

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. 11,399,206
Filing Date: January 28, 2022
Issue Date: July 26, 2022
Title: METHOD FOR RECEIVING A TELEVISION SIGNAL

Inter Partes Review No.: IPR2024-00440

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.***

TABLE OF CONTENTS

	Page
1. INTRODUCTION.....	1
2. PROFESSIONAL BACKGROUND AND QUALIFICATIONS	2
3. MATERIALS CONSIDERED	8
4. UNDERSTANDING OF APPLICABLE LEGAL STANDARDS.....	10
5. THE RELEVANT ART AND LEVEL OF ORDINARY SKILL IN THE RELEVANT ART	16
6. CLAIM CONSTRUCTION	17
7. OVERVIEW OF THE '206 PATENT	18
7.1. Prosecution History	20
7.2. Earliest Priority Date for the Claims.....	22
8. OVERVIEW OF THE PRIOR ART.....	22
8.1. Cable and Satellite Television Networks.....	22
8.2. Modulated RF Signals	25
8.3. Radio Receivers or Tuners for Cable and Satellite Television Networks.....	31
8.4. Serial vs. Parallel Data Communication.....	47
8.5. International Pub. No. 2007/145637 – Pugel (Ex. 1224)	48
8.6. Crols (Ex. 1225).....	52
8.7. Chandrakasan (Ex. 1217).....	56
8.8. U.S. Publication No. 2006/0029170 – Jensen '170 (Ex. 1230).....	57
8.9. U.S. Publication No. 2008/0120667 – Zaltsman (Ex. 1274)	60
9. OPINIONS WITH RESPECT TO THE '206 PATENT	61
9.1. Ground A0 and A1: Pugel	61
9.2. Ground B: Pugel/Crols	83
9.3. Ground C: Pugel/Chandrakasan	103
9.4. Ground D: Pugel/Crols/Chandrakasan	116
9.5. Ground E: Pugel/Zaltsman	123
9.6. Ground F: Pugel/Crols/Zaltsman	124

9.7.	Ground G: Pugel/Chandrakasan/Zaltsman	125
9.8.	Ground H: Pugel/Crols/Chandrakasan/Zaltsman	126
9.9.	Ground I: Pugel/Crols/Zaltsman/Jensen '170.....	127
9.10.	Ground J: Pugel/Crols/Chandrakasan/Zaltsman/Jensen '170.....	133
10.	CONCLUSION.....	134
	CLAIMS LISTING APPENDIX.....	135

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. 11,399,206 (“the ’206 patent”) (Ex. 1201) 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 ’206 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. 1203, 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 the 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 an 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 '206 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 '206 patent (U.S. Pat. No. 11,399,206 to Reddy et al.) (Ex. 1201), 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 '206 patent (included in Ex. 1204) as well as the following references:

- | | |
|-----------|--|
| Ex. 1201: | U.S. Patent No. 11,399,206 ("the '206 patent") |
| Ex. 1202: | Expert Declaration of David B. Lett |
| Ex. 1203: | Curriculum Vitae of David B. Lett |
| Ex. 1204: | Certified Prosecution History of the '206 patent |
| Ex. 1207: | Certified Prosecution History of U.S. Provisional App. No. 61/170,526 ("526 provisional") |
| Ex. 1214: | U.S. Patent No. 7,237,214 ("Pandey") |
| Ex. 1215: | Excerpts of "IEEE Std 100-2000, The Authoritative Dictionary of IEEE Standards Terms, Seventh Edition" (IEEE Press. 2000) ("IEEE Std 100") |
| Ex. 1216: | Excerpts of Jan M Rabaey, "Digital Integrated Circuits: A Design Perspective" (Pearson, 2nd ed. 2002) ("Rabaey") |
| Ex. 1217: | 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. 1218: S. Mirabbasi and K. Martin, “Classical and Modern Receiver Architectures,” IEEE Communications Magazine, vol. 38, no. 11, pp. 132-139, November 2000 (“Mirabbasi”)
- Ex. 1219: U.S. Patent No. 6,061,406 (“Carson”)
- Ex. 1221: “Data-Over-Cable Service Interface Specifications: Radio Frequency Interface Specification CM-SP-RFiv2.0-I11-060602,” DOCSIS, June 2006
- Ex. 1224: International Pub. No. 2007/145367 (“Pugel”)
- Ex. 1225: 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. 1227: U.S. Patents and Patent Applications Family Tree for U.S. Patent No. 11,399,206
- Ex. 1230: U.S. Pub. No. 2006/0029170 (“Jensen ’170”)
- Ex. 1233: 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. 1234: Excerpts of J. Crols and M. Steyaert, “CMOS Wireless Transceiver Design” (1997)
- Ex. 1235: U.S. Patent No. 7,340,230 (“Khoini-Poorfard”)
- Ex. 1236: U.S. Pub. No. 2003/0217362 (“Summers”)
- Ex. 1237: U.S. Pub. No. 2006/0256799 (“Eng”)
- Ex. 1238: U.S. Pub. No. 2006/0083335 (“Seendripu”)
- Ex. 1239: Excerpts of Chris Bowick, “RF Circuit Design” (2nd ed. 2008)

- Ex. 1241: Excerpts of Roland Priemer, “Introductory Signal Processing” (1991)
- Ex. 1242: U.S. Patent No. 7,272,375 (“Tuttle”)
- Ex. 1243: U.S. Patent No. 7,130,576 (“Gurantz”)
- Ex. 1244: U.S. Patent No. 5,278,837 (“Kelly”)
- Ex. 1245: Jeffrey Hugh Reed, “Software Radio: A Modern Approach to Radio Engineering” (2002)
- Ex. 1246: U.S. Patent No. 7,213,042 (“Cannon”)
- Ex. 1248: Excerpts of William Buchanan, “Computer Busses” (2000) (“Buchanan”)
- Ex. 1249: U.S. Patent No. 7,079,528 (“Ziegler”)
- Ex. 1250: Excerpts of “Software Defined Radio: Enabling Technologies” (Walter H.W. Tuttlebee ed., 2003)
- Ex. 1251: U.S. Pub. No. 2005/0183015 (“Dunton”)
- Ex. 1252: U.S. Pub. No. 2003/0229900 (“Reisman”)
- Ex. 1273: Expert Declaration of Dr. Sylvia Hall-Ellis
- Ex. 1274: U.S. Pub. No. 2008/0120667 (“Zaltsman”)
- Ex. 1275: U.S. Patent No. 6,791,995 (“Azenkot”)
- Ex. 1276: 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 '206 patent based on the following grounds:

Ground	References	Basis	Claims Challenged
A0/A1	Pugel	§102/§103	25 , 26, 31, 35, 37, 51 , 52, 57, 61, 63
B	Pugel-Crols	§103	27-28, 30, 38 , 39-41, 43-44, 48, 50, 53-54, 56, 64 , 65-67, 69-70, 74, 76
C	Pugel-Chandrakasan	§103	1 , 2, 7-9, 11-12, 32-34, 58-60
D	Pugel-Crols-Chandrakasan	§103	3, 4, 6, 13 , 14-16, 18-21, 23-24, 45-47, 71-73
E	Pugel-Zaltsman	§103	36, 62
F	Pugel-Crols-Zaltsman	§103	49, 75
G	Pugel-Chandrakasan-Zaltsman	§103	10
H	Pugel-Crols-Chandrakasan-Zaltsman	§103	22

I	Pugel-Crols-Zaltsman-Jensen '170	§103	29, 42, 55, 68
J	Pugel-Crols-Chandrakasan-Zaltsman-Jensen '170	§103	5, 17

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 ’206 patent is directed to a wideband receiver system 200 “capable of receiving multiple desired television channels that extend over multiple non-contiguous portions of the broad frequency spectrum.” Ex. 1201, 1:30-35; *see also id.*, 4:35-37. 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 (POSITA) of the ’206 patent, at the time of the alleged invention of the ’206 patent, would have had a degree in electrical engineering, or a similar discipline, along with three-to-four years of experience with digital signal processing (DSP) and RF tuning systems for satellite and/or cable communications. I also believe that 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 ’206 patent, and thus, I am familiar with the knowledge that such persons had at the time (*e.g.*, early 2009 or early 2010). At that time, I had a skill level that was at least as high as the skill level I described above for a person of ordinary skill in the art of the ’206 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 '206 patent (which, as I discuss below, is April 17, 2009). Although some claims of the '206 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.

6. CLAIM CONSTRUCTION

33. I understand that my analysis requires an understanding of the scope of the claims of the '206 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.

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.

35. The claims use the term “wideband.” The ’206 patent implicitly defines “wideband” as a band that carries multiple channels. For example, the ’206 patent states that a receiver is “wideband” if it is “designed to concurrently receive several TV channels.” Ex. 1201, 1:36-39. This is consistent with the ordinary and customary meaning of “wideband.”

7. OVERVIEW OF THE ’206 PATENT

36. The ’206 patent describes a wideband receiver system 200 illustrated below “capable of receiving multiple radio frequency channels located in a broad radio frequency spectrum.” Ex. 1201, 1:28-30; *see also id.*, 4:35-37. According to the ’206 patent, a receiver is “wideband” if it is “designed to concurrently receive several TV channels.” *Id.*, 1:36-39.

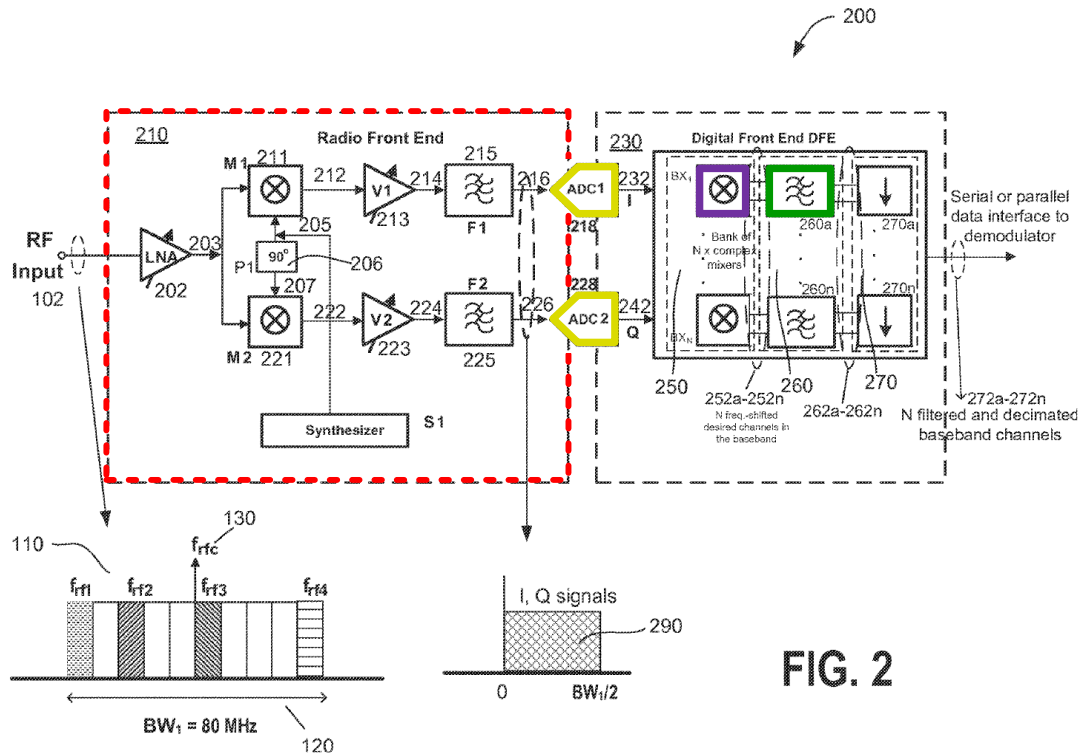


FIG. 2

Ex. 1201, Fig. 2 (annotated)

37. The system 200 receives desired and undesired television channels as frequencies dispersed within a frequency bandwidth BW_1 . Ex. 1201, 4:38-51. A radio frontend 210 (**red**) downconverts the bandwidth of channels as in-phase and quadrature signals 212 and 222 at a low intermediate frequency (IF), which are then digitized by wideband analog-to-digital converters ADC1 and ADC2 (**gold**). *Id.*, 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 ’206 patent incorporates by reference, admits that the left side of Figure 2 (up to and including ADC1 and ADC2) “is similar to conventional tuners.” Ex. 1207 at 4; Ex. 1201, 1:20-22.

38. The digital I and Q signals 232 and 242 from ADC1 and ADC2 are input to a bank of N complex mixers 250 (one annotated above in **purple**) in a digital front end 230. Ex. 1201, 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.*, 6:2-8. Filters 260a-260n (one annotated above in **green**) filter each frequency-shifted desired channel. *Id.* 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.*, 7:10-13.

7.1. Prosecution History

39. It is my understanding that U.S. Application No. 17/587,462, which became the '206 patent, was filed on January 28, 2022, with a preliminary amendment canceling claims 1-18 and adding new claims 19-48. Ex. 1204 at 2-9. On April 13, 2022, an Office Action rejected claims 19-48 for non-statutory double patenting over claims 1-27 of U.S. Patent No. 9,100,622, and rejected claims 19-27, 29, 30, 33-42, 44, 45, and 48 as obvious over U.S. Patent No. 6,760,342 (Skones) in view of International Publication No. WO 02/087230 (Uskali). *Id.* at 119-133. The Office Action indicated that dependent claims 28 and 43 (which recited providing channels “via a serial interface”), claims 31 and 46 (which recited performing the

method by “a device comprising a digital video recorder (DVR)”), and claims 32 and 47 (which recited “a picture-in-picture display”) contained allowable subject matter. *Id.* at 6-9, 131.

40. On April 14, 2022, the Applicant filed a terminal disclaimer and an amendment that added the limitations of claim 28 to claim 19, added the limitations of claim 43 to claim 34, added new independent claim 49 based on original claims 19 and 31, added new independent claim 63 based on original claims 34 and 46, added new independent claim 77 based on original claims 19 and 32, added new independent claim 91 based on original claims 34 and 47, and added multiple sets of new dependent claims that paralleled existing dependent claims. *Id.* at 220-238.

41. On June 2, 2022, the Applicant filed a supplemental amendment that amended claims 19, 49, and 77 (’206 patent claims 1, 25, and 51, respectively) to add “receiving an input signal from a cable network” and amend the “digitizing” step: “... wherein the contiguous band of frequencies comprises all received channels that exist in the input signal and the received channels comprise[[s]] a plurality of desired channels and a plurality of undesired channels.” *Id.* at 260-268. That supplemental amendment also amended claims 34, 63, and 91 (’206 patent claims 13, 38, and 64, respectively) to add “receiving an input signal from a cable network” and amend the “digitizing” step: “digitizing ~~an~~ all received channels in the input signal ... wherein the input signal comprises received channels comprise a

plurality of desired channels and a plurality of undesired channels.” *Id.* at 262-270. The Office issued a Notice of Allowance on June 15, 2022. *Id.* at 275. The ’206 patent was issued on July 26, 2022. Ex. 1201, cover.

42. The prior art relied upon in this petition—Pugel, Crols, Chandrakasan Zaltsman, or Jensen ’170 —was not considered during the prosecution of the ’462 application. Ex. 1201, cover.

7.2. Earliest Priority Date for the Claims

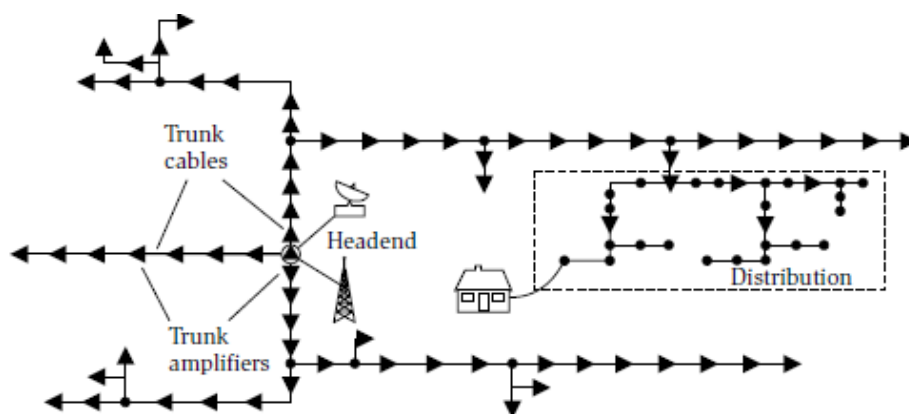
43. I understand that the earliest possible effective filing date for the ’206 patent is April 17, 2009, the filing date of the ’526 provisional. Each of the references relied on herein is prior art to that date, as explained below.

8. OVERVIEW OF THE PRIOR ART

8.1. Cable and Satellite Television Networks

44. The origins of the cable and satellite television networks long predate the earliest claimed priority date (April 17, 2009) of the ’206 patent. Cable television networks are entertainment distribution systems that allow consumers to access and enjoy various television channels. Ex. 1233 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. 1234 at 20-21. This is illustrated in Figure 1.1 of Ex. 1233.

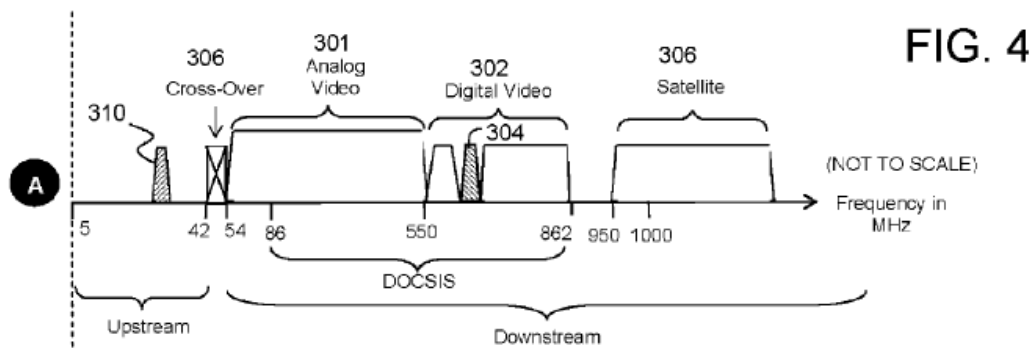


Ex. 1233, Fig. 1.1 (page 34)

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. 1215 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. 1221 at 2-5, Fig. 1-2; Ex. 1233 at 27, 211-212.

45. Consumers can also access television channels from satellites via conventional home satellite television systems. Ex. 1235, 1:30-31; Ex. 1236, [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.

1235, 1:31-35; Ex. 1236, [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. 1233 at 262, 280-282; Ex. 1236, [0009].



Ex. 1237, Fig. 4 (Excerpted)

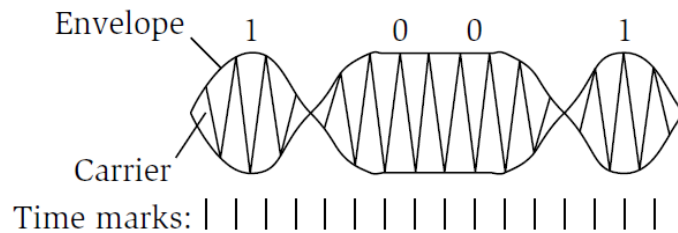
46. Figure 4 of Exhibit 1237 (partially reproduced above) illustrates the RF spectrum usage of television channels from cable and satellite television networks. Ex. 1237, [0079]-[0080]. In North America, television channels from cable television networks occupy the RF spectrum from 54 to 864 MHz, with digital channels occupying the RF spectrum above 550 MHz. Ex. 1233 at 413, 503; Ex. 1237, [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. 1221 at 1, 23-24; Ex. 1233 at 45, 413, 515-520.

47. Television channels from satellite networks occupy various bands in frequencies greater than 950 MHz. Ex. 1235, 1:37-48; Ex. 1237, [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. 1235, 1:37-48.

8.2. Modulated RF Signals

48. 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. 1233 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 '206 patent, multiple modulation techniques facilitating high spectral efficiencies were known to a POSITA by the earliest claimed priority date of the '206 patent.

8.2.1. Biphase Shift Keying



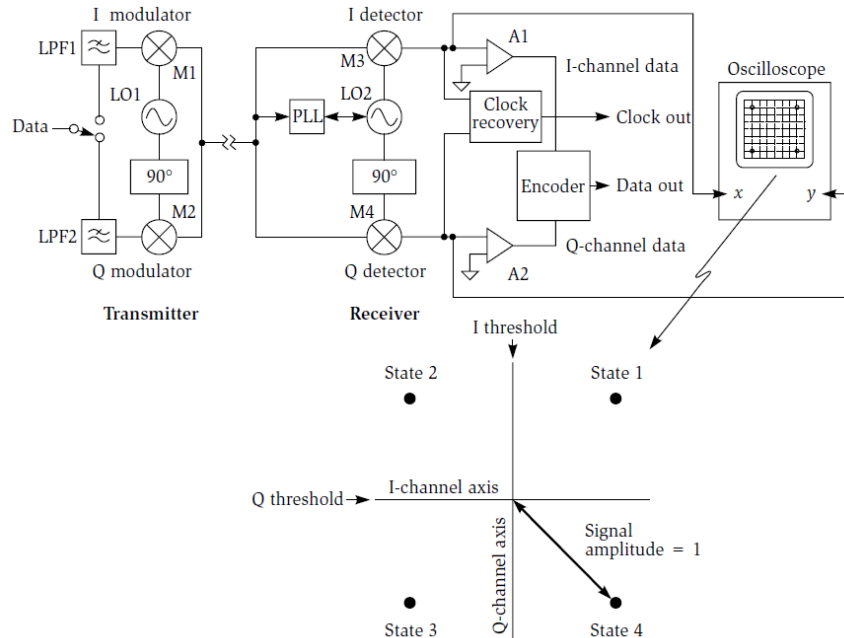
Ex. 1233, Fig. 4.3 (Excerpted) (page 161)

49. 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. 1233 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)

50. 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. 1233 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.



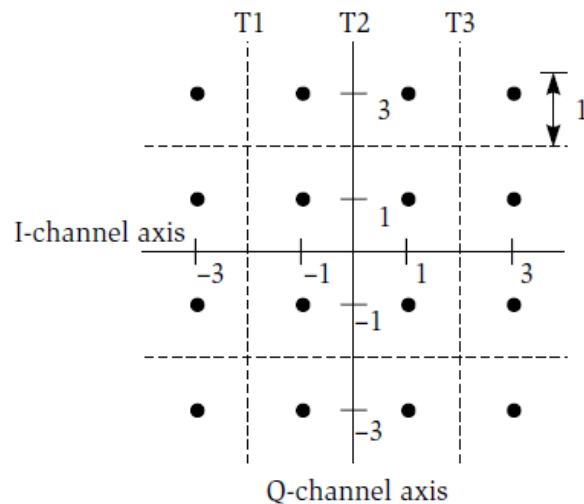
Ex. 1233, Fig. 4.4 (page 164)

51. 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. 1233 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.

52. A POSITA would have been well aware that satellite television networks primarily used QPSK modulation. Ex. 1233 at 280; Ex. 1236, [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. 1233 at 280. QPSK modulation met this requirement of satellite transponders. *Id.*

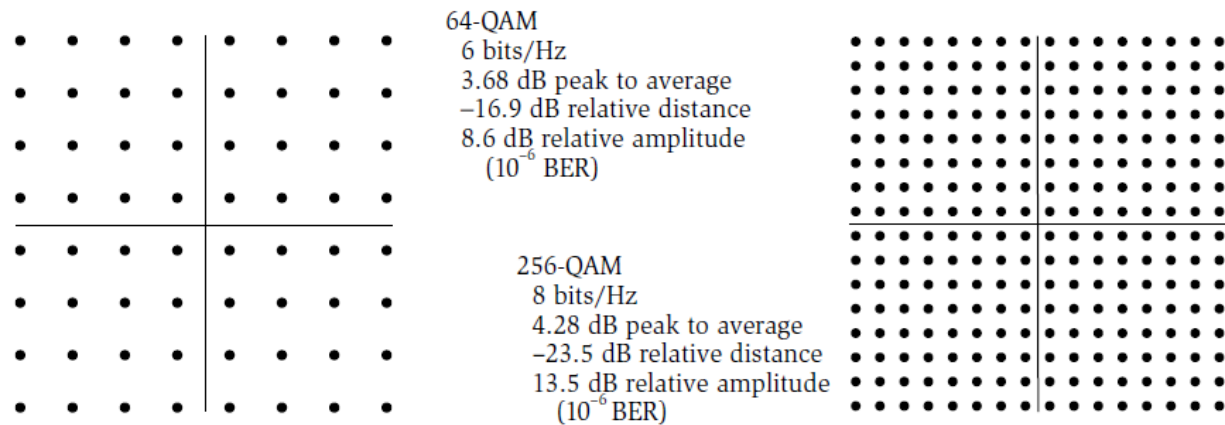
8.2.3. 16-Quadrature Amplitude Modulation (QAM), 64-QAM, and 256-QAM



Ex. 1233, Fig. 4.5 (Partial Excerpt) (page 167)

53. Modulation schemes with greater numbers of constellation points are able to transmit more information per symbol. Ex. 1233 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. 1233, 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. 1233, Fig. 4.6 (Partial Excerpt) (page 168)

54. Similarly, the I/Q constellation of 64-QAM (illustrated by Figure 4.6 of Ex. 1233, 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.*

55. 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. 1233 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

56. 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. 1233 at 22, 30, 40, 352; Ex. 1235, 1:30-35; Ex. 1236, [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. 1233 at 408-411, Fig. 22.1; Ex. 1235, 1:35-37; Ex. 1236, [0018], [0020]-[0021].

