), 9.4.10 (claims 9, 22), 9.4.11 (claims 11, 24), and 9.4.12 (claims 13 and 26). Thus, these claims are obvious over Cholas-Petrovic-Takahiko-Rabaey.

9.15.4 Dependent claims 5 and 18

252. Claims 5 and 18 add the same limitations as claims 31 and 45, are disclosed by Cholas-Petrovic-Takahiko for the reasons explained in Section 9.12.4, and are obvious over Cholas-Petrovic-Takahiko-Rabaey, as modification in view of Rabaey does not affect the disclosure of claims 5 and 18 by Cholas-Petrovic-Takahiko.

9.16 Cholas in View of Petrovic, Takahiko, Rabaey, and Burris Renders Claims 2 and 15 Obvious

253. In the following, I provide a limitation-by-limitation analysis showing how Cholas in view of Petrovic, Takahiko, Rabaey, and Burris renders claims 2 and 15 obvious.

9.16.1 Dependent Claims 2 and 15

254. Modification in view of Takahiko does not affect the disclosure by Cholas-Petrovic-Rabaey-Burris of the limitations of claims 2 and 15 explained in

Section 9.5, and so these claims are obvious over Cholas-Petrovic-Takahiko-Rabaey-Burris.

9.17 Cholas in View of Petrovic, Takahiko, Rabaey, and Maalej Renders Claims 6-8, 19-21, 34, and 48 Obvious

255. In the following, I provide a limitation-by-limitation analysis showing how Cholas in view of Petrovic, Takahiko, Rabaey, and Maalej renders claims 6-8, 19-21, 34, and 48 obvious.

9.17.1 Dependent Claims 6-8, 19-21, 34, and 48

256. Modification in view of Takahiko does not affect the disclosure by Cholas-Petrovic-Rabaey-Maalej of the limitations of claims 6-8, 19-21, 34, and 48 explained in Section 9.6, and so these claims are obvious over Cholas-Petrovic-Takahiko-Rabaey-Maalej.

9.18 Cholas in View of Petrovic, Takahiko, and Lee Renders Claims 38, 39, 52, 53, 55-61, 65-75, and 79-82 Obvious

257. In the following, I provide a limitation-by-limitation analysis showing how Cholas in view of Petrovic, Takahiko, and Lee renders claims 38, 39, 52, 53, 55-61, 65-75, and 79-82 obvious.

9.18.1 Independent Claim 55

258. Limitation [55C] is disclosed by Cholas-Petrovic-Takahiko for the reasons explained in Section 9.12.1.b. Preamble [55A] and limitations [55B] and [55D] are disclosed by Cholas-Petrovic-Lee for the reasons explained in Sections

9.7.3.a, 9.7.3.b, and 9.7.3.d. Modification of Cholas-Petrovic in view of Takahiko does not affect modification of Cholas-Petrovic in view of Lee. Accordingly, claim 55 is obvious over Cholas-Petrovic-Takahiko-Lee.

9.18.2 Independent Claim 69

259. Limitation [69C] is taught by Cholas-Petrovic-Takahiko for the reasons explained in Section 9.12.2.b. Preamble [69A] and limitations [69B] and [69D] are disclosed by Cholas-Petrovic-Lee for the reasons explained in Sections 9.7.4.a, 9.7.4.b, and 9.7.4.d. Modification of Cholas-Petrovic in view of Takahiko does not affect modification of Cholas-Petrovic in view of Lee. Accordingly, claim 69 is obvious over Cholas-Petrovic-Takahiko-Lee.

9.18.3 Dependent claims 38, 39, 52, 53, 56-58, 60, 61, 65-68, 70-72, 74, 75, and 79-82

260. Modification in view of Takahiko does not affect the disclosure by Cholas-Petrovic-Lee of the limitations of claims 38, 39, 52, 53, 56-58, 60, 61, 65-68, 70-72, 74, 75, and 79-82 explained in Sections 9.7.1 (claims 38 and 52), 9.7.2 (claims 39 and 53), 9.7.5 (claims 57, 58, 71, and 72), 9.7.7 (claims 60, 61, 74, 75), 9.7.8 (claims 65 and 79), 9.7.9 (claims 66 and 80), 9.7.10 (claims 67 and 81), 9.7.11 (claims 68 and 82), and 9.7.12 (claims 56 and 70). Thus, these claims are obvious over Cholas-Petrovic-Takahiko-Rabaey.