57. Cable television RF receivers concurrently receive RF signals for multiple digital television channels allocated in the RF frequency spectrum of 550

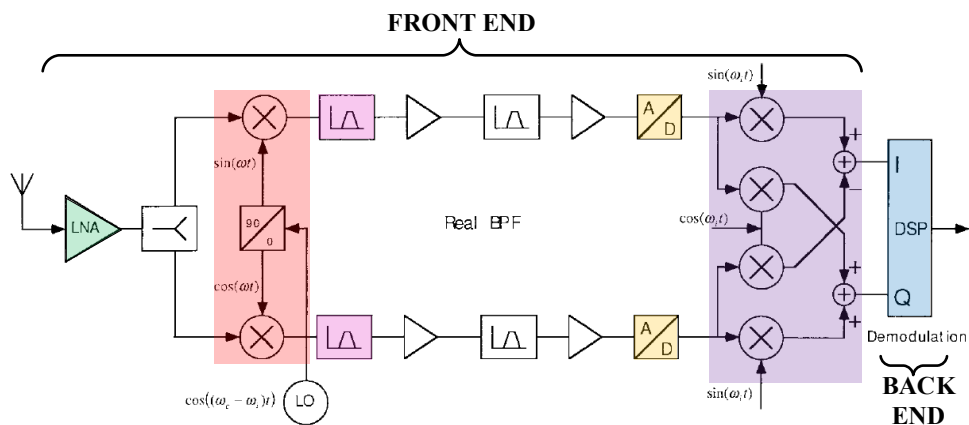
to 862 MHz. Ex. 1233 at 413, 503; Ex. 1237, [0079]-[0080], Fig. 4. Satellite RF receivers concurrently receive RF signals for multiple television channels allocated in the RF frequency spectrum above 950 MHz. Ex. 1235, 1:37-47; Ex. 1237, [0080]. Furthermore, the POSITA was aware that cable and satellite television radio receivers could tune (e.g., 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. 1233 at 299; Ex. 1236, [0020]-[0021]; Ex. 1242, 4:10-36; Ex. 1244, 1:51-58.

58. 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 '206 patent, IF receivers, including low-IF receivers, were well-known in wireless communication systems for their high performance and low power consumption. Ex. 1225 at 270, 272; Ex. 1234 at 17, 65-74. It was also known to a POSITA, by the earliest claimed priority date of the '206 patent, that low-IF receivers were conventionally used for receiving RF signals from cable television networks and satellite television networks. Ex. 1235, 1:49-61; Ex. 1238, [0022]-[0023], [0029]-[0030], [0042].

59. IF receivers have been used for a long time, and their way of operating is very well known. Ex. 1225 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. 1215 at 4 (defining “baseband”). Intermediate frequency falls below the frequency of the RF signals but above the baseband frequency. Ex. 1234 at 22. Low-IF receivers initially downconvert to an IF that is at a relatively low frequency, such as a few hundred kilohertz. Ex. 1225 at 269.

8.3.1. Architecture of Low-IF receivers



Ex. 1225, Fig. 22(a) (annotated)

60. Low-IF receivers (illustrated by Figure 22(a) of Ex. 1225, 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. 1234 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. 1239 at 11; Ex. 1225 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. 1234 at 23.

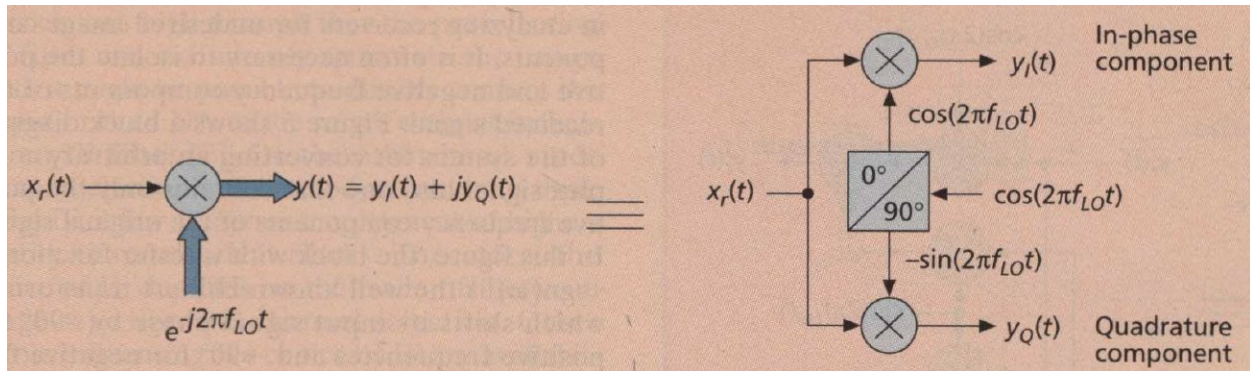
61. Still referring to Figure 22(a) of Ex. 1225 (reproduced and annotated above), in the front end of a low-IF receiver, the incoming RF signals are first amplified by a front-end low noise amplifier (LNA) (**green**) to provide enough gain to boost the received RF signal levels to an acceptable level 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. 1234 at 40-41; Ex. 1239 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. 1225 at 270, 272; Ex. 1234 at 23.

62. 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. 1234 at 65-72; Ex. 1239 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. 1218 at 133-134. For example, as explained in an article by Shahriar Mirabbasi and Ken Martin in IEEE Communications Magazine in November 2000:

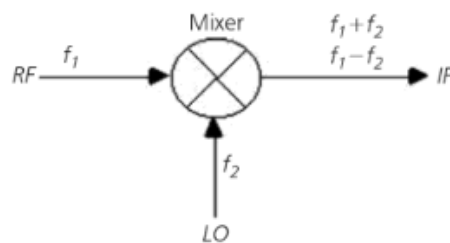
The realization of a multiplier for mixing a real signal with a complex exponential requires two real multipliers, as illustrated in Fig. 2. The real and imaginary parts of the mixer output are called the in-phase (I) and quadrature (Q) components of the downconverted signal (since cosine and sine are 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. 1218 at 134 (emphasis added).



Ex. 1218, Fig. 2

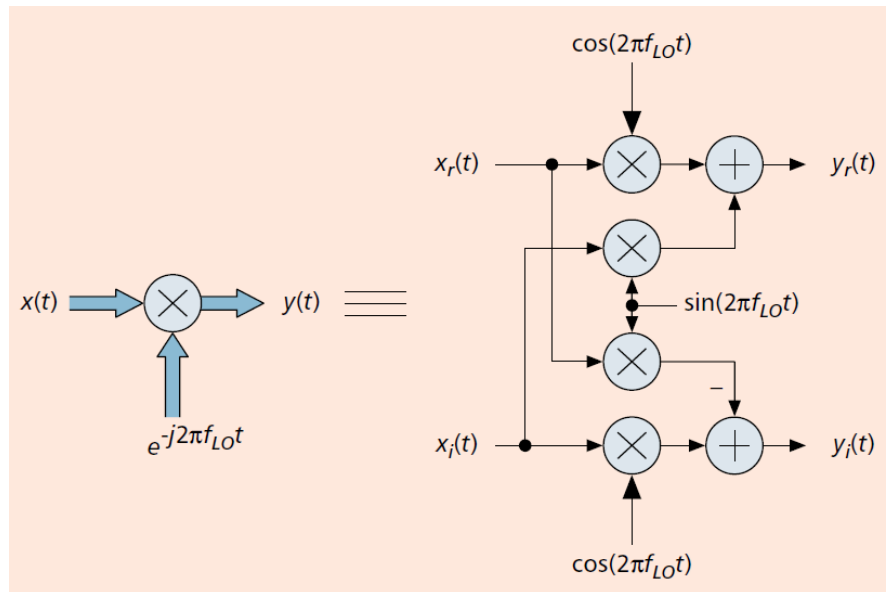
The term “mixer” and “multiplier” are often used interchangeably to refer to an analog or digital electrical circuit (represented by the symbol $\otimes$) that multiplies a modulated input signal (e.g., an RF signal) at frequency f_1 and a reference signal (e.g., from a local oscillator LO) at frequency 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. 1239 at 12-13. This is illustrated in Figure 8-9 from Ex. 1239.



Ex. 1239, Fig. 8-9 (page 12)

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

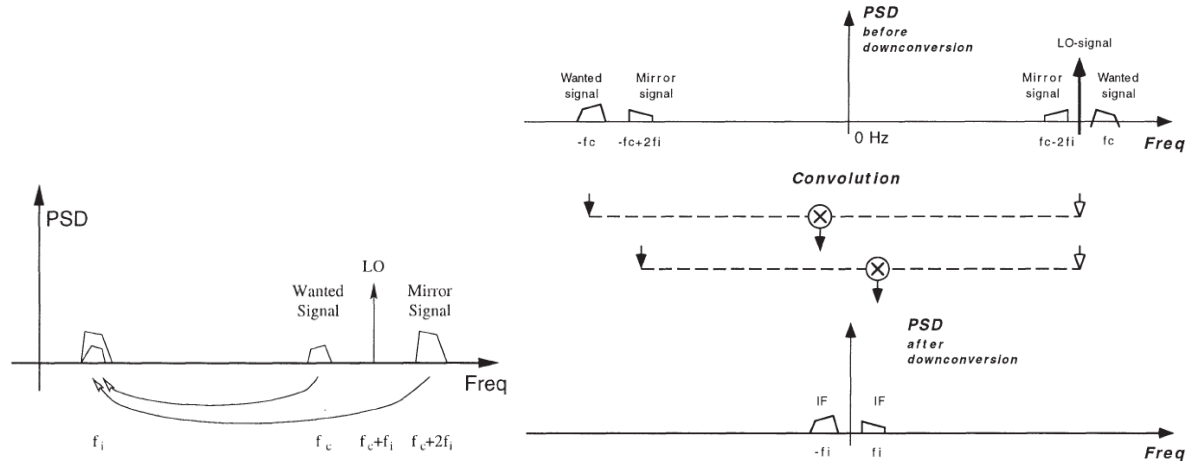
quadrature signals. Ex. 1218 at 133. A complex mixer/multiplier can include two real mixers/multipliers when the input signal is real and the reference signal is complex as shown in Figure 22(a) of Ex. 1225 above, or it can include four real mixers/multipliers if both the input signal and reference signal are complex as shown below. Ex. 1218 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. 1218, Fig. 3 (Partial Excerpt) (page 134)

Referring back to Figure 22(a) of Ex. 1225, the RF signals could also be downconverted using a single mixer and a sinusoidal signal (as shown by Figure 2.6 of Ex. 1234, reproduced below); however, the main disadvantage of mixing an RF signal of frequency f_c with just a single sinusoidal signal $\cos(2\pi f_i t)$ 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. 1234 at 24.



Ex. 1234, Fig. 2.6 (page 26)

Ex. 1234, Fig. 3.23 (page 67)

63. 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. 1234 at 28, 43; Ex. 1239 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+2f_i 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. 1234 at 23. Filters (pink) can be used after the first stage of downconversion to filter out unwanted mirror signals. *Id.* at 28; Ex. 1239 at 17.

64. 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. 1234 at 28; Ex. 1250 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. 1218 at 136; Ex. 1234 at 29; Ex. 1250 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 bonding between the different components of the RF receivers. Ex. 1218 at 136; Ex. 1234 at 29, 55-62; Ex. 1250 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. 1218 at 137-138; Ex. 1234 at 72. 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. 1218 at 138; Ex. 1234 at 29, 42, 55. However, such

mismatches are not an issue in the second digital downconversion step. Ex. 1218 at 137-138; Ex. 1234 at 74, 76.

65. Analog-to-digital converters (ADCs) (**gold**) were commonly used in RF receivers for either IF or baseband signal sampling. Ex. 1239 at 18. Therefore, referring again to Figure 22(a) of Ex. 1225 (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. 1234 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

66. RF receivers receive RF signals for multiple television channels from cable and satellite television networks. Ex. 1235, 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. 1233 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. 1241 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. 1235, 11:13-23, Fig. 7A; Ex. 1242, 6:5-8, Fig. 1B; Ex. 1243, 5:13-29, 5:46-53; Ex. 1250 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. 1241 at 14.

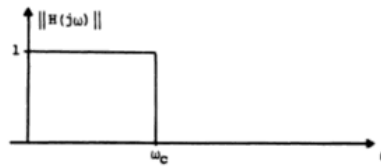


Fig. 1.23. Ideal LP filter magnitude frequency response.

Ex. 1241, Fig. 1.23 (page 14)

- 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. 1241 at 21.

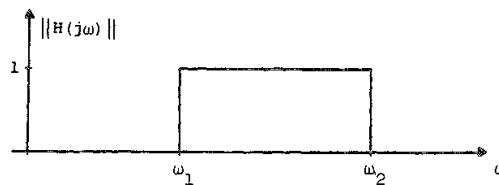


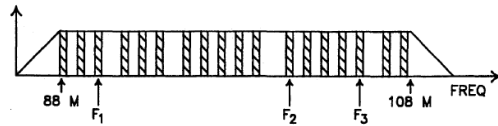
Fig. 1.27. Ideal BP filter.

Ex. 1241, Fig. 1.27 (page 21)

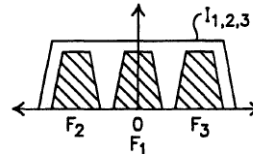
A bandpass filter allows signals within a selected frequency range (e.g., signals for a selected television channel) to be isolated from undesired signals from outside the range. Ex. 1243, 5:13-15; Ex. 1250 at 44. Signals for a desired television channel can also be isolated from signals of undesired 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. 1243, 5:46-50; Ex. 1250 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. 1250 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. 1241 at 24-63; Ex. 1243, 5:15-17; Ex. 1250 at 44.

67. 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. 1233 at 467; Ex. 1235, 4:37-43. For example, Khoini-Poorfard (Ex. 1235) 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. 1235, 4:37-43, 11:13-23, Fig. 7A.

8.3.3. Stacking of Desired Channels before Demodulation



Ex. 1244, Fig. 1



Ex. 1244, Fig. 6

68. Khoini-Poorfard (Ex. 1235) describes using two RF receivers that individually filter and demodulate two television channels. Ex. 1235, 4:37-43, 11:13-23, Fig. 7A. Kelly (Ex. 1244) describes an RF receiver that demodulates multiple desired channel bands without expensive hardware requirements and hardware duplications. Ex. 1244, 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. 1244 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. 1244 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

69. 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. 1245 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. 1233 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. 1233 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. 1234 at 104; Ex. 1245 at 70. Decimation is a well-known process that reduces the original sample rate of a signal to a lower rate. Ex. 1245 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. 1234 at 104; Ex. 1245, Fig. 3.57 (page 71); Ex. 1246, 2:51-57.

8.3.5. Demodulation of Multiple Channels

70. 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. 1219, 1:67-2:7, 2:32-35, 2:61-63, 3:50-52; Ex. 1244,

7:53:57. For example, Carson (Ex. 1219) describes a multichannel time-shared demodulator that demodulates the signals of multiple channels concurrently using time division multiple access (TDMA) techniques. Ex. 1219, 1:67-2:7, 2:32-35, 2:61-63, 3:50-52. Kelly (Ex. 1244) illustrates an RF receiver that demodulates two channels separately with two demodulators. Ex. 1244, 7:53-57. Another example is shown in Azenkot (Ex. 1275), 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. 1257, Abstract, 1:6-14, 6:14-22, 6:30-37; 7:15-20, 32:53-33:14. As another example, Shadwell (Ex. 1276) 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**). Kelly (Ex. 1244) illustrates an RF receiver that demodulates two channels separately with two demodulators. Ex. 1244, 7:53-57.

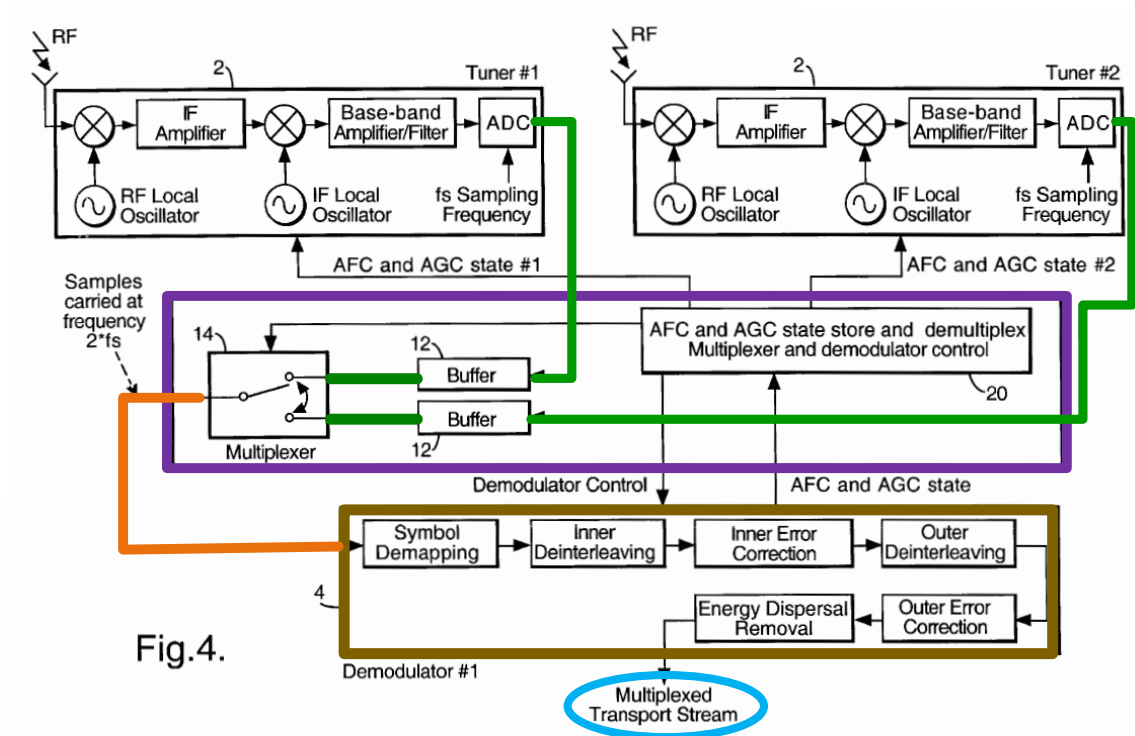


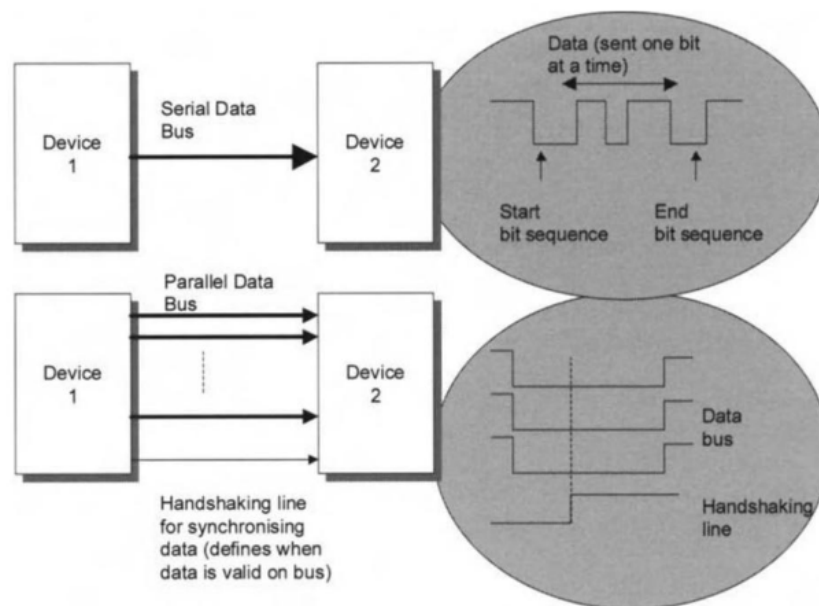
Fig.4.

Ex. 1276, Fig. 4 (annotated).

A POSITA would have been well aware that a single demodulator at the time, such as those disclosed in Carson, Azenkot, and Shadwell, or as disclosed in Pugel as further discussed below, were capable of demodulating multiple selected channels. Ex. 1276, 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. 1276, 2:13-26, 2:53-59.

8.4. Serial vs. Parallel Data Communication

71. 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 '206 patent. It was also known to the POSITA by the earliest claimed priority date (April 17, 2009) of the '206 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. 1234 at 23, 183; Ex. 1248 at 16. Data buses were known to pass data between electronic components. Ex. 1248 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. 1249, 1:10-28.



Ex. 1248, Fig. 2.3 (page 17)

72. 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. 1248 at 16. However, the parallel bus structure requires a larger number of conductors and more space on the chip. Ex. 1249, 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.*

73. Therefore, it was well known before the claimed priority date of the ’206 patent to use technologies such as those described above in 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. International Pub. No. 2007/145637 – Pugel (Ex. 1224)

74. International Pub. No. 2007/145637 (“Pugel”) (Ex. 1224) is a PCT Application Published December 21, 2007. As the publication date is more than a year prior to the earliest filing date of the ’206 patent, I understand that Pugel is prior

art under pre-AIA 35 U.S.C. § 102(b). I also understand that Pugel was not considered during the prosecution of the '206 patent. Ex. 1201, cover.

75. Pugel describes a “digital television receiver capable of simultaneously receiving a plurality of channels ... suitable for use with conventional cable television delivery systems.” Ex. 1224, [0008]. Pugel’s Figure 1 shows a multichannel receiver circuit 100 annotated with colors referenced in the description below. Ex. 1224, [0022]-[0028], Fig. 1.

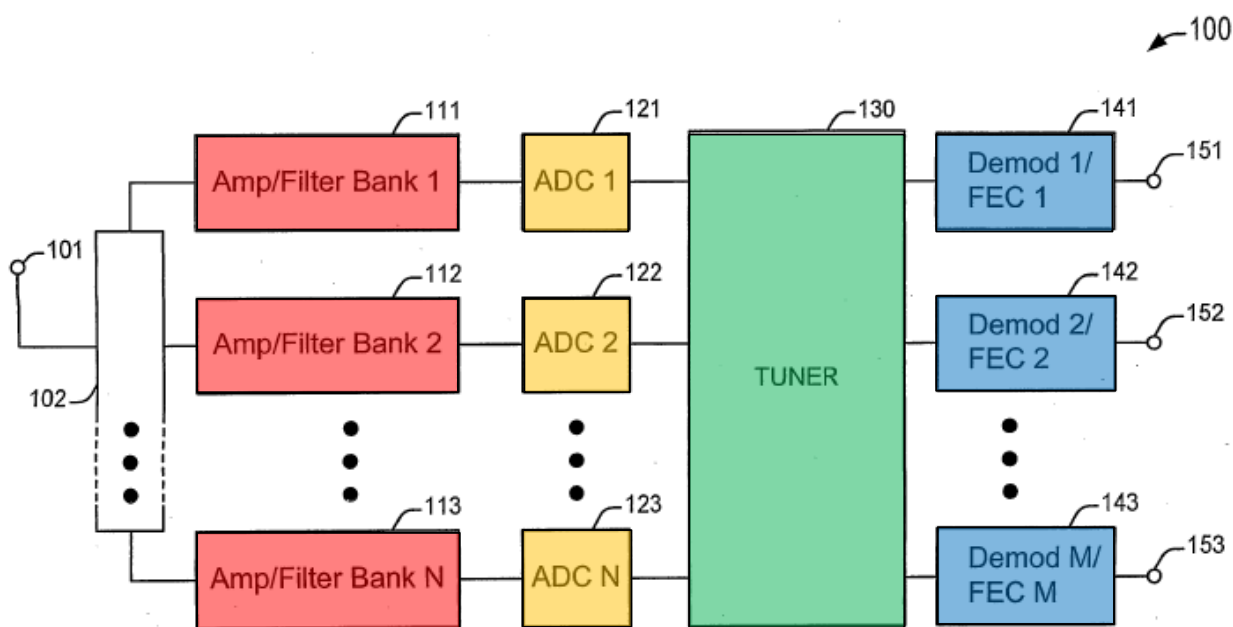


FIG. 1

Ex. 1224, Fig. 1 (annotated)

76. The receiver circuit 100 receives a multichannel analog RF input signal, such as a signal used in a conventional cable television delivery system, received at

input coupler 101. Ex. 1224, [0008], [0024]. That signal is wideband, as it may comprise multiple channels. Ex. 1224, [0009], [0020]-[0023]. The signal can be optionally split. Ex. 1224, [0024]-[0025]. The receiver circuit comprises “a plurality of amplifier-filter banks or circuits 111, 112, 113, a plurality of analog-to-digital converters 121, 122, 123, a digital tuner 130, and a plurality of demodulator circuits 141, 142, 143.” Ex. 1224, [0023].