9.18.4 Dependent claims 59 and 73

261. Claims 59 and 73 add the same limitations as claims 31 and 45, are disclosed by Cholas-Petrovic-Takahiko for the reasons explained in Section 9.12.4, and are obvious over Cholas-Petrovic-Takahiko-Lee, as modification of Cholas-Petrovic in view of Lee does not affect the disclosure of claims 59 and 73 by Cholas-Petrovic-Takahiko.

9.19 Cholas in View of Petrovic, Takahiko, Lee, and Burris Renders Claims 56 and 70 Obvious

262. In the following, I provide a limitation-by-limitation analysis showing how Cholas in view of Petrovic, Takahiko, Lee, and Burris renders claims 56 and 70 obvious.

9.19.1 Dependent Claims 56 and 70

263. Modification in view of Takahiko does not affect the disclosure by Cholas-Petrovic-Lee-Burris of the limitations of claims 56 and 70 explained in Section 9.8, and so these claims are obvious over Cholas-Petrovic-Takahiko-Lee-Burris.

9.20 Cholas in View of Petrovic, Takahiko, Lee, and Maalej Renders Claims 60, 61, 74, and 75 Obvious

264. In the following, I provide a limitation-by-limitation analysis showing how Cholas in view of Petrovic, Takahiko, Lee, and Maalej renders claims 60, 61, 74, and 75 obvious.

9.20.1 Dependent Claims 60, 61, 74, and 75

265. Modification in view of Takahiko does not affect the disclosure by Cholas-Petrovic-Lee-Maalej of the limitations of claims 60, 61, 74, and 75 explained in Section 9.9, and so these claims are obvious over Cholas-Petrovic-Takahiko-Lee-Maalej.

9.21 Cholas in View of Petrovic, Takahiko, Lee, Maalej, and Rabaey Renders Claims 62 and 76 Obvious

266. In the following, I provide a limitation-by-limitation analysis showing how Cholas in view of Petrovic, Takahiko, Lee, Maalej, and Rabaey renders claims 62 and 76 obvious.

9.21.1 Dependent Claims 62 and 76

267. Modification in view of Takahiko does not affect the disclosure by Cholas-Petrovic-Lee-Maalej-Rabaey of the limitations of claims 62 and 76 explained in Section 9.10, and so these claims are obvious over Cholas-Petrovic-Takahiko-Lee-Maalej-Rabaey.

9.22 Cholas in View of Petrovic, Takahiko, Lee, and Rabaey Renders Claims 10, 12, 23, 25, 63, 64, 77, and 78 Obvious

268. In the following, I provide a limitation-by-limitation analysis showing how Cholas in view of Petrovic, Takahiko, Lee, and Rabaey renders claims 10, 12, 23, 25, 63, 64, 77, and 78 obvious.

9.22.1 Dependent Claims 10, 12, 23, 25, 63, 64, 77, and 78

269. Modification in view of Takahiko does not affect the disclosure by Cholas-Petrovic-Lee-Rabaey of the limitations of claims 10, 12, 23, 25, 63, 64, 77, and 78 explained in Section 9.11, and so these claims are obvious over Cholas-Petrovic-Takahiko-Lee-Rabaey.

10. CONCLUSION

270. 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: 2/16/2024 By: 
David B. Lett

CLAIMS LISTING APPENDIX

U.S. Pat. No. 11,381,866

Designation	Claim Language
Claim 1	
[1A]	A cable television (TV) device comprising:
[1B]	a wideband analog-to-digital converter (ADC) configured to digitize a contiguous band of frequencies in an input signal, wherein the contiguous band of frequencies comprises a plurality of desired channels and a plurality of undesired channels; and
[1C]	a digital frontend (DFE) coupled to the wideband ADC, wherein the DFE is configured to concurrently select and provide each of the plurality of desired channels, via a serial interface, without providing any of the plurality of undesired channels.
Claim 2	
2	The cable TV device of claim 1, wherein: the cable TV device comprises a cable network connector, and the input signal is operably communicated from the cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.
Claim 3	
3	The cable TV device of claim 1, wherein: the DFE comprises a plurality of mixers, and each mixer, of the plurality of mixers, is operable to generate a corresponding complex signal comprising an in-phase (I) component and a quadrature (Q) component.
Claim 4	
4	The cable TV device of claim 3, wherein: the I and Q components of each corresponding complex signal are at baseband.
Claim 5	
5	The cable TV device of claim 3, wherein: the DFE comprises a plurality of filters, and each filter, of the plurality of filters, is operable to filter the corresponding complex signal comprising a 6 MHz channel.
Claim 6	

Designation	Claim Language
6	The cable TV device of claim 3, wherein: the DFE comprises a plurality of digital demodulators, and each digital demodulator, of the plurality of digital demodulators, is operable to demodulate the corresponding complex signal.
Claim 7	
7	The cable TV device of claim 1, wherein: the DFE comprises a plurality of digital demodulators, and each digital demodulator, of the plurality of digital demodulators, is operable to demodulate a desired channel, of the plurality of desired channels.
Claim 8	
8	The cable TV device of claim 7, wherein: the DFE is operable to provide a plurality of demodulated desired channels via a parallel interface.
Claim 9	
9	The cable TV device of claim 1, wherein: the plurality of desired channels comprises at least one cable broadcast channel.
Claim 10	
10	The cable TV device of claim 1, wherein: the plurality of desired channels comprises at least one channel delivered via a Data Over Cable Service Interface Specification (DOCSIS) protocol.
Claim 11	
11	The cable TV device of claim 1, wherein: the cable TV device comprises a digital video recorder (DVR).
Claim 12	
12	The cable TV device of claim 1, wherein: the cable TV device is operable to configure at least some of the plurality of desired channels as an output for a picture-in-picture display.
Claim 13	
13	The cable TV device of claim 1, wherein: the contiguous band of frequencies comprises a portion of a frequency spectrum of the input signal.
Claim 14	
[14A]	A cable TV device comprising:

Designation	Claim Language
[14B]	a wideband analog-to-digital converter (ADC) configured to digitize an input signal, wherein the input signal comprises a plurality of desired channels and a plurality of undesired channels; and
[14C]	a plurality of digital down converters coupled to the wideband ADC, wherein each digital down converter, of the plurality of digital down converters, is operable to generate a digital channel output corresponding to each desired channel, of the plurality of desired channels, and
[14D]	wherein the plurality of digital down converters is operable to provide each digital channel output via a serial interface.
Claim 15	
15	The cable TV device of claim 14, wherein: the cable TV device comprises a cable network connector, and the input signal is operably communicated from the cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.
Claim 16	
16	The cable TV device of claim 14, wherein: each digital down converter comprises a digital mixer operable to generate a corresponding complex signal comprising an in-phase (I) component and a quadrature (Q) component.
Claim 17	
17	The cable TV device of claim 16, wherein: the I and Q components of each corresponding complex signal are at baseband.
Claim 18	
18	The cable TV device of claim 16, wherein: each digital down converter comprises a filter operable to select the corresponding complex signal comprising a 6 MHz channel.
Claim 19	
19	The cable TV device of claim 16, wherein: each digital down converter comprises a digital demodulator operable to demodulate the corresponding complex signal to provide a demodulated channel as the digital channel output.
Claim 20	