77. The amplifier-filter banks 111-113 (**red**) that “segregates the multichannel analog input signal into a plurality of separate analog signals of differing frequency ranges.” Ex. 1224, [0024], [0028]-[0032], [0043]. The plurality of separate signals are undersampled, such that the sampling frequency range of any downstream analog-to-digital converters (ADCs) is reduced. Ex. 1224, [0033]-[0034]. Undersampling, as described in Pugel, is more economical because it reduces the need to supply ADCs supporting high-frequency sampling. Ex. 1224, [0034].

78. The undersampled signals are then converted to digital form in analog-to-digital converters 121-123 (**gold**) “sufficient for satisfactorily processing digital television signals and associated signals intended for end users in a conventional cable television broadcast system.” Ex. 1224, [0036], [0033]-[0037], [0044]-[0045]. The digital signals are received by a digital tuner (**green**) such that “a selected set of digital cable television channels” may be demultiplexed from the digital signals. Ex.

1224, [0038], [0037]-[0039], [0045]. Those demultiplexed channels may then be outputted to one or more demodulator circuits 141-143 (blue), which may perform a variety of demodulation techniques, including quadrature amplitude modulation (QAM) demodulation or quadrature phase shift keying (QPSK) demodulation. Ex. 1224, [0039]-[0040], [0046].

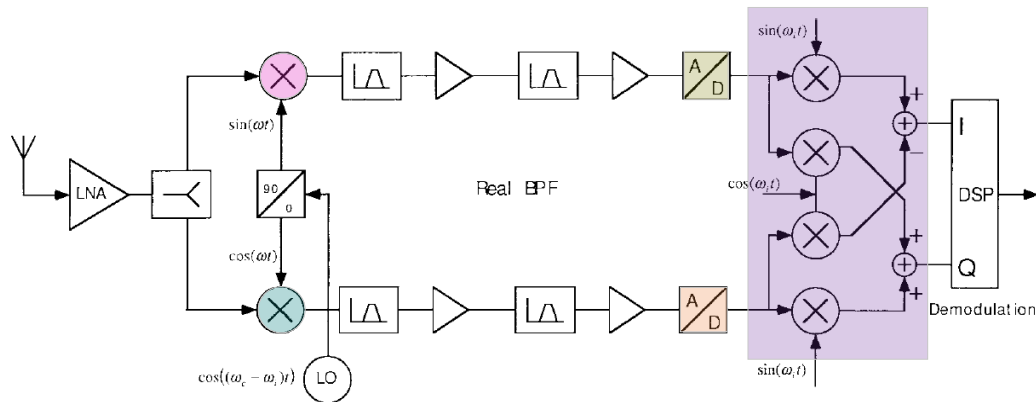
79. It is my opinion that Pugel is in the same field of endeavor as the '206 patent and thus is analogous art. For example, the '206 patent “relates to wideband receiver systems and methods having a wideband receiver that is capable of receiving multiple radio frequency channels located in a broad radio frequency spectrum.” Ex. 1201, 1:27-30. Similarly, Pugel relates to a “multi-channel receiver circuit” that “receive[s] a multichannel analog RF input signal.” Ex. 1224, [0009], [0011], [0022]-[0023], Fig. 1. It is also my opinion that Pugel is also reasonably pertinent to problems with which the '206 patent is concerned, and is also analogous art on that basis. For example, the '206 patent describes that “[i]n certain applications such as DVR and picture-in-picture, the receiver system may have to concurrently receive several desired channels” and “[a]n embodiment of the present invention includes a wideband receiver system that is configured to concurrently receive multiple radio frequency (RF) channels including a number of desired channels.” Ex. 1201, 1:49-51, 2:45:48. Pugel similarly describes that “consumers now demand support for simultaneous reception and display of multiple television

channels on a single television screen (e.g., picture-in-picture (PiP)) ... [and] the emergence of personal video recorder (PVR) technology increases the demand for multi-channel reception capability,” therefore, discloses “a digital television receiver capable of simultaneously receiving a plurality of channels” Ex. 1224, [0005], [0008].

8.6. Crols (Ex. 1225)

80. Crols (Ex. 1225) is a Non-Patent Literature published in March 1998. Crols was publicly available as of April 3, 1998. Ex. 1273, 44-50, 52. Thus, I understand Crols is prior art under pre-AIA 35 U.S.C. 102(b). I also understand that Crols was not considered during the prosecution of the '206 patent. Ex. 1201, cover.

81. Crols describes various topologies for implementing intermediate frequency (IF) receivers in a telecommunication environment and, in particular, a type of receiver known as a low-IF receiver (illustrated by Figure 22(a) of Ex. 1225 reproduced below). Ex. 1225 at 269, 272. Crols discusses that IF Receivers may create unwanted signals (e.g., a mirror frequency) during downconversion of analog RF signals and discusses techniques to avoid the unwanted signals. Ex. 1225 at 270, 273-274.



Ex. 1225, Fig. 22(a) (annotated)

82. Crols discusses how low-IF receivers can avoid the mirror frequency problem during the downconversion of analog RF signals to IF by downconverting the signals once with a first mixer (**fuchsia**) using a sine signal as input to generate Q components and again with a second mixer (**teal**) using a cosine signal as an input to generate I components. Ex. 1225 at 271, 281. The I and Q components have a phase shift of 90° between them. Ex. 1225 at 277. The I and Q components are then digitized separately by two analog-to-digital converters (**olive** and **orange**). Ex. 1225 at 280-281. The digitized I and Q components can be further downconverted to baseband frequency by a complex mixing circuit (**purple**) with four mixers and two adders before forwarding the components to the digital signal processor (DSP) for demodulation. Ex. 1225 at 280-281.

83. It is my opinion that Crols is reasonably pertinent to problems with which the '206 patent is concerned, and is analogous art to the '206 patent on at least that basis. For example, the '206 patent indicates a circuit wherein an RF signal is

amplified, and the downconverted I and Q signals are generated, prior to digitization by an ADC. Ex. 1201, 4:35-6:15, Fig. 2.

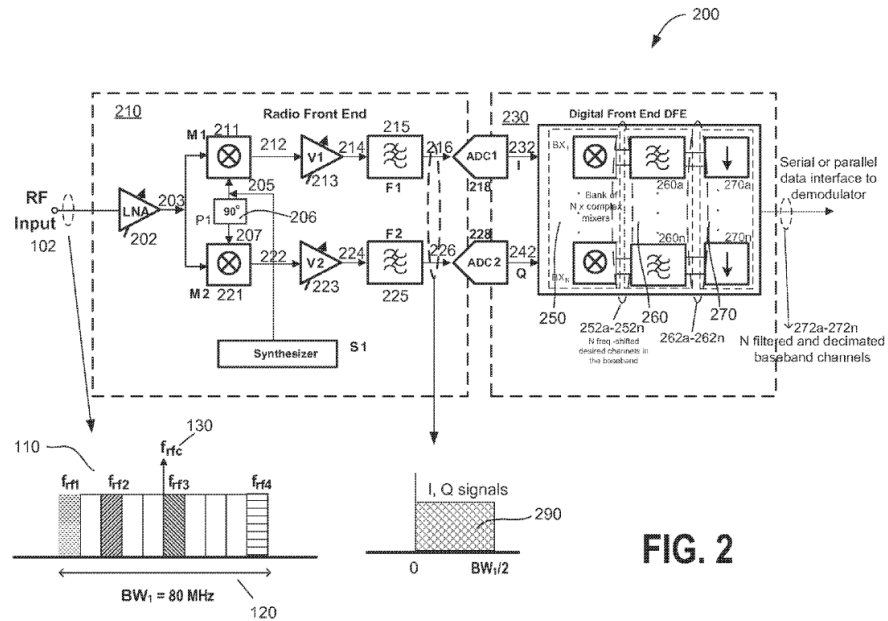


FIG. 2

Ex. 1201, Fig. 2

84. Similarly, Crols presents circuit diagrams depicting complex bandpass filters consistent with the '206 patent's analog circuit topologies:

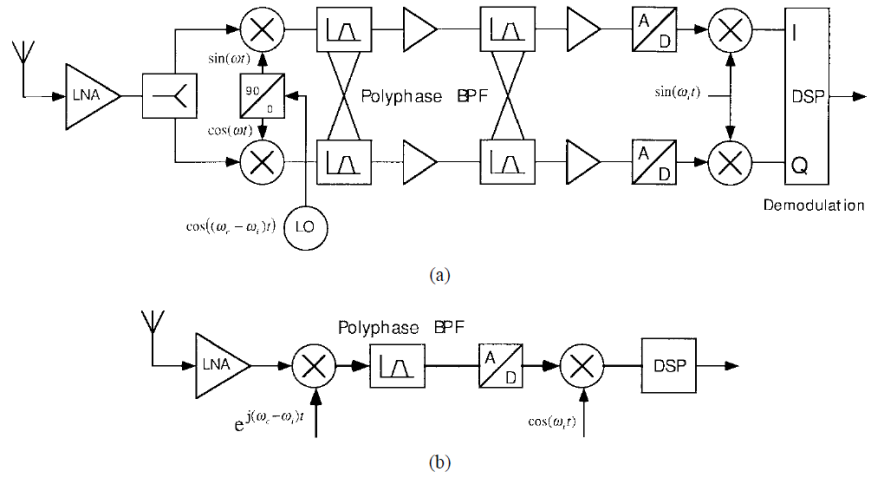


Fig. 21. The topology of a low-IF receiver which uses a complex bandpass filter in the LF part. (a) Full notation and (b) compact notation.

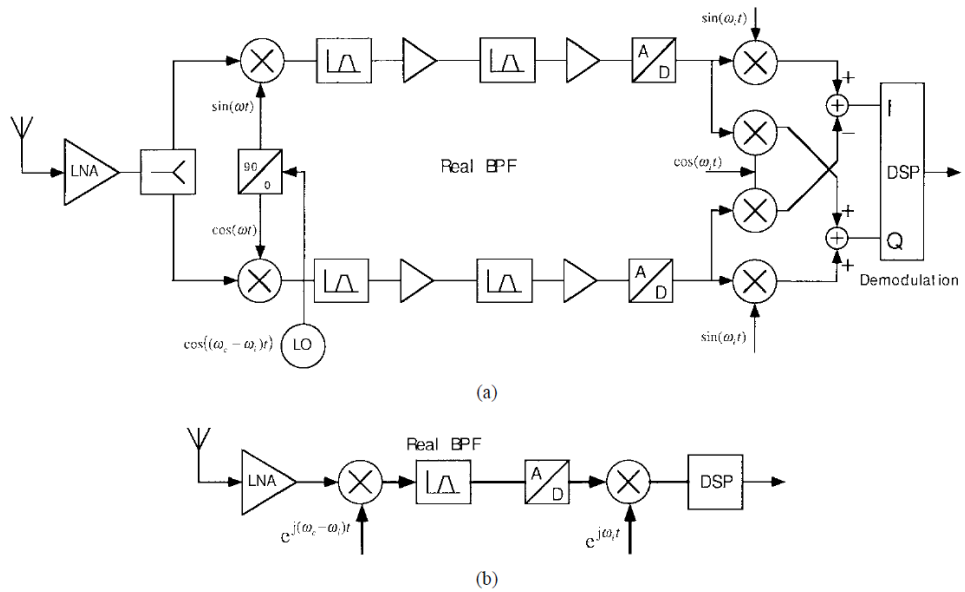


Fig. 22. The topology of a low-IF receiver which uses real filters in the LF part. (a) Full notation and (b) compact notation.

Ex. 1225, Figs. 21-22

Both techniques show ways to suppress unwanted signals as part of downconversion to IF prior to digital processing, providing example implementations for a POSITA looking to build systems in real-world applications. Ex. 1225 at 279-280; Ex. 1201, 4:11-5:32.

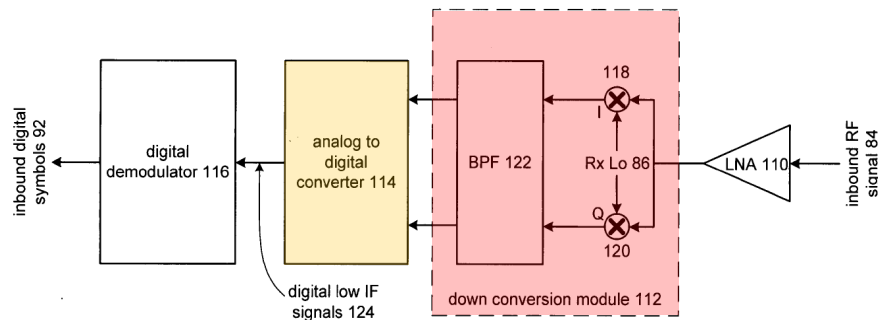
8.7. Chandrakasan (Ex. 1217)

85. Chandrakasan (Ex. 1217) is a Non-Patent Literature published in 1996. Chandrakasan was publicly available as of April 3, 1998. Ex. 1273, 35-39, 52. Thus, it is my understanding that Chandrakasan is a prior art under pre-AIA 35 U.S.C. 102(b). Chandrakasan was not considered during the prosecution of the '206 patent. Ex. 1201, cover. Chandrakasan describes the trade-offs between selecting serial time-multiplex architecture and parallel architecture to implement digital signal processing functions. Ex. 1217 at 354-356. Parallel architectures comprise “one to one correspondence between the operations on the signal flow graph” and “require[] a small or no controller.” Ex. 1217 at 354-355. However, when there is a constraint in the circuit area, serial time-multiplexed architectures may be preferred where “multiple operations on a signal flowgraph can be mapped onto the same functional hardware unit.” Ex. 1217 at 355.

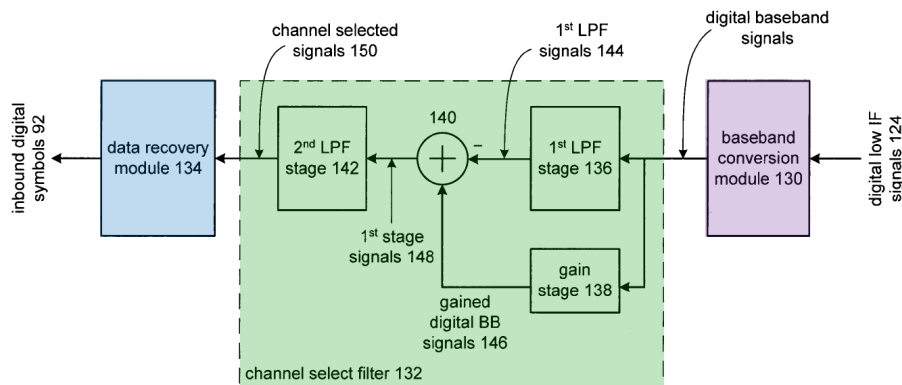
86. Chandrakasan is reasonably pertinent to problems with which the '206 patent is concerned, and is analogous art to the '206 patent on at least that basis. Both techniques represent well-known approaches to signal transmissions in digital systems, providing example implementations for a POSITA looking to build systems in real-world applications. Ex. 1217 at 352; Ex. 1201, 7:10-19.

8.8. U.S. Publication No. 2006/0029170 – Jensen '170 (Ex. 1230)

87. Jensen '170 (U.S. Pub. No. 2006/0029170, Ex. 1230) is a U.S. Published Application published on February 9, 2006. Thus, I understand that Jensen '170 is prior art under pre-AIA 35 U.S.C. 102(b). It is my understanding that Jensen '170 was not considered during the prosecution of the '206 patent. Ex. 1201, cover.



Ex. 1230, Fig. 8 (annotated)

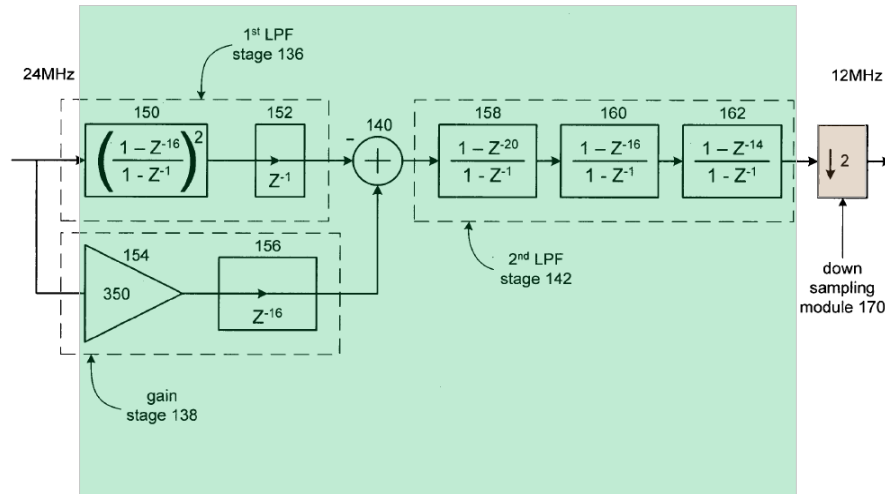


Ex. 1230, Fig. 9 (annotated)

88. Jensen '170 describes a radio receiver (illustrated in Jensen '170 Figures 8 and 9 reproduced above annotated with colors referenced in the discussion below) that comprises a down-conversion module 112 (**red**), an analog to digital converter 114 (**gold**), a baseband conversion module 130 (**purple**), a channel select

filter 132 (**green**), and a data recovery module 134 (**blue**). Ex. 1230, [0060]-[0068].

The down-conversion module 112 includes mixers 118 and 120 that mix the inbound RF signals 84 with in-phase (I) and quadrature (Q) components of a receiver local oscillator to produce in-phase intermediate frequency (IF) mixed signals and quadrature IF mixed signals. Ex. 1230, [0060]-[0061]. The analog to digital converter 114 converts the in-phase IF mixed signals and quadrature IF mixed signals to digital IF signals 124. Ex. 1230, [0062]. The baseband conversion module 130 converts the digital IF signals 124 into digital baseband signals. Ex. 1230, [0065]. The channel-select filter 132 includes a first low pass filter stage 136, a gain stage 138, a subtraction module 140, and a second low pass filter stage 142, which in combination (**green**) filters channel-selected signals 150 from the digital baseband signals. Ex. 1230, [0008]-[0009], [0017], [0060], [0064]-[0068]. The first low pass filter stage 136 and the second low pass filter stage 138 are implemented with finite impulse filters. Ex. 1230, [0010], [0071]-[0073]. The data recovery module 134 converts the channel-selected signals 150 into inbound digital symbols 92. Ex. 1230, [0068].



Ex. 1230, Fig. 15 (annotated)

89. Jensen '170 further describes that the channel select filter 132 may further include a down-sampling module 170 (**brown**), which reduces the sampling rate of the signals of the selected channel to produce down-sampled signals for the data recovery module 134 of the RF receiver. Ex. 1230, [0074]-[0075].

90. It is my opinion that Jensen '170 is reasonably pertinent to problems with which the '206 patent is concerned (as well as to problems with which Pugel is concerned), and is analogous art to the '206 patent (and to Pugel) on that basis. For example, similar to Jensen '170, the '206 patent describes a receiver that generates downconverted I and Q components of a received RF signal in the analog domain, digitizes those signals, downconverts the digital signals to baseband, filters out desired digital signals, and then decimates the desired digital signals. Ex. 1201, 4:35-7:14, Figs. 2-3; Ex. 1230, [0060]-[0068], [0074]-[0075], Figs. 8, 9. Jensen '170 and the '206 patents both describe using channel select filters to filter out desired

digital signals and implementing the channel select filters based on the digital architectures of FIR filters. Ex. 1201, 7:4-9, 8:2-5; Ex. 1230, [0010], [0064]-[0066], [0071]-[0073].

8.9. U.S. Publication No. 2008/0120667 – Zaltsman (Ex. 1274)

91. Zaltsman (U.S. Publication No. 2008/0120667, Ex. 1274) is a U.S. Patent Application Publication published May 22, 2008. As the publication date is more than a year prior to the earliest priority date of the '206 patent claims against which it is asserted herein, it is my understanding that Zaltsman is prior art under pre-AIA 35 U.S.C. § 102(b). Further, in view of its October 29, 2007, priority date, Zaltsman is prior art under pre-AIA 35 U.S.C. § 102(e) as to all claims. It is my understanding that Zaltsman was not considered during the prosecution of the '206 patent. Ex. 1201, cover.

92. Zaltsman discloses a cable gateway system and architecture incorporating a hybrid digital video transceiver. Ex. 1274, Abstract, [0003]-[0023]. Zaltsman provides a detailed background section discussing known technology as of 2007, particularly regarding the use of digital television standards, including DOCSIS in wideband television transmission to a set-top receiver. Ex. 1274, [0003]-[0023]. In particular, Zaltsman states that, in the latest DOCSIS standard of the day, multiple television channels were bonded together, typically using a 6 MHz frequency band. Ex. 1274, [0012]-[0013].

93. It is my opinion that Zaltsman is reasonably pertinent to problems with which the '206 patent is concerned, and is analogous art to the '206 patent on at least that basis. Zaltsman describes cable systems for transmitting digital data signals using RF signals and QAM, similar to the '206 patent, and a POSITA would turn to Zaltsman when looking for technical details known in the art for such systems. Ex. 1274, Abstract, [0003]-[0023]; Ex. 1201, 1:27-57, 2:45-3:67, 8:54-9:8.

9. OPINIONS WITH RESPECT TO THE '206 PATENT

9.1. Ground A0 and A1: Pugel

94. In the following, I provide an element-by-element analysis showing how Pugel alone anticipates (ground A0) and renders obvious (ground A1) claims 25, 26, 31, 35, 37, 51, 52, 57, 61, and 63. 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 25

95. Elements [25A]-[25E] are anticipated (ground A0) and rendered obvious (ground A1) by Pugel.

a. [25A] “A method for receiving a television (TV) signal comprising:”

96. To the extent the preamble is limiting, it is my opinion that Pugel discloses “[a] method for receiving a television (TV) signal comprising:” as claimed.

97. 111. Pugel discloses a multichannel receiver circuit that is capable of “simultaneous reception of a plurality of digital television channels” and “recover ... a wide variety of digital content,” such that devices such as “television receivers, PVR’s, or other devices” may receive those recovered digital content. Ex. 1224, [0001]-[0013], [0048]-[0049].

98. Thus, it is my opinion that Pugel discloses Element [25A].

b. [25B] “receiving an input signal from a cable network;”

99. It is my opinion that Pugel discloses “receiving an input signal from a cable network,” as claimed.

100. Pugel discloses a “method ... for simultaneous reception of a plurality of digital RF channels” with a multichannel receiver circuit “designed for delivery of a variety of digital content” and “suitable for use with conventional cable delivery systems and at a reasonable cost.” Ex. 1224, Abstract, [0008]. Pugel’s multichannel receiver circuit comprises an input coupler 101 (**green**), via which the multichannel receiver circuit receives a multichannel analog RF input signal from conventional cable delivery systems. Ex. 1224, Abstract, [0008]-[0013], [0022], [0048].

101. Pugel's multichannel receiver circuit also comprises a splitter 102 that connects the input coupler 101 to a plurality of amplifier-filter circuits (**red**), which in turn connect to a plurality of ADCs (**gold**). Ex. 1224, [0025]-[0026], [0029]-[0031], [0042]-[0044], Figs. 1-2. The contents of Pugel's Amp/Filter Bank in Figure 1 are shown in Pugel's Figure 2. The amplifier-filter circuits comprise at least one analog amplifier (e.g., amplifier 201) and analog filter (e.g., bandpass filter 202). Ex. 1224, [0029]-[0031], Fig. 2. The multichannel analog RF input signal received by the input coupler 101 is passed to the plurality of amplifier-filter circuits 111, 112, 113. Ex. 1224, [0025]-[0026], [0029]-[0031], [0042]-[0044].

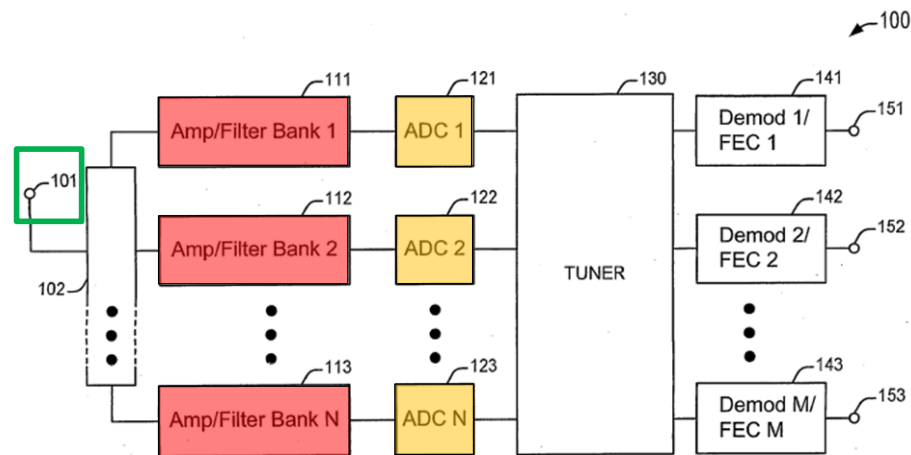


FIG. 1

Ex. 1224, Fig. 1 (annotated)

102. As such, it is my opinion that Pugel discloses Element [25B].

- c. [25C] **“digitizing a contiguous band of frequencies in the input signal via a wideband analog-to-digital converter (ADC), wherein the contiguous band of frequencies comprises all received channels that exist in the input signal and the received channels comprise a plurality of desired channels and a plurality of undesired channels;”**

103. It is my opinion that Pugel discloses “digitizing a contiguous band of frequencies in the input signal via a wideband analog-to-digital converter (ADC), wherein the contiguous band of frequencies comprises all received channels that exist in the input signal and the received channels comprise a plurality of desired channels and a plurality of undesired channels,” as claimed.

104. As discussed in Section 9.1.1.a, Pugel discloses a multichannel receiver circuit that is capable of “simultaneous reception of a plurality of digital television channels” via a multichannel analog RF input signal. Ex. 1224, [0008]-[0013], [0023]-[0024], [0028]. The digital tuner 130 in Pugel’s multichannel receiver circuit includes a channel selector 315 that permits users to select one or more digital television channels “desired to be recovered” by the users, and the digital tuner 130 demultiplexes only the of the selected digital television channels. Ex. 1224, Abstract, [0001], [0008]-[0009], [0011], [0022], [0028], [0036]-[0044], [0048]-[0049]. I would understand that the selected digital television channels are “desired” by the users. Additionally, I would also understand that the example multichannel analog RF input signal described in Pugel (ranging from about 5 MHz to about 900 MHz, the claimed “contiguous band of frequencies in an input signal”) includes more

digital television channels than those selected by the users, and these other channels can be understood as “undesired” digital channels that are present in the multichannel analog RF input signal but not selected by the users. *See* Section 8.1, *supra* (citing Ex. 1233 at 27, 852, 985-990). My understanding of “desired” and “undesired” digital television channels in Pugel is consistent with the use of “desired” and “undesired” in the ’206 patent. Ex. 1201, Abstract, 1:41-46, 3:25-56, 4:38-53, 5:61-65, 6:3-15, 6:52-63, 7:10-19.

105. Pugel’s receiver circuit includes analog-to-digital converters (ADCs) 121, 122, 123 (the claimed “wideband ...ADC”, **gold**) “sufficient for satisfactorily processing digital television signals and associated signals intended for end users in a conventional cable television broadcast system.” Ex. 1224, [0036], [0033]-[0037], [0044]-[0045], Fig. 1.

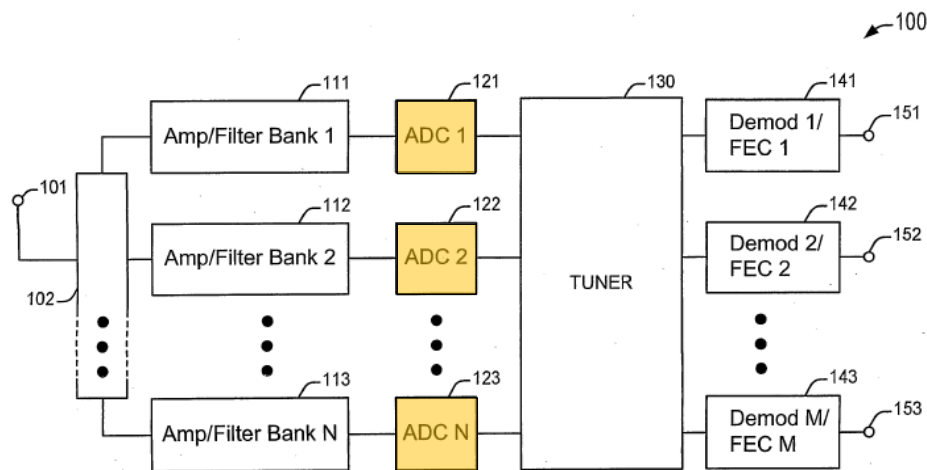


FIG. 1

Ex. 1224, Fig. 1 (annotated)

106. Pugel describes receiving a multichannel analog RF input signal and splitting the multichannel analog RF input signal into multiple analog bands by using the amplifier-filter circuits 111, 112, 113. Ex. 1224, Abstract, [0001], [0008]-[0009], [0011], [0022], [0028], [0036]-[0044], [0048]-[0049]. The bands correspond to the claimed “all received television channels,” including “desired” and “undesired” television channels. Ex. 1224, Abstract, [0001], [0008]-[0009], [0011], [0022], [0028], [0036]-[0044], [0048]-[0049]. As an example, Pugel discusses receiving a multichannel analog RF input signal ranging from about 5 MHz to about 900 MHz, and splitting the multichannel analog RF input signal into three analog bands (the first analog band ranging from 5 to 300 MHz, the second analog band ranging from 300 to 600 MHz, and the third analog band ranging from 600 to 900 MHz). Ex. 1224, [0024]-[0026], [0028], [0034]. Each of the analog bands is then outputted to a different ADC for converting the analog band of analog signals to a digital band of digital signals, and each ADC may comprise a frequency selector “for setting the sampling frequency and/or input frequency corresponding to the desired band.” Ex. 1224, [0035], [0024], [0034].

107. As I explain in Section 6, the ’206 patent implicitly defines “wideband” as a band that carries multiple channels, and this definition of “wideband” is consistent with the ordinary and customary meaning of “wideband.” Ex. 1201, 1:36-39. If each television channels are allocated 6 MHz of frequency bandwidth in the

RF frequency spectrum, it is my opinion that a POSITA would consider the three analog bands produced by Pugel's amplifier-filter circuits 111, 112, 113 to also be wideband as they also comprise signals of multiple cable televisions, and that each analog band may comprise a combination of desired and undesired television channels or all undesired television channels.

108. It is my opinion that a POSITA would consider each of Pugel's ADCs as a "wideband" ADC as it is digitizing a wideband signal (e.g., an analog band that has a width of a 300MHz band and comprises multiple channels). *Compare* Ex. 1224, [0035]-[0036] *with* Ex. 1201, 1:36-39. Pugel discloses that the bands of frequencies may be contiguous or non-contiguous. Ex. 1224, [0043]. Pugel's ADCs are structurally equivalent to, and perform the same function as, the structure described by the '206 patent for performing the function recited in the Element [25C] (e.g., ADC1 218 and ADC2 228). Ex. 1201, 5:48-51.

109. Thus, it is my opinion that Pugel discloses Element [25C].

d. [25D] "concurrently selecting each of the plurality of desired channels from the input signal without selecting any of the plurality of undesired channels; and"

110. It is my opinion that Pugel discloses "concurrently selecting each of the plurality of desired channels from the input signal without selecting any of the plurality of undesired channels," as claimed.

111. Pugel's receiver circuit comprises a digital tuner 130 configured to concurrently select a plurality of desired television channels from the digital bands that were outputted by the ADCs 121, 122, 123 such that "a selected set of digital cable television channels" may be demultiplexed from the digital signals. Ex. 1224, [0038], [0037]-[0039], [0045], Fig. 1. The digital tuner 130 in Pugel's multichannel receiver circuit includes a channel selector 315 that permits users to select one or more digital television channels "desired to be recovered" by the users, and the digital tuner 130 demultiplexes only the of the selected digital television channels and does not allow unselected digital television channels to be outputted. Ex. 1224, Abstract, [0001], [0008]-[0009], [0011], [0022], [0028], [0036]-[0044], [0048]-[0049]. The digital tuner 130 may include digital multiplexers, demultiplexers, or "a multitude of components configured as is well known in the art to recover a plurality of digital channel signals substantially simultaneously using a plurality of separate digital processors or a single digital processor." Ex. 1224, [0037].

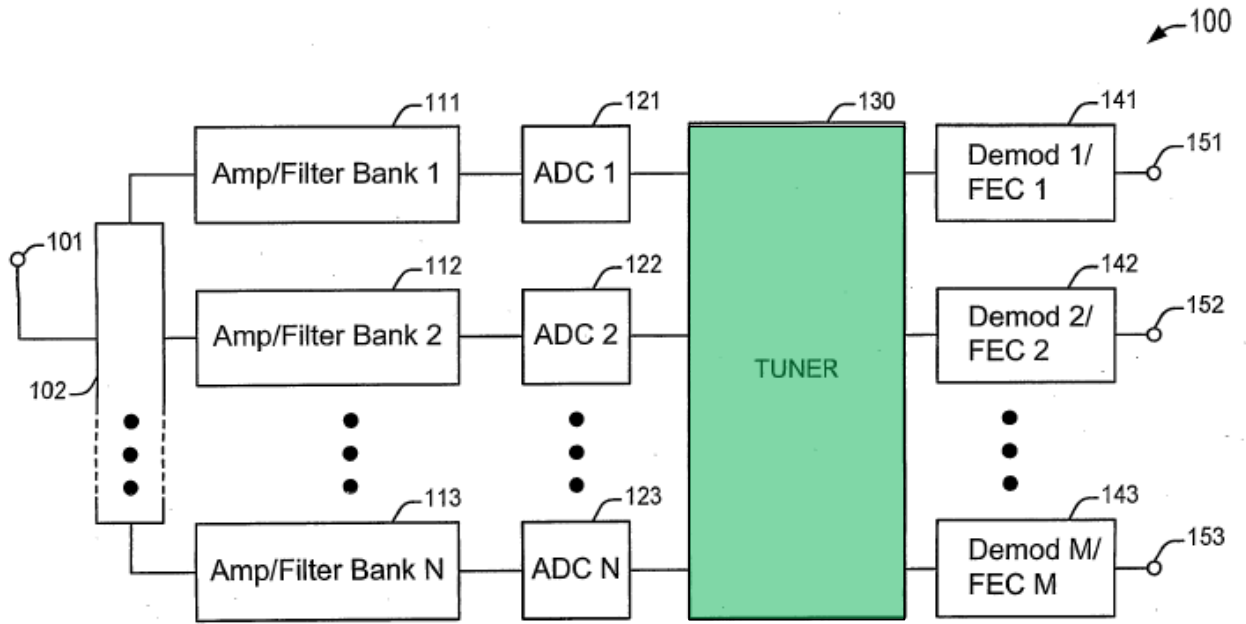


FIG. 1

Ex. 1224, Fig. 1 (annotated)

112. For example, Pugel discloses that the digital tuner may concurrently select and only demultiplex digital channels corresponding to certain pay-per-view selections, or may demultiplex all channels. Ex. 1224, [0038]. In such an example, the selected digital channels are the claimed “desired television channels,” and the channels that are not selected are “undesired channels.” The digital tuner may perform a variety of other functions, including “coding, decoding, scrambling, descrambling, rotating, and/or derotating operations prior to passing the digital channel signals to demodulation circuits.” Ex. 1224, [0039].

113. Thus, it is my opinion that Pugel discloses Element [25D].

e. [25E] “providing the plurality of desired channels.”

114. It is my opinion that Pugel discloses “providing the plurality of desired channels,” as claimed.

115. As I explained in Section 9.1.1.d, Pugel’s digital tuner 130 is configured to concurrently select a plurality of desired television channels from the plurality of frequencies that the ADCs digitized and provide them to demodulators 141, 142, 143 (blue). Ex. 1224, [0037]-[0039], [0045], Fig. 1. Pugel’s teaching, for example, that the digital tuner 130 “may perform coding, decoding, scrambling, descrambling, rotating, and/or derotating operations prior to passing the digital channel signals to demodulation circuits 141, 142, 143” thus discloses “providing the plurality of desired channels.” *Id.*, [0039].

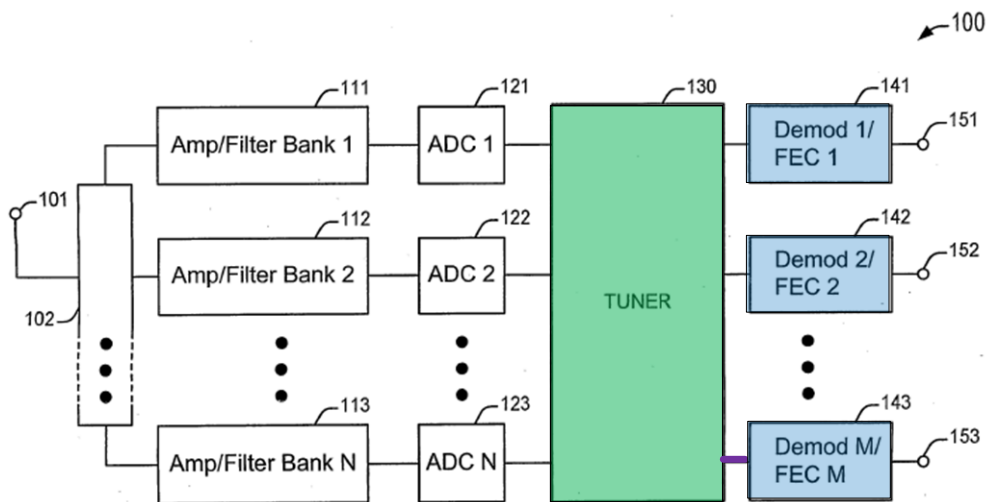


FIG. 1

Ex. 1224, Fig. 1 (annotated)

116. Pugel discloses that each demodulator can receive and demodulate one of the selected desired channels outputted by the digital tuner 130. Ex. 1224, [0010] (“the plurality of demodulator circuits including at least a first demodulator circuit configured to receive and demodulate a first channel of the plurality of digital RF channels and a second demodulator circuit being configured to receive and demodulate a second channel of the plurality of digital RF channels”), [0046] (“In step 406, the first digital RF channel signal is demodulated and forward-error-corrected. In step 407, the second digital RF channel signal is demodulated and forward-error-corrected. Steps 406 and 407 may be accomplished using demodulation circuits 141, 142, 143.”). Thus, Pugel’s digital tuner outputs multiple desired digital television channels where each demodulator can demodulate one of the desired digital television channels.

117. Thus, it is my opinion that Pugel discloses Element [25E].

f. [25F] “wherein the method is performed by a device comprising a digital video recorder (DVR).”

118. It is my opinion that Pugel discloses “wherein the method is performed by a device comprising a digital video recorder (DVR),” as claimed.

119. Pugel discloses that its system may comprise “a PVR device” for receiving digital video signals. Ex. 1224, [0048]-[0049]. A POSITA would have understood that “PVR” stands for “personal video recorder,” which is an alternate

name for “DVR” or “digital video recorder,” which is a device for recording audio and video content, for example, received by a set-top box. Ex. 1251, [0018] (“A PVR is also referred to as [] digital video recorder (DVR)”); Ex. 1252, [0048], [0060] (“Digital Video Recorders (DVRs, also known as Personal Video Recorders, PVRs)”). Thus, Pugel discloses the method of claim 25 is performed by a device comprising a DVR.

120. To any extent it is asserted that Pugel does not explicitly disclose that Pugel’s multichannel receiver circuit may be located in a device that also comprises a DVR, or that Pugel’s multichannel receiver circuit may be located in a DVR, it is my opinion that it was well-known to a POSITA before the earliest priority date of the ’206 patent that consumer terminal equipment (e.g., television receivers, set-top boxes, digital video recorders, personal video recorders, and other terminal equipment) included receivers or receiver circuits that received RF signals of multiple cable television channel and selected signals for certain desired cable television channels for output. *See* Sections 8.1, 8.2, 8.3, *supra*. Therefore, it is my opinion that it would have been obvious to a POSITA to co-locate the Pugel’s multichannel receiver circuit and a DVR into the same device, such as a set-top box, as it would allow for a more feature-filled device and would be more cost-efficient. *See id.* Incorporating Pugel’s multichannel receiver circuit and a DVR into the same device (e.g., set-top box) would be nothing more than applying a known technique

(placing an RF receiver and a DVR together) to a known device (a set-top box) ready for improvement to yield predictable results (a single device with DVR and multichannel tuning functionality, as taught by Pugel). A POSITA would have a reasonable expectation of success, as Pugel expressly discloses co-locating both elements into a single device, which would have been well within the skill of a POSITA.

121. It is also my opinion that it would also be obvious to a POSITA that Pugel's multichannel receiver circuit may be a part of a DVR. For example, Pugel provides an express teaching that "[m]any PVR's include the ability to tune one or more channels for viewing, while simultaneously tuning one or more additional channels for recording to a recording medium." Ex. 1224, [0005]. It would have been obvious to a POSITA that a DVR for tuning and recording multiple channels, as taught by Pugel, could be implemented using the multichannel receiver circuit, including a tuner as also taught by Pugel. Nothing in Pugel forecloses that a DVR and receiver circuit could be co-located. And co-locating the bundled receiver circuit/DVR device would still be consistent with Pugel's other teachings, as the device could then send additional tuned signals to other devices (e.g., receivers or other DVRs) throughout the home. *See* Ex. 1224, [0049]. This may have the benefit of being more cost-efficient for the consumer, as the consumer could buy a bundled receiver circuit/DVR device to start, and they may purchase further devices in their

home compatible with the receiver circuit later. This would be nothing more than applying a known technique (incorporating an RF receiver circuit into a PVR, as taught by Pugel) to a known device (Pugel's PVR) ready for improvement to yield predictable results (a single device with DVR and multichannel tuning functionality, as taught by Pugel). A POSITA would have a reasonable expectation of success, as Pugel expressly discloses DVRs incorporating RF receivers and co-locating both elements into a single device, which would have been well within the skill of a POSITA.

122. Thus, it is my opinion that Pugel discloses Element [25F].

9.1.2. Independent Claim 51

123. The elements of claim 51 appear in the Claims Listing Appendix, labeled as Elements [51A]-[51F]. For the following reasons, it is my opinion that Elements [51A]-[51F] are anticipated and rendered obvious by Pugel.

a. [51A] “A method for receiving a television (TV) signal comprising:”

[51B] “receiving an input signal from a cable network;”

[51C] “digitizing a contiguous band of frequencies in the input signal via a wideband analog-to-digital converter (ADC), wherein the contiguous band of frequencies comprises all received channels that exist in the input signal and the received channels comprise a plurality of desired channels and a plurality of undesired channels;”

[51D] “concurrently selecting each of the plurality of desired

channels from the input signal without selecting any of the plurality of undesired channels;”

[51E] “providing the plurality of desired channels; and”

124. Elements [51A]-[51E] recite similar features as Elements [25A]-[25E], and it is my opinion Elements [51A]-[51E] are thus disclosed and taught as obvious by Pugel for the same reasons discussed above with respect to Elements [25A]-[25E]. *See* Section 9.1.1.a-e, *supra*.

b. [51F] “configuring at least some of the plurality of desired channels as an output for a picture-in-picture display.”

125. Regarding Element [51F], Pugel discloses that its system is designed to support a television displaying multiple channels on the same television using a picture-in-picture (PiP) display. Ex. 1224, [0005], [0048]-[0049]. Pugel discloses that PiP demands support for the simultaneous reception of multiple television channels. *Id.* A POSITA would have understood that an advantage of Pugel’s multichannel receiver is that it supports the output of multiple television channels to support such a PiP system when “traditional solutions lack the flexibility required.” Ex. 1224, [0005]. Thus, Pugel discloses configuring desired channels as an output for a PiP display.

126. To any extent it is asserted that Pugel does not explicitly disclose Element [51F], it would have been obvious to a POSITA in view of Pugel’s express teachings that a device, such as Pugel’s multichannel receiver circuit, would be configured to output a plurality of desired channels for use in a PiP display in the

home. A POSITA would have understood the benefits of such a configuration because it would support the display of PiP material from Pugel's multichannel receiver circuit, as taught by Pugel. This would have been nothing more than applying a known technique (generation of multiple data streams for PiP display) to a known device (Pugel's multichannel receiver circuit) ready for improvement to yield predictable results (the output of the Pugel's multichannel receiver circuit could be used for PiP display). A POSITA would have a reasonable expectation of success, as Pugel's multichannel receiver circuit is designed to output a plurality of desired channels, and any necessary modification would have been well within the skill of a POSITA.

127. As such, it is my opinion that Element [51F] is anticipated and rendered obvious based on Pugel.

9.1.3. Dependent Claims 26, 52

[26/52] “The method of claim [25/51], wherein the method comprises: communicating the input signal from a cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.”

128. It is my opinion that Pugel discloses the “method of claim [25/51], wherein the method comprises: communicating the input signal from a cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter,” as recited in claims 26 and 52.

129. As I discuss in Sections 9.1.1.a-f and 9.1.2.a-b, Pugel discloses the features of the base claims 25 and 51.

130. Pugel discloses the claimed “a cable network connector” comprising an input coupler 101 (**green**) for a multichannel analog RF input signal, and optionally a splitter 102, that connects the input signal to a plurality of amplifier-filter circuits (**red**), which in turn connect to a plurality of ADCs (**gold**). Ex. 1224, [0025]-[0026], [0029]-[0031], [0042]-[0044], Figs. 1-2. The contents of Pugel’s Amp/Filter Bank in Figure 1 are shown in Pugel’s Figure 2. The amplifier-filter circuits comprise at least one “analog amplifier” (e.g., amplifier 201, **purple**) and at least one “analog filter” (e.g., bandpass filter 202, **pink**). Ex. 1224, [0029]-[0031], Fig. 2.

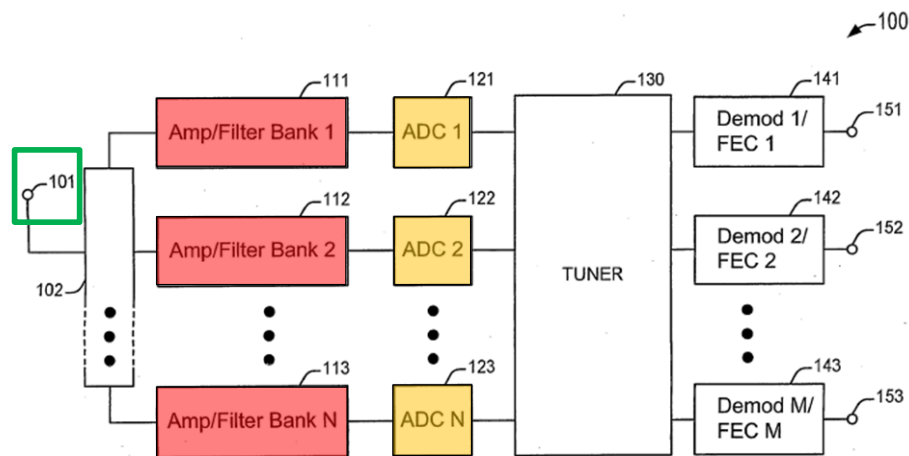


FIG. 1

Ex. 1224, Fig. 1 (annotated)

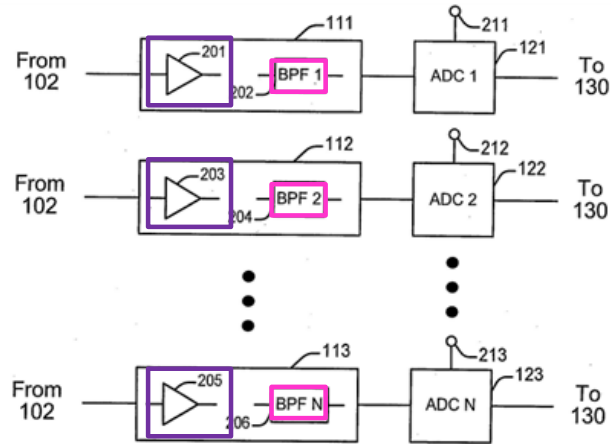


FIG. 2

Ex. 1224, Fig. 2 (annotated)

131. As such, it is my opinion that Pugel anticipates and renders obvious claims 26 and 52.

9.1.4. Dependent Claims 31, 57

[31/57] “The method of claim [25/51], wherein the method comprises: demodulating, via each demodulator of a plurality of demodulators, a desired channel, of the plurality of desired channels.”

132. It is my opinion that Pugel discloses these additional features of claims 31 and 57. As I discuss in Sections 9.1.1.a-f and 9.1.2.a-b, Pugel discloses the features of the base claims 25 and 51.

133. As I explained in Section 9.1.1.c, the input to Pugel’s multichannel receiver circuit corresponds to all received television channels, including desired and undesired television channels. Ex. 1224, Abstract, [0001], [0008]-[0009], [0011], [0022], [0028], [0036]-[0044], [0048]-[0049]. Pugel discloses the digital tuner 130

comprising a channel selector 315 for selecting channels to be demultiplexed, wherein a channel selected by the digital tuner is desired, and a channel unselected by the digital tuner is undesired. *Id.* This is consistent with the use of “desired” and “undesired” in the ’206 patent. Ex. 1201, Abstract, 1:40-45, 3:25-56, 4:38-53, 5:56-65, 6:3-15, 6:53-63, 7:10-19.