Designation	Claim Language
20	The cable TV device of claim 14, wherein: each digital down converter comprises a digital demodulator operable to demodulate a desired channel, of the plurality of desired channels, to provide a demodulated channel as the digital channel output.
Claim 21	
21	The cable TV device of claim 20, wherein: the plurality of digital down converters is operable to provide a plurality of demodulated desired channels via a parallel interface.
Claim 22	
22	The cable TV device of claim 14, wherein: the plurality of desired channels comprises at least one cable broadcast channel.
Claim 23	
23	The cable TV device of claim 14, wherein: the plurality of desired channels comprises at least one channel delivered via a Data Over Cable Service Interface Specification (DOCSIS) protocol.
Claim 24	
24	The cable TV device of claim 14, wherein: the cable TV device comprises a digital video recorder (DVR).
Claim 25	
25	The cable TV of claim 14, wherein: the cable TV device is operable to provide a picture-in-picture display according to the plurality of digital channel outputs.
Claim 26	
26	The cable TV device of claim 14, wherein: the plurality of desired channels and the plurality of undesired channels comprise a portion of a frequency spectrum of the input signal.
Claim 27	
[27A]	A cable television (TV) device comprising:
[27B]	a wideband analog-to-digital converter (ADC) configured to digitize a contiguous band of frequencies in an input signal, wherein the contiguous band of frequencies comprises a plurality of desired channels and a plurality of undesired channels; and

Designation	Claim Language
[27C]	a digital frontend (DFE) coupled to the wideband ADC, wherein the DFE is configured to concurrently select and provide each of the plurality of desired channels without providing any of the plurality of undesired channels, and
[27D]	wherein the cable TV device comprises a digital video recorder (DVR).
Claim 28	
28	The cable TV device of claim 27, wherein: the cable TV device comprises a cable network connector, and the input signal is operably communicated from the cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.
Claim 29	
29	The cable TV device of claim 27, wherein: the DFE comprises a plurality of mixers, and each mixer, of the plurality of mixers, is operable to generate a corresponding complex signal comprising an in-phase (I) component and a quadrature (Q) component.
Claim 30	
30	The cable TV device of claim 29, wherein: the I and Q components of each corresponding complex signal are at baseband.
Claim 31	
31	The cable TV device of claim 29, wherein: the DFE comprises a plurality of filters, and each filter, of the plurality of filters, is operable to filter the corresponding complex signal comprising a 6 MHz channel.
Claim 32	
32	The cable TV device of claim 29, wherein: the DFE comprises a plurality of digital demodulators, and each digital demodulator, of the plurality of digital demodulators, is operable to demodulate the corresponding complex signal.
Claim 33	
33	The cable TV device of claim 27, wherein: the DFE comprises a plurality of digital demodulators, and each digital demodulator, of the plurality of digital

Designation	Claim Language
	demodulators, is operable to demodulate a desired channel, of the plurality of desired channels.
Claim 34	
34	The cable TV device of claim 33, wherein: the DFE is operable to provide a plurality of demodulated desired channels via a parallel interface.
Claim 35	
35	The cable TV device of claim 27, wherein: the DFE is operable to provide the plurality of desired channels via a parallel interface.
Claim 36	
36	The cable TV device of claim 27, wherein: the DFE is operable to provide the plurality of desired channels via a serial interface.
Claim 37	
37	The cable TV device of claim 27, wherein: the plurality of desired channels comprises at least one cable broadcast channel.
Claim 38	
38	The cable TV device of claim 27, wherein: the plurality of desired channels comprises at least one channel delivered via a Data Over Cable Service Interface Specification (DOCSIS) protocol.
Claim 39	
39	The cable TV device of claim 27, wherein: the cable TV device is operable to configure at least some of the plurality of desired channels as an output for a picture-in-picture display.
Claim 40	
40	The cable TV device of claim 27, wherein: the contiguous band of frequencies comprises a portion of a frequency spectrum of the input signal.
Claim 41	
[41A]	A cable TV device comprising:
[41B]	a wideband analog-to-digital converter (ADC) configured to digitize an input signal, wherein the input signal comprises a plurality of desired channels and a plurality of undesired channels; and