134. Pugel discloses outputting the selected, demultiplexed desired channels output from digital tuner 130 and forwarding them to one or more demodulators 141-143 (blue). Ex. 1224, [0040]-[0041]. Pugel discloses that each demodulator can receive and demodulate one of the selected desired channels outputted by the digital tuner 130. Ex. 1224, [0010] (“the plurality of demodulator circuits including at least a first demodulator circuit configured to receive and demodulate a first channel of the plurality of digital RF channels and a second demodulator circuit being configured to receive and demodulate a second channel of the plurality of digital RF channels”), [0046] (“[i]n step 406, the first digital RF channel signal is demodulated and forward-error-corrected. In step 407, the second digital RF channel signal is demodulated and forward-error-corrected. Steps 406 and 407 may be accomplished using demodulation circuits 141, 142, 143”). Thus, Pugel’s digital tuner outputs multiple desired digital television channels where each demodulator can demodulate one of the desired digital television channels.

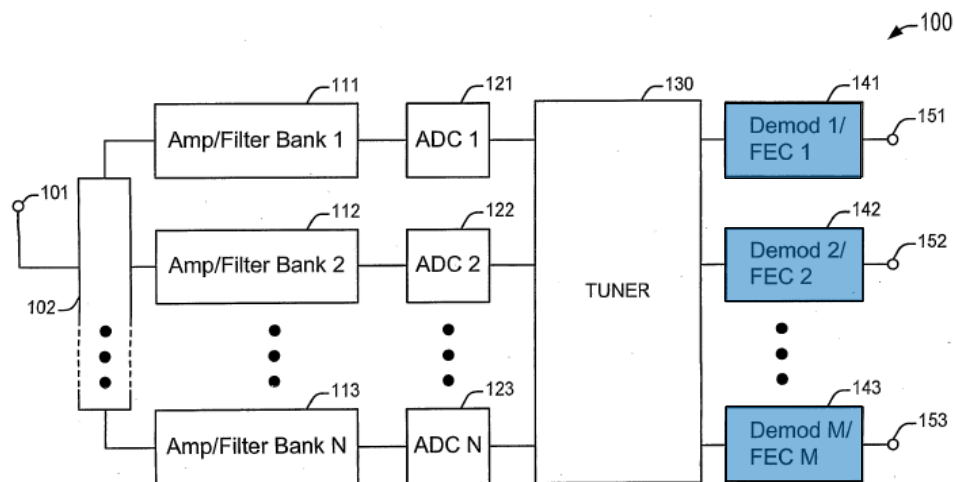


FIG. 1

Ex. 1224, Fig. 1 (annotated)

135. Pugel discloses that the demodulators 141-143 (**blue**) may perform a variety of demodulation techniques, including quadrature amplitude modulation (QAM) or quadrature phase shift keying demodulation (QPSK). Ex. 1224, [0027], [0039]-[0040], [0046], Figs. 1, 3, 4. For example, “a first demodulator 301 may be configured to perform [QAM] demodulation of digital cable television signals.” Ex. 1224, [0040]. Pugel discloses the use of QAM or QPSK demodulation, which are required for cable television channels, and that in-phase and quadrature signals are used in those modulation schemes. Ex. 1224, [0040]; *See* Sections 8.2.2, 8.2.3, *supra*.

136. Pugel further discloses that the digital tuner 130 “may perform coding, decoding, scrambling, descrambling, rotating, and/or derotating operations prior to

passing the digital channel signals to demodulation circuits 141, 142, 143.” Ex. 1224, [0039]. The demodulated signal is then provided as a digital channel output at one or more output couplers 151-153. Ex. 1224, [0010]-[0012], [0027], [0039]-[0041], [0046], Figs. 3-4.

137. Regarding the number of demodulators, while Figure 1 shows multiple demodulators, Pugel expressly discloses that “the present invention is not so limited and any number of ... demodulator circuits may be used in accordance with the present invention.” Ex. 1224, [0023]. Moreover, Pugel expressly discloses that “the number (1 . . . M) of demodulator circuits provided is not necessarily related to the number (1 . . . N) of amplifier-filter circuits and/or analog-to-digital converters provided.” Ex. 1224, [0023], [0027], [0040].

138. As such, it is my opinion that Pugel discloses the limitations of claims 31 and 57.

9.1.5. Dependent Claims 35, 61

[35/61] “The method of claim [25/51], wherein: the plurality of desired channels comprises at least one cable broadcast channel.”

139. It is my opinion that Pugel discloses the additional features of claims 35 and 61. As I discuss in Sections 9.1.1.a-f and 9.1.2.a-b, Pugel discloses the features of the base claims 25 and 51.

140. Pugel’s system is “sufficient for satisfactorily processing digital television signals and associated signals intended for end users in a conventional

cable television broadcast system.” Ex. 1224, [0033]-[0037], [0044]-[0045]; *See also* Ex. 1224, Abstract (“This combination of components permits substantially simultaneous reception of multiple digital cable channels within a single digital receiver circuit suitable for use with conventional cable delivery systems and at a reasonable cost.”). Therefore, Pugel discloses tuning desired channels comprising at least one cable broadcast channel. Ex. 1224, [0037]-[0039], [0045].

9.1.6. Dependent Claim 37

[37] “The method of claim [25], wherein the method comprises: configuring at least some of the plurality of desired channels as an output for a picture-in-picture display.”

141. It is my opinion that Pugel discloses the features of claim 37. As I discuss in Sections 9.1.1.a-f, Pugel discloses the features of the base claim 25.

142. Claim 37 recites the identical limitation as in Elements [51F], and thus this claim is anticipated and rendered obvious by Pugel (grounds A0 and A1) for the same reasons discussed above with respect to its base claim 25, and for Pugel’s additional teaching of picture-in-picture feature with respect to Element [51F]. *See* Sections 9.1.1.a-f, 9.1.2.b, *supra*.

9.1.7. Dependent Claim 63

[63] “The method of claim 51, wherein: the method is performed by a device comprising a digital video recorder (DVR).”

143. It is my opinion that Pugel discloses the features of claim 63. As I discuss in Section 9.1.2.a-b, Pugel discloses the features of the base claim 51.

144. Claim 63 recites the identical limitation as Element [25F], and thus, it is my opinion that claim 63 is disclosed and rendered obvious by Pugel (grounds A0 and A1) for the same reasons discussed above with respect to its base claim 51, and for Pugel’s additional teaching of a DVR as described above with respect to Element [25F]. *See* Sections 9.1.1.f, 9.1.2.a-b, *supra*.

9.2. Ground B: Pugel/Crols

145. It is my opinion that Pugel in view of Crols renders obvious claims 27-28, 30, 38, 39-41, 43-44, 48, 50, 53-54, 56, 64, 65-67, 69-70, 74, and 76.

9.2.1. Independent Claim 38

146. The elements of claim 38 appear in the Claims Listing Appendix, labeled as Elements [38A]-[38E]. For the following reasons, it is my opinion that Elements [38A]-[38E] are disclosed and rendered obvious by Pugel in view of Crols.

a. [38A] “A method comprising:”

147. Element [38A] is similar to Element [25A], and it is my opinion that Element [38A] is disclosed by Pugel for the same reasons discussed above with respect to Element [25A]. *See* Section 9.1.1.a, *supra*.

b. [38B] “receiving an input signal from a cable network;”

148. Element [38B] is identical to Element [25B], and it is my opinion that Element [38B] is disclosed by Pugel for the same reasons discussed above with respect to Element [25B]. *See* Section 9.1.1.b, *supra*.

c. [38C] “digitizing all received channels in the input signal via a wideband analog-to-digital converter (ADC), wherein the received channels comprise a plurality of desired channels and a plurality of undesired channels;”

149. Element [38C] recites similar features as Element [25C], except that [38C] recites “digitizing all received channels in the input signal via a wideband analog-to-digital converter (ADC),” while Element [25C] recites “digitizing a contiguous band of frequencies in the input signal ... wherein the contiguous band of frequencies comprises all received channels that exist in the input signal” (emphasis added). *See* Section 9.1.1.c, *supra*.

150. To the extent there is any difference between a “contiguous band of frequencies in an input signal” in Element [25C] and “all received channels in the input signal” in [38C] (emphasis added), it is my opinion that both limitations are taught for the same rationale discussed above in Section 9.1.1.c. *See also* Section 8.1, *supra* (citing Ex. 1233 at 45, 413, 515-520).

151. Pugel thus discloses Element [38C] for the same reasons discussed above with respect to Element [25C]. *See* Section 9.1.1.c, *supra*.

d. [38D] “digitally down converting each desired channel, of the plurality of desired channels, to generate a plurality of digital channel outputs,”

152. It is my opinion that Pugel in view of Crols discloses “digitally down converting each desired channel, of the plurality of desired channels, to generate a plurality of digital channel outputs,” as claimed.

153. As I explained in Section 9.1.1.d for Element [25D], Pugel’s digital tuner 130 receives, via a channel selector 315 coupled to the digital tuner 130, selections of one or more television channels desired by users. Ex. 1224, [0038]. Pugel’s digital tuner 130 is configured to select the signals of the desired television channels from “digital signals converted by the plurality of analog-to-digital converters 121, 122, 123” and output the selected digital channels to demodulation circuits 141, 142, 143. Ex. 1224, [0037]-[0039]. The digital signals from Pugel’s analog-to-digital converters 121, 122, 123 include signals of both desired and undesired television channels. *See* Section 9.1.1, *supra*. Pugel’s digital tuner 130 only outputs the signals of the desired television channels to the demodulation circuits 141, 142, 143. Ex. 1224, [0038]-[0039]. Pugel further elaborates that the digital tuner 130 can be implemented with one or more digital signal processors. Ex. 1224, [0037].

154. The digital tuner 130 or demodulators may comprise “circuitry for providing additional functions, for example adaptive filters for removing multi-path

propagation effects.” Ex. 1224, [0041]. Pugel discloses that the additional functions include “coding, decoding, scrambling, descrambling, rotating, and/or derotating operations prior to passing the digital channel signals to demodulation circuits.” Ex. 1224, [0039]. A POSITA would have understood this to provide an express teaching of modifying Pugel to perform digital downconversion as claimed, because the claims of Pugel provide an express teaching that the digital tuner 130 may itself perform downconverting of digital signals to generate a plurality of digital channel outputs. Ex. 1224, claims 14-15, 18, 20-21. Before selecting the signals of the desired television channels from the digital signals produced by the analog-to-digital converters 121, 122, 123, Pugel’s digital tuner 130 downconverts the digital signals. Ex. 1224, [0037], claims 14 (reciting “digital processor (130) ... downconverts said multiplexed signal and extracts desired information to be coupled to said first and second demodulator circuits”), 15 (reciting “digital processor (130) downconverts and extracts desired information to be coupled to said first and second demodulator circuits (141, 142)”), 18 (reciting “downconverting said first digital signal and said second signal ... and ... extracting desired television program information from said downconverted first digital signal and said second digital signal”), 20-21; *See* Section 9.1.4, *supra*.

155. A POSITA would have been well aware that digitally implemented low pass filters were used in RF receivers to select signals of desired television channels

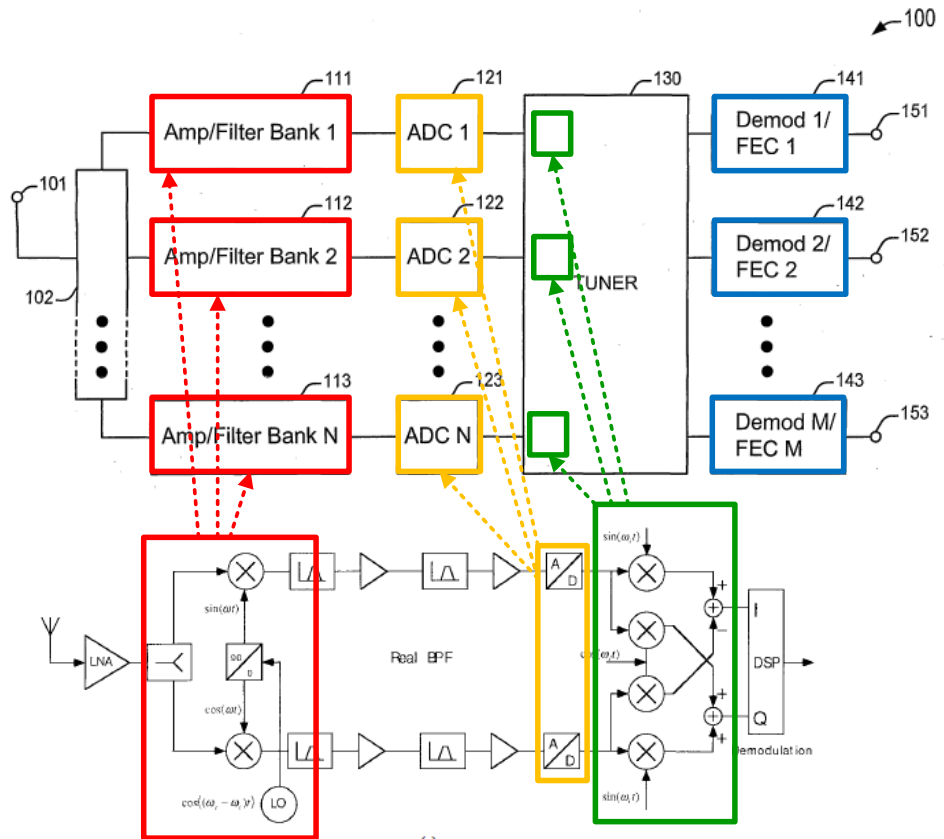
in RF receivers. *See* Section 8.3.2, *supra*. Signals for a desired television channel are isolated from signals of undesired television channels by downconverting all the signals such that the signals for the desired television frequency are placed at baseband and then applying a low pass filter function to isolate the signals of the desired television channel. *See* Section 8.3.2, *supra*.

156. Pugel does not expressly disclose in detail the components inside the digital tuner 130 that perform the downconversion process followed by the selection process. However, Pugel discloses that the digital tuner may include “a multitude of components configured as is well known in the art to recover a plurality of digital channel signals substantially simultaneously.” Ex. 1224, [0037].

157. To any extent it is asserted that Pugel does not teach or suggest implementation details about components in the digital tuner 130 to perform downconverting at the digital tuner 130 to generate a plurality of digital channel outputs, this would have been obvious to a POSITA in view of Crols. Crols discloses a complex mixer for processing digital signals output by the ADC. The figures of Pugel and Crols relate as follows, with the corresponding mixer in **green**:

Ex. 1224, Fig. 1
(annotated)

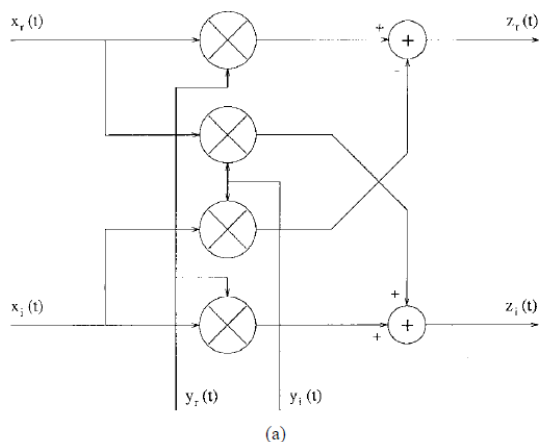
Ex. 1225, Fig. 22
(annotated)



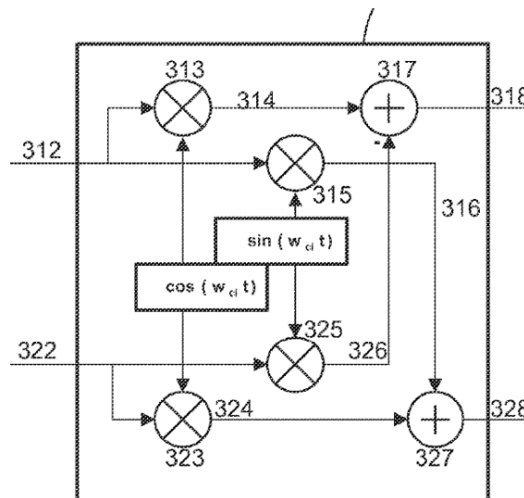
As Crols explains and illustrates, the circuitry outlined in green is a “complex mixer” that is utilized to perform downconversion. Ex. 1225 at 273-274, 279-280, Figs. 8(a), 21-22; *see also* Ex. 1234, [0035]-[0036], Fig. 3.3. Both sine and cosine signals are used to downconvert each of the in-phase and quadrature components such that unwanted mirror signals are not present in the downconverted signals. Ex. 1225 at 273-274.

158. Crols’ complex mixer has the identical structure and performs the identical downconversion (e.g., shifting the frequency of in-phase and quadrature components of the digital complex input signal) as mixer 300 shown in Figure 3 of

the '206 patent. Compare Ex. 1225 at 273-274, 279-280, Figs. 8(a), 21-22, with Ex. 1201, 6:28-47, 9:42-47, Fig. 3; see also Ex. 1234 at 74.



Ex. 1225, Fig. 8(a)



Ex. 1201, Fig. 3 (excerpted)

159. It is my opinion that it would have been obvious to a POSITA that Pugel's digital tuner 130 would incorporate a complex mixer for downconversion as taught by Crols in view of Pugel's express teachings that its digital tuner 130 employs downconversion and the POSITA's awareness that the digital signals needed to be shifted to baseband to use low pass filters for channel selection. Ex. 1224, [0039], claims 14-15, 18, 20-21; see Section 8.3.2, *supra*. Furthermore, a POSITA looking to implement downconversion would have turned to techniques known to the art, such as taught by Crols. Even if not expressly taught, such an implementation would have been obvious to try, as Crols' complex mixer topology is one of a finite number of identified, predictable solutions to implement

downconversion in digital circuitry, such as a digital tuner and Pugel's express teaching that Pugel's "digital tuner 130 may include a multitude of components configured as is well known in the art to recover a plurality of digital channel signals substantially simultaneously." Ex. 1224, [0037]. A POSITA would have had a reasonable expectation of success given the express teachings in Pugel to turn to other systems, Crols' detailed descriptions of the operational effectiveness of its topologies, and the POSITA's own familiarity with known receiver circuit topologies in the art.

e. [38E] "wherein the method is performed by a device comprising a digital video recorder (DVR)."

160. Element [38E] is identical to Element [25F], and it is my opinion that Element [38E] is disclosed by Pugel for the same reasons discussed above with respect to Element [25F]. *See* Section 9.1.1.f, *supra*.

9.2.2. Independent Claim 64

161. The elements of claim 64 appear in the Claims Listing Appendix, labeled as Elements [64A]-[64E]. For the following reasons, it is my opinion that Elements [64A]-[64E] are disclosed and rendered obvious by Pugel in view of Crols.

a. [64A] "A method comprising:"

[64B] "receiving an input signal from a cable network;"

[64C] "digitizing all received channels in the input signal via a wideband analog-to-digital converter (ADC), wherein the received

channels comprise a plurality of desired channels and a plurality of undesired channels;”

[64D] “digitally down converting each desired channel, of the plurality of desired channels, to generate a plurality of digital channel outputs; and

162. Elements [64A]-[64D] are identical to Elements [38A]-[38D], and thus, it is my opinion that Elements [64A]-[64D] are disclosed by Pugel, or taught by Pugel in view of Crols for the same reasons discussed above with respect to Elements [38A]-[38D]. *See* Sections 9.2.1.a-d, *supra*.

b. [64E] “configuring at least some of the plurality of desired channels as an output for a picture-in-picture display.”

163. Element [64E] is identical to Element [51F], and thus, it is my opinion that Element [64E] is taught or disclosed by Pugel for the same reasons as discussed above with respect to Element [51F]. *See* Section 9.1.2.b, *supra*.

9.2.3. Dependent Claims 39, 65

[39/65] “The method of claim [38/64], wherein the method comprises: communicating the input signal from a cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.”

164. As I discuss in Sections 9.2.1.a-e and 9.2.2.a-b, Pugel in view of Crols discloses the features of the base claims 38 and 64. Claims 39 and 65 recite similar features to those in claims 26 and 52, and thus, it is my opinion that Pugel discloses the additional limitations of claims 39 and 65 for the same reasons discussed above in Section 9.1.3.

9.2.4. Dependent Claims 27, 40, 53, 66

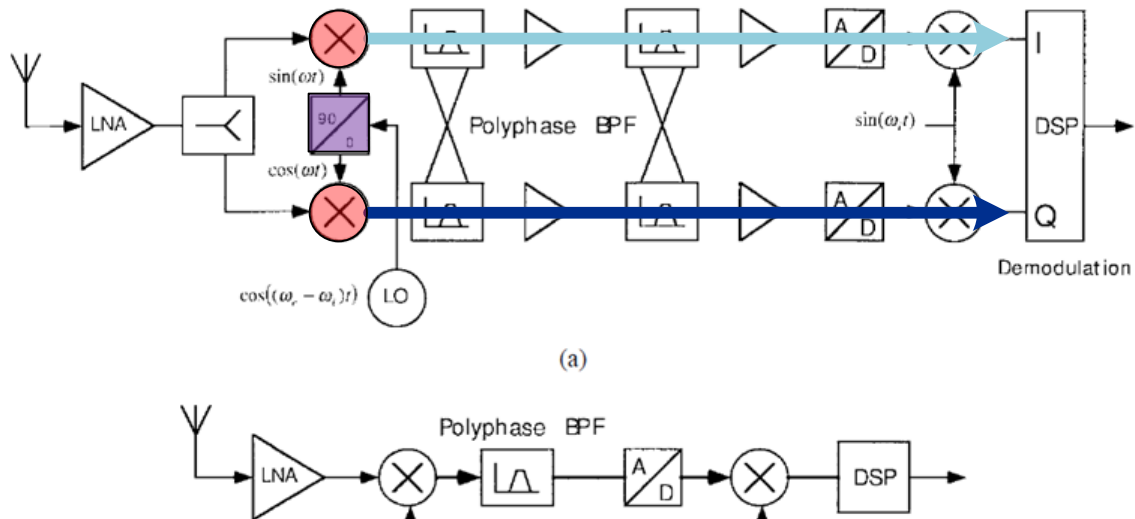
[27/53] “The method of claim [25/51], wherein the method comprises: generating, via each mixer of a plurality of mixers, a complex signal corresponding to each of the plurality of desired channels, and wherein each corresponding complex signal comprises an in-phase (I) component and a quadrature (Q) component.”

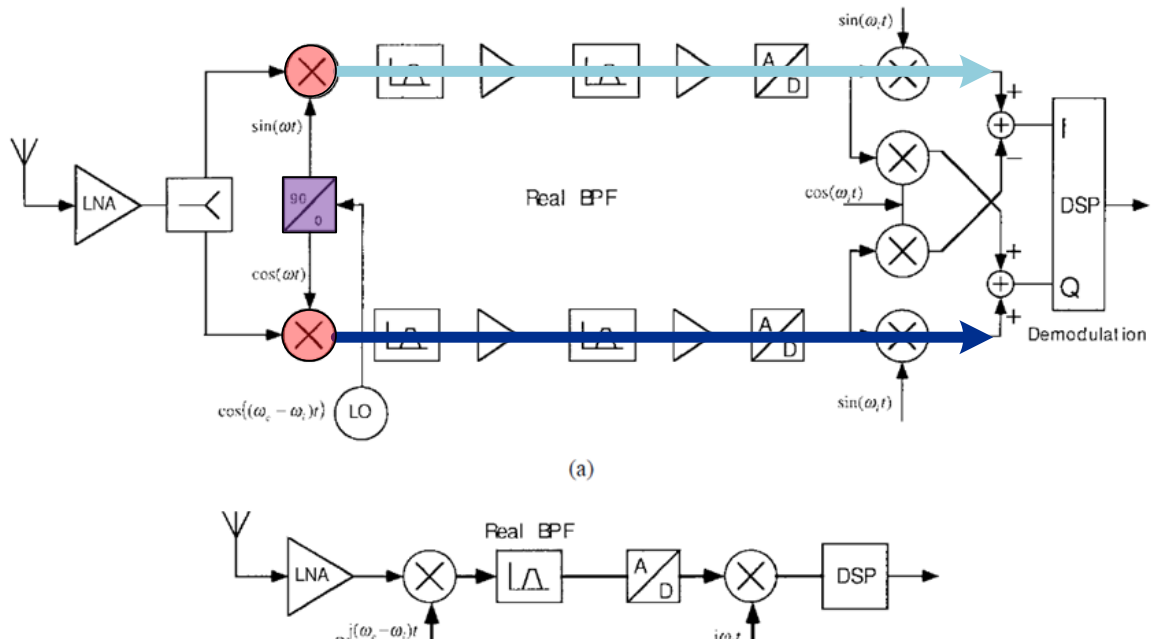
[40/66] “The method of claim [38/64], wherein: digitally down converting comprises generating a corresponding complex signal for each of the plurality of desired channels, and wherein each corresponding complex signal comprises an in-phase (I) component and a quadrature (Q) component.”

165. It is my opinion that Pugel in view of Crols discloses the features of claims 27, 40, 53, and 66. As I discuss in Sections 9.1.1.a-f and 9.1.2.a-b, Pugel discloses the features of the base claims 25 and 51. As I discuss in Sections 9.2.1.a-e and 9.2.2.a-b, Pugel in view of Crols discloses the features of the base claims 38 and 64.

166. As I explained above in Section 9.2.1, Pugel’s multichannel receiver circuit modified with the teaching of Crols includes Pugel’s digital tuner 130 comprising a plurality of mixers. Further, Pugel-Crols teaches that the resultant complex mixers generate complex signals comprising in-phase and quadrature signals. Crols discloses the generation of a “complex signal” for each channel (the claimed “each of the plurality of desired channels”) comprising of an in-phase signal (**dark blue line**) and a quadrature signal (**light blue line**). Ex. 1225 at 277, 279, 281-282; *see* Ex. 1234 at 42-43, 65-67. Crols discloses using two mixers (**red**) to create

an in-phase signal (the output of the lower mixer with “ $\cos(\omega t)$ ” input in Figures 21(a) and 22(a), **dark blue**) and a quadrature signal (the output of the upper mixer with “ $\sin(\omega t)$ ” input in Figs. 21(a) and 22(a), **light blue**) by respectively using a sine signal and a cosine signal generated by a quadrature oscillator (**purple**). Ex. 1225 at 277 (“Quadrature oscillators often use an RC-CR circuit to obtain the 90° phase shift. The phase shift is a result of comparing the phase shift of a pole and a zero.”), 279-282; Ex. 1234, at 42-43, 65-67; *See* Section 8.3.1, *supra*.





Ex. 1225, Figs. 21, 22 (annotated)

167. It is my opinion that it would have been obvious to a POSITA to modify Pugel's receiver circuit to implement Crols' mixers (as illustrated above) because, in doing so, a POSITA would have understood that Pugel discloses the use of QAM or QPSK demodulation, which are required for cable television channels, and that in-phase and quadrature signals are used in those modulation schemes. Ex. 1224, [0040]; See Sections 8.2.2, 8.2.3, *supra*. Thus, applying Crols' topologies comprising mixer modules to Pugel's receiver circuits would have been nothing more than applying a known technique (generating in-phase and quadrature signals) to improve a known device (Pugel's receiver which performs QAM or QPSK demodulation) ready for improvement to yield predictable results (the resulting

implementation of Pugel-Crols would be capable of performing QAM or QPSK modulation as taught by Pugel).

168. Thus, it is my opinion that the combination of Pugel and Pugel-Crols teach claims 27, 40, 53, and 66 for the same reasons discussed above with respect to their base claims 25, 38, 51, and 64, and further based on the additional teachings of Crols as discussed above. Thus, Pugel in view of Crols renders obvious claims 27, 40, 53, and 66.

9.2.5. Dependent Claims 28, 41, 54, 67

[28/41/54/67] “The method of claim [27/40/53/66], wherein: the I and Q components of each corresponding complex signal are at baseband.”

169. It is my opinion that Pugel in view of Crols discloses the features of claims 28, 41, 54, and 67. As I discuss in Section 9.2.4, Pugel discloses the features of the base claims 27, 40, 53, and 66.

170. As I explained in Section 9.2.4, Pugel in view of Crols discloses generating a corresponding complex signal comprising an I component and a Q component. Ex. 1225 at 269, 279-280. Crols further discloses that the resulting I and Q components of Pugel-Crols are at baseband in view of Crols’ express teaching, which states that “[i]t will be presumed that the demodulation is preferably done with a DSP at baseband.” Ex. 1225 at 269; *see also* Section 8.3.1 (citing Ex. 1239 at 11). For example, concerning Crols’ Figures 21-22, Crols discloses that “[t]he final

downconversion of the wanted signal to the baseband can then be done by multiplication with a sine.” Ex. 1225 at 279. Furthermore, it is my opinion that a POSITA would be aware that the digital signals needed to be shifted to baseband to use low pass filters for channel selection. Ex. 1224, [0039], claims 14-15, 18, 20-21; *see* Section 8.3.2, *supra*.

171. To any extent it is asserted that Pugel in view of Crols does not explicitly disclose I and Q components of each complex signal at baseband, it would have been obvious to implement Pugel-Crols’ system to support a DSP demodulating at baseband based on Crols’ express teachings. As discussed in Section 8.1, DSPs typically perform demodulation on baseband signals. Ex. 1234 at 22-23; Ex. 1239 at 11; Ex. 1225 at 269, 279. Therefore, a POSITA would have understood that Pugel’s digital tuner 130 must produce baseband quadrature I and Q components of the incoming RF signals to be usable by the demodulators implemented in DSPs. Ex. 1224, [0046]; Ex. 1234 at 23.

172. To any extent this is not explicitly disclosed, downconverting a signal to baseband would be obvious to a POSITA because of the disclosures in Pugel-Crols, including recitations of downconversion in the claims of Pugel, and Crols’ disclosure of converting to baseband. Ex. 1224, claims 14-15, 18, 20-21; Ex. 1225 at 269, 279-280. It would have been obvious from Pugel’s and Crols’ express teachings (regarding downconversion in Pugel and selecting of desired channels

after downconversion, and that signals should be at baseband for demodulation in Crols) to use well-known techniques of downconversion to baseband to implement the system of Pugel-Crols. At most, this would have been nothing more than applying a known technique (downconversion to baseband as taught by Pugel and Crols and filtering of selected channels with low pass filters after signals are downconverted to baseband) to a known device (Pugel's multichannel receiver circuit) ready for improvement to yield predictable results (a signal at baseband as taught by Crols). A POSITA would have had a reasonable expectation of success, as downconversion was well-known in the art, as evidenced by Pugel and Crols.

173. Thus, it is my opinion that the combination of Pugel-Crols teaches claims 28, 41, 54, and 67 for the same reasons discussed above with respect to their base claims 27, 40, 53, and 66, and further based on the additional teachings of Crols as discussed above. Thus, Pugel in view of Crols renders obvious claims 28, 41, 54, and 67.

9.2.6. Dependent Claims 44, 70

[44/70] “The method of claim [38/64], wherein the method comprises: demodulating each digitally down converted, desired channel to generate a plurality of demodulated channels.”

174. It is my opinion that Pugel in view of Crols discloses “demodulating each digitally down converted, desired channel to generate a plurality of

demodulated channels,” as claimed. As I discuss in Sections 9.2.1.a-e and 9.2.2.a-b, Pugel in view of discloses the features of the base claims 38 and 64.

175. As I also explained in Section 9.2.1.c for Element [38C], Pugel provides express teaching that before selecting the signals of the desired television channels from the digital signals produced by the analog-to-digital converters 121, 122, 123, Pugel’s digital tuner 130 downconverts the digital signals. Ex. 1224, [0037], claims 14 (reciting “digital processor (130) ... downconverts said multiplexed signal and extracts desired information to be coupled to said first and second demodulator circuits”), 15 (reciting “digital processor (130) downconverts and extracts desired information to be coupled to said first and second demodulator circuits (141, 142)”), 18 (reciting “downconverting said first digital signal and said second signal ... and ... extracting desired television program information from said downconverted first digital signal and said second digital signal”), 20-21; *See* Section 9.1.4, *supra*. The digital signals from Pugel’s analog-to-digital converters 121, 122, 123 include signals of both desired and undesired television channels and therefore, the downconverted digital signals will also include signals of both desired and undesired television channels. *See* Section 9.1.1, *supra*.

176. Pugel’s digital tuner 130 then selects the signals of the desired television channels from the downconverted digital signals and outputs the selected digital channels to demodulation circuits 141, 142, 143. Ex. 1224, [0037]-[0039],

claims 14, 18, 20-21. Pugel's digital tuner 130 only outputs the signals of the desired television channels to the demodulation circuits 141, 142, 143, where the signals of the desired television channel were downconverted before the selection process. Ex. 1224, [0038]-[0039].

177. As discussed in Section 9.1.4, Pugel discloses outputting that the selected, demultiplexed desired channels output from digital tuner 130 and forwarding them to one or more demodulators 141-143. Ex. 1224, [0040]. Pugel discloses that the demodulators can receive and demodulate the selected desired channels outputted by the digital tuner 130. Ex. 1224, [0010], [0046]. Pugel discloses that the demodulators 141-143 may perform a variety of demodulation techniques, including quadrature amplitude modulation (QAM) or quadrature phase shift keying demodulation (QPSK). Ex. 1224, [0027], [0039]-[0040], [0046], Figs. 1, 3, 4. For example, "a first demodulator 301 may be configured to perform [QAM] demodulation of digital cable television signals." Ex. 1224, [0040]. Pugel discloses the use of QAM or QPSK demodulation, which are required for cable television channels, and that in-phase and quadrature signals are used in those modulation schemes. Ex. 1224, [0040]; *See* Sections 8.2.2, 8.2.3, *supra*.

178. Therefore, it is my opinion that the combination of Pugel-Crols teaches claims 44 and 70 for the same reasons discussed above with respect to their base

claims 38 and 64, and further based on the additional teachings of Crols as discussed above.

9.2.7. Dependent Claim 30, 43, 56, 69

[30/56] “The method of claim [27/53], wherein the method comprises: demodulating, via each demodulator of a plurality of demodulators, the corresponding complex signal to generate a demodulated signal as a desired channel output.”

[43/69] “The method of claim [40/66], wherein the method comprises: demodulating the corresponding complex signal to provide a demodulated channel as a digital channel output.”

179. It is my opinion that Pugel in view of Crols discloses the features of claims 30, 43, 56, 69. As I discuss in Section 9.2.4, Pugel discloses the features of the base claims 27, 40, 53, and 66.

180. Claims 30, 43, 56, and 69 recite features similar to those in claims 31, 44, 57, and 70, except that “a desired channel, of the plurality of desired channels” in claims 31 and 57 and “each digitally down converted, desired channel to generate a plurality of demodulated channels” in claims 44 and 70 is replaced in claims 30, 43, 56, and 69 with “the corresponding complex signal to [generate/provide] a demodulated [signal/channel] as a [desired/digital] channel output.” As discussed above with respect to claims 31, 44, 57, and 70, it is my opinion that Pugel and Pugel in view of Crols disclose or teach the claimed “demodulating” and “plurality of demodulators.” *See* Sections 9.1.4, 9.2.6. Moreover, as I discussed above with respect to claims 27-28, 40-41, 53-54, and 66-67 in Section 9.2.4-5, it is my opinion

that a POSITA would have understood that the complex mixer of Pugel-Crols combined system outputs a complex signal, which Pugel's demodulators 141-143 would receive. A POSITA would have understood that Pugel's demodulators would have been designed for such signals, as, for example, Pugel discloses that the demodulators may perform QAM demodulation of digital cable television signals, and QAM demodulation utilizes complex signals comprising in-phase and quadrature components. Ex. 1224, [0040]. To any extent this is not explicitly disclosed, it would have been obvious for Pugel's demodulators to receive a complex signal to enable the performance of QAM demodulation based on Pugel's express teachings. Applying Crols topologies comprising complex signals to Pugel's receiver circuits would have been nothing more than applying a known technique (generating in-phase and quadrature signals) to improve a known device (Pugel's receiver which performs QAM or QPSK demodulation) ready for improvement to yield predictable results (the resulting implementation of Pugel-Crols would be capable of performing QAM or QPSK modulation as taught by Pugel).

181. Thus, it is my opinion that Pugel in view of Crols renders obvious claims 30, 43, 56, and 69.

9.2.8. Dependent Claims 48, 74, 76

[48] “The method of claim 38, wherein: the plurality of desired channels comprises at least one cable broadcast channel.”

[74] “The method of claim 64, wherein: the plurality of desired channels comprises at least one cable broadcast channel.”

[76] “The method of claim 64, wherein: the method is performed by a device comprising a digital video recorder (DVR).”

182. It is my opinion that Pugel in view of Crols discloses the features of claims 48, 74, and 76. As I discuss in Section 9.2.1.a-e, Pugel discloses the features of the base claim 38. And I discuss that Pugel discloses the features of base claim 64 in Section 9.2.2.a-b.

183. Claims 48 and 74 recite features similar to those in claims 35 and 61, and claim 76 recite features similar to those in claim 63. As I explained above in Section 9.1.5, Pugel discloses the features of claims 35 and 61. In Section 9.1.7, I explain that Pugel discloses the features of claim 63. Therefore, in my opinion, Pugel also discloses the identical additional limitations of claims 48, 74, and 76. *See* Sections 9.1.5, 9.1.7, *supra*.

184. Thus, it is my opinion Pugel in view of Crols renders claims 48, 74, and 76 obvious.

9.2.9. Dependent Claim 50

[50] “The method of claim 38, wherein the method comprises: providing a picture-in-picture display signal according to the plurality of digital channel outputs.”

185. It is my opinion that Pugel in view of Crols discloses the features of claim 50. As I discuss in Section 9.2.1.a-e, Pugel discloses the features of the base claim 38.

186. As I explained above in Section 9.1.2.b regarding Element [51F], Pugel discloses providing display signals for use in a picture-in-picture display. Thus, it is my opinion that claim 50 is rendered obvious by Pugel in view of Crols for the same reasons discussed above with respect to its base claim 38, and for Pugel’s additional teaching of providing a digital signal for use in a picture-in-picture display as described above with respect to Element [51F]. *See* Sections 9.1.2.b, 9.2.1.a-e, *supra*. Thus, it is my opinion that Pugel in view of Crols renders claim 50 obvious.

9.3. Ground C: Pugel/Chandrakasan

187. Pugel in view of Crols renders obvious claims 1, 2, 7-9, 11-12, 32-34, 58-60.

9.3.1. Independent Claim 1

188. The elements of claim 1 appear in the Claims Listing Appendix, labeled as Elements [1A]-[1E]. For the following reasons, it is my opinion that Elements [1A]-[1E] are rendered obvious by Pugel in view of Chandrakasan.

a. [1A] “A method for receiving a television (TV) signal comprising:”

[1B] “receiving an input signal from a cable network;”

[1C] “digitizing a contiguous band of frequencies in the input signal via a wideband analog-to-digital converter (ADC), wherein the contiguous band of frequencies comprises all received channels that exist in the input signal and the received channels comprise a plurality of desired channels and a plurality of undesired channels;”

[1D] “concurrently selecting each of the plurality of desired channels from the input signal without selecting any of the plurality of undesired channels; and”

189. Elements [1A]-[1D] recites similar features as Elements [25A]-[25D]. Thus, it is my opinion that Elements [1A]-[1D] are disclosed by Pugel for the same reasons discussed above with respect to Elements [25A]-[25D]. *See* Section 9.1.1.a-d, *supra*.

b. [1E] “providing the plurality of desired channels via a serial interface.”

190. Element [1E] is identical to Element [25E], except Element [1E] recites “provide ... via a serial interface.” Except for the feature of “provide ... via a serial interface,” it is my opinion that the other features of Element [1E] are thus disclosed by Pugel for the same reasons discussed above with respect to Element [25E]. *See* Section 9.1.1.e, *supra*. But Pugel is silent with regard to whether its selected channels may be output via a serial interface or via a parallel interface.

191. However, as the '206 patent concedes, outputting a digital datastream via serial and parallel interfaces were “commonly known methods,” which I have been informed is Applicant Admitted Prior Art (AAPA). Ex. 1201, 7:10-14; *see* Section 8.4, *supra*. Indeed, as explained in dictionaries, basic textbooks and technical papers on digital integrated circuit design at the time, a POSITA would have understood that using these two interfaces were two common options for

outputting data in standard integrated circuits. Ex. 1214, 30:31-42, 31:15-22; Ex. 1215 at 6, 8; Ex. 1216 at 69-70; Ex. 1217 at 354-355.

192. For example, the 7th edition of the Authoritative Dictionary of IEEE Standard Terms (“IEEE”) discloses both “serial interface” and “parallel interface.” IEEE defines “serial” as “[o]ne bit following another over a single pathway” and “serial interface” as “[a]n interface that transmits data bit by bit rather than in whole bytes.” Ex. 1215 at 8. IEEE defines “bit parallel” as “[p]ertaining to a method for simultaneously processing all bits as a contiguous set of bits over separate wires, one wire for each bit.” Ex. 1215 at 5.

193. Basic textbooks also teach a “serial interface” and a “parallel interface.” For example, as explained in the textbook “Digital Integrated Circuits: A Design Perspective” published in 2002 (“Rabaey”), a digital integrated circuit represents data 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. 1216 at 31-34, 23, 28-29, 49-51, 79-80, Fig. 6.25.

194. To output multiple bits (e.g., from multiple channels), the circuit can either transmit the bits over multiple separate wires, one wire for each bit, which is 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.” Ex. 1216 at 79-80, Fig. 6.25.

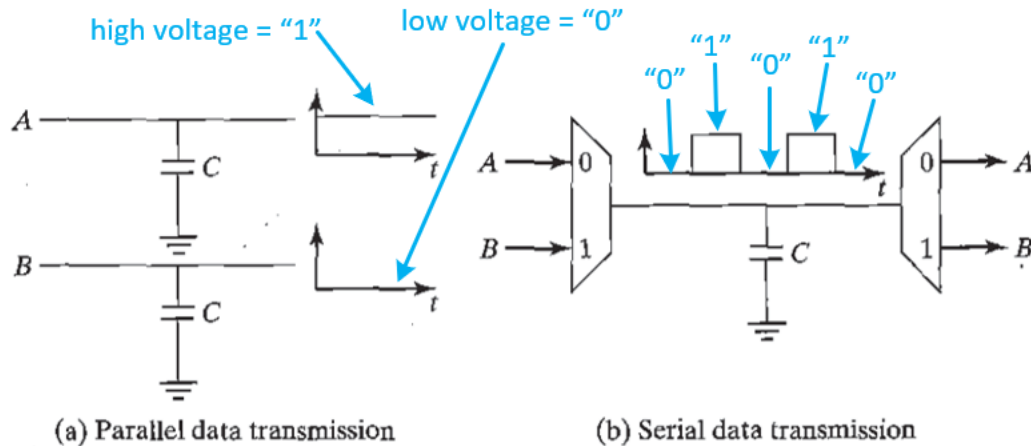


Figure 6-25 Parallel versus time-multiplexed data busses.

Ex. 1216, Fig. 6.25 (annotated) (page 80)

195. At the most fundamental level, a digital integrated circuit represents data 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. 1216 at 31-34; 17, 27-28, 49-51. Pugel discloses that its ADCs output digital signals at varying resolutions with differing numbers of bits. Ex. 1224, [0036]. To output multiple bits (e.g., as a “digital datastream”), the digital tuner 130 can either transmit the bits over multiple separate wires, one wire for each bit, which is 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 is known as a “serial interface.” Ex. 1215 at 5-6, 8; Ex. 1216 at 79-80, Fig. 6.25.

196. Implementing Pugel’s data interface to a demodulator using either option would have been obvious as design choices, because both were “commonly known methods,” as Applicant admits and as shown in the background art that

demonstrates such interfaces were known and used by POSITAs in integrated circuit designs at the time. Ex. 1214, 30:31-42, 31:15-22; Ex. 1215 at 5-6, 8; Ex. 1216 at 79-80; Ex. 1217 at 354-355; Ex. 1248 at 16. 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.

197. As another example, Chandrakasan, an article on "Ultra Low Power Digital Signal Processing," discloses that both serial (referred to in Chandrakasan as "time-multiplexed") and parallel interfaces such as those illustrated in Figure 6.25 above were used in integrated circuits. Ex. 1217 at 355; Ex. 1216 at 79-80. Specifically, Chandrakasan discloses that time-multiplexing (e.g., a serial interface) is often used "due to area constraints or if very high-throughput is not the goal," but that "[g]iven that there is a choice between time-multiplexed and fully-parallel architectures... an important question which arises is what architecture will result in the lowest switching activity." Ex. 1217 at 355. Minimizing the circuit area minimizes the cost of the integrated circuit, while minimizing the switching activity minimizes the power consumed by the integrated circuit. Ex. 1217 at 355-357. Thus, Chandrakasan discloses 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. *Id.*

198. It is my opinion that it would thus have been obvious to a POSITA to apply either of parallel data or serial data communication as taught by Chandrakasan to the interconnection between Pugel's digital tuner 130 and demodulators 141-143 because a known, useful interface would facilitate better and more reliable data transmission. Ex. 1224, [0038]-[0041], [0045]-[0046]; Ex. 1217 at 354-356.

199. As such, the modification of Pugel with Chandrakasan that results in a serial interface between Pugel's digital tuner 130 and demodulators 141-143 is nothing more than choosing from a finite number of identified and predictable solutions (using serial or parallel communications as taught by Chandrakasan and known in the art) with a reasonable expectation of success (resulting in Pugel's system implemented with either serial or parallel communication). The resultant combinations of Pugel and Chandrakasan are predictable, and it is my opinion that a POSITA would have had a reasonable expectation of success, because Chandrakasan discloses basic techniques used by POSITAs to design integrated circuits and because those techniques are specifically directed to overcoming specific issues, such as meeting area and power constraints, that are often necessary for a successful design. Ex. 1217 at 355-357.

200. Thus, it is my opinion that the combination of Pugel and Chandrakasan discloses claim 1.

9.3.2. Dependent Claim 2

[2] “The method of claim 1, wherein the method comprises: communicating the input signal from a cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.”

201. As I explained in Section 9.3.1, Pugel in view of Chandrakasan discloses the features of base claim 1. It is my opinion that claim 2 recites features similar to those in claims 26 and 52, and thus, Pugel discloses the additional limitations of claim 2 for the same reasons discussed above in Section 9.1.3.

9.3.3. Dependent Claim 7

[7] The method of claim 1, wherein the method comprises: demodulating, via each demodulator of a plurality of demodulators, a desired channel, of the plurality of desired channels.

202. As I explained in Section 9.3.1, Pugel in view of Chandrakasan discloses the features of base claim 1. It is my opinion that claim 7 recites features similar to those in claims 31 and 57, and thus, Pugel discloses the additional limitations of claim 7 for the same reasons discussed above in Section 9.1.4.

9.3.4. Dependent Claims 8, 32, 58

[8/32/58] “The method of claim [7/31/57], wherein the method comprises: providing a plurality of demodulated channels via a parallel interface.”

203. As I explained in Section 9.3.3, Pugel in view of Chandrakasan discloses the features of base claim 7. I explain that Pugel discloses the features of claims 31 and 57 in Section 9.1.4.

204. As I explained above, Pugel discloses a digital tuner 130 in communication with one or more demodulators 141-143. *See* Sections 9.1.4, 9.3.3, *supra*. And as I furthered explained above with respect to Element [1E], Pugel in view of Chandrakasan discloses that it would have been obvious to provide the plurality of channels as an input to demodulators 141-143 via a parallel or serial interface (as illustrated below in annotated Figure 1 of Pugel). *See* Sections 9.3.1.e, 8.4, *supra*. Based on a similar rationale, it is my opinion that it would have been obvious to a POSITA that the output of the demodulators 141-143 would also be provided via a parallel interface or a serial interface (as illustrated below in annotated Figure 1 of Pugel). *See* Sections 9.3.1.e, 8.4, *supra*.