Designation	Claim Language
[41C]	a plurality of digital down converters coupled to the wideband ADC, wherein each digital down converter, of the plurality of digital down converters, is operable to generate a digital channel output corresponding to each desired channel, of the plurality of desired channels, and
[41D]	wherein the cable TV device comprises a digital video recorder (DVR).
Claim 42	
42	The cable TV device of claim 41, wherein: the cable TV device comprises a cable network connector, and the input signal is operably communicated from the cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.
Claim 43	
43	The cable TV device of claim 41, wherein: each digital down converter comprises a digital mixer operable to generate a corresponding complex signal comprising an in-phase (I) component and a quadrature (Q) component.
Claim 44	
44	The cable TV device of claim 43, wherein: the I and Q components of each corresponding complex signal are at baseband.
Claim 45	
45	The cable TV device of claim 43, wherein: each digital down converter comprises a filter operable to select the corresponding complex signal comprising a 6 MHz channel.
Claim 46	
46	The cable TV device of claim 43, wherein: each digital down converter comprises a digital demodulator operable to demodulate the corresponding complex signal to provide a demodulated channel as the digital channel output.
Claim 47	
47	The cable TV device of claim 41, wherein: each digital down converter comprises a digital demodulator operable to demodulate a desired channel, of the plurality of desired channels, to provide a demodulated channel as the digital channel output.

Designation	Claim Language
Claim 48	
48	The cable TV device of claim 47, wherein: the plurality of digital down converters is operable to provide a plurality of demodulated desired channels via a parallel interface.
Claim 49	
49	The cable TV device of claim 41, wherein: the plurality of digital down converters is operable to provide a plurality of digital channel outputs, comprising each digital channel output, via a parallel interface.
Claim 50	
50	The cable TV device of claim 41, wherein: the plurality of digital down converters is operable to provide each digital channel output via a serial interface.
Claim 51	
51	The cable TV device of claim 41, wherein: the plurality of desired channels comprises at least one cable broadcast channel.
Claim 52	
52	The cable TV device of claim 41, wherein: the plurality of desired channels comprises at least one channel delivered via a Data Over Cable Service Interface Specification (DOCSIS) protocol.
Claim 53	
53	The cable TV of claim 41, wherein: the cable TV device is operable to provide a picture-in-picture display according to the plurality of digital channel outputs.
Claim 54	
54	The cable TV device of claim 41, wherein: the plurality of desired channels and the plurality of undesired channels comprise a portion of a frequency spectrum of the input signal.
Claim 55	
[55A]	A cable television (TV) device comprising:
[55B]	a wideband analog-to-digital converter (ADC) configured to digitize a contiguous band of frequencies in an input signal, wherein the contiguous band of frequencies comprises a plurality of desired channels and a plurality of undesired channels; and

Designation	Claim Language
[55C]	a digital frontend (DFE) coupled to the wideband ADC, wherein the DFE is configured to concurrently select and provide each of the plurality of desired channels without providing any of the plurality of undesired channels, and
[55D]	wherein the cable TV device is operable to configure at least some of the plurality of desired channels as an output for a picture-in-picture display.
Claim 56	
56	The cable TV device of claim 55, wherein: the cable TV device comprises a cable network connector, and the input signal is operably communicated from the cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.
Claim 57	
57	The cable TV device of claim 55, wherein: the DFE comprises a plurality of mixers, and each mixer, of the plurality of mixers, is operable to generate a corresponding complex signal comprising an in-phase (I) component and a quadrature (Q) component.
Claim 58	
58	The cable TV device of claim 57, wherein: the I and Q components of each corresponding complex signal are at baseband.
Claim 59	
59	The cable TV device of claim 57, wherein: the DFE comprises a plurality of filters, and each filter, of the plurality of filters, is operable to filter the corresponding complex signal comprising a 6 MHz channel.
Claim 60	
60	The cable TV device of claim 57, wherein: the DFE comprises a plurality of digital demodulators, and each digital demodulator, of the plurality of digital demodulators, is operable to demodulate the corresponding complex signal.
Claim 61	
61	The cable TV device of claim 55, wherein: the DFE comprises a plurality of digital demodulators, and each digital demodulator, of the plurality of digital