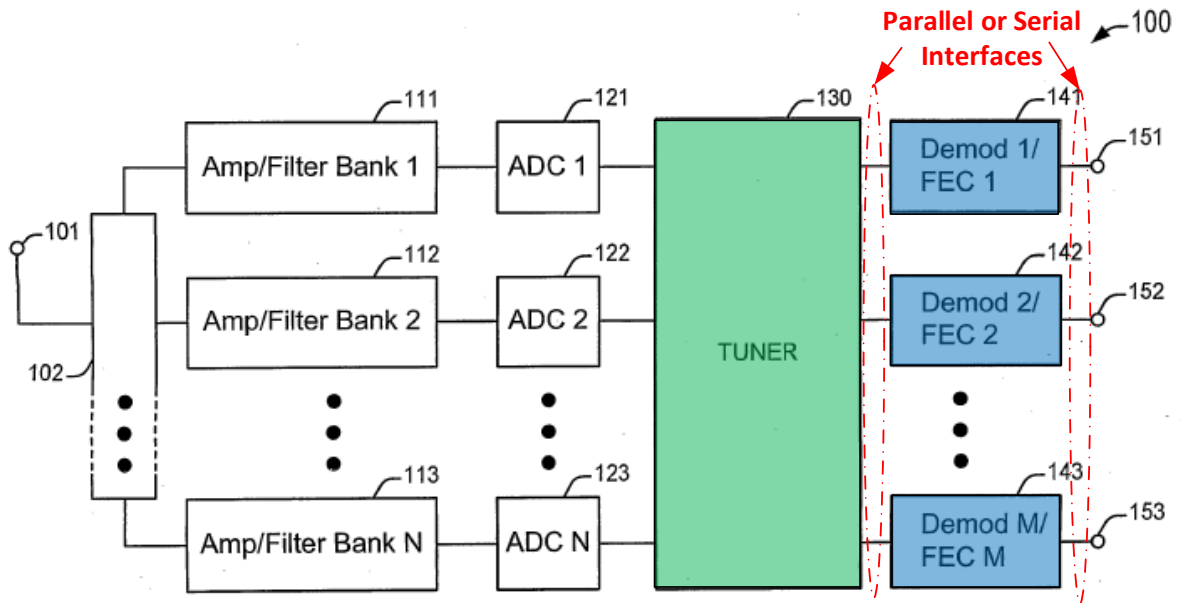


FIG. 1

Ex. 1224, Fig. 1 (annotated)

205. It is my opinion that Pugel’s output couplers 151, 152, 153 can output demodulated digital video signals from the demodulators 141, 142, 143 using either option, parallel interface or serial interface, as both would have been obvious as available design choices. Both parallel and serial interfaces were “commonly known methods,” as Applicant admits and as shown in the background art that demonstrates such interfaces where known and used by POSITAs in integrated circuit designs at the time. Ex. 1214, 30:31-42, 31:15-22; Ex. 1215 at 5-6, 8; Ex. 1216 at 79-80; Ex. 1217 at 354-355; *see* Sections 9.3.1.b, 8.4, *supra*. For the same reasons, implementing serial and parallel interfaces at Pugel’s output coupler 151, 152, 153

would have been well within the POSITA's skillset, and thus, a POSITA that would have had a high expectation of success leading to predictable results.

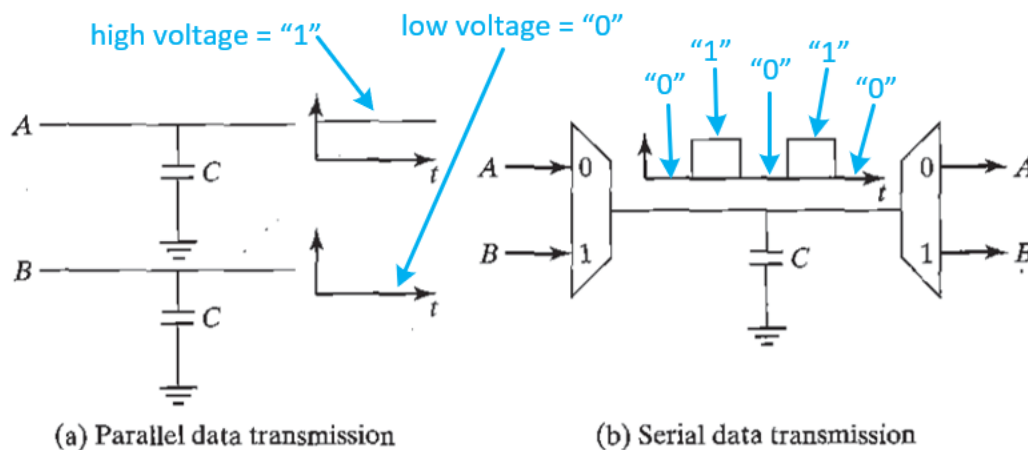


Figure 6-25 Parallel versus time-multiplexed data busses.

Ex. 1216, Fig. 6.25 (annotated) (page 80)

206. Furthermore, Chandrakasan discloses that both serial (referred to in Chandrakasan as “time-multiplexed”) and parallel interfaces, such as those illustrated in Figure 6.25 above, were used in integrated circuits. Ex. 1217 at 355; Ex. 1216 at 79-80. Specifically, Chandrakasan discloses that time-multiplexing (e.g., a serial interface) is often used “due to area constraints or if very high-throughput is not the goal,” but that “[g]iven that there is a choice between time-multiplexed and fully-parallel architectures... an important question which arises is what architecture will result in the lowest switching activity.” Ex. 1217 at 355. Minimizing the circuit area minimizes the cost of the integrated circuit, while minimizing the switching activity minimizes the power consumed by the integrated circuit. Ex. 1217 at 355-357. Thus, Chandrakasan discloses 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. *Id.*

207. It would thus have been obvious to apply either of parallel data or serial data communication, as taught by Chandrakasan, to the output from Pugel's demodulators 141-143 via the output couplers, 151, 152, 153 because a known, useful interface would facilitate better and more reliable data transmission. Ex. 1224, [0038]-[0041], [0045]-[0046]; Ex. 1217 at 354-356. As such, the modification of Pugel with Chandrakasan that results in a parallel interface as an output from demodulators 141-143 is nothing more than choosing from a finite number of identified, predictable solutions (using serial or parallel communications as taught by Chandrakasan and known in the art) with a reasonable expectation of success (resulting in Pugel's system implemented with either serial or parallel communication). The resultant combinations of Pugel and Chandrakasan are predictable, and a POSITA would have had a reasonable expectation of success, because Chandrakasan discloses basic techniques used by POSITAs to design integrated circuits, and because those techniques are specifically directed to overcoming specific issues, such as meeting area and power constraints, that are often necessary for a successful design. Ex. 1217 at 355-357

208. Thus, the combination of Pugel and Chandrakasan discloses claims 8, 32, and 58.

9.3.5. Dependent Claims 9, 11, 12

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

[11] “The method of claim 1, wherein: the method is performed by a device comprising a digital video recorder (DVR).”

[12] “The method of claim 1, wherein the method comprises: configuring at least some of the plurality of desired channels as an output for a picture-in-picture display.”

209. As I explained in Section 9.3.1, Pugel in view of Chandrakasan discloses the features of base claim 1. It is my opinion that Claims 9, 11, and 12 recite features similar to those in claims 35, 63, and 37, respectively, and thus Pugel discloses the additional limitations of claims 9, 11, and 12 for the same reasons discussed above in Sections 9.1.5-7.

9.3.6. Dependent Claims 33, 59

[33/59] “The method of claim [25/51], wherein the method comprises: providing the plurality of desired channels via a parallel interface.”

210. As I discuss in Sections 9.1.1.a-f and 9.1.2.a-b, Pugel discloses the features of the base claims 25 and 51. Claims 33 and 59 recite the same limitations as Element [1E], except that they recite a “parallel interface” rather than a “serial interface.” As I discussed above with respect to Element [1E], Pugel in view of

Chandrakasan discloses providing the plurality of desired channels via a serial or parallel interface. *See* Section 9.3.1.b, *supra*. Thus, it is my opinion that it would have been obvious to apply either of parallel data or serial data communication, as taught by Chandrakasan, to the interconnection between Pugel's digital tuner 130 and demodulators 141-143. *Id.* Pugel discloses sending a digital RF signal and the use of parallel or serial data interfaces, as taught in Chandrakasan, would have enabled such transmission. Ex. 1224, [0038]-[0041], [0045]-[0046]; Ex. 1217 at 354-356.

211. As such, the modification of Pugel with Chandrakasan that results in a serial interface or parallel interface as an output from demodulators 141-143 is nothing more than choosing from a finite number of identified, predictable solutions (using serial or parallel communications as taught by Chandrakasan and known in the art) with a reasonable expectation of success (resulting in Pugel's system implemented with either serial or parallel communication).

212. The resultant combinations of Pugel and Chandrakasan are predictable, and a POSITA would have had a reasonable expectation of success, because Chandrakasan discloses basic techniques used by POSITAs to design integrated circuits, and because those techniques are specifically directed to overcoming specific issues, such as meeting area and power constraints, that are often necessary for a successful design. Ex. 1217 at 355-357.

213. Thus, it is my opinion that Pugel in view of Chandrakasan renders obvious claims 33 and 59.

9.3.7. Dependent Claims 34, 60

[34/60] “The method of claim [25/51], wherein the method comprises: providing the plurality of desired channels via a serial interface.”

214. As I discuss in Sections 9.1.1.a-f and 9.1.2.a-b, Pugel discloses the features of the base claims 25 and 51. Claims 34 and 60 recite an identical limitation to Element [1E], and thus, it is my opinion that Pugel in view of Chandrakasan renders obvious the additional limitations of claims 34 and 36 for the same reasons discussed above in Section 9.3.1.b.

9.4. Ground D: Pugel/Crols/Chandrakasan

215. It is my opinion that Pugel in view of Crols and further in view of Chandrakasan renders obvious claims 3-4, 6, 13-16, 18-21, 23-24, 45-47, and 71-73.

9.4.1. Independent Claim 13

216. The elements of claim 13 appear in the Claims Listing Appendix, labeled as Elements [13A]-[13E]. For the following reasons, it is my opinion that Elements [13A]-[13E] are rendered obvious by Pugel-Crols in view of Chandrakasan.

a. **[13A] “A method comprising:”**

[13B] “receiving an input signal from a cable network;”

[13C] “digitizing all received channels in the input signal via a wideband analog-to-digital converter (ADC), wherein the received channels comprise a plurality of desired channels and a plurality of undesired channels;”

[13D] “digitally down converting each desired channel, of the plurality of desired channels, to generate a plurality of digital channel outputs; and”

217. Elements [13A]-[13D] recites similar features as Elements [38A]-[38D]. Thus, it is my opinion that Elements [13A]-[13D] are thus disclosed and taught as obvious by Pugel in view of Crols for the same reasons discussed above with respect to Elements [38A]-[38D]. *See* Section 9.2.1.a-d, *supra*.

b. [13E] “providing the plurality of desired channels via a serial interface.”

218. Element [13E] is identical to Element [1E], and it is my opinion that Pugel in view of Chandrakasan discloses Element [13E]. *See* Section 9.3.1.b, *supra*. It is also my opinion that modifying Pugel in view of Crols further in view of Chandrakasan would have been obvious for the same rationales as discussed above, and the addition of Chandrakasan to the combination of Pugel and Crols would have presented no additional difficulties for the combination to a POSITA.

9.4.2. Dependent Claim 14

[14] “The method of claim 13, wherein the method comprises: communicating the input signal from a cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.”

219. As I explained in Section 9.4.1, Pugel in view of Crols and Chandrakasan discloses the features of base claim 13. It is my opinion that claim 14 recites features similar to those in claims 26 and 52, and thus, Pugel discloses the additional limitations of claim 14 for the same reasons discussed above in Section 9.1.3.

9.4.3. Dependent Claims 3, 15

[3] “The method of claim 1, wherein the method comprises: generating, via each mixer of a plurality of mixers, a complex signal corresponding to each of the plurality of desired channels, and wherein each corresponding complex signal comprises an in-phase (I) component and a quadrature (Q) component”

[15] The method of claim 13, wherein: digitally down converting comprises generating a corresponding complex signal for each of the plurality of desired channels, and wherein each corresponding complex signal comprises an in-phase (I) component and a quadrature (Q) component.

220. As I explained in Section 9.4.1, Pugel in view of Crols and Chandrakasan discloses the features of base claim 13. And I explained in Section 9.3.1 that Pugel in view of Chandrakasan discloses the features of base claim 1.

221. Claims 3 and 15 recite features similar to those in claims 27 and 40, respectively, and thus Pugel in view of Crols discloses the additional limitations of claims 3 and 15 for the same reasons discussed above in Section 9.2.4. It is my opinion that modifying Pugel in view of Crols further in view of Chandrakasan would have been obvious for the same rationales as discussed above, and the

additional reference would have presented no additional difficulties for the combination to a POSITA. *See* Sections 9.2.4, 9.2.1.a-d, 9.3.1.b, *supra*.

9.4.4. Dependent Claims 4, 6, 16, 18, 19

[4] “The method of claim 3, wherein: the I and Q components of each corresponding complex signal are at baseband.”

[6] “The method of claim 3, wherein the method comprises: demodulating, via each demodulator of a plurality of demodulators, the corresponding complex signal to generate a demodulated signal as a desired channel output.”

[16] “The method of claim 15, wherein: the I and Q components of each corresponding complex signal are at baseband.”

[18] “The method of claim 15, wherein the method comprises: demodulating the corresponding complex signal to provide a demodulated channel as a digital channel output.”

[19] “The method of claim 13, wherein the method comprises: demodulating each digitally down converted, desired channel to generate a plurality of demodulated channels.”

222. As I explained in Section 9.4.3, Pugel in view of Crols and Chandrakasan discloses the features of base claims 3 and 15. Claims 4, 6, 16, 18, and 19 recite identical additional limitations as those in claims 28, 30, 41, 43, and 44, respectively, and thus, it is my opinion that Pugel in view of Crols discloses the additional limitations of claims 4, 6, 16, 18, and 19 for the same reasons discussed above in Sections 9.2.5-7. It is also my opinion that modifying Pugel in view of Crols further in view of Chandrakasan would have been obvious for the same rationales as discussed above, and the additional reference would have presented no

additional difficulties for the combination to a POSITA. *See* Sections 9.2.5-7, 9.2.1.a-d, 9.3.1.b, *supra*.

9.4.5. Dependent Claims 20, 45, 71

[20/45/71] “The method of claim [19/44/70], wherein the method comprises: providing the plurality of demodulated channels via a parallel interface.”

223. As I discuss in Sections 9.2.6 and 9.4.4, Pugel discloses the features of the base claims 19, 44, and 70. Claims 20, 45, and 71 recite identical additional limitations as those in claims 8, 32, and 58, except that “a plurality of demodulated desired channels” in claims 20, 45, and 71 is replaced with “the plurality of demodulated channels.” It is my opinion that Pugel in view of Chandrakasan discloses the additional limitations of claims 20, 45, and 71 for the same reasons discussed above in Section 9.3.4. It is also my opinion that modifying Pugel in view of Crols further in view of Chandrakasan would have been obvious for the same rationales as discussed above, and the additional reference would have presented no additional difficulties for the combination to a POSITA. *See* Sections 9.3.4, 9.2.1.d, 9.3.1.b, *supra*.

9.4.6. Dependent Claims 46, 72

[46/72] “The method of claim [38/64], wherein the method comprises: providing the plurality of digital channel outputs via a parallel interface.”

224. As I discuss in Sections 9.2.1.a-e and 9.2.2.a-b, Pugel in view of Crols discloses the features of the base claims 38 and 64. Claims 46 and 72 recite identical additional limitations as those in claims 33 and 59, except that “desired channels” in claims 33 and 59 is replaced with “digital channel outputs.” It is my opinion that Pugel in view of Chandrakasan discloses the additional limitations of claims 46 and 72 for the same reasons discussed above in Section 9.3.6. It is also my opinion that modifying Pugel in view of Crols further in view of Chandrakasan would have been obvious for the same rationales as discussed above, and the additional reference would have presented no additional difficulties for the combination to a POSITA. *See* Sections 9.3.6, 9.2.1.a-d, 9.3.1.b, *supra*.

9.4.7. Dependent Claims 47, 73

[47/73] “The method of claim [38/64], wherein the method comprises: providing the plurality of digital channel outputs via a serial interface.”

225. As I discuss in Sections 9.2.1.a-e and 9.2.2.a-b, Pugel in view of Crols discloses the features of the base claims 38 and 64. Claims 47 and 73 recite identical additional limitations as those in claims 34 and 60, except that “desired channels” in claims 34 and 60 is replaced with “digital channel outputs.” Thus, it is my opinion that Pugel in view of Chandrakasan discloses the additional limitations of claims 47 and 73 for the same reasons discussed above in Section 9.3.7. It is also my opinion that modifying Pugel in view of Crols further in view of Chandrakasan would have

been obvious for the same rationales as discussed above, and the additional reference would have presented no additional difficulties for the combination to a POSITA. *See* Sections 9.3.7, 9.2.1.a-d, 9.3.1.b, *supra*.

9.4.8. Dependent Claims 21, 23

[21] “The method of claim 13, wherein: the plurality of desired channels comprises at least one cable broadcast channel.”

[23] “The method of claim 13, wherein: the method is performed by a device comprising a digital video recorder (DVR).”

226. As I explained in Section 9.4.1, Pugel in view of Crols and Chandrakasan discloses the features of base claim 13. Claims 21 and 23 recite identical additional limitations as those in claims 35 and 63, respectively, and thus, it is my opinion that Pugel discloses the additional limitations of claims 21 and 23 for the same reasons discussed above in Sections 9.1.5 and 9.1.7.

9.4.9. Dependent Claim 24

[24] “The method of claim 13, wherein the method comprises: providing a picture-in-picture display signal according to the plurality of digital channel outputs.”

227. As I explained in Section 9.4.1, Pugel in view of Crols and Chandrakasan discloses the features of base claim 13. Claim 24 recites identical additional limitations as those in claim 50, and thus, it is my opinion that Pugel discloses the additional limitations of claim 24 for the same reasons discussed above in Sections 9.1.6 and 9.2.9.

9.5. Ground E: Pugel/Zaltsman

228. It is my opinion that Pugel in view of Zaltsman renders obvious claims 36 and 62.

9.5.1. Dependent Claims 36, 62

[36/62] “The method of claim [25/51], wherein: the plurality of desired channels comprises at least one channel delivered via a Data Over Cable Service Interface Specification (DOCSIS) protocol.”

229. As I discuss in Sections 9.1.1.a-f and 9.1.2.a-b, Pugel discloses the features of the base claims 25 and 51.

230. Pugel discloses the transmission of digital cable television signals using well-known methods, including transmission using QAM, QPSK, VSB, and/or HDTV signals. Ex. 1224, [0040]. Thus, in my opinion, it would have been obvious to a POSITA in view of those teachings that the digital cable transmissions should be sent according to well-known standards, such as the DOCSIS standard. *See* Section 8.1, *supra*; *see* Ex. 1221. DOCSIS was the predominant standard at the time of the alleged invention for sending digital cable transmissions, and it would have been obvious to any POSITA to have turned to the standard to deliver cable television channels as taught by Pugel. *See* Section 8.1, *supra*; *see* Ex. 1221.

231. To any extent it is asserted that Pugel does not explicitly teach the DOCSIS protocol, use of the protocol would have been obvious in view of Zaltsman because it would support transmission in consumer networks using the most

common standard of the day. Zaltsman provides a detailed background section discussing known technology as of 2007, particularly regarding the use of digital television standards, including DOCSIS, in wideband television transmission to a set-top box. Ex. 1274, [0003]-[0023]. In particular, Zaltsman states that, in the latest DOCSIS standard of the day, multiple television channels were bonded together, typically using a 6 MHz frequency band. Ex. 1274, [0012]-[0013]. Modifying Pugel to use the DOCSIS standard as taught by Zaltsman would have been nothing more than applying a known technique (DOCSIS standardized transmission) to a known device (Pugel's receiver circuit for digital cable television transmission) ready for improvement to yield a predictable result (signals from Pugel's receiver circuit are transmitted according to the known DOCSIS standard). A POSITA would have had a reasonable expectation of success, as the standard was well-documented and implementation was well within the skill of the art. *See* Ex. 1221.

9.6. Ground F: Pugel/Crols/Zaltsman

232. It is my opinion that Pugel in view of Crols and further in view of Zaltsman renders obvious claims 49 and 75.

9.6.1. Dependent Claims 49, 75

[49/75] “The method of claim [38/64], wherein: the plurality of desired channels comprises at least one channel delivered via a Data Over Cable Service Interface Specification (DOCSIS) protocol.”

233. As I discuss in Sections 9.2.1.a-e and 9.2.2.a-b, Pugel in view of Crols discloses the features of the base claims 38 and 64. Claims 49 and 75 recite identical additional limitations as those in claims 36 and 62, and thus, it is my opinion Pugel in view of Zaltsman discloses the additional limitations of claims 49 and 75 for the same reasons discussed above in Section 9.5.1. It is also my opinion that modifying Pugel in view of Crols further in view of Zaltsman would have been obvious for the same rationales as discussed above, and the additional reference would have presented no additional difficulties for the combination to a POSITA. *See* Sections 9.5.1, 9.2.1-2, *supra*

9.7. Ground G: Pugel/Chandrakasan/Zaltsman

234. It is my opinion that Pugel in view of Chandrakasan and further in view of Zaltsman renders obvious claim 10.

9.7.1. Dependent Claim 10

[10] “The method 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.”

235. As I explained in Section 9.3.1, Pugel in view of Chandrakasan discloses the features of base claim 1. Claim 10 recites identical additional limitations as those in claims 36 and 62, and thus it is my opinion that Pugel in view of Zaltsman discloses the additional limitations of claim 10 for the same reasons

discussed above in Section 9.5.1. It is also my opinion that modifying Pugel in view of Chandrakasan further in view of Zaltsman would have been obvious for the same rationales as discussed above, and the additional reference would have presented no additional difficulties for the combination to a POSITA. *See* Sections 9.5.1, 9.3.1, *supra*.

9.8. Ground H: Pugel/Crols/Chandrakasan/Zaltsman

236. Pugel in view of Crols and Chandrakasan further in view of Zaltsman renders obvious claim 22.

9.8.1. Dependent Claim 22

[22] “The method of claim 13, wherein: the plurality of desired channels comprises at least one channel delivered via a Data Over Cable Service Interface Specification (DOCSIS) protocol.”

237. As I explained in Section 9.4.1, Pugel in view of Crols and Chandrakasan discloses the features of base claim 13. Claim 22 recites identical additional limitations as those in claims 36 and 62, and thus it is my opinion that Pugel in view of Zaltsman discloses the additional limitations of claim 22 for the same reasons discussed above in Section 9.5.1. It is also my opinion that modifying Pugel in view of Crols and Chandrakasan further in view of Zaltsman would have been obvious for the same rationales as discussed above, and the additional reference would have presented no additional difficulties for the combination to a POSITA. *See* Sections 9.5.1, 9.2.1, 9.3.1, 9.4.1, *supra*.

9.9. Ground I: Pugel/Crols/Zaltsman/Jensen '170

238. It is my opinion that Pugel in view of Crols and further in view of Zaltsman and Jensen '170 renders obvious claims 29, 42, 55, and 68.

9.9.1. Dependent Claim 29, 42, 55, 68

[29/55] “The method of claim [27/53], wherein the method comprises: filtering, via each filter of a plurality of filters, the corresponding complex signal, and wherein each corresponding complex signal comprises a 6 MHz channel.”

[42/68] “The method of claim [40/66], wherein the method comprises: a filtering the corresponding complex signal, wherein a bandwidth of the complex signal is 6 MHz.”

239. As I explained in Section 9.2.4, Pugel in view of Crols discloses the features of base claims 27, 40, 53, and 66.

240. As discussed above, Pugel's digital tuner 130 receives, via a channel selector 315 coupled to the digital tuner 130, selections of one or more television channels desired by users. Ex. 1224, [0038]. Pugel's digital tuner 130 is configured to select the signals of the desired television channels from “digital signals converted by the plurality of analog-to-digital converters 121, 122, 123” and output the selected digital channels to demodulation circuits 141, 142, 143. Ex. 1224, [0037]-[0039]. The digital signals from Pugel's analog-to-digital converters 121, 122, 123 include signals of both desired and undesired television channels. *See* Section 9.1.1, *supra*. Pugel's digital tuner 130 only outputs the signals of the desired television channels to the demodulation circuits 141, 142, 143. Ex. 1224, [0038]-[0039]. Pugel further

elaborates that the digital tuner 130 can be implemented with one or more digital signal processors. Ex. 1224, [0037].

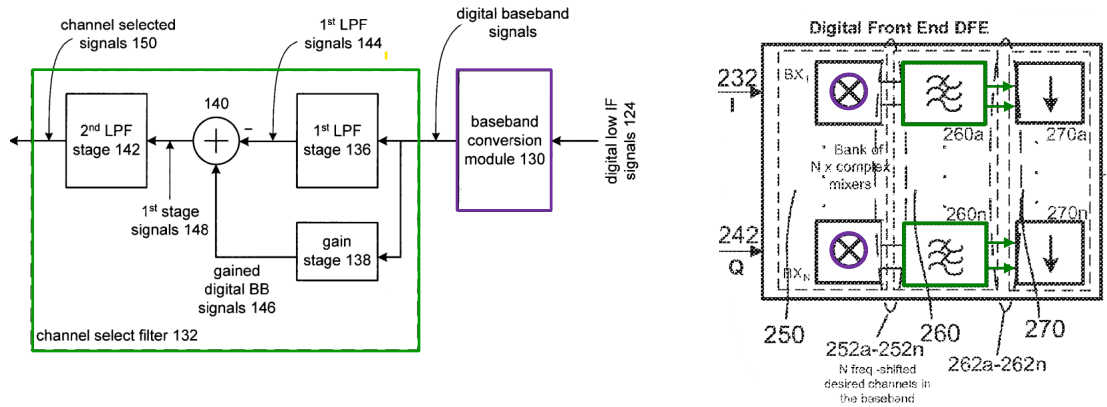
241. Before selecting the signals of the desired television channels from the digital signals produced by the analog-to-digital converters 121, 122, 123, Pugel's digital tuner 130 downconverts the digital signals. Ex. 1224, [0037], claims 14 (reciting "digital processor (130) ... downconverts said multiplexed signal and extracts desired information to be coupled to said first and second demodulator circuits"), 15 (reciting "digital processor (130) downconverts and extracts desired information to be coupled to said first and second demodulator circuits (141, 142)"), 18 (reciting "downconverting said first digital signal and said second signal ... and ... extracting desired television program information from said downconverted first digital signal and said second digital signal"), 20-21; *See* Section 9.2.1.d, *supra*.