Designation	Claim Language
	demodulators, is operable to demodulate a desired channel, of the plurality of desired channels.
Claim 62	
62	The cable TV device of claim 61, wherein: the DFE is operable to provide a plurality of demodulated desired channels via a parallel interface.
Claim 63	
63	The cable TV device of claim 55, wherein: the DFE is operable to provide the plurality of desired channels via a parallel interface.
Claim 64	
64	The cable TV device of claim 55, wherein: the DFE is operable to provide the plurality of desired channels via a serial interface.
Claim 65	
65	The cable TV device of claim 55, wherein: the plurality of desired channels comprises at least one cable broadcast channel.
Claim 66	
66	The cable TV device of claim 55, wherein: the plurality of desired channels comprises at least one channel delivered via a Data Over Cable Service Interface Specification (DOCSIS) protocol.
Claim 67	
67	The cable TV device of claim 55, wherein: the cable TV device comprises a digital video recorder (DVR).
Claim 68	
68	The cable TV device of claim 55, wherein: the contiguous band of frequencies comprises a portion of a frequency spectrum of the input signal.
Claim 69	
[69A]	A cable TV device comprising:
[69B]	a wideband analog-to-digital converter (ADC) configured to digitize an input signal, wherein the input signal comprises a plurality of desired channels and a plurality of undesired channels; and
[69C]	a plurality of digital down converters coupled to the wideband ADC, wherein each digital down converter, of

Designation	Claim Language
	the plurality of digital down converters, is operable to generate a digital channel output corresponding to each desired channel, of the plurality of desired channels, and
[69D]	wherein the cable TV device is operable to provide a picture-in-picture display according to the plurality of digital channel outputs.
Claim 70	
70	The cable TV device of claim 69, wherein: the cable TV device comprises a cable network connector, and the input signal is operably communicated from the cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.
Claim 71	
71	The cable TV device of claim 69, wherein: each digital down converter comprises a digital mixer operable to generate a corresponding complex signal comprising an in-phase (I) component and a quadrature (Q) component.
Claim 72	
72	The cable TV device of claim 71, wherein: the I and Q components of each corresponding complex signal are at baseband.
Claim 73	
73	The cable TV device of claim 71, wherein: each digital down converter comprises a filter operable to select the corresponding complex signal comprising a 6 MHz channel.
Claim 74	
74	The cable TV device of claim 71, wherein: each digital down converter comprises a digital demodulator operable to demodulate the corresponding complex signal to provide a demodulated channel as the digital channel output.
Claim 75	
75	The cable TV device of claim 69, wherein: each digital down converter comprises a digital demodulator operable to demodulate a desired channel, of the plurality of desired channels, to provide a demodulated channel as the digital channel output.
Claim 76	

Designation	Claim Language
76	The cable TV device of claim 75, wherein: the plurality of digital down converters is operable to provide a plurality of demodulated desired channels via a parallel interface.
Claim 77	
77	The cable TV device of claim 69, wherein: the plurality of digital down converters is operable to provide a plurality of digital channel outputs, comprising each digital channel output, via a parallel interface.
Claim 78	
78	The cable TV device of claim 69, wherein: the plurality of digital down converters is operable to provide each digital channel output via a serial interface.
Claim 79	
79	The cable TV device of claim 69, wherein: the plurality of desired channels comprises at least one cable broadcast channel.
Claim 80	
80	The cable TV device of claim 69, wherein: the plurality of desired channels comprises at least one channel delivered via a Data Over Cable Service Interface Specification (DOCSIS) protocol.
Claim 81	
81	The cable TV device of claim 69, wherein: the cable TV device comprises a digital video recorder (DVR).
Claim 82	
82	The cable TV device of claim 69, wherein: the plurality of desired channels and the plurality of undesired channels comprise a portion of a frequency spectrum of the input signal.

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