242. Pugel does not expressly disclose in detail the components inside the digital tuner 130 that perform the downconversion process followed by the selection process. However, Pugel discloses that the digital tuner may include "a multitude of components configured as is well known in the art to recover a plurality of digital channel signals substantially simultaneously." Ex. 1224, [0037].

243. To any extent that Pugel does not explicitly disclose the components of the digital tuner 130 configured to perform the downconversion and the selection, it is my opinion that Jensen '170 teaches "filtering, via each filter of a plurality of

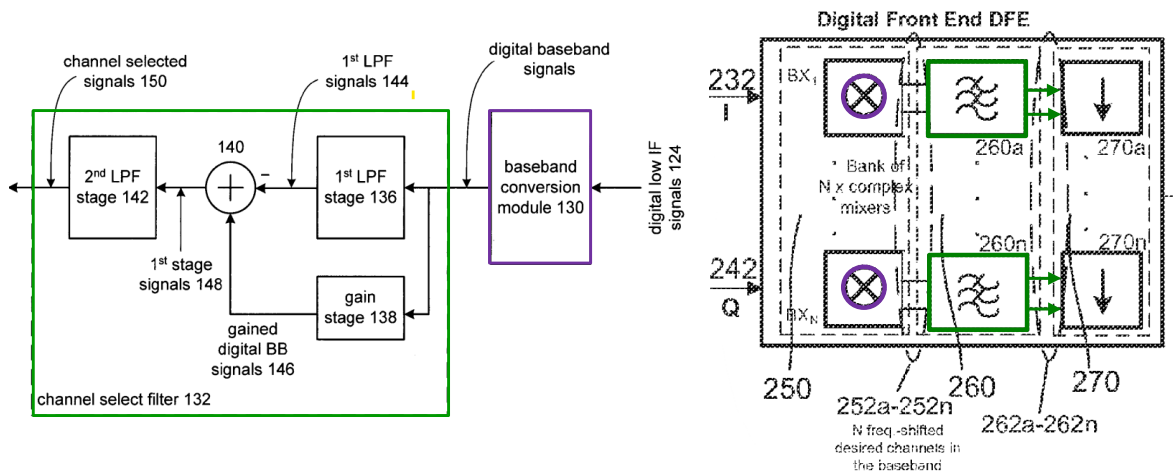
filters, the corresponding complex signal.” Ex. 1230, [0010], [0064]-[0066], [0071]-[0073]. Jensen ’170 discloses components that can be implemented in digital signal processors of RF receivers, where the digital signal processors perform the downconversion process followed by the selection process of desired channels. Ex. 1230, [0007], [0009], [0016]-[0017], [0064]-[0067]. For example, Jensen ’170 describes using a baseband conversion module 130 to downconvert digital signals. Ex. 1230, [0017], [0064]-[0065]. It is my opinion that the operation of Jensen ’170’s baseband conversion module 130 is similar to the frequency-shifting operation of the complex mixers 250 of the ’206 patent as both components downconvert digital signals to baseband frequency. *Compare* Ex. 1230, [0017], [0064]-[0065] *with* Ex. 1201, Fig. 2 (mixers 250), 5:49-52, 6:32-42.

244. A “channel select” filter 132 follows the baseband conversion module 130 in Jensen ’170, where low pass filters (LPFs) are used to build the channel select filter 132. Ex. 1230, Fig. 9 (channel select filter 132), [0009], [0016]-[0017], [0064], [0066]-[0067]. It is my opinion that Jensen ’170’s channel select filter 132 is like the filters 260 in the ’206 patent as they both perform the claimed selection by allowing only selected signals to pass through the filters and blocking the undesired signals. *Compare* Ex. 1230, Fig. 9 (channel select filter 132), [0009], [0016]-[0017], [0064], [0066]-[0067] *with* Ex. 1201, Fig. 2 (filters 260), 5:49-58, 6:43-54.



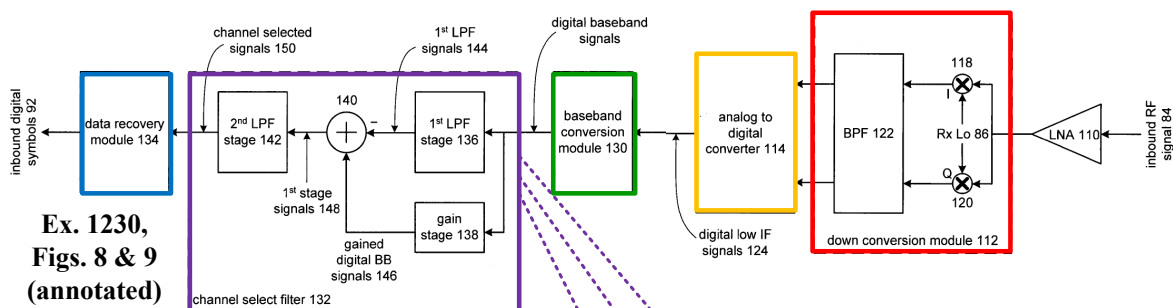
Ex. 1230, Fig. 9 (annotated, excerpted); Ex. 1201, Fig. 2 (annotated, excerpted)

245. Specifically, it is my opinion that a portion of Jensen '170's digital demodulator 116 (above left), including the baseband conversion module 130 (purple) followed by the channel select filter 132 (green), is the same as each of the I path 232 and Q path 242 of the '206 patent's digital front end 230 (above right). Compare Ex. 1230, Fig. 9, [0064]-[0066] with Ex. 1201, Fig. 2, 6:3-12. The channel select filter 132 in Jensen '170 includes a first low pass filter stage 136 and a second low pass filter stage 142, and the low-pass filters are implemented with finite impulse response (FIR) filters. Ex. 1230, [0010], [0064]-[0066], [0071]-[0073].

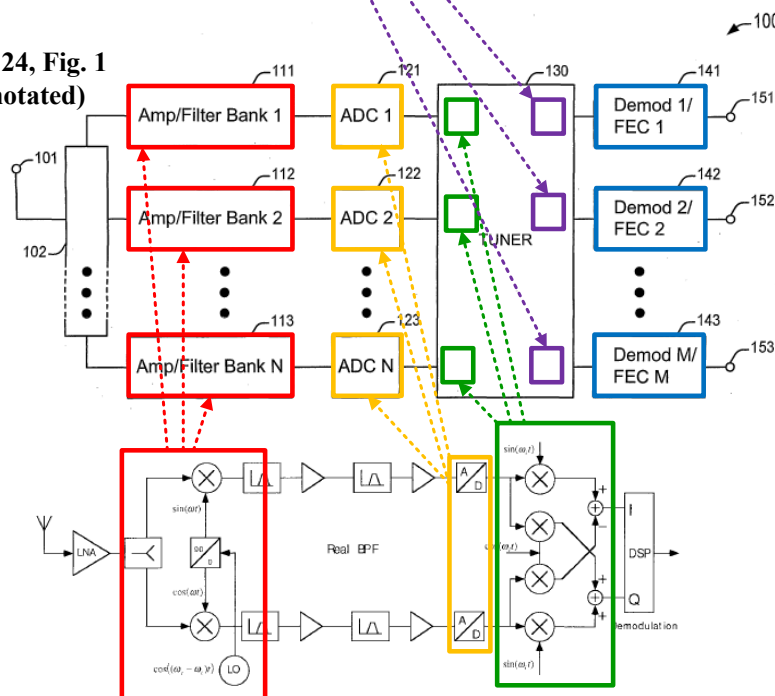


Ex. 1230, Fig. 9 (annotated, excerpted); Ex. 1201, Fig. 2 (annotated, excerpted)

246. Digital low IF signals enter the baseband conversion module 130 in Jensen '170, where the baseband conversion module 130 shifts the frequency of the desired channel to baseband. Ex. 1230, [0064]-[0065]. The channel select filter 132 then selects the desired channels, while filtering out the remaining channels. Ex. 1230, [0007], [0009]-[0010], [0012], [0067]-[0068].



Ex. 1224, Fig. 1 (annotated)



247. Following Jensen '170, it is my opinion that a POSITA would have included circuit topologies of the channel select filter 132 as taught by Jensen '170 in the digital tuner 130 of Pugel/Crols' receiver (as illustrated above) because a POSITA would have been motivated to implement Pugel's digital tuner 130 with known solutions, in view of Pugel's express teaching that digital tuner 130 could be implemented with "a multitude of components configured as is well known in the art to recover a plurality of digital channel signals." Ex. 1224, [0037].

248. It is my opinion that applying Jensen '170 channel select filter 132 comprising FIR-based low pass filters to Pugel's digital tuner 130 would have been nothing more than applying a known technique (using channel select filters to filter signals of desired channels as taught by Jensen '170) to improve a known device (Pugel's digital tuner 130) to yield predictable results (Pugel's digital tuner 130 filtering signals of desired television channels using Jensen '170's channel select filters). A POSITA would have had a reasonable expectation of success given the express teachings in Pugel to turn to other systems, such as Jensen '170's detailed descriptions of using channel select filters implemented using FIR architecture, and the POSITA's own familiarity with known receiver circuit topologies in the art.

249. And, as further described in Section 9.5.1, it would have been obvious to modify Pugel in view of Zaltsman to use the DOCSIS standard, which specifies that the signal for each television channel (the claimed "complex signal") is a

channel with a 6 MHz bandwidth. Ex. 1274, [0012]-[0013]; *See* Section 8.1, *supra* (citing Ex. 1221 at 2-5, Fig. 1-2; Ex. 1233 at 27, 211-212). Modifying Pugel in view of Crols and Jensen '170 would have been obvious for the same rationale, and the additional references would have presented no additional difficulties for the combination to a POSITA. *See* Sections 9.5, 9.2.1-2, *supra*.

250. Thus, it is my opinion that Pugel in view of Crols and further in view of Jensen '170 teaches claims 29, 42, 55 and 68.

9.10. Ground J: Pugel/Crols/Chandrakasan/Zaltsman/Jensen '170

251. It is my opinion that Pugel in view of Crols and Chandrakasan further in view of Zaltsman and Jensen '170 renders obvious claims 5 and 17.

9.10.1. Dependent Claims 5 and 17

[5] “The method of claim 3, wherein the method comprises: filtering, via each filter of a plurality of filters, the corresponding complex signal, and wherein each corresponding complex signal comprises a 6 MHz channel.”

[17] “The method of claim 15, wherein the method comprises: a filtering the corresponding complex signal, wherein a bandwidth of the complex signal is 6 MHz.”

252. Claims 5 and 17 recite features similar to those in claims 29 and 42, respectively. As I explain above in section 9.3.1, Pugel in view of Chandrakasan and Crols discloses the base claims 3 and 15 from which claims 5 and 17 depend. And it is my opinion that the same reasons set forth above in Section 9.4.1, Zaltsman and Jensen '170 teach the additional features of these claims. It is also my opinion that

modifying Pugel in view of Chandrakasan and Crols further in view of Zaltsman and Jensen would have been obvious for the same rationales as discussed above, and the additional references would have presented no additional difficulties for the combination to a POSITA. Therefore, in my opinion, claims 5 and 17 are rendered obvious based on the combination of Pugel, Chandrakasan, Crols, Zaltsman, and Jensen '170. *See* Sections 9.9, 9.5, 9.2.1-2, 9.3.1, *supra*.

10.CONCLUSION

253. 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
David B. Lett

CLAIMS LISTING APPENDIX

U.S. Pat. No. 11,399,206

Designation	Claim Language
Claim 1	
[1A]	A method for receiving a television (TV) signal comprising:
[1B]	receiving an input signal from a cable network;
[1C]	digitizing a contiguous band of frequencies in the input signal via a wideband analog-to-digital converter (ADC), wherein the contiguous band of frequencies comprises all received channels that exist in the input signal and the received channels comprise a plurality of desired channels and a plurality of undesired channels;
[1D]	concurrently selecting each of the plurality of desired channels from the input signal without selecting any of the plurality of undesired channels; and
[1E]	providing the plurality of desired channels via a serial interface.
Claim 2	
2	The method of claim 1, wherein the method comprises: communicating the input signal from a cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.
Claim 3	
[3A]	The method of claim 1, wherein the method comprises: generating, via each mixer of a plurality of mixers, a complex signal corresponding to each of the plurality of desired channels, and
[3B]	wherein each corresponding complex signal comprises an in-phase (I) component and a quadrature (Q) component.
Claim 4	
4	The method of claim 3, wherein: the I and Q components of each corresponding complex signal are at baseband.
Claim 5	
5	The method of claim 3, wherein the method comprises:

Designation	Claim Language
	filtering, via each filter of a plurality of filters, the corresponding complex signal, and wherein each corresponding complex signal comprises a 6 MHz channel.
Claim 6	
6	The method of claim 3, wherein the method comprises: demodulating, via each demodulator of a plurality of demodulators, the corresponding complex signal to generate a demodulated signal as a desired channel output.
Claim 7	
7	The method of claim 1, wherein the method comprises: demodulating, via each demodulator of a plurality of demodulators, a desired channel, of the plurality of desired channels.
Claim 8	
8	The method of claim 7, wherein the method comprises: providing a plurality of demodulated desired channels via a parallel interface.
Claim 9	
9	The method of claim 1, wherein: the plurality of desired channels comprises at least one cable broadcast channel.
Claim 10	
10	The method 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 method of claim 1, wherein: the method is performed by a device comprising a digital video recorder (DVR).
Claim 12	
12	The method of claim 1, wherein the method comprises: configuring at least some of the plurality of desired channels as an output for a picture-in-picture display.
Claim 13	
[13A]	A method comprising:
[13B]	receiving an input signal from a cable network;

Designation	Claim Language
[13C]	digitizing all received channels in the input signal via a wideband analog-to-digital converter (ADC), wherein the received channels comprise a plurality of desired channels and a plurality of undesired channels;
[13D]	digitally down converting each desired channel, of the plurality of desired channels, to generate a plurality of digital channel outputs; and
[13E]	providing the plurality of digital channel outputs via a serial interface.
Claim 14	
14	The method of claim 13, wherein the method comprises: communicating the input signal from a cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.
Claim 15	
[15A]	The method of claim 13, wherein: digitally down converting comprises generating a corresponding complex signal for each of the plurality of desired channels, and
[15B]	wherein each corresponding complex signal comprises an in-phase (I) component and a quadrature (Q) component.
Claim 16	
16	The method of claim 15, wherein: the I and Q components of each corresponding complex signal are at baseband.
Claim 17	
17	The method of claim 15, wherein the method comprises: a filtering the corresponding complex signal, wherein a bandwidth of the complex signal is 6 MHz.
Claim 18	
18	The method of claim 15, wherein the method comprises: demodulating the corresponding complex signal to provide a demodulated channel as a digital channel output.
Claim 19	
19	The method of claim 13, wherein the method comprises: demodulating each digitally down converted, desired channel to generate a plurality of demodulated channels.
Claim 20	

Designation	Claim Language
20	The method of claim 19, wherein the method comprises: providing the plurality of demodulated channels via a parallel interface.
Claim 21	
21	The method of claim 13, wherein: the plurality of desired channels comprises at least one cable broadcast channel.
Claim 22	
22	The method of claim 13, wherein: the plurality of desired channels comprises at least one channel delivered via a Data Over Cable Service Interface Specification (DOCSIS) protocol.
Claim 23	
23	The method of claim 13, wherein: the method is performed by a device comprising a digital video recorder (DVR).
Claim 24	
24	The method of claim 13, wherein the method comprises: providing a picture-in-picture display signal according to the plurality of digital channel outputs.
Claim 25	
[25A]	A method for receiving a television (TV) signal comprising:
[25B]	receiving an input signal from a cable network;
[25C]	digitizing a contiguous band of frequencies in the input signal via a wideband analog-to-digital converter (ADC), wherein the contiguous band of frequencies comprises all received channels that exist in the input signal and the received channels comprise a plurality of desired channels and a plurality of undesired channels;
[25D]	concurrently selecting each of the plurality of desired channels from the input signal without selecting any of the plurality of undesired channels; and
[25E]	providing the plurality of desired channels,
[25F]	wherein the method is performed by a device comprising a digital video recorder (DVR).
Claim 26	
26	The method of claim 25, wherein the method comprises:

Designation	Claim Language
	communicating the input signal from a cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.
Claim 27	
[27A]	The method of claim 25, wherein the method comprises: generating, via each mixer of a plurality of mixers, a complex signal corresponding to each of the plurality of desired channels, and
[27B]	wherein each corresponding complex signal comprises an in-phase (I) component and a quadrature (Q) component.
Claim 28	
28	The method of claim 27, wherein: the I and Q components of each corresponding complex signal are at baseband.
Claim 29	
29	The method of claim 27, wherein the method comprises: filtering, via each filter of a plurality of filters, the corresponding complex signal, and wherein each corresponding complex signal comprises a 6 MHz channel.
Claim 30	
30	The method of claim 27, wherein the method comprises: demodulating, via each demodulator of a plurality of demodulators, the corresponding complex signal to generate a demodulated signal as a desired channel output.
Claim 31	
31	The method of claim 25, wherein the method comprises: demodulating, via each demodulator of a plurality of demodulators, a desired channel, of the plurality of desired channels.
Claim 32	
32	The method of claim 31, wherein the method comprises: providing a plurality of demodulated desired channels via a parallel interface.
Claim 33	
33	The method of claim 25, wherein the method comprises: providing the plurality of desired channels via a parallel interface.
Claim 34	

Designation	Claim Language
34	The method of claim 25, wherein the method comprises: providing the plurality of desired channels via a serial interface.
Claim 35	
35	The method of claim 25, wherein: the plurality of desired channels comprises at least one cable broadcast channel.
Claim 36	
36	The method of claim 25, wherein: the plurality of desired channels comprises at least one channel delivered via a Data Over Cable Service Interface Specification (DOCSIS) protocol.
Claim 37	
37	The method of claim 25, wherein the method comprises: configuring at least some of the plurality of desired channels as an output for a picture-in-picture display.
Claim 38	
[38A]	A method comprising:
[38B]	receiving an input signal from a cable network;
[38C]	digitizing all received channels in the input signal via a wideband analog-to-digital converter (ADC), wherein the received channels comprise a plurality of desired channels and a plurality of undesired channels; and
[38D]	digitally down converting each desired channel, of the plurality of desired channels, to generate a plurality of digital channel outputs,
[38E]	wherein the method is performed by a device comprising a digital video recorder (DVR).
Claim 39	
39	The method of claim 38, wherein the method comprises: communicating the input signal from a cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.
Claim 40	
[40A]	The method of claim 38, wherein: digitally down converting comprises generating a corresponding complex signal for each of the plurality of desired channels, and

Designation	Claim Language
[40B]	wherein each corresponding complex signal comprises an in-phase (I) component and a quadrature (Q) component.
Claim 41	
41	The method of claim 40, wherein: the I and Q components of each corresponding complex signal are at baseband.
Claim 42	
42	The method of claim 40, wherein the method comprises: a filtering the corresponding complex signal, wherein a bandwidth of the complex signal is 6 MHz.
Claim 43	
43	The method of claim 40, wherein the method comprises: demodulating the corresponding complex signal to provide a demodulated channel as a digital channel output.
Claim 44	
44	The method of claim 38, wherein the method comprises: demodulating each digitally down converted, desired channel to generate a plurality of demodulated channels.
Claim 45	
45	The method of claim 44, wherein the method comprises: providing the plurality of demodulated channels via a parallel interface.
Claim 46	
46	The method of claim 38, wherein the method comprises: providing the plurality of digital channel outputs via a parallel interface.
Claim 47	
47	The method of claim 38, wherein the method comprises: providing the plurality of digital channel outputs via a serial interface.
Claim 48	
48	The method of claim 38, wherein: the plurality of desired channels comprises at least one cable broadcast channel.
Claim 49	
49	The method of claim 38, wherein:

Designation	Claim Language
	the plurality of desired channels comprises at least one channel delivered via a Data Over Cable Service Interface Specification (DOCSIS) protocol.
Claim 50	
50	The method of claim 38, wherein the method comprises: providing a picture-in-picture display signal according to the plurality of digital channel outputs.
Claim 51	
[51A]	A method for receiving a television (TV) signal comprising:
[51B]	receiving an input signal from a cable network;
[51C]	digitizing a contiguous band of frequencies in the input signal via a wideband analog-to-digital converter (ADC), wherein the contiguous band of frequencies comprises all received channels that exist in the input signal and the received channels comprise a plurality of desired channels and a plurality of undesired channels;
[51D]	concurrently selecting each of the plurality of desired channels from the input signal without selecting any of the plurality of undesired channels;
[51E]	providing the plurality of desired channels; and
[51F]	configuring at least some of the plurality of desired channels as an output for a picture-in-picture display.
Claim 52	
52	The method of claim 51, wherein the method comprises: communicating the input signal from a cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.
Claim 53	
[53A]	The method of claim 51, wherein the method comprises: generating, via each mixer of a plurality of mixers, a complex signal corresponding to each of the plurality of desired channels, and
[53B]	wherein each corresponding complex signal comprises an in-phase (I) component and a quadrature (Q) component.
Claim 54	
54	The method of claim 53, wherein: the I and Q components of each corresponding complex signal are at baseband.

Designation	Claim Language
Claim 55	
55	The method of claim 53, wherein the method comprises: filtering, via each filter of a plurality of filters, the corresponding complex signal, and wherein each corresponding complex signal comprises a 6 MHz channel.
Claim 56	
56	The method of claim 53, wherein the method comprises: demodulating, via each demodulator of a plurality of demodulators, the corresponding complex signal to generate a demodulated signal as a desired channel output.
Claim 57	
57	The method of claim 51, wherein the method comprises: demodulating, via each demodulator of a plurality of demodulators, a desired channel, of the plurality of desired channels.
Claim 58	
58	The method of claim 57, wherein the method comprises: providing a plurality of demodulated desired channels via a parallel interface.
Claim 59	
59	The method of claim 51, wherein the method comprises: providing the plurality of desired channels via a parallel interface.
Claim 60	
60	The method of claim 51, wherein the method comprises: providing the plurality of desired channels via a serial interface.
Claim 61	
61	The method of claim 51, wherein: the plurality of desired channels comprises at least one cable broadcast channel.
Claim 62	
62	The method of claim 51, wherein: the plurality of desired channels comprises at least one channel delivered via a Data Over Cable Service Interface Specification (DOCSIS) protocol.
Claim 63	
63	The method of claim 51, wherein:

Designation	Claim Language
	the method is performed by a device comprising a digital video recorder (DVR).
Claim 64	
[64A]	A method comprising:
[64B]	receiving an input signal from a cable network;
[64C]	digitizing all received channels in the input signal via a wideband analog-to-digital converter (ADC), wherein the received channels comprise a plurality of desired channels and a plurality of undesired channels;
[64D]	digitally down converting each desired channel, of the plurality of desired channels, to generate a plurality of digital channel outputs; and
[64E]	configuring at least some of the plurality of desired channels as an output for a picture-in-picture display.
Claim 65	
65	The method of claim 64, wherein the method comprises: communicating the input signal from a cable network connector to the wideband ADC via at least one of an analog amplifier and an analog filter.
Claim 66	
[66A]	The method of claim 64, wherein: digitally down converting comprises generating a corresponding complex signal for each of the plurality of desired channels, and
[66B]	wherein each corresponding complex signal comprises an in-phase (I) component and a quadrature (Q) component.
Claim 67	
67	The method of claim 66, wherein: the I and Q components of each corresponding complex signal are at baseband.
Claim 68	
68	The method of claim 66, wherein the method comprises: a filtering the corresponding complex signal, wherein a bandwidth of the complex signal is 6 MHz.
Claim 69	
69	The method of claim 66, wherein the method comprises: demodulating the corresponding complex signal to provide a demodulated channel as a digital channel output.

Designation	Claim Language
Claim 70	
70	The method of claim 64, wherein the method comprises: demodulating each digitally down converted, desired channel to generate a plurality of demodulated channels.
Claim 71	
71	The method of claim 70, wherein the method comprises: providing the plurality of demodulated channels via a parallel interface.
Claim 72	
72	The method of claim 64, wherein the method comprises: providing the plurality of digital channel outputs via a parallel interface.
Claim 73	
73	The method of claim 64, wherein the method comprises: providing the plurality of digital channel outputs via a serial interface.
Claim 74	
74	The method of claim 64, wherein: the plurality of desired channels comprises at least one cable broadcast channel.
Claim 75	
75	The method of claim 64, wherein: the plurality of desired channels comprises at least one channel delivered via a Data Over Cable Service Interface Specification (DOCSIS) protocol.
Claim 76	
76	The method of claim 64, wherein: the method is performed by a device comprising a digital video recorder (DVR